p-ISSN 2618-0413
e-ISSN 2959-4596
BMDC- Recognized

# JOURNAL OF RANGPUR MEDICAL COLLEGE

Official Organ of Rangpur Medical College
A Peer Review Journal

March 2026 Vol. 11 No. 1

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Open access Editorial

# Recent Advancements in General Surgery

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Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.89917

**Citation:** Hossain MA.Recent Advancements in General Surgery.J Rang Med Col.2026 Mar;11(1):1-2.doi: https://doi.org/10.3329/jrpmc.v11i1.89917

The landscape of general surgery is undergoing a profound transformation in recent years. Today's operating room is no longer of resemblance to that of a decade ago. The ongoing expansion of the volume and complexity of surgical procedures based on the WHO Surgical Safety Checklist which is now a cornerstone of preoperative safety accelerates a new wave of technological integration is fundamentally reshaping how surgeons plan, execute, and follow up on operations. This editorial emphasizes key recent advancements, focusing on the maturation of robotic systems, the rise of artificial intelligence (AI), innovations in minimally invasive techniques, and the evolution of perioperative care.

**Robot-assisted surgery (RAS): From Emergency to Essential**

Robot-assisted surgery (RAS) has incorporated from an experimental adjunct to a standard-of-care tool across multiple subspecialties of general surgery. Robust data demonstrates that RAS minimizes surgical invasiveness through smaller incisions, minimal intraoperative blood loss, and accelerates patient recovery. The introduction of the da Vinci Surgical System which enhanced three-dimensional visualization, tremor filtration, and ergonomic superiority have already been well-documented advantages in complex colorectal resections, pancreaticoduodenectomies, and hernia repairs.[1]

However, the most important recent development is the expansion of RAS beyond the elective setting into emergency general surgery (EGS). Previously, it was considered that, the robotic platforms was not suitable for acute settings due to time constraints and logistical hurdles. But, recent national-level analyses from the United States indicate that the proportion of minimally invasive EGS procedures performed robotically has dramatically increased from 2008 to 2020, with the largest growth observed in robot-assisted large bowel resections and perforated ulcer repairs.[2] Robot-assisted approaches in EGS have been associated with significantly reduced odds of perioperative blood transfusion (for cholecystectomy: aOR 0.66; for large bowel resection: aOR 0.73) compared to traditional laparoscopy. While costs remain higher- by increments of up to $4,900—the safety and feasibility of RAS in the acute setting are now well-established.[2] Concurrently, a diverse array of new robotic platforms, including the Senhance and Versius systems, are entering the market, promising increased competition, lower costs, and specialized capabilities that may further democratize access to RAS.[1]

**Artificial Intelligence: Augmenting surgeon's mind**

If robotics has extended the surgeon's hands, artificial intelligence is augmenting the surgeon's mind. AI is no longer a futuristic concept but a tangible tool enhancing decision-making across the entire surgical continuum. Preoperatively, machine learning models are improving cancer detection and refining surgical risk stratification.[3] Intraoperatively, systematic reviews now confirm AI's capacity to track hand movements, identify anatomical landmarks, and even predict the next operative steps in real time.[4]

The emergence of foundation model architectures and multimodal AI- systems capable of processing diverse types of data (video, images, text, sensor data) simultaneously- is poised to drive the next leap forward.[5] These models hold immense potential to reduce variability in surgical technique, provide real-time decision support, and

accelerate the learning curve for trainees. But there are significant challenges e.g. data unavailability, lack of robust validation tools, and unresolved ethical concerns regarding autonomy and accountability.[4]

**Refining Minimally Invasive Techniques and Enhanced Recovery**

The continual drive of refinement of core surgical principles is progressing beyond the introduction of high-tech platforms. Natural Orifice Specimen Extraction (NOSE) surgery has emerged as a compelling option for colorectal procedures, offering superior cosmetic outcomes by avoiding abdominal incisions for specimen retrieval. NOSE compromise oncologic safety or increase postoperative complications compared to conventional laparoscopy despitelonger operative time.[6]

The principles of Enhanced Recovery After Surgery (ERAS) are being successfully adapted to increasingly challenging clinical contexts. A randomized controlled trial published in 2024 demonstrated that a modified Enhanced Recovery After Surgery (ERAS) protocol is not only safe but significantly effective in trauma patients undergoing emergency laparotomy. The ERAS group experienced a reduced median length of stay (6 vs. 8 days), earlier recovery of bowel function, and lower rates of deep surgical site infections compared to conventional care.[7] This represents a paradigm shift, extending the benefits of structured perioperative optimization from elective oncology patients to the most acute and vulnerable surgical populations.

The integration of AI, robotics, and 3D printing into unified, patient-specific workflows heralds an era of truly personalized surgery. Custom 3D-printed anatomical models are already enabling surgeons to rehearse complex procedures before entering the operating room, while bioprinting and smart implants remain on the horizon.[3] The challenge for the surgical community will be to critically evaluate these innovations through further researches, ensuring that the pursuit of technological novelty never supersedes the fundamental goals of safety, efficacy, and patient-centered care.

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Open access Original article

# Febuxostat and Renal Outcomes in Stage 3-4 CKD Patients with Asymptomatic Hyperuricemia: A Prospective Observational Study

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Submission Date : 20 Nov 2025
Accepted Date : 05 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.89919

**Abstract**

**Background:**
Chronic kidney disease (CKD) is commonly accompanied by asymptomatic hyperuricemia, which has been linked to faster renal deterioration.

**Objective:**
This study evaluated whether febuxostat provides renal benefit compared with standard care in adults with stage 3–4 CKD and elevated serum uric acid.

**Methods:**
This prospective observational study was conducted in the Department of Nephrology at the National Institute of Kidney Diseases & Urology (NIKDU), Dhaka, from February to July 2016, on 150 adults with chronic kidney disease (CKD) Stage 3-4 and asymptomatic hyperuricemia (serum uric acid ≥7 mg/dL), allocated in equal numbers by a closed-envelope technique to either a Febuxostat group (40 mg once daily after breakfast) or a conventional-therapy group receiving standard CKD care without Febuxostat (75 patients in each group). Participants were followed at baseline, 2 months, and 4 months with repeat clinical and biochemical assessments. The primary outcome was a ≥10% decline from baseline eGFR at 4 months. Secondary outcomes included between-group differences in CKD stage distribution, mean eGFR, and serum creatinine at 2 and 4 months, change in serum uric acid, and significant adverse events (myocardial infarction, stroke, heart failure, mortality).

**Results:**
Over four months, febuxostat was associated with better preservation of kidney function: eGFR remained higher, creatinine rose more slowly, and progression to CKD stage 5 was markedly lower. The primary endpoint, a ≥10% eGFR decline, occurred far less frequently with febuxostat, corresponding to a substantially reduced adjusted risk. Serum uric acid decreased to near-target levels, and cardiovascular events were infrequent and comparable between groups.

**Conclusion:**
These findings indicate the short-term renoprotective potential of febuxostat in selected CKD patients, underscoring the need for longer controlled trials.

**Keywords:** Febuxostat, Asymptomatic hyperuricemia, Chronic kidney disease (CKD), EGFR, And Renal Outcomes

**Citation:** Paul RS,Roy DK,Chowdhury HS.Febuxostat and Renal Outcomes in Stage 3-4 CKD Patients with Asymptomatic Hyperuricemia: A Prospective Observational Study.J Rang Med Col.2026 Mar;11(1):3-8.doi: https://doi.org/10.3329/jrpmc.v11i1.89919

## Introduction:

Chronic kidney disease (CKD) continues to impose a substantial global health burden, with progressive loss of kidney function leading to increased cardiovascular morbidity and premature mortality. Extensive epidemiologic analyses, including data from the Global Burden of Disease Study, highlight CKD as a leading contributor to years of life lost worldwide and a priority condition for targeted intervention.[1] In parallel, population-based studies from Asia demonstrate a high prevalence of CKD, particularly in rapidly

urbanizing countries such as China and India, where approximately 1 in 10 adults fulfil diagnostic criteria.[2,3] Within this high-risk landscape, asymptomatic hyperuricemia has emerged as a recurring clinical feature in CKD and has been implicated in diverse pathways of renal and cardiovascular injury. A substantial body of experimental and observational evidence links elevated serum uric acid (SUA) with endothelial dysfunction, afferent arteriolar vasoconstriction, glomerular hypertension, tubular inflammation, and activation of the renin–angiotensin system.[4,5] Meta-analytic data reinforce these mechanistic findings: a synthesis of 13 prospective cohorts with more than 190,000 participants showed that each 1 mg/dL increase in SUA was associated with a measurable rise in incident CKD risk, and categorical hyperuricemia more than doubled the likelihood of new-onset CKD.[6] These associations extend to accelerated eGFR decline, increased proteinuria, and heightened cardiovascular events, all of which converge in the clinical trajectory of stage 3–4 CKD. Pharmacologic urate-lowering has therefore gained attention as a potential reno protective strategy. Febuxostat, a non-purine-selective xanthine oxidase inhibitor (XOI), provides a potent and predictable reduction in SUA across a wide range of kidney functions. Phase III randomized trials established its superior biochemical efficacy relative to allopurinol, particularly in achieving target SUA levels in individuals with mild to moderate renal impairment.[7] Moreover, early prospective data from Japanese CKD cohorts suggested that febuxostat may slow renal functional decline in asymptomatic hyperuricemia. However, most studies were limited by short follow-up durations and incomplete representation of advanced CKD.[8] Despite strong biologic plausibility and supportive early signals, real-world prospective evidence evaluating febuxostat's effect on renal trajectories in stage 3-4 CKD without gout remains limited. This gap is clinically relevant, given the high prevalence of hyperuricemia in moderate to advanced CKD and the ongoing debate about whether urate-lowering therapy should be routinely offered in asymptomatic individuals. The present study addressed this evidence gap by examining whether febuxostat therapy is associated with improved renal outcomes in adults with stage 3-4 CKD and asymptomatic hyperuricemia.

**Method:**

This prospective observational study was conducted in the Department of Nephrology at the National Institute of Kidney Diseases & Urology (NIKDU), Dhaka, from February to July 2016, following Institutional Review Board approval. Consecutive adults with chronic kidney disease (CKD) Stage 3–4 and asymptomatic hyperuricemia (serum uric acid ≥7 mg/dL) were screened. The inclusion criteria were age 18-65 years, either sex, CKD Stage 3 or 4, and the absence of gout symptoms. Exclusion criteria comprised primary disorders of uric acid metabolism, autosomal dominant polycystic kidney disease, pregnancy or lactation, and symptomatic hyperuricemia/gout. After consent, 150 eligible participants were allocated in equal numbers by a closed-envelope technique to either a Febuxostat group (40 mg once daily after breakfast) or a conventional-therapy group receiving standard CKD care without Febuxostat (75 patients in each group).

Baseline demographics (age, sex, weight, height), comorbidities (diabetes mellitus, hypertension, ischemic heart disease, tobacco use), medications (loop diuretics, calcium-channel blockers, ACE inhibitors/ARBs), and laboratory variables (serum creatinine, estimated glomerular filtration rate [eGFR], serum uric acid, total cholesterol, albuminuria) were recorded. eGFR was calculated using the laboratory's standard equation, and CKD stages were defined according to prevailing criteria. Participants were followed at baseline, 2 months, and 4 months with repeat clinical and biochemical assessments. The primary outcome was a ≥10% decline from baseline eGFR at 4 months. Secondary outcomes included between-group differences in CKD stage distribution, mean eGFR, and serum creatinine at 2 and 4 months, change in serum uric acid, and significant adverse events (myocardial infarction, stroke, heart failure, mortality).

Data analyses were performed using standard statistical software, SPSS (v. 26.0). Between-group comparisons used $\chi^2$ tests for categorical variables and t-tests or nonparametric equivalents for continuous variables, as appropriate; longitudinal within- and between-group changes were assessed with repeated-measures analyses. Univariable and multivariable logistic regression identified predictors of ≥10% eGFR decline, including

clinically relevant covariates (treatment group, baseline renal indices, CKD stage, diuretic use, and tobacco use). Two-sided p <0.05 indicated statistical significance.

**Results:**

At baseline, both groups had similar distributions of age, sex, and significant comorbidities, although tobacco use was more frequent in the conventional group (56.0% vs 40.0%, p=0.048) (Table-I). Renal function was comparable except for slightly higher serum creatinine in Group II (2.9±0.6 vs 2.5±0.6 mg/dL, p=0.001). Diuretic use was also more common in the conventional group (50.7% vs 33.3%, p=0.032) (Table-II). By 2 months, clinically meaningful differences had already emerged. Group I demonstrated higher mean eGFR (28.1±7.7 vs 20.1±8.1 ml/min/1.73m , p<0.001) and lower serum creatinine (2.5±0.6 vs 3.2±0.8 mg/dL, p<0.001). These advantages persisted at 4 months, with the febuxostat group maintaining significantly better renal function (eGFR 27.2±8.9 ml/min/1.73m ) compared with the conventional group (16.5±7.0 ml/min/1.73m; p<0.001). Likewise, serum creatinine remained substantially lower (2.8±0.7 vs 4.1±1.5 mg/dL; p<0.001). Febuxostat also produced stronger urate control, reducing SUA to 6.1±0.2 mg/dL versus 7.9±1.1 mg/dL (p<0.001). Progression to CKD stage 5 was markedly less frequent with febuxostat (2.7% vs 22.7%, p<0.001) (Table-III). Overall, only 30.7% of febuxostat patients experienced ≥10% decline in eGFR over 4 months, compared with 89.3% in the conventional group (p<0.001) (Table-IV). Logistic regression confirmed febuxostat therapy as a strong independent protective factor against rapid renal decline (aOR 0.18; 95% CI 0.09–0.36; p<0.001). Higher baseline creatinine modestly increased the risk (aOR 1.18 per 0.5 mg/dL; p=0.028) (Table-V).

**Table-I: Baseline demographic and clinical characteristics (N=150)**

| Baseline characteristics | Group I (Febuxostat, n=75) no. (%) | Group II (Conventional, n=75) no. (%) | p-value |
|---|---|---|---|
| Age (years), mean±SD | 48±10 | 47±13 | 0.401 |
| Age <40 years | 22(29.3) | 20(26.7) | |
| Age 40–49 years | 18(24.0) | 17(22.7) | |
| Age 50–59 years | 20(26.7) | 19(25.3) | |
| ≥60 years | 15(20.0) | 19(25.3) | |
| Male sex | 46(61.3) | 41(54.7) | 0.408 |
| Diabetes mellitus | 33(44.0) | 29(38.7) | 0.496 |
| Hypertension | 49(65.3) | 52(69.3) | 0.612 |
| Ischemic heart disease | 12(16.0) | 15(20.0) | 0.523 |
| Tobacco use | 42(56.0) | 30(40.0) | 0.048 |

**Table-II: Baseline renal and biochemical status (N=150)**

| Baseline renal and biochemical status | Group I (Febuxostat, n=75) no. (%) | Group II (Conventional, n=75) no. (%) | p-value |
|---|---|---|---|
| CKD Stage 3 | 29(38.7) | 25(33.3) | 0.496 |
| CKD Stage 4 | 46(61.3) | 50(66.7) | |
| eGFR (ml/min/1.73m ) | 26.9±7.4 | 25.3±6.2 | 0.223 |
| Serum creatinine (mg/dL) | 2.5±0.6 | 2.9±0.6 | 0.001 |
| Serum uric acid (mg/dL) | 8.3±1.2 | 7.9±0.9 | 0.231 |
| Total cholesterol (mg/dL) | 197.3±48.5 | 191.1±41.9 | 0.405 |
| Loop diuretics | 25(33.3) | 38(50.7) | 0.032 |
| ARB/ACEi | 45(60.0) | 51(68.0) | 0.307 |

**Table-III: Renal outcomes at 2 and 4 months (N=150)**

| Renal outcomes | Group I | Group II | p-value |
|---|---|---|---|
| eGFR (ml/min/1.73m ) | | | |
| 2 months | 28.1±7.7 | 20.1±8.1 | <0.001 |
| 4 months | 27.2±8.9 | 16.5±7.0 | <0.001 |
| Serum creatinine (mg/dL) | | | |
| 2 months | 2.5±0.6 | 3.2±0.8 | <0.001 |
| 4 months | 2.8±0.7 | 4.1±1.5 | <0.001 |
| Serum uric acid (mg/dL) | | | |
| 2 months | 7.5±0.6 | 7.6±0.9 | 0.569 |
| 4 months | 6.1±0.2 | 7.9±1.1 | <0.001 |
| CKD Stage 5 at 4 months | 2(2.7) | 17(22.7) | <0.001 |

**Table-IV: Primary outcome and CKD progression (N=150)**

| Primary outcome | Group I no. (%) | Group II no. (%) | p-value |
|---|---|---|---|
| ≥10% decline in eGFR | 23(30.7) | 57(89.3) | <0.001 |
| CKD Stage 3 at 4 months | 27(36.0) | 1(1.3) | <0.001 |
| CKD Stage 4 at 4 months | 46(61.3) | 57(76.0) | 0.054 |
| CKD Stage 5 at 4 months | 2(2.7) | 17(22.7) | <0.001 |
| Death | 0(0.0) | 1(1.3) | 0.5 |

**Table-V: Predictors of ≥10% eGFR decline at 4 months (Logistic Regression, N=150)**

| Predictor | Adjusted OR (95% CI) | p-value |
|---|---|---|
| Febuxostat therapy (vs conventional) | 0.18(0.09–0.36) | <0.001 |
| Baseline eGFR (per 5 ml/min higher) | 0.92(0.78–1.08) | 0.31 |
| Baseline serum creatinine (per 0.5 mg/dL higher) | 1.18(1.02–1.38) | 0.028 |
| CKD Stage 4 (vs Stage 3) | 1.34(0.66–2.73) | 0.41 |
| Loop diuretic use | 1.29 (0.66–2.52) | 0.46 |
| Tobacco use | 1.22(0.64–2.34) | 0.54 |

**Discussion:**

In this prospective study on adults with stage 3–4 CKD and asymptomatic hyperuricemia, febuxostat therapy was associated with significantly better short-term renal outcomes compared with conventional management. Patients receiving febuxostat demonstrated higher eGFR, lower serum creatinine, reduced progression to CKD stage 5, and markedly lower odds of≥10% eGFR decline over 4 months. These benefits were observed despite comparable baseline clinical features, and a higher burden of tobacco use in the febuxostat group. The findings are consistent with a growing body of evidence suggesting that urate-lowering therapy may confer reno-protective effects in CKD. Epidemiologic studies have shown that elevated serum uric acid is independently associated with accelerated renal decline and incident CKD, supporting a mechanistic link through endothelial dysfunction, afferent arteriolar injury, and oxidative stress pathways.[9,10] Longitudinal observational data in hypertensive and obese populations similarly demonstrate that higher urate levels predict faster eGFR loss and higher cardiovascular risk.[9,10] These pathophysiologic insights provide a biologically plausible foundation for therapeutic urate reduction as a strategy to slow CKD progression. Randomized and prospective clinical trials evaluating febuxostat in CKD populations reinforce these associations. In a landmark 6-month double-masked trial, febuxostat significantly slowed eGFR decline in stage 3–4 CKD patients with asymptomatic hyperuricemia,

without increasing serious adverse events.[11] Smaller controlled trials in moderate CKD consistently report improvements in eGFR slope and reductions in proteinuria over 8–12 weeks.[12,13] In surgical CKD cohorts, febuxostat also reduced uric acid more effectively than allopurinol and improved vascular parameters, including arterial stiffness and blood pressure, suggesting broader cardio-renal benefits.[14] A significant phase III program across hyperuricemic populations has further confirmed febuxostat's predictability in achieving serum urate targets irrespective of renal function, due to its pharmacokinetics being largely independent of renal clearance.[15,16] Our findings align with these prior observations. Achieving SUA levels near 6 mg/dL in the febuxostat group corresponded with renal stability, echoing treat-to-target advantages documented in randomized trials. Although loop diuretic exposure was higher in the conventional-therapy group, febuxostat remained independently protective in multivariable models, suggesting that the observed benefits were not attributable solely to confounding. Evidence from allopurinol trials also supports the concept of urate-lowering renoprotection. Several randomized and long-term follow-up studies demonstrated slower CKD progression and fewer cardiovascular events with allopurinol in hyperuricemic CKD patients.[17-19] Although these studies used different agents, the consistency of benefit across xanthine oxidase inhibitors reinforces urate-lowering as a potential disease-modifying strategy in CKD.

**Limitations:**

This single-centre, non-randomized design with a short follow-up period (4 months) and a modest sample size limits causal inference and the detection of rare outcomes. Background therapies and adherence were not standardized; proteinuria data were incomplete, indicating that residual confounding is likely. eGFR was the primary surrogate endpoint, and the findings may be generalized only to similar stage 3–4 CKD patients with asymptomatic hyperuricemia.

**Conclusion:**

Febuxostat therapy was associated with short-term preservation of kidney function compared with conventional management in stage 3–4 CKD patients with asymptomatic hyperuricemia. Over 4 months, febuxostat maintained higher eGFR, lowered serum creatinine, reduced progression to CKD stage 5, and markedly decreased the odds of clinically relevant decline in renal function (adjusted OR ≈0.18), despite comparable baseline profiles. Urate lowering was robust, and achieving a serum uric acid level near 6 mg/dL was associated with renal stability. Cardiovascular events and mortality rates were similar between groups throughout the study period. At the same time, these findings support febuxostat as a potential renoprotective option for carefully selected stage 3–4 CKD patients with asymptomatic hyperuricemia.

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# First Acute Myocardial Infarction (AMI) in the Very Young Versus Older Population: A Clinical and Prognostic Comparison

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Submission Date : 24 Nov 2025
Accepted Date : 05 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.89920

**Abstract**

**Background:**
South Asians, including Bangladeshis, experience AMI at younger age, yet local comparative data are limited.

**Objective:**
This study aimed to compare the very young (≤30 years) versus older (≥50 years) patients presenting with their first AMI.

**Methods:**
This cross-sectional comparative study was conducted at Dhaka Medical College and Hospital from July 2022 to December 2023, including 160 first-AMI patients, very young (n=80) and older (n=80), diagnosed by the Fourth Universal Definition (2018).

**Results:**
Mean age was 26.4±2.8 vs 61.7±7.4 years; male predominance was higher in the very young (87.5% vs 75.0%, p=0.048). Very young patients had more smoking (57.5% vs 30.0%, p<0.001) and family history (42.5% vs 20.0%, p=0.003), while older patients had more hypertension, diabetes, and dyslipidaemia (all p<0.05). STEMI, higher LVEF, and single-vessel disease were more frequent in the very young, whereas triple-vessel disease was more common in older patients. Older patients had longer stays and higher heart failure, shock, and mortality (all p<0.05).

**Conclusion:**
Very young first-AMI patients showed a smoking-dominant, single-vessel pattern with better in-hospital outcomes; older patients had cardiometabolic risk clustering, multivessel disease, and worse prognosis.

**Keywords:** Acute Myocardial Infarction, Young-Adults, Coronary Artery Disease, and Cardiovascular Risk Factors

**Citation:** Razib MAH,Chowdhury AW,Mahmoda AR.First Acute Myocardial Infarction (AMI) in the Very Young versus Older Population: A Clinical and Prognostic Comparison.J Rang Med Col.2026 Mar;11(1):9-15.doi: https://doi.org/10.3329/jrpmc.v11i1.89920

## Introduction:

Ischaemic heart disease (IHD) remains the leading cause of death worldwide, contributing heavily to cardiovascular mortality and disability-adjusted life-years despite major gains in primary prevention and reperfusion therapy.[1] The Global Burden of Disease (GBD) 2019 analysis highlights that population ageing, rapid urbanization, and continued exposure to modifiable risks, particularly tobacco use, hypertension, dyslipidaemia, diabetes, and obesity, are sustaining the global IHD burden.[1] South Asia has undergone a rapid epidemiological transition, with non-communicable diseases now dominating mortality profiles; IHD and stroke are central to this shift.[2] In Bangladesh, GBD 2019 estimates similarly rank stroke and IHD among the top causes of death and disability, with high blood pressure, elevated fasting plasma glucose, and smoking identified as leading attributable risks.[2]

A consistent and clinically important feature of South Asian cardiovascular epidemiology is the earlier occurrence of myocardial infarction (MI), often 5–10 years younger than in many other regions, reflecting early clustering of metabolic and lifestyle risks such as central obesity, insulin resistance, dyslipidaemia, and smoking.[3,4] Against this background, acute MI in “very young” adults, commonly defined as MI occurring at or before 40–45 years, has emerged as a distinct subgroup of interest.[5,6] Although very young patients constitute a minority of overall MI admissions, multiple

datasets suggest a rising absolute number of cases in settings where tobacco exposure, sedentary behaviour, and dietary westernisation are increasing.[5,6] Prior studies describe very young MI patients as predominantly male, frequently smokers, and more likely to report a family history of premature coronary artery disease; they often present with ST-segment elevation MI (STEMI), single-vessel coronary disease, and comparatively preserved left ventricular function.[5,7] Registry evidence, including the Partners YOUNG-MI Registry, further shows that most very young patients have at least one modifiable risk factors, and that non-traditional contributors, including substance use and inflammatory conditions, may also play a role.[7] In contrast, older MI populations typically have a higher burden of cardiometabolic comorbidity and more complex, multivessel coronary disease, which can translate into worse short-term outcomes.[8] Importantly, even when early outcomes appear favourable in very young patients, long-term risks of recurrent events and mortality remain meaningful.[7-9]

In Bangladesh, available reports in younger MI cohorts commonly note male predominance, high smoking and dyslipidaemia prevalence, frequent anterior wall STEMI, and notable in-hospital complications, including arrhythmias and left ventricular failure.[10,11] However, much of the local literature is either limited to young-only cohorts or unstratified MI samples, leaving a shortage of direct, within-setting comparisons between very young and older patients.[10,11] Clarifying age-specific differences in risk factor patterns, presentation, angiographic disease burden, ventricular function, and in-hospital outcomes are particularly relevant in Bangladesh, where premature MI carries substantial loss of productive life-years and may require tailored secondary prevention. Therefore, this study aimed to compare demographic characteristics, cardiovascular risk profiles, clinical and angiographic features, and in-hospital outcomes between very young (≤30 years) and older (≥50 years) patients presenting with first acute myocardial infarction (AMI).

**Methods:**

This cross-sectional comparative study was conducted in the Department of Cardiology, Dhaka Medical College and Hospital, Dhaka, Bangladesh, from July 2022 to December 2023. A total of 160 consecutive patients with first acute myocardial infarction (AMI) were enrolled and stratified by age into a very young group (≤30 years, n=80) and an older group (≥50 years, n=80). First AMI was diagnosed using the Fourth Universal Definition of Myocardial Infarction (2018)[12] requiring a rise and/or fall of cardiac troponin with at least one value above the 99th percentile upper reference limit plus electrocardiographic and/or imaging evidence of ischaemia. Adults (≥18 years) presenting within 24 hours of symptom onset and providing informed consent were included. Exclusion criteria were prior MI or revascularization, significant valvular or congenital heart disease, advanced hepatic or renal dysfunction (creatinine >2.0 mg/dL), chronic inflammatory or autoimmune disease, and incomplete records. Data were collected using a structured proforma via interview, bedside assessment, and chart review, covering demographics, risk factors, clinical presentation, laboratory results, echocardiography, angiography, treatments, complications, and in-hospital mortality. SPSS v26 was used; t-test and Chi-square/Fisher's exact tests compared groups, and multivariable logistic regression identified independent predictors, with $p<0.05$ considered significant.

**Results:**

Across 160 first-AMI patients, very young (≤30 years, n=80) and older (≥50 years, n=80) groups differed meaningfully in baseline profile, presentation, disease burden, and outcomes. Very young patients were predominantly male (87.5% vs 75.0%, p=0.048) and presented more often with STEMI (78.8% vs 63.8%, p=0.041), shorter symptom-to-hospital time (5.4±2.1 vs 7.2±3.4 hours, p=0.002), fewer signs of congestion (Killip ≥ II: 22.5% vs 47.5%, p=0.002), and lower systolic blood pressure at admission (118±16 vs 128±18 mmHg, p=0.001) (Table-I)

Risk factor patterns diverged: very young patients had higher smoking (57.5% vs 30.0%, p<0.001) and family history of CAD (42.5% vs 20.0%, p=0.003), whereas older patients had markedly higher hypertension (72.5%), diabetes (65.0%), and dyslipidaemia (70.0%) (all p≤0.014) (Table-II). Biochemically, older patients showed higher fasting glucose (134±39 vs 108±26 mg/dL, p<0.001) and creatinine (1.35±0.29 vs 1.02±0.18 mg/dL, p<0.001), while very young patients had slightly higher HDL-C (39±8 vs 36±7 mg/dL,

p=0.019) and higher hemoglobin (13.8±1.4 vs 12.6±1.7 g/dL, p<0.001) (Table-III).
Echocardiography and angiography demonstrated higher LVEF in the very young (47.5±8.9% vs 42.6±9.8%, p=0.001) with more single-vessel disease (47.5% vs 23.8%, p=0.002), while older patients more often had triple-vessel disease (42.5% vs 21.3%, p=0.005) (Table-IV).
Outcomes favored the very young, with shorter stay (4.8±1.6 vs 6.2±2.1 days, p<0.001) and lower heart failure, shock, mortality, and composite adverse events (all p≤0.029); independent predictors included age ≥50, hypertension, diabetes, LVEF <40%, and multivessel disease (Table-V).

**Table-I: Baseline characteristics and clinical presentation at admission (N=160)**

| Variables | Very Young (n=80) no. (%) | Older (n=80) no. (%) | Total (N=160) no. (%) | p-value |
|---|---|---|---|---|
| Age (years), mean±SD | 26.4±2.8 | 61.7±7.4 | 44.1±16.5 | <0.001 |
| Male sex | 70(87.5) | 60(75.0) | 130(81.3) | 0.048 |
| Urban residence | 55(68.8) | 46(57.5) | 101(63.1) | 0.148 |
| BMI (kg/m$^2$), mean±SD | 25.8±3.2 | 26.4±3.8 | 26.1±3.5 | 0.242 |
| Socioeconomic status (middle+high) | 49(61.3) | 44(55.0) | 93(58.1) | 0.429 |
| STEMI | 63(78.8) | 51(63.8) | 114(71.3) | 0.041 |
| NSTEMI | 17(21.2) | 29(36.2) | 46(28.7) | - |
| Anterior-wall infarction | 35(43.8) | 28(35.0) | 63(39.4) | 0.264 |
| Inferior-wall infarction | 28(35.0) | 33(41.3) | 61(38.1) | - |
| Chest-pain-to-hospital time (h), mean±SD | 5.4±2.1 | 7.2±3.4 | - | 0.002 |
| Dyspnea | 49(61.3) | 62(77.5) | 111(69.4) | 0.033 |
| Killip class ≥ II | 18(22.5) | 38(47.5) | 56(35.0) | 0.002 |
| Systolic BP (mmHg), mean±SD | 118±16 | 128±18 | - | 0.001 |
| Heart rate (bpm), mean±SD | 93±14 | 89±13 | - | 0.066 |

**Table-II: Cardiovascular risk factors (N=160)**

| Risk factor | Very Young (n=80) no. (%) | Older (n=80) no. (%) | p-value |
|---|---|---|---|
| Current smoker | 46(57.5) | 24(30.0) | <0.001 |
| Hypertension | 28(35.0) | 58(72.5) | <0.001 |
| Diabetes mellitus | 20(25.0) | 52(65.0) | <0.001 |
| Dyslipidaemia | 40(50.0) | 56(70.0) | 0.014 |
| Family history of CAD | 34(42.5) | 16(20.0) | 0.003 |
| Obesity (BMI ≥25 kg/m$^2$) | 37(46.3) | 41(51.3) | 0.545 |
| Physical inactivity | 49(61.3) | 53(66.3) | 0.505 |
| Alcohol intake | 12(15.0) | 9(11.3) | 0.491 |

**Table-III: Laboratory and biochemical profile (N=160)**

| Parameter | Very Young (n=80) mean±SD | Older (n=80) mean±SD | Reference range | p-value |
|---|---|---|---|---|
| Troponin-I (ng/mL) | 9.8±3.7 | 10.5±4.0 | ≤0.03 | 0.243 |
| CK-MB (U/L) | 135±54 | 142±63 | ≤25 | 0.471 |
| Fasting glucose (mg/dL) | 108±26 | 134±39 | 70–110 | <0.001 |
| Total cholesterol (mg/dL) | 205±42 | 217±48 | <200 | 0.093 |
| LDL-C (mg/dL) | 132±34 | 142±39 | <100 | 0.071 |
| HDL-C (mg/dL) | 39±8 | 36±7 | >40 | 0.019 |
| Triglycerides (mg/dL) | 190±62 | 176±54 | <150 | 0.164 |
| Serum creatinine (mg/dL) | 1.02±0.18 | 1.35±0.29 | 0.6–1.3 | <0.001 |
| Hemoglobin (g/dL) | 13.8±1.4 | 12.6±1.7 | 13–17 | <0.001 |

**Table-IV: Echocardiography and coronary angiography findings (N=160)**

| Parameter | Very Young (n=80) no. (%) | Older (n=80) no. (%) | p-value |
|---|---|---|---|
| LVEF (%), mean±SD | 47.5±8.9 | 42.6±9.8 | 0.001 |
| RWMA present | 57(71.3) | 62(77.5) | 0.359 |
| Single-vessel disease | 38(47.5) | 19(23.8) | 0.002 |
| Double-vessel disease | 25(31.3) | 27(33.8) | 0.745 |
| Triple-vessel disease | 17(21.3) | 34(42.5) | 0.005 |
| Culprit artery LAD | 46(57.5) | 40(50.0) | 0.354 |
| Thrombus noted | 19(23.8) | 14(17.5) | 0.317 |
| TIMI flow grade 3 post-PCI | 69(86.3) | 60(75.0) | 0.077 |

**Table-V: Treatment, in-hospital outcomes, and predictors of adverse events (N=160)**

| Variable | Very Young (n=80) no. (%) | Older (n=80) no. (%) | p-value |
|---|---|---|---|
| **Treatment** | | | |
| Primary PCI | 42(52.5) | 31(38.8) | 0.092 |
| Thrombolysis | 29(36.3) | 32(40.0) | 0.647 |
| Conservative management | 9(11.3) | 17(21.3) | 0.091 |
| Door-to-balloon time (min), mean±SD | 83±22 | 96±28 | 0.003 |
| DAPT | 80(100) | 80(100) | - |
| Statin | 78(97.5) | 76(95.0) | 0.41 |
| Beta-blocker | 73(91.3) | 69(86.3) | 0.317 |
| ACEI/ARB | 70(87.5) | 66(82.5) | 0.372 |
| **In-hospital outcomes** | | | |
| Hospital stays (days), mean±SD | 4.8±1.6 | 6.2±2.1 | <0.001 |
| Heart failure | 12(15.0) | 28(35.0) | 0.005 |
| Arrhythmia | 9(11.3) | 16(20.0) | 0.138 |
| Cardiogenic shock | 3(3.8) | 11(13.8) | 0.028 |
| Reinfarction | 2(2.5) | 5(6.3) | 0.243 |
| In-hospital mortality | 2(2.5) | 9(11.3) | 0.029 |
| Composite adverse event | 16(20.0) | 37(46.3) | 0.001 |
| **Multivariable predictors of adverse events** | | | |
| Age ≥50 years, aOR (95% CI) | 2.76(1.31–5.83) | - | 0.007 |
| Hypertension, aOR (95% CI) | 2.11(1.04–4.29) | - | 0.038 |
| Diabetes mellitus, aOR (95% CI) | 2.58(1.22–5.44) | - | 0.013 |
| LVEF <40%, aOR (95% CI) | 3.22(1.45–7.16) | - | 0.004 |
| Multivessel disease, aOR (95% CI) | 2.85(1.32–6.16) | - | 0.008 |
| STEMI presentation, aOR (95% CI) | 1.64(0.78–3.42) | - | 0.189 |

**Discussion:**

The present study demonstrates that first AMI in very young adults (≤30 years) differs meaningfully from AMI in older patients (≥50 years) within the same Bangladeshi tertiary-care setting. Very young patients were predominantly male and had a risk profile dominated by active smoking and a positive family history of premature coronary artery disease, with substantially lower frequencies of hypertension, diabetes, and dyslipidaemia than older patients. This pattern is consistent with the systematic review by Lei and Bin, which reported higher smoking and familial predisposition but lower hypertension and diabetes in younger first-AMI patients compared with older cohorts,[13] and with prior comparative work showing

smoking enrichment in young patients while cardiometabolic risk clusters in older individuals.[14] Local evidence similarly describes young Bangladeshi AMI patients as largely male smokers with notable familial clustering, while traditional metabolic risk factors rise with age,[15,16] supporting a model where modifiable lifestyle exposure interacts with genetic susceptibility to trigger premature events in South Asians.[15-19] In our cohort, older patients showed the expected cardiometabolic gradient, paralleling Bangladeshi series that report markedly higher hypertension and diabetes among older or non-young CAD patients;[20] even though young patients can already exhibit overweight and dyslipidaemia, these tend to be less prominent than in older regional cohorts, as noted by Ahmed et al[18] and Dan et al.[17] Clinically, the predominance of STEMI in the very young group aligns with South Asian reports where younger AMI patients frequently present with STEMI and anterior wall infarction, often related to LAD involvement,[5,16,19,21] and Bangladeshi data in patients ≤30 years also indicate more single-vessel disease and LAD involvement in STEMI than NSTEMI.[22] Our angiographic findings, with more single-vessel disease in the very young and more triple-vessel disease in older patients, mirror patterns across South Asia [21-24] and those described by Malik et al and Tamrakar et al, where younger patients more commonly have focal disease while older patients exhibit diffuse atherosclerosis;[16,19] importantly, the presence of multivessel disease in a meaningful minority of very young patients cautions against framing premature AMI as benign. Outcomes followed the same gradient, with fewer heart failure episodes, cardiogenic shock, and deaths among very young patients, consistent with reports of more favorable in-hospital prognosis in young AMI [5,19,24] and with Bangladeshi comparative findings from Karim et al.[15] Our multivariable model, identifying older age, hypertension, diabetes, reduced LVEF, and multivessel disease as independent predictors of adverse in-hospital events, reinforces that structural myocardial compromise and cardiometabolic burden, rather than age alone, drive early complications.[23,24] Differences from some South Asian series, in which dyslipidaemia and obesity are strongly over-represented even in very young AMI, may reflect regional variation, referral patterns, or under-recognition of subclinical dyslipidaemia in younger adults in our setting;[17,18] nevertheless, the convergent implication is clear, premature AMI in Bangladesh is tightly linked to preventable risk exposures, requiring aggressive tobacco control, early risk screening, and sustained secondary prevention across age groups.[13,15-18]

**Limitations:**

This single-centre study used a relatively small, non-random sample and captured only in-hospital outcomes, limiting generalizability and precluding assessment of long-term prognosis. In addition, some risk factors were self-reported, so recall and residual confounding biases cannot be entirely excluded.

**Conclusion:**

In this Bangladeshi cohort, very young first AMI patients were predominantly male and more often smokers. They had more single-vessel disease, better left ventricular function, and more favorable in-hospital outcomes than older patients. Older patients exhibited a heavier burden of hypertension, diabetes, dyslipidemia, and multivessel coronary disease, which translated into higher rates of complications and mortality. These findings highlight the need for aggressive primordial and primary prevention targeting tobacco use and familial risk in younger adults, alongside intensified risk factor control and timely revascularization in older first AMI patients.

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# Associations Between Socio-Economic Factors and Prevalence of Shigella Infection: An Analysis of Isolated Cases

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Submission Date : 28 Nov 2025
Accepted Date : 05 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.89944

**Abstract**

**Background:**
Shigella infection is a major contributor to childhood diarrhoea, particularly in settings where socio-economic and environmental disadvantages limit access to safe water, sanitation, and healthcare.

**Objective:**
This study assessed the association between socio-economic factors and Shigella prevalence among isolated paediatric cases.

**Methods:**
A hospital-based observational study was conducted from July 2021 to June 2022 in the Paediatrics inpatient department of Sylhet MAG Osmani Medical College Hospital. Ninety-eight children aged ≥6 months with diarrhoea and no recent antibiotic exposure were enrolled. Stool samples underwent culture, biochemical testing, and PCR confirmation.Associations were analysed using SPSS, with significance set at $p<0.05$.

**Results:**
Shigella species were isolated in 13 of 98 children (13.3%), predominantly among those aged 1–5 years and from lower socio-economic backgrounds, although age, gender and socio-economic class showed no significant associations.

**Conclusion:**
Shigella infection persists in disadvantaged socio-economic settings, underscoring the need for targeted preventive measures.

**Keywords:** Shigella infection, Diarrhoea, Socio-economic factors.

**Citation:** Rahman T,Haque MM,Rahman MH.Associations Between Socio-Economic Factors and Prevalence of Shigella Infection: An Analysis of Isolated Cases.J Rang Med Col.2026 Mar;11(1):16-20. doi: https://doi.org/10.3329/jrpmc.v11i1.89944

## Introduction:

Shigella infection remains a significant global health problem, and its prevalence is closely related to socio-economic and environmental conditions. Shigella species are among the major bacterial causes of diarrhoeal diseases worldwide, according to the World Health Organization.[1] They contribute to a considerable burden of morbidity and mortality. The distribution and frequency of Shigella infection reflect patterns of inequality. Populations of lower socio-economic status experience greater exposure because of poor sanitation, unsafe water, and limited access to health services.[2] Low socio-economic status plays a crucial role in the persistence and transmission of Shigella. In areas with inadequate sanitation, overcrowding, and limited access to safe water, faecal–oral transmission becomes more common. These environments facilitate the spread of Shigella through contaminated food, water, or direct person-to-person contact. Studies have shown that households with lower incomes, limited education, and poor hygienic practices exhibit higher infection rates than those with better socio-economic conditions.[3,4] The combination of these factors increases the likelihood of repeated exposure and prolonged infection. It also enhances community-level outbreaks, allowing Shigella to maintain endemic transmission. Socioeconomic factors influence the predominance of specific Shigella species in analyses of isolated cases. Shigella flexneri is more

prevalent in financially disadvantaged areas. Shigella sonnei tends to dominate in communities with improved sanitation and higher income levels, in contrast.[5,6] This distribution pattern indicates that the socio-economic environment directly affects both the prevalence and the types of Shigella circulating across different populations. Patterns of infection within households, neighbourhoods, and broader communities reveal that environmental conditions, crowding, and access to hygienic facilities are critical determinants of species distribution and transmission dynamics. The rise of multidrug-resistant (MDR) Shigella strains is another obstacle linked to socio-economic conditions. Uncontrolled antibiotic usage, limited diagnostic facilities, and insufficient healthcare resources have escalated the spread of resistant strains in low-income communities.[7,8] Inappropriate antibiotic use due to self-medication, lack of professional guidance, and poor knowledge contributes to treatment failure and prolonged illness. These conditions are more pronounced in areas with low healthcare affordability and accessibility. They raise the risk of community-level spread and exacerbate treatment outcomes. Nutritional status also plays a critical role in determining the risk and severity of Shigella infection. Malnourished individuals, often concentrated in socio-economically deprived areas, exhibit weaker immune responses. This increases their vulnerability to infection and its complications.[9] The interaction of malnutrition, poor sanitation, and limited healthcare access reinforces a cycle of recurrent infection and poverty. In such conditions, Shigella infection can have more severe consequences and a prolonged course of illness. This further increases the public health burden. This study aims to analyze the association between socio-economic factors and the prevalence of Shigella infection by examining isolated cases.

**Methods:**

This descriptive observational study was conducted from July 2021 to June 2022 in the Paediatrics inpatient department of Sylhet MAG Osmani Medical College Hospital, a tertiary care teaching hospital in Sylhet, Bangladesh. Ninety-eight children admitted with diarrhoeal diseases were selected using consecutive sampling. Children older than six months who had not received antibiotics in the previous week were included, while children below six months or with recent antibiotic exposure were excluded. Data on socio-economic factors, including household income, parental education, and living conditions, were collected using a pre-designed questionnaire. Stool samples were collected aseptically before antibiotic administration and transported immediately to the Microbiology Laboratory. Shigella species were identified using standard culture, Gram staining, motility, biochemical tests, and molecular confirmation was performed by PCR detection of the ipaH gene. The Institutional Review Board of Sylhet MAG Osmani Medical College obtained ethical approval. Data were analyzed using SPSS version 26, and descriptive statistics were applied. Associations between socio-economic variables and Shigella infection were assessed; $p<0.05$ was considered statistically significant.

**Results:**

Table-I showed that the study population was predominantly aged 1-5 years (52.0%), followed by infants aged 6 months to 1 year (32.6%), with only 15.3% older than 5 years; males accounted for 56.1% of participants. Most children belonged to the lower socio-economic class (63.3%), while middle-class representation was 35.7% and upper-class representation was only 1%.

**Table-I: Demographical characteristics of the study population (N=98)**

| Characteristics | no. (%) |
|---|---|
| **Age distribution** | |
| 6 months to 1 year | 32(32.60) |
| 1–5 years | 51(52.00) |
| >5 years | 15(15.30) |
| **Gender distribution** | |
| Male | 55(56.10) |
| Female | 43(43.90) |
| **Socio-economic class** | |
| Lower class | 62(63.30) |
| Middle class | 35(35.70) |
| Upper class | 1(1.00) |

Table-II indicated that watery diarrhoea was the most common presentation (54.1%), followed by mucoid diarrhoea (30.6%) and bloody diarrhoea

(15.3%). The study found 13 cases with Shigella-positive results, and the remaining 85 cases were negative.

**Table-II: Distribution of diarrhoeal children by type of diarrhoea (N=98)**

| Type of Diarrhoea | no. (%) |
|---|---|
| Mucoid | 30(30.6) |
| Watery | 53(54.1) |
| Bloody | 15(15.3) |

Table-III demonstrated no statistically significant association between Shigella isolation and age (p=0.783), gender (p=0.673), or socio-economic status (p=0.796); Shigella positivity remained low across all groups, with an overall detection rate of 13.3% (13 out of 98).

**Table-III: Associations of socio-economic factors with prevalence of shigella infection (N=98)**

| Socio-Economic Factors | Shigella Positive no. (%) | Shigella Negative no. (%) | p-value |
|---|---|---|---|
| **Age Group** | | | |
| 6 months–1 year (n=32) | 4(12.5) | 28(87.5) | 0.783 |
| 1 – 5 years (n=51) | 8(15.7) | 43(84.3) | |
| >5 years (n=15) | 1(6.67) | 14(93.3) | |
| Total (N=98) | 13 | 85 | |
| **Gender** | | | |
| Male (n=55) | 8(14.5) | 47(85.5) | 0.673 |
| Female (n=43) | 5(11.6) | 38(88.4) | |
| Total (n=98) | 13 | 85 | |
| **Socio-Economic Status** | | | |
| Lower class (n=62) | 9(14.5) | 53(85.5) | 0.796 |
| Middle class (n=35) | 4(11.4) | 32(88.6) | |
| Upper class (n=1) | 0(0.0) | 1(100.0) | |
| Total (n=98) | 13 | 85 | |

**Discussion:**

In this study, the overall isolation rate of Shigella among diarrhoeal children was 13.3%, with the majority of cases observed in the 1–5 years age group and among children from lower socio-economic backgrounds. Although associations with age, gender, and socio-economic class were not statistically significant, the distribution trends provide essential public health insight. A predominance of Shigella infection in early childhood is well documented. The Global Enteric Multicenter Study (GEMS) reported that Shigella was a leading cause of moderate-to-severe diarrhoea in children under five years in low-resource settings, with risk peaking in the toddler and preschool years.[10] In our study, 15.7% of cases in the 1–5 years group were Shigella-positive, whereas only 6.7% occurred in children aged five or older. Ferdous et al in Bangladesh also found the highest prevalence among children aged 1–5 years, citing increased exposure to contaminated food/water and immature hygiene practices at this age.[11] These patterns suggest age-related vulnerability associated with behavioural and environmental exposures. The gender distribution in our study showed slightly higher Shigella positivity among males (14.5%) than among females (11.6%), though the difference was not significant. Similar gender patterns have been reported in South Asian contexts. Rahman et al observed a mild male predominance in Shigella infections among Bangladeshi children, attributing this to higher outdoor exposure among boys in many socio-cultural settings.[12] However, gender differences are not consistently significant across studies, indicating that biological susceptibility is likely similar, while exposure differences may vary culturally. Socio-economic factors showed a more definable pattern, with most Shigella cases occurring among the lower socio-economic group (14.5%), compared to 11.4% in the middle class and none in the upper class. This association aligns with evidence that Shigella transmission is strongly linked to sanitation conditions, crowding, unsafe water, and limited access to hygiene facilities.[13] Pavlinac et al demonstrated that children in households without clean water and proper sanitation had a significantly higher risk of Shigella infection across multiple low-income regions.[14] Hossain et al, examining diarrhoeal admissions in Bangladesh, similarly highlighted a high burden of Shigella in low-income urban settlements, where poor sanitation infrastructure and overcrowding were major contributors.[15] Our findings reinforce the persistent relationship between socio-economic deprivation and enteric disease transmission. The overall Shigella isolation rate of 13.3% in this study is consistent with earlier findings from Bangladesh, where isolation rates have ranged between 10% and 20% depending on seasonal and population variations. Ferdous et al reported an isolation rate of 12.9% among paediatric diarrhoeal patients in Mirpur, Dhaka,[11] while Rahman et al found rates near 15% in rural

hospital settings.[12] Although improvements in sanitation and vaccination strategies have reduced the burden of other enteric pathogens, such as rotavirus, Shigella remains a persistent pathogen due to its low infectious dose and ease of person-to-person transmission.

**Limitations:**
A small sample size, a single-center design, and a short study duration limited the study. Additionally, limited representation of upper socio-economic groups and lack of longitudinal follow-up may affect generalizability.

**Conclusion:**
Shigella infection was detected in 13.3% of cases, occurring more often among children aged 1–5 years and in those from lower socio-economic backgrounds, though these associations were not statistically significant. Overall, the findings suggest that while Shigella infection appears more common in socio-economically disadvantaged groups, no strong association with age, gender, or socio-economic status was established.For future research, a larger sample size and multiple study sites would be included to improve representativeness and reliability. Longitudinal follow-up, detailed socio-economic assessments, and molecular characterization of Shigella strains with antibiotic resistance analysis are recommended.

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# Arthroscopic Evaluation Followed by Reconstruction of Both Anterior Cruciate Ligament (ACL) and Posterior Cruciate Ligament (PCL) Injuries

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Submission Date : 30 Nov 2025
Accepted Date : 05 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.89945

**Abstract**

**Background:**
Knee ligament injuries involving combined anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) lead to substantial instability, often affecting young, active individuals following high-energy trauma.

**Objective:**
This study aimed to evaluate the outcomes of arthroscopic assessment followed by reconstruction of both the ACL and PCL in patients with combined knee ligament injuries.

**Methods:**
This prospective observational study was conducted at the Nilphamari Medical College, from July 2024 to June, 2025. All 80 patients aged 18-50 years had MRI-confirmed combined injuries and underwent standardized arthroscopic techniques using hamstring or alternative grafts. Functional improvement was assessed at 3, 6, and 12 months.

**Results:**
Most patients were men, primarily injured in road traffic accidents, and arthroscopy frequently revealed associated meniscal and cartilage lesions. By 12 months, Lysholm, IKDC, and Tegner scores improved significantly, with high overall satisfaction and a substantial return to sports. Complications remained modest, mainly arthrofibrosis and residual instability.

**Conclusion:**
Arthroscopic reconstruction yielded strong short-term recovery and functional restoration when combined with timely surgery and structured rehabilitation.

**Keywords:** Arthroscopic reconstruction, ACL, PCL, Multiligament knee Injury, Functional Outcome

**Citation:** Miah MHA,Rahman MA.Arthroscopic Evaluation followed by Reconstruction of both anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) Injuries.J Rang Med Col.2026 Mar;11(1):21-26.doi: https://doi.org/10.3329/jrpmc.v11i1.89945

## Introduction:

Knee ligament injuries constitute a significant source of functional disability in young, active individuals, with the anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) serving as the principal stabilizers responsible for anterior–posterior control and rotational restraint. Rupture of either ligament causes symptomatic instability and impaired performance. At the same time, combined disruption leads to profound mechanical insufficiency, compromising basic weight-bearing and increasing the risk of long-term joint deterioration. Population-based data indicate that ACL injuries remain the most common severe knee ligament trauma, with an incidence of approximately 68.6 per 100,000 person-years and an apparent predilection for adolescents and young adults involved in pivoting or contact sports.[1] PCL injuries, though less frequent, still account for up to 17% of surgically treated knee ligament cases in large registries, typically arising from high-energy trauma such as

motor vehicle collisions or forceful posterior translation of the tibia during sports.[2] Combined ACL–PCL injuries represent a severe subset of multiligament knee trauma often associated with knee dislocation. These injuries create multidirectional instability that exceeds the functional loss observed with isolated ligament tears, and patients frequently experience difficulty with routine ambulation, rapid fatigue, and recurrent giving-way episodes.[3] The injury burden falls disproportionately on individuals in their second to fourth decades of life, a period marked by peak occupational demands and sports participation. Recent evidence from both global and regional studies highlights consistent patterns: male predominance in absolute numbers, high contribution from football, basketball, and cricket, and a substantial proportion linked to road traffic accidents.[4,5] The long-term consequences of inadequately managed bicruciate injuries are substantial. Multiligament knee injuries significantly accelerate the development of post-traumatic osteoarthritis, with structural degeneration observed even after reconstruction in a notable fraction of patients.[6] Functional recovery is also variable; studies show that only about 60–75% of patients return to pre-injury occupational or sports activity, underscoring the complexity of restoring physiological knee stability after bicruciate trauma.[6] These challenges reinforce the need for effective surgical strategies, and arthroscopic reconstruction remains the preferred modality due to its ability to visualize intra-articular pathology comprehensively while enabling precise graft placement. Despite increased interest, management of multiligament knee injuries still lacks uniform consensus, particularly regarding timing and technique of reconstruction.[7] Evidence from diverse healthcare settings suggests that outcomes may vary considerably depending on available resources and surgeon expertise. Consequently, region-specific data remains essential to guide practice. Therefore, the present study was undertaken to evaluate the outcomes of arthroscopic assessment followed by reconstruction of both the ACL and PCL in patients with combined ligament injuries of the knee at a tertiary care center.

**Methods:**

This prospective observational study was conducted at the Nilphamari Medical College, from July 2024 to June, 2025. A total of 80 patients aged 18–50 years with MRI-confirmed bicruciate ligament injuries were included, while those with isolated ligament injuries, associated fractures, osteoarthritis, or revision surgeries were excluded. Ethical approval was obtained from the institutional review board, and informed written consent was taken from all participants. Preoperative assessment included detailed history, clinical examination, and MRI evaluation of both ligaments and associated intra-articular pathology. Baseline functional status was recorded using the Lysholm Knee Score,[8] International Knee Documentation Committee (IKDC) subjective score,[9] and Tegner Activity Scale.[10] Demographic data, including age, sex, side of injury, mechanism of injury, time since trauma, and body mass index (BMI), were also collected. All surgeries were performed arthroscopically under regional or general anesthesia. Femoral fixation was achieved with Endobuttons or interference screws, and tibial fixation with interference screws or screw–washer constructs. Graft tensioning and tunnel positioning were standardized to restore anatomical alignment and knee stability. Postoperative management followed a uniform rehabilitation protocol emphasizing early range-of-motion (ROM) exercises and quadriceps strengthening. Partial weight bearing began at 6-8 weeks, progressing to full weight bearing by 12 weeks. Return to light sports activity was permitted around six months post-surgery, with full return to pre-injury activity at approximately one year, depending on recovery and knee stability. Patients were followed up at 3, 6, and 12 months after surgery. Data were analyzed using SPSS software (version 26.0). Continuous variables were expressed as mean±standard deviation (SD), while categorical variables were presented as frequencies and percentages. Preoperative and postoperative functional scores were compared using paired t-tests. Correlations between intraoperative findings (meniscal injury, cartilage lesion grade, and surgical delay) and outcomes were analyzed using Pearson's correlation coefficient. Binary logistic regression was applied to identify

independent predictors of poor functional outcome, defined as Lysholm <85 or IKDC <80 at 12 months. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated, and a p-value <0.05 was considered statistically significant.

**Results:**

The study included 80 patients with combined ACL and PCL injuries, predominantly young males (80.0%), with most injuries resulting from road-traffic accidents (70.0%). A large proportion had complete ACL tears (78.8%) and complete PCL tears (67.5%), while associated meniscal injury was frequent, particularly medial tears (47.5%). Cartilage lesions were also common, with 27.5% showing Grade I–II damage and 15.0% demonstrating more advanced Grade III–IV lesions (Table-I). Hamstring autografts were the most frequently used grafts for both ACL (73.8%) and PCL (76.2%) reconstructions. Endobutton fixation on the femoral side was used in 77.5%, and interference screw fixation on the tibial side in 86.2% of cases. Nearly one-third of surgeries (40.0%) exceeded 120 minutes (Table-II). Functional outcomes demonstrated consistent and significant improvement across all domains. The Lysholm score increased from 53.6±8.4 preoperatively to 89.2±6.5 at 12 months, while the IKDC score rose from 49.8±9.1 to 85.7±7.9; both changes were highly significant (p<0.001). Activity level, measured by the Tegner scale, improved from 2.1±0.9 to 5.3±1.2, and knee range of motion increased from 108±15 degrees to 135±7 degrees (p<0.001). Full weight-bearing was typically achieved by 12±3 weeks (Table-III). Complications occurred in 21.3% of patients, with arthrofibrosis (7.5%) and graft failure (5.0%) being the most frequent. These complications were associated with lower functional scores. Satisfaction outcomes were favorable, with 55 percent reporting excellent results and 72.5% returning to activity at 12 months (Table-IV). Correlation and regression analyses identified delayed surgery (>6 months), combined meniscal tears, severe cartilage lesions, and persistent instability as significant predictors of poorer functional outcomes, with adjusted odds ratios ranging from 2.43 to 3.06 (p<0.05). Age above 35 years showed a weaker, nonsignificant association (Table-V).

**Table-I: Baseline and intra-operative characteristics (N=80)**

| Variable | Category | no. (%) |
|---|---|---|
| Age (years) | <25 | 28(35.0) |
| | 25–35 | 34(42.5) |
| | >35 | 18(22.5) |
| Sex | Male | 64(80.0) |
| | Female | 16(20.0) |
| Mechanism of Injury | RTA | 56(70.0) |
| | Sports | 18(22.5) |
| | Fall | 6(7.5) |
| ACL Tear Pattern | Complete | 63(78.8) |
| | Partial | 17(21.2) |
| PCL Tear Pattern | Complete | 54(67.5) |
| | Partial | 26(32.5) |
| Meniscal Injury | Medial | 38(47.5) |
| | Lateral | 26(32.5) |
| | Both | 10(12.5) |
| | None | 6(7.5) |
| Cartilage Lesion | Grade I–II | 22(27.5) |
| | Grade III–IV | 12(15.0) |

**Table-II: Surgical reconstruction details (N=80)**

| Variable | Category | no. (%) |
|---|---|---|
| ACL Graft Used | Hamstring autograft | 59(73.8) |
| | BPTB autograft | 14(17.5) |
| | Allograft | 7(8.7) |
| PCL Graft Used | Hamstring autograft | 61(76.2) |
| | Allograft | 19(23.8) |
| Femoral Fixation | Endobutton | 62(77.5) |
| | Interference screw | 18(22.5) |
| Tibial Fixation | Interference screw | 69(86.2) |
| | Screw + washer | 11(13.8) |
| Duration of Surgery | <120 min | 48(60.0) |
| | ≥120 min | 32(40.0) |

**Table-III: Functional outcomes over time (N=80)**

| Measure | Preoperative | 3 months | 6 months | 12 months | p-value |
|---|---|---|---|---|---|
| Lysholm Score (Mean± SD) | 53.6±8.4 | 71.2±7.8 | 82.5±6.9 | 89.2±6.5 | <0.001 |
| IKDC Score (Mean±SD) | 49.8±9.1 | 68.5±8.6 | 79.3±7.2 | 85.7±7.9 | <0.001 |
| Tegner Scale | 2.1±0.9 | 3.8±1.1 | 4.7±1.0 | 5.3±1.2 | <0.001 |
| Knee ROM (°) | 108±15 | 124±10 | 132±8 | 135±7 | <0.001 |
| Time to full weight-bearing | - | - | - | 12±3 weeks | - |

**Table-IV: Complications, satisfaction, and return to activity (N=80)**

| Parameter | no. (%) |
|---|---|
| **Post-operative Complications** | |
| Any complication | 17(21.3) |
| Arthrofibrosis | 6(7.5) |
| Graft failure | 4(5.0) |
| Infection | 3(3.8) |
| Residual instability | 8(10.0) |
| **Functional Impact** | |
| Lysholm (no complication) | 91.3 |
| IKDC (no complication) | 55.4 |
| Lysholm (complication groups range) | 72.8–80.2 |
| IKDC (complication groups range) | 69.9–75.8 |
| **Satisfaction** | |
| Excellent | 55 |
| Good | 28.8 |
| Fair | 11.2 |
| Poor | 5 |
| **Return to Activity** | |
| Yes | 72.5 |
| No | 27.5 |

**Table-V: Predictors of poor functional outcome (Correlation + Regression)**

| Predictor | Statistical Measure | p-value |
|---|---|---|
| Meniscal injury severity | r=-0.54 | <0.01 |
| Cartilage lesion grade | r=-0.49 | <0.01 |
| Delay to surgery | r=-0.46 | <0.05 |
| Rehab duration | r=0.38 | <0.05 |
| Age | r=-0.21 | 0.12 |
| **Logistic Regression** | **Adjusted OR** | **p-value** |
| Delay >6 months | OR 3.06(1.20–7.82) | 0.014 |
| Combined meniscal tear | OR 2.64(1.10–6.33) | 0.021 |
| Cartilage Grade III–IV | OR 2.43(1.06–5.58) | 0.035 |
| Persistent instability | OR 2.51(1.05–6.02) | 0.041 |
| Age >35 years | OR 1.80(0.94–3.46) | 0.081 |

**Discussion:**

Simultaneous arthroscopic reconstruction of both the ACL and PCL demonstrated marked functional recovery in this cohort, with significant improvement in Lysholm and IKDC scores at 12 months. These findings reinforce evidence from earlier multicenter and registry-based studies showing that bicruciate reconstruction effectively restores knee stability and patient-reported outcomes when performed with standardized arthroscopic techniques.[11,12] The demographic profile in our study predominantly young males injured in high-energy mechanisms closely follows regional and global patterns of multiligament knee trauma, where road-traffic accidents remain the predominant cause in low- and middle-income settings, while sports-related injuries dominate in Western cohorts.[13,4] Intra-articular pathology was frequent, with 47.5% demonstrating medial meniscal tears and 27.5% presenting with cartilage lesions. These rates align with previous reports indicating that meniscal injury accompanies 50–80% of bicruciate ligament injuries.[14,15] Importantly, increasing severity of meniscal and chondral damage correlated with reduced functional scores, supporting existing evidence that concomitant intra-articular injury negatively affects medium- and long-term outcomes.[15,16] This highlights the need for comprehensive arthroscopic evaluation and timely management of associated lesions to optimize overall recovery. Surgical delay emerged as a significant determinant of outcome, as patients undergoing reconstruction after 6 months demonstrated lower ROM and lower functional scores. This observation mirrors prior systematic reviews and meta-analyses showing that delayed treatment is associated with capsular contracture, secondary meniscal tears, and cartilage degeneration, ultimately compromising postoperative recovery.[17] The exclusive or predominant use of hamstring autografts for both

ACL and PCL reconstruction in the present study aligns with widely adopted practice patterns. Prior comparative evidence suggests that, although graft type influences early recovery profiles, surgical technique, tunnel accuracy, and fixation strength are more influential determinants of outcome.[11,14,16] Functional outcomes in this cohort, Lysholm 89.2 and IKDC 85.7 at one year, were comparable to those previously reported in large series of bicruciate reconstructions, where typical Lysholm scores range between 85 and 95.[14,18] A similar ROM restoration (mean 135° at one year) reflects the benefit of structured, early rehabilitation, which has been consistently associated with a reduced risk of postoperative stiffness and improved functional recovery.[15,18] The complication rate of 21.3% in this study aligns with previously reported rates of 19–22% in the literature on complex knee reconstruction.[4,17] Arthrofibrosis, residual instability, and graft failure were the most frequent issues, yet none exceeded reported benchmarks. The presence of residual instability at three months independently predicted poorer functional outcomes, echoing past reports that early post-reconstruction laxity is an important prognostic factor.[12] Importantly, 72.5% of patients returned to activity at 12 months, a rate similar to reports indicating 70–80% return after bicruciate reconstruction.[18,19] Although these figures remain slightly inferior to isolated ACL reconstruction, they reflect acceptable recovery expectations given the complexity of the initial injury. Finally, the moderate association between rehabilitation duration and improved Lysholm scores reinforces the established principle that adherence to progressive physiotherapy significantly enhances functional recovery.[19] Collectively, the findings demonstrate that simultaneous arthroscopic ACL–PCL reconstruction provides predictable short-term restoration of knee function. Early surgery, meticulous management of associated meniscal and chondral injuries, and dedicated rehabilitation are critical determinants of optimal outcomes.

**Limitation:**

This study's limitations include a relatively small sample size and short-term follow-up of only 12 months, which may not reflect long-term outcomes like graft failure or osteoarthritis. The absence of a control group limits comparative analysis, and reliance on subjective scoring systems introduces possible bias.

**Conclusion:**

This study demonstrates that arthroscopic reconstruction of both the ACL and PCL using predominantly hamstring autografts yields excellent short-term functional outcomes, significant improvement in knee stability, and a high rate of return to activity. Early intervention, meticulous surgical technique, and structured rehabilitation were key contributors to success. Factors such as delayed surgery, associated meniscal or chondral injuries, and postoperative instability were found to negatively impact recovery. Overall, arthroscopic bicruciate reconstruction is a safe and effective approach that restores knee function to near-normal levels in most patients.

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# Viral Skin Infections in Diabetes: Age, Socioeconomic, and Glycemic Correlates in a Bangladeshi Cohort

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Submission Date : 05 Dec 2025
Accepted Date : 05 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.89946

**Abstract**

**Background:**
Diabetes mellitus increases susceptibility to viral skin infections through impaired immunity, yet evidence from low-income settings is scarce.

**Objective:**
This study examined demographic, socioeconomic, and glycemic correlates of viral skin infections among diabetic patients in Bangladesh.

**Methods:**
This cross-sectional study was conducted among 173 diabetic patients with clinically confirmed viral skin infections at the Department of Dermatology, BIRDEM General Hospital, Dhaka, Bangladesh from June 2024 to July 2025. Demographic variables, socioeconomic status (SES), environmental exposures, and glycemic control were analyzed.

**Results:**
Young adults constituted the largest group (45.7%), and males predominated (64.2%). Uncontrolled glycemia was observed in 46.2% of cases. Lower SES was strongly associated with herpes zoster (61.3%) and genital herpes (61.0%). Multivariable analysis identified low SES (aOR 2.60, 95% CI 1.40–4.85), uncontrolled diabetes (aOR 2.25, 95% CI 1.20–4.25), slum residence (aOR 2.35), and jail confinement (aOR 2.50) as independent predictors.

**Conclusion:**
Viral skin infections in diabetic patients are shaped by socioeconomic vulnerability and poor glycemic control.

**Keywords:** Diabetes Mellitus, Viral Skin Infections, Socioeconomic Status, Glycemic Control, Bangladesh

**Citation:** Khan MM,Mou I,Ahsan K.Viral Skin Infections in Diabetes: Age, Socioeconomic, and Glycemic Correlates in a Bangladeshi Cohort.J Rang Med Col.2026 Mar;11(1):27-32.doi: https://doi.org/10.3329/jrpmc.v11i1.89946

## Introduction:

Diabetes mellitus affects hundreds of millions worldwide and continues to rise sharply, bringing with it a broad spectrum of infectious complications that extend beyond classical metabolic and vascular outcomes.[1] Immune dysfunction driven by chronic hyperglycemia contributes directly to this heightened susceptibility; impaired neutrophil function, reduced chemotaxis, and altered cell-mediated immunity together weaken host defenses and facilitate a broad range of infections.[2] Skin infections are among the earliest and most visible manifestations of this vulnerability, often signaling poor glycemic control and compromised systemic immunity.[3] Within this spectrum, viral skin infections represent a clinically significant yet under-recognized burden in diabetic populations. Conditions such as herpes zoster, herpes simplex, molluscum contagiosum, and pityriasis rosea frequently present with more severe, prolonged, or atypical manifestations in patients with diabetes.[4] Population-based data further indicate that diabetic adults are at elevated risk of herpes zoster and its complications, including prolonged healing and post-herpetic neuralgia, underscoring the synergistic impact of impaired immunity and metabolic stress.[5] These infections can also recur more frequently in individuals with poor glycemic control, illustrating a direct biological link

between viral activity and chronic hyperglycemia.In low- and middle-income countries, the dermatological burden of diabetes intersects with socioeconomic constraints. Crowded living environments, limited hygiene infrastructure, and variable access to healthcare amplify the risk of communicable skin diseases, including viral infections. Bangladeshi households in lower socioeconomic strata consistently report higher infection prevalence across multiple communicable disease domains, reflecting the structural drivers that shape exposure and access to treatment.[6,7] These conditions create a setting in which diabetes and poverty function synergistically, increasing the frequency and severity of skin infections.Glycemic control remains a central determinant of infection susceptibility. Elevated HbA1c weakens innate and adaptive immune pathways and compromises skin barrier integrity, raising the likelihood of recurrent or extensive viral lesions. Clinical studies show significant associations between poor glycemic control and a range of dermatological manifestations in type 2 diabetes, supporting the concept of skin disease as both a marker and consequence of inadequate metabolic regulation.[8] Despite the epidemiological importance of these infections, data from South Asia remain limited. Few studies examine viral skin infections among diabetic patients within Bangladesh's socioeconomic and demographic realities. This study, therefore, investigates the prevalence and correlates of viral skin infections in a diabetic cohort, emphasizing age distribution, socioeconomic background, and glycemic control.

**Methods:**

This cross-sectional study was conducted in the Department of Skin and Venereal Diseases, BIRDEM General Hospital, Dhaka, Bangladesh, during one year from June 2024 to July 2025. A total of 173 diabetic patients with viral skin infections were included during the study period. Ethical clearance was obtained from the Institutional Review Board, and informed written consent was taken from all participants. Viral skin infections were diagnosed clinically and confirmed independently by two consultant dermatologists. Data were collected on age, sex, socioeconomic status (SES), residence type (urban/slum), duration and control of diabetes, and seasonal occurrence. Glycemic control was assessed using fasting blood glucose and HbA1c, with uncontrolled diabetes defined according to standard thresholds. Socioeconomic status was classified based on household income, education, and occupation. Viral infections recorded included herpes zoster, herpes simplex, molluscum contagiosum, pityriasis rosea, and chickenpox. Data were analyzed using SPSS (v-26.0) descriptive statistics for frequency, proportion, and mean values. Correlations between viral infections and SES, residence, and glycemic control were assessed using Pearson's correlation. Logistic regression was applied to estimate odds ratios (OR) with 95% confidence intervals (CI). Results were summarized in tables, heatmaps, network diagrams, and forest plots.

**Results:**

The study evaluated 173 patients with diabetes and viral skin infections. Most participants were 25-54 years old, accounting for 63.8% of the cohort, and males accounted for 64.2% of all cases. Slum environments were the predominant source of exposure (26.0%), followed by linen or towel sharing (20.2%) and jail settings (13.3%). Nearly half of all patients (46.2%) had uncontrolled glycemic levels, while only 20.2% maintained strict glycemic control (Table-I). Socioeconomic disparities were evident across all viral diseases. Among individuals with herpes zoster, 61.3% belonged to the lower socioeconomic group, compared with 20.0% in the middle and only 5.3% in the higher SES categories (p=0.032). Similar trends were observed for pityriasis rosea, molluscum contagiosum, and genital herpes, in which lower SES accounted for 50.0%, 52.0%, and 61.0% of cases, respectively (p-values 0.029–0.041). Chickenpox showed a milder gradient, yet 40.0% of cases occurred among participants with lower SES (p=0.044) (Table-II). Sources of infection also differed significantly by sex. Among those infected from slum areas, 62.2% were male. Linen or towel transmission showed a similar pattern, with 65.7% of cases among men. Jail-related infections displayed a male distribution of 65.2%, while husband/wife transmission accounted for 65.0% male cases (p-values 0.027–0.046) (Table-III). Glycemic status demonstrated a clear relationship

with infection distribution. For herpes zoster, 46.7% of cases occurred in individuals with uncontrolled glycemia, compared with 33.3% in the controlled group and only 20.0% in the strictly controlled group. Pityriasis rosea and molluscum contagiosum followed the same pattern, with 50.0% and 48.0% of cases occurring in uncontrolled patients, respectively (Table-IV). Multivariable logistic regression confirmed these associations. Lower SES significantly increased infection risk (AOR 2.60, 95% CI 1.40–4.85), and uncontrolled glycemic status raised odds by more than twofold (AOR 2.25, 95% CI 1.20–4.25). Certain diseases, particularly herpes zoster (AOR 2.80) and genital herpes (AOR 2.45), carried higher risks relative to chickenpox. Source exposures such as jail (AOR 2.50) and slum environments (AOR 2.35) were also strong predictors of viral skin infections (Table-V).

**Table-I: Baseline characteristics of the study population (N=173)**

| Characteristic | Category | no. (%) |
|---|---|---|
| Age group (years) | 15–24 | 38(22) |
| | 25–34 | 40(23.7) |
| | 35–44 | 35(20.2) |
| | 45–54 | 35(20.2) |
| | 55–64 | 22(12.7) |
| | 65+ | 8(4.6) |
| Sex | Male | 111(64.2) |
| | Female | 62(35.8) |
| Source of infection | Slum areas | 45(26) |
| | Linen/towel | 35(20.2) |
| | Jail | 23(13.3) |
| | Husband/Wife | 20(11.6) |
| | School | 15(8.7) |
| | Playing partner | 10(5.8) |
| Glycemic level | Strictly controlled | 35(20.2) |
| | Controlled | 58(33.5) |
| | Uncontrolled | 80(46.2) |

**Table-II: Distribution of viral skin diseases by socioeconomic status (N=173)**

| Disease | Lower no.(%) | Middle no.(%) | Upper Middle no.(%) | Higher no.(%) | Total | p-value |
|---|---|---|---|---|---|---|
| Herpes zoster | 46(61.3) | 15(20.0) | 10(13.3) | 4(5.3) | 75 | 0.032 |
| Pityriasis rosea | 15(50.0) | 10(33.3) | 3(10.0) | 2(6.7) | 30 | 0.041 |
| Molluscum contagiosum | 13(52.0) | 8(32.0) | 2(8.0) | 2(8.0) | 25 | 0.038 |
| Genital herpes | 14(61.0) | 6(26.1) | 2(8.7) | 1(4.3) | 23 | 0.029 |
| Chickenpox | 8(40.0) | 5(25.0) | 4(20.0) | 3(15.0) | 20 | 0.044 |

**Table-III: Distribution of infection sources by sex (N=173)**

| Source of Infection | Male no. (%) | Female no. (%) | Total | p-value* |
|---|---|---|---|---|
| School | 10(66.7) | 5(33.3) | 15 | 0.042 |
| Jail | 15(65.2) | 8(34.8) | 23 | 0.038 |
| Slum areas | 28(62.2) | 17(37.8) | 45 | 0.027 |
| Linen/Towel | 23(65.7) | 12(34.3) | 35 | 0.031 |
| Husband/Wife | 13(65.0) | 7(35.0) | 20 | 0.034 |
| Playing partner | 5(50.0) | 5(50.0) | 10 | 0.046 |

**Table-IV: Distribution of viral skin diseases by glycemic level (N=173)**

| Disease | Strictly Controlled no.(%) | Controlled no.(%) | Uncontrolled no.(%) | Total |
|---|---|---|---|---|
| Herpes zoster | 15(20.0) | 25(33.3) | 35(46.7) | 75 |
| Pityriasis rosea | 5(16.7) | 10(33.3) | 15(50.0) | 30 |
| Molluscum contagiosum | 6(24.0) | 7(28.0) | 12(48.0) | 25 |
| Genital herpes | 6(26.1) | 7(30.4) | 10(43.5) | 23 |
| Chickenpox | 3(15.0) | 9(45.0) | 8(40.0) | 20 |

**Table-V: Multivariable logistic regression of risk factors for viral skin infections (N=173)**

| Predictor | Adjusted OR (95% CI) | p-value |
|---|---|---|
| **Socioeconomic Status** | | |
| Lower vs non-lower | 2.60(1.40–4.85) | 0.003 |
| **Glycemic Control** | | |
| Controlled vs Strict | 1.90(1.08–3.40) | 0.027 |
| Uncontrolled vs Strict | 2.25(1.20–4.25) | 0.012 |
| **Disease Type** | | |
| Herpes zoster vs Chickenpox | 2.80(1.25–6.35) | 0.013 |
| Genital herpes vs Chickenpox | 2.45(1.10–5.60) | 0.031 |
| Molluscum contagiosum vs Chickenpox | 2.00(1.05–3.85) | 0.038 |
| Pityriasis rosea vs Chickenpox | 1.75(1.02–2.95) | 0.041 |
| **Source of Infection** | | |
| Slum vs School | 2.35(1.15–4.82) | 0.019 |
| Linen/Towel vs School | 1.95(1.02–3.74) | 0.042 |
| Husband/Wife vs School | 2.10(1.05–4.25) | 0.037 |
| Jail vs School | 2.50(1.20–5.15) | 0.014 |
| Playing partner vs School | 1.85(1.01–3.40) | 0.046 |

**Discussion:**

The present study examined the distribution and determinants of viral skin infections among diabetic patients in a Bangladeshi cohort, focusing on age, sex, socioeconomic status, exposure sources, and glycemic control. Younger adults accounted for a substantial proportion of cases, and males accounted for nearly two-thirds of the sample. Similar male predominance has been reported for communicable and hygiene-related diseases in disadvantaged Bangladeshi communities, where men are more exposed to crowded public and occupational environments.[6,7] Although many skin disease surveys emphasize the burden in older adults,[12] our findings indicate that, in the context of diabetes, viral infections also cluster among younger working-age groups who are frequently mobile and socially exposed. Socioeconomic gradients were striking. Across all viral entities, more than half of cases occurred in the lower-SES group, and lower SES remained a strong independent predictor in multivariable models. This pattern is consistent with Bangladeshi and regional evidence that poverty, crowding, and inadequate hygiene infrastructure increase the risk of communicable diseases.[6-9] Informal settlements and urban slums have been identified as hotspots for infectious pathogens and antimicrobial resistance, reflecting intense environmental transmission in settings with limited WASH services.[9] Our findings extend this literature by showing that, in diabetics, these structural disadvantages translate into a higher burden of viral skin disease. Glycemic control emerged as a key modifiable determinant. Nearly half of all patients had uncontrolled diabetes, and this group contributed the largest share of each viral infection type. Previous reviews of invasive and cutaneous infections in diabetes describe similar relationships between chronic hyperglycemia, impaired innate and adaptive immunity, and infection risk.[8-10] A cross-sectional study has demonstrated that poorer glycemic control is associated with a higher frequency of skin manifestations in type 2 diabetes, supporting the role of HbA1c as a clinical marker of dermatologic risk.[11] Our regression models, which show that controlled and uncontrolled glycemia both conferred significantly higher odds of infection relative to strict control, reinforce the importance of intensive metabolic management. The observed correlation between lower SES and uncontrolled glycemia highlights how social disadvantage shapes biological vulnerability. Studies from Bangladesh and other LMIC urban slums show that low income, food insecurity, and limited access to chronic disease care contribute to unfavorable glycemic trajectories in type 2 diabetes.[12,13] In such settings, diabetes rarely occurs in isolation; instead, it is embedded in a syndemic context of stress, infection, and social adversity that amplifies morbidity.[14] Global reviews have emphasized this double burden of diabetes and infection in low

and middle-income countries and have called for integrated models of care that combine metabolic control with infection prevention.[15] In this cohort, environmental exposures such as slum residence, jail confinement, and household or intimate contact remained independent risk factors even after adjustment. These findings, together with the strong SES and glycemic effects, suggest that viral skin infections in diabetic patients are shaped by intersecting structural, behavioral, and biological determinants. Targeted interventions must therefore couple strict glycemic management with improved hygiene, decongestion of high-risk environments, and focused screening of diabetics living in urban slums or other vulnerable settings in Bangladesh.

**Limitations:**

This cross sectional, single center study cannot establish causality and may not be fully generalizable to all diabetic patients in Bangladesh. Key exposures and socioeconomic status were self-reported, and diagnoses were primarily clinical, so recall bias and misclassification are possible. Important confounders, such as nutritional status and detailed immune parameters, were not measured and could have influenced the associations observed.

**Conclusion:**

This study highlights the multifactorial vulnerability of diabetic patients to viral skin infections in a Bangladeshi cohort, shaped by the intersection of poor glycemic control, socioeconomic disadvantage, and environmental exposures. Herpes zoster and genital herpes emerged as the most clinically significant infections, strongly associated with both uncontrolled diabetes and lower SES, while molluscum contagiosum and pityriasis rosea were moderately linked to environmental risk factors such as slum residence. Male predominance across most sources of infection, combined with the clustering of glycemic and socioeconomic disadvantage, underscores the role of both biological and social determinants in shaping infection risk. These findings reinforce the urgent need for integrated interventions that combine clinical glycemic management with targeted public health strategies addressing hygiene, overcrowding, and healthcare access inequities in low- and middle-income settings like Bangladesh. By doing so, the burden of preventable viral infections in this high-risk population may be significantly reduced.

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# Post Tonsillectomy Secondary Haemorrhage Cold Versus Hot Method

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Submission Date : 08 Dec 2025
Accepted Date : 05 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.89947

**Abstract**

**Background:**
Tonsillectomy is a frequently performed otolaryngological procedure for recurrent infections or obstructive symptoms. The surgical technique may affect bleeding risk.

**Objective:**
The study aimed to compare post-tonsillectomy secondary haemorrhage incold versus hot tonsillectomy techniques.

**Methods:**
This prospective study was conducted at an otolaryngology unit in North Bengal Medical College & Hospital, Sirajganj, Bangladesh on 90 consecutive patients underwent tonsillectomy or adenotonsillectomy, from January, 2023 to December, 2023, 45 by cold steel dissection and 45 by hot electrosurgical technique. Baseline factors and preoperative Hb and platelet counts were recorded.

**Results:**
Both groups were comparable in demographics and baseline clinical factors, including indication, recent URTI, NSAID exposure, hemoglobin, and platelet count (all $p>0.05$). Haemostasis differed significantly: ties were used more in the cold group (48.9% vs 13.3%) and bipolar diathermy more in the hot group (75.6% vs 40.0%) ($p<0.001$). Operative time was similar, but blood loss was lower with the hot technique (median 26 vs 43 mL, $p<0.001$).

**Conclusion:**
Hot tonsillectomy significantly reduced intraoperative blood loss with similar primary haemorrhage, but showed a higher, non-significant trend toward secondary haemorrhage and related interventions compared with cold dissection.

**Keywords:** Post-tonsillectomy haemorrhage, Tonsillectomy technique, Cold dissection, Bipolar diathermy

**Citation:** Khan KR,Islam S,Islam I.Post Tonsillectomy Secondary Haemorrhage Cold Versus Hot Method.J Rang Med Col.2026 Mar;11(1):33-38.doi: https://doi.org/10.3329/jrpmc.v11i1.89947

## Introduction:

Tonsillectomy, with or without adenoidectomy, is among the most frequently performed otolaryngologic procedures globally, especially in pediatric and adolescent populations. The primary indications are recurrent throat infections and sleep-disordered breathing associated with adenotonsillar hypertrophy.[1] Although considered routine, this operation is associated with significant morbidity. Post-tonsillectomy haemorrhage is the most serious complication, as it may occur unpredictably, necessitate emergency readmission, and, in rare cases, result in life threatening airway compromise.[2,3] Haemorrhage is classified as primary if it occurs within 24 hours, or secondary if it occurs after 24 hours, with a peak incidence during the first postoperative week when the eschar separates.[2] The reported incidence of haemorrhage varies depending on definitions, patient populations, and surveillance methods. However, recent data indicate that both primary and secondary bleeding continue to pose significant quality and safety challenges across health systems.[2,3]

Surgical technique is a primary source of variability in tonsillectomy outcomes. “Cold” tonsillectomy, typically involving cold steel dissection with cold haemostasis or ties, is contrasted with “hot”

techniques that utilize thermal energy for dissection or haemostasis, such as mono- and bipolar electrocautery and other energy-based systems. Hot techniques may decrease intraoperative blood loss and occasionally reduce operative time. However, thermal injury to adjacent tissues has been proposed to increase the risk of delayed sloughing and secondary haemorrhage, rendering the overall safety profile dependent on clinical context.[3-5] Evidence from randomized and comparative studies is mixed: some trials indicate more favorable postoperative recovery with cold techniques compared to bipolar electrocautery, while others report similar bleeding outcomes but differences in pain, healing, and resource utilization.[4,5] Large-scale quality register analyses and quality-improvement data from Nordic countries further indicate that meticulous cold dissection and cold haemostasis may reduce readmission rates for secondary haemorrhage. These findings underscore the importance of technique standardization and surgeon training, in addition to device selection.[3] Patient-specific factors, including age, sex, smoking status, and perioperative NSAID exposure, have also been associated with haemorrhage risk in observational studies, emphasizing the necessity of interpreting technique effects in the context of baseline patient risk.[2,6]

Significant evidence gaps persist in low- and middle-income settings, including South Asia, where variations in practice patterns, haemostasis preferences, perioperative analgesic protocols, and criteria for readmission or return to theatre may differ from those observed in high-income registry environments. Regional open-access studies comparing energy-based surgical techniques, such as coblation and bipolar electrocautery, indicate that postoperative bleeding and pain outcomes vary across centres and populations, highlighting the necessity for locally relevant comparative data.[7-9] Furthermore, ongoing multicentre investigations into haemorrhage following newer thermal modalities indicate continued uncertainty and emphasize the need for robust and standardized outcome assessment.[10]Against this background, the study aimed to compare cold versus hot tonsillectomy techniques regarding the incidence of post-tonsillectomy secondary haemorrhage.

**Methods:**

This prospective study was conducted at an otolaryngology unit in North Bengal Medical College & Hospital, Sirajganj, Bangladesh, Bangladesh over one year, from January, 2023 to December, 2023. Consecutive patients undergoing tonsillectomy or adenotonsillectomy for recurrent tonsillitis or obstructive symptoms were enrolled; 90 participants were included, 45 in the cold dissection group and 45 in the hot technique group. Exclusion criteria were known bleeding disorders, inability to withhold antiplatelet or anticoagulant drugs, acute infection requiring postponement, and missing baseline tests. Baseline data included age, sex, residence, indication for surgery, upper respiratory tract infection within the preceding two weeks, and NSAID exposure within seven days.

Preoperative hemoglobin and platelet counts came from routine laboratory tests. Cold tonsillectomy was performed by steel dissection with hemostasis mainly by ligatures, with selective diathermy when required. Hot tonsillectomy used electrosurgical dissection, predominantly bipolar diathermy, with monopolar diathermy as needed. Operative duration (from mouth gag insertion to removal) and estimated blood loss were recorded. Discharge day and prescribed antibiotics, NSAIDs, and steroids were documented. Primary hemorrhage was defined as bleeding within 24 hours; secondary hemorrhage as bleeding after 24 hours up to postoperative day 14. Clinically significant secondary hemorrhage was bleeding requiring emergency review, readmission, operative hemostasis, or transfusion. Data were analyzed using SPSS (v-26.0); categorical variables were compared with chi-square or Fisher's exact test, and continuous variables with independent t-test or Mann-Whitney U test, as appropriate. A two-sided p-value $<0.05$ was considered significant.

**Results:**

Table-I showed both groups were comparable demographically: most patients were 11–18 years, 53.3% in the cold group versus 55.6% in the hot group, mean age was similar, 14.89±7.35 vs 15.07±7.50 years, p=0.91, males slightly predominated, 53.3% vs 57.8%, p=0.671, and most participants were from rural areas, 60.0% vs 55.6%, p=0.67.

**Table-I: Socio-demographic characteristics of patients undergoing tonsillectomy, by surgical technique (N=90)**

| Socio-demographics | Cold (n=45) no.(%) | Hot (n=45) no.(%) | p value |
|---|---|---|---|
| **Age (years)** | | | |
| ≤10 | 13(28.9) | 12(26.7) | 0.97 |
| 11–18 | 24(53.3) | 25(55.6) | |
| >18 | 8(17.8) | 8(17.8) | 0.91 |
| Mean±SD | 14.89 ± 7.35 | 15.07 ± 7.50 | |
| **Sex** | | | |
| Male | 24(53.3) | 26(57.8) | 0.671 |
| Female | 21(46.7) | 19(42.2) | |
| **Residence** | | | |
| Urban | 18 (40.0) | 20 (44.4) | 0.67 |
| Rural | 27 (60.0) | 25 (55.6) | |

Table-II indicated similar baseline clinical profiles: recurrent tonsillitis was the leading indication, 66.7% in cold vs 62.2% in hot, p=0.90, recent URTI was reported in 13.3% vs 15.6%, p=0.764, preop NSAID exposure was low, 6.7% vs 8.9%, and antiplatelet or anticoagulant use was rare, 2.2% in both groups, mean Hb, 12.63 vs 12.42 g/dL, and platelet counts, 265.87 vs 270.67 $\times 10^9$/L, were comparable, p>0.05.

**Table-II: Clinical profile and preoperative factors (N=90)**

| Variable | Cold (n=45) no.(%) | Hot (n=45) no.(%) | p value |
|---|---|---|---|
| **Indication for surgery** | | | |
| Recurrent tonsillitis | 30(66.7) | 28(62.2) | 0.9 |
| Obstructive symptoms | 13(28.9) | 15(33.3) | |
| Other | 2(4.4) | 2(4.4) | |
| Recent URTI (within 2 weeks) | 6(13.3) | 7(15.6) | 0.764 |
| Preop NSAID use (within 7 days) | 3(6.7) | 4(8.9) | 1 |
| Antiplatelet or anticoagulant use | 1(2.2) | 1(2.2) | 1 |
| Hb(g/dL), Mean±SD | 12.63±1.07 | 12.42±0.83 | 0.287 |
| Platelet ($\times 10^9$/L), Mean±SD | 265.87±60.65 | 270.67±49.36 | 0.682 |

Table-III highlighted differences in intraoperative haemostasis practice: procedure type distribution was similar, tonsillectomy alone 71.1% vs 66.7%, p=0.649, but ties were used much more often in the cold group, 48.9% vs 13.3%, while bipolar diathermy predominated in the hot group, 75.6% vs 40.0%, overall difference p<0.001.

**Table-III: Operative characteristics, including procedure type and primary haemostasis technique, by surgical technique (N=90)**

| Variable | Cold (n=45) no.(%) | Hot (n=45) no.(%) | p value |
|---|---|---|---|
| **Procedure type** | | | |
| Tonsillectomy | 32 (71.1) | 30 (66.7) | 0.649 |
| Adenotonsillectomy | 13 (28.9) | 15 (33.3) | |
| **Primary hemostasis technique** | | | |
| Ties | 22 (48.9) | 6 (13.3) | <0.001 |
| Bipolar diathermy | 18 (40.0) | 34 (75.6) | |
| Monopolar diathermy | 5 (11.1) | 5 (11.1) | |

Operative efficiency and blood loss patterns: median operative time was slightly shorter with hot technique, 30 vs 32 minutes, p=0.08, while estimated blood loss was significantly lower in the hot group, 26(20–34) mL vs 43(34–55) mL, p<0.001, primary haemorrhage within 24 hours was uncommon and equal, 2.2% in each arm, discharge was typically on day 1 in both groups, and postoperative medications were similar, antibiotics about 71–73%, NSAIDs 18–22%, steroids 22–27%, all p>0.05 (Table-IV).

**Table-IV: Perioperative course and immediate postoperative management (N=90)**

| Variable | Cold (n=45) no.(%) | Hot (n=45) no.(%) | p value |
|---|---|---|---|
| Duration of surgery (min), Median (IQR) | 32(27–39) | 30 (26–35) | 0.08 |
| Estimated blood loss (mL), Median (IQR) | 43(34–55) | 26 (20–34) | <0.001 |
| Primary haemorrhage, within 24h | 1(2.2) | 1(2.2) | 1 |
| Discharge day, Median (IQR) | 1(1–1) | 1(1–1) | 0.754 |
| Postop antibiotics given | 32 (71.1) | 33 (73.3) | 0.816 |
| Postop NSAID prescribed | 8 (17.8) | 10 (22.2) | 0.603 |
| Postop steroid given | 10 (22.2) | 12 (26.7) | 0.626 |

Secondary haemorrhage was more frequent after the hot technique, 17.8% vs 6.7%, p=0.108. Clinically significant bleeding, readmission, and return to OT were also higher in the hot group, 8.9% vs 2.2%, 13.3% vs 4.4%, and 6.7% vs 2.2%, respectively, but all were non-significant, p>0.05. Only one patient required transfusion, in the hot group (Table-V).

**Table-V: Secondary haemorrhage outcomes (N=90)**

| Outcome | Cold (n=45) no.(%) | Hot (n=45) no.(%) | p value |
|---|---|---|---|
| Secondary haemorrhage, any | 3(6.7) | 8(17.8) | 0.108 |
| Clinically significant secondary haemorrhage | 1(2.2) | 4(8.9) | 0.361 |
| Readmission for bleeding | 2(4.4) | 6(13.3) | 0.266 |
| Return to OT for haemostasis | 1(2.2) | 3(6.7) | 0.616 |
| Blood transfusion required | 0(0.0) | 1(2.2) | 1 |

**Discussion:**

In this comparative series of 90 tonsillectomies, the cold and hot groups were well matched for age, sex, residence, indication, recent upper respiratory tract infection, and baseline hematologic indices. This comparability supports the attribution of observed outcome differences to operative technique rather than case mix. The cohort primarily comprised adolescents aged 11 to 18 years, a group consistently associated with higher rates of secondary post-tonsillectomy haemorrhage (PTH) compared to younger children. This elevated background risk is clinically relevant when interpreting bleeding events in both groups.[11,12] Intraoperatively, the hot technique demonstrated a clear advantage in haemostatic efficiency, with significantly lower estimated blood loss (median 26 mL vs 43 mL; p<0.001) and a trend toward shorter operative time (30 vs 32 minutes; p=0.08). These findings are consistent with randomized and comparative studies indicating that bipolar electrocautery reduces intraoperative blood loss and often shortens operative time relative to cold dissection, although downstream morbidity, particularly pain and delayed bleeding, varies across studies and devices.[13-15] Broader syntheses further emphasize that 'hot' technologies are heterogeneous, with outcomes influenced by energy modality, extent of tissue thermal spread, and the method of haemostasis, whether by suture or ligation compared to diathermy.[16-18]

The most clinically significant finding in this dataset is the higher secondary haemorrhage rate observed following the hot technique (17.8% vs 6.7%), accompanied by increases in clinically significant bleeding, readmission, and return to theatre. Although these differences did not reach statistical significance, this may be attributable to limited statistical power. Large registry analyses provide additional context. For example, the Swedish National Tonsil Surgery Register found that 'hot haemostasis' and other hot techniques were associated with higher rates of late PTH compared to cold steel dissection with cold haemostasis, with substantially increased relative risks for several hot modalities.[16] Notably, Table 3 demonstrates that haemostasis practices differed significantly between groups; ties were used more frequently in the cold arm, while bipolar diathermy was predominant in the hot arm (overall p<0.001). Registry and comparative studies indicate that the haemostasis strategy itself is a key determinant of delayed bleeding risk, likely due to thermal injury, eschar formation, and subsequent sloughing during the typical secondary bleeding window.[16,19,20] The age distribution of the cohort may further amplify this effect, as studies of bipolar-based techniques report substantially higher secondary haemorrhage rates in patients aged 15 years and older, regardless of primary indication and observational studies similarly note increased bleeding risk with advancing age.[11,12]

These findings support a nuanced approach to technique selection. When minimizing intraoperative blood loss is a priority, hot techniques remain advantageous; however, surgeons should mitigate delayed bleeding risk by limiting thermal spread, employing the lowest effective energy, and considering selective ligation, particularly in adolescents and adults.[12,16,20] In resource-limited settings, 'cold dissection plus secure, low-thermal haemostasis' may provide a safer profile for delayed bleeding, while still allowing for selective use of diathermy when intraoperative haemostasis is difficult. The lack of differences in primary haemorrhage and discharge timing aligns with evidence that early bleeding is uncommon and that most technique-related differences manifest in delayed outcomes. This underscores the importance of comprehensive discharge counselling and rapid access pathways for secondary bleeding events.[17,20]

**Limitations:**

The study's limitations include its single-center design and modest sample size, which reduced statistical power to detect differences in secondary haemorrhage. Technique allocation was not randomized, and haemostasis methods varied between groups, introducing potential

confounding factors. Outcomes were derived from routine clinical documentation, which may have resulted in missed minor bleeding events managed outside the hospital.

**Conclusion:**

Cold and hot tonsillectomy had similar baseline profiles and comparable primary haemorrhage rates. The hot technique significantly reduced intraoperative blood loss but showed a higher, non-significant trend toward secondary haemorrhage and related interventions, suggesting careful haemostasis strategy and close postoperative counselling are particularly important when using hot techniques.Use hot tonsillectomy when minimizing intraoperative blood loss is a priority, but apply low-energy, targeted diathermy and consider supplementary ligation to reduce thermal injury, especially in adolescents and adults. Strengthen discharge counselling and ensure rapid-access pathways for delayed bleeding.

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Open access Original article

# Comparison of Hemodynamic Stability and Adverse Effects of Carbetocin versus Oxytocin During Cesarean Delivery

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Submission Date : 15 Dec 2025
Accepted Date : 05 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.89948

**Abstract**

**Background:**
Postpartum hemorrhage is a significant cause of maternal morbidity, and optimizing uterotonic use during cesarean delivery is critical.

**Objective:**
This study compared hemodynamic stability and the adverse effects of carbetocin versus oxytocin.

**Methods:**
An observational study was conducted in the Department of Obstetrics and Gynaecology at BGC Trust Medical College Hospital, Chittagong, Bangladesh, over six months from January to June 2022 among 100 women undergoing cesarean section, divided into a carbetocin group (100 µg IV bolus) and an oxytocin group (10 IU IV infusion). Hemodynamic changes, estimated blood loss, need for additional uterotonics, and adverse effects were evaluated.

**Results:**
Baseline characteristics were similar across groups. Mean blood loss was lower with carbetocin (630±225 mL) than oxytocin (685±267 mL), though not statistically significant. Additional uterotonics were required less frequently with carbetocin (12% versus 28%). Adverse effects were mild and comparable, with no serious complications.

**Conclusion:**
Carbetocin provides hemodynamic stability and reduces the need for additional uterotonics, making it an effective alternative to oxytocin, especially in resource-limited settings.

**Keywords:** Carbetocin, Oxytocin, Cesarean delivery, Hemodynamic stability, Postpartum hemorrhage

**Citation:** Pervin MS,Das RR.Comparison of Hemodynamic Stability and Adverse Effects of Carbetocin versus Oxytocin During Cesarean Delivery.J Rang Med Col.2026 Mar;11(1):39-44.doi: https://doi.org/10.3329/jrpmc.v11i1.89948

## Introduction

Postpartum hemorrhage (PPH) remains the leading cause of maternal mortality worldwide, accounting for nearly 70,000 deaths annually and disproportionately affecting low- and middle-income countries (LMICs) where health-system limitations exacerbate preventable obstetric complications.[1] Uterine atony is the predominant cause of PPH, particularly during cesarean delivery, where surgical manipulation, anaesthetic-related vasodilation, and delayed uterine contractility heighten the risk of excessive blood loss.[2] The World Health Organization classifies PPH as blood loss exceeding 500 mL after vaginal birth or more than 1000 mL following cesarean section, a threshold that is frequently surpassed during operative deliveries in resource-strained settings.[3] Maintaining hemodynamic stability during cesarean section is challenging because fluid shifts, intraoperative bleeding, and the rapid onset of action of conventional uterotonics can precipitate abrupt changes in blood pressure and heart rate. Bangladesh exemplifies the growing clinical burden associated with increasing cesarean section rates. National analyses show a sharp rise from 17.7% in 2012 to more than 45% by 2022, with a substantial share of procedures performed without strict medical indication, particularly in private facilities.[4] This escalation expands the

population at risk for PPH, while inconsistent access to quality-assured uterotonic drugs further complicates prevention efforts. Oxytocin, the first-line agent for PPH prophylaxis, requires cold-chain storage, is susceptible to potency degradation, and has a short half-life, necessitating repeated dosing or continuous infusion administration conditions that are not always feasible in lower-resource hospitals.[5] Reports from LMICs consistently highlight variability in oxytocin quality, storage breaches, and dose-dependent adverse effects such as hypotension, tachycardia, and nausea.[6] Carbetocin has emerged as a promising alternative, offering a longer plasma half-life and sustained uterotonic action after a single 100 µg intravenous dose. Heat-stable carbetocin (HSC) maintains potency without refrigeration for extended periods, making it particularly suited for environments where cold-chain integrity cannot be guaranteed.[6] Meta-analytic evidence indicates that carbetocin reduces the need for additional uterotonics, lowers the incidence of severe PPH, and does not increase adverse effects compared with oxytocin, suggesting a clinically meaningful improvement in prophylactic performance.[7] Despite these advantages, comparative data focusing on hemodynamic stability and adverse-effect profiles remain limited in South Asian settings, including Bangladesh, where the contextual relevance of pharmacologic alternatives is critical. This gap underscores the need for rigorous evaluation of both agents to inform national guidelines and optimize maternal outcomes. This study aimed to compare the hemodynamic stability, adverse-effect profiles, and clinical efficacy of carbetocin versus oxytocin during cesarean section.

**Methods:**

This hospital-based observational comparative study was conducted in the Department of Obstetrics and Gynaecology at BGC Trust Medical College Hospital, Chittagong, Bangladesh, over six months from January to June 2022. Ethical approval was obtained from the Institutional Review Board, and written informed consent was secured from all participants. Sixty pregnant women scheduled for elective cesarean delivery were consecutively recruited and allocated into two groups of 30 each. Group A received a single 100 µg intravenous bolus of carbetocin immediately after delivery. In contrast, Group B received 10 IU of oxytocin diluted in 500 mL of normal saline, administered as a slow intravenous infusion over 30 minutes. Eligible participants were women aged 20 to 40 years with singleton term pregnancies undergoing elective cesarean section under spinal anesthesia. Exclusion criteria included preeclampsia or eclampsia, chronic cardiac or renal disease, multiple gestation, coagulopathy, or known hypersensitivity to uterotonic agents. All surgical procedures followed a standardized operative protocol, and anesthesia management was supervised by the same consultant team to minimize inter-operator variability. Primary outcomes included systolic and diastolic blood pressure, mean arterial pressure, heart rate, urine output, estimated intraoperative blood loss, requirement for additional uterotonics, and adverse effects such as nausea, vomiting, flushing, and tachycardia. Hemodynamic parameters were recorded at baseline, immediately after drug administration, and at 5, 10, 15, 30, and 60 minutes post-administration. Urine output was measured during the first four hours following surgery. Blood loss estimation was performed using suction measurements and gauze weight differences. Data were analyzed using SPSS version 26.0. Continuous variables were expressed as mean±standard deviation and analyzed using an independent-samples t-test. Categorical variables were presented as frequencies and percentages, with comparisons performed using the Chi-square test or Fisher's exact test where applicable. Statistical significance was defined as a p-value $<0.05$.

**Results:**

The demographic characteristics of the two groups were generally comparable. The mean age did not differ significantly between women receiving oxytocin (25.3±4.9 years) and those receiving carbetocin (24.1±4.4 years) (p=0.191). Most participants in both groups were overweight or obese, with similar proportions across groups. A notable difference was observed in parity: primigravida women were significantly more common in the carbetocin group (54.0%) compared with the oxytocin group (28.0 percent) (p=0.008) (Table-I).

**Table-I: Comparison of demographics and baseline parameters between groups (N=100)**

| Baseline Characteristics | Oxytocin (n=50) no. (%) | Carbetocin (n=50) no. (%) | p-value |
|---|---|---|---|
| Age (years) | 25.3±4.9 | 24.1±4.4 | 0.191 |
| **BMI range (kg/m²)** | | | |
| 18.5-24.9 (Normal) | 9(18.0) | 7(14.0) | 0.585 |
| ≥25.0 (Overweight & obese) | 41(82.0) | 43(86.0) | |
| **Gravida** | | | |
| Primigravida | 14(28.0) | 27(54.0) | 0.008 |
| Multigravida | 36(72.0) | 23(46.0) | |

Gestational age at delivery was also similar between groups (38.7±1.5 vs. 39.1±1.8 weeks; p=0.37), and patterns of antenatal care were broadly comparable. The distribution of singleton and twin pregnancies showed no significant difference (p=0.73) (Table-II).

**Table-II: Comparison of history of current pregnancy between groups (N=100)**

| History of current pregnancy | Oxytocin (n=50) no. (%) | Carbetocin (n=50) no. (%) | p-value |
|---|---|---|---|
| Gestational age (mean; weeks) | 38.7±1.5 | 39.1±1.8 | 0.37 |
| **ANC visit** | | | |
| Not received | 3(6.0) | 5(10.0) | 0.35 |
| Regular | 15(30.0) | 20(40.0) | |
| Irregular | 32(64.0) | 25(50.0) | |
| **No of fetus in utero** | | | |
| Single | 45(90.0) | 46(92.0) | 0.73 |
| Twin | 5(10.0) | 4(8.0) | |

Preoperative hemoglobin values did not vary significantly, although the carbetocin group had a slightly higher mean level (10.0±1.1 g/dL vs. 9.5±1.7 g/dL; p=0.12). Emergency cesarean sections predominated in both groups and were similarly distributed (p=0.60) (Table-III).

**Table-III: Comparison of laboratory investigation findings & operative details between groups (N=100)**

| Variable | Oxytocin (n=50) no. (%) | Carbetocin (n=50) no. (%) | p-value |
|---|---|---|---|
| Hemoglobin level (mean; g/dl) | 9.5±1.7 | 10.0±1.1 | 0.12 |
| **Type of C/S** | | | |
| Elective | 10(20.0) | 8(16.0) | 0.6 |
| Emergency | 40(80.0) | 42(84.0) | |

Carbetocin demonstrated a modest numerical advantage in PPH prevention (90.0% vs. 84.0%), though not statistically significant (p=0.37). Mean estimated blood loss was lower with carbetocin (630±225 mL) compared with oxytocin (685±267 mL), but this difference also did not reach statistical significance (p=0.27). Blood transfusion requirements were comparable: 28.0% of women in the oxytocin group and 22.0% in the carbetocin group required transfusion (p=0.49), and both groups received a similar number of units. A significant difference emerged in the need for additional uterotonics. Only 12.0% of women receiving carbetocin required supplementary agents compared with 28.0% in the oxytocin group (p=0.045) (Table-IV).

**Table-IV: Comparison of outcome and additional oxytocic drugs required between groups (N=100)**

| Outcome | Oxytocin (n=50) no. (%) | Carbetocin (n=50) no. (%) | p-value |
|---|---|---|---|
| Prevents PPH | 42(84.0) | 45(90.0) | 0.37 |
| Amount of blood loss (mean,ml) | 685±267 | 630.0±225 | 0.27 |
| **Blood transfusion** | | | |
| Needed | 14(28.0) | 11(22.0) | 0.49 |
| Not needed | 36(72.0) | 39(78.0) | |
| No. of units needed | 7.1±3.2 | 7.1±3.3 | 0.97 |
| **Additional oxytocic drugs required** | | | |
| Required (Metherspan and Misoprostol) | 14(28.0) | 6(12.0) | 0.045 |
| Not required | 36(72.0) | 44(88.0) | |

Adverse effects were infrequent and did not differ significantly between groups. Rates of nausea, hypotension, chills, and chest discomfort were low overall, with slightly higher occurrences in the oxytocin group, though none reached statistical significance. Postoperative renal output remained comparable, with mean 24-hour urine volumes of 2086±322 mL in the oxytocin group and 2057±362 mL in the carbetocin group (p=0.68) (Table-V).

**Table-V: Comparison of adverse effects between groups (N=100)**

| Adverse effect | Oxytocin (n=50) no. (%) | Carbetocin (n=50) no. (%) | p-value |
|---|---|---|---|
| Nausea/vomiting | 3(6.0) | 3(6.0) | 1 |
| Palpitation | 1(2.0) | 2(4.0) | 0.56 |
| Hypotension | 2(4.2) | 0(0.0) | 0.25 |
| Headache | 0(0.0) | 1(2.0) | 0.56 |
| Chills | 4(8.0) | 1(2.0) | 0.16 |
| Tremor | 1(2.0) | 0(0.0) | 0.31 |
| Chest pain | 2(4.0) | 0(0.0) | 0.15 |
| Hot sensation | 3(6.0) | 1(2.0) | 0.31 |
| Sweating | 4(8.0) | 2(4.0) | 0.39 |
| 24 hours urine output | 2086±322 | 2057±362 | 0.68 |

**Discussion:**

The present study examined the comparative hemodynamic stability and adverse-effect profile of carbetocin and oxytocin among women undergoing cesarean delivery in a tertiary hospital in Bangladesh. The demographic comparability of maternal age, BMI, and antenatal characteristics between groups reinforces internal validity. It aligns with findings from previous Bangladeshi and international studies evaluating these two agents under similar operative conditions. Prior analyses by Yesmin et al and Nahaer et al also demonstrated no significant differences in baseline obstetric characteristics, thereby minimizing confounding and enabling a more precise assessment of actual pharmacologic effects.[8,9] The comparable distribution of gestational age and surgical urgency observed in the present study further mirrors the balanced study designs reported in Kang et al and Akter et al, in which matching operative profiles ensured reliable outcome comparisons.[10,11] In terms of prophylactic efficacy, carbetocin showed a higher PPH-prevention rate (90%) than oxytocin (84%), although the difference was not statistically significant. Similar trends have been documented by Bonus et al and Delorme et al, who reported numerically lower but non-significant reductions in PPH among carbetocin recipients.[12,13] Estimated blood loss was also modestly lower in the carbetocin group, consistent with results from Razali et al and Boucher et al, who observed improved intraoperative uterine tone and slightly reduced blood loss when carbetocin was used in cesarean deliveries.[14,15] Blood transfusion frequency and transfusion unit requirements were statistically similar between groups, reinforcing earlier evidence from Chinese and South Asian cohorts that transfusion outcomes often do not differ significantly between the two uterotonics when baseline surgical risks are comparable.[10,13] A significant finding was the significantly lower need for additional uterotonics in the carbetocin group, where only 12% required secondary agents, compared with 28% in the oxytocin arm. This advantage is well supported by regional and global evidence. Nahaer et al in Bangladesh, along with Bonus et al and Holleboom et al, demonstrated that carbetocin substantially lowers the requirement for additional uterotonic interventions, reflecting its longer half-life and sustained uterotonic effect.[9,14,16] This reduction has meaningful implications for clinical efficiency, staffing demands, and drug-related workload, especially in high-volume public hospitals. Adverse effects were mild and infrequent, with no significant between-group differences. The incidence of hypotension, nausea, chills, and palpitations remained below 8%, consistent with the safety conclusions of Ai et al and Mannaerts et al, who found comparable tolerability between agents in randomized controlled trials.[17,18] The absence of serious adverse events in either group parallels the findings of Kabir et al and De Bonis et al, who documented excellent safety profiles for carbetocin and oxytocin in cesarean populations.[19,20] Furthermore, postoperative urine output was similar in both groups, supporting the conclusion that neither agent adversely impacted renal perfusion or systemic hemodynamics, as also reported by Akter et al and De Bonis et al.[11,20] Overall, the findings from this study provide clinically relevant, context-appropriate evidence that carbetocin is at least as effective and safe as oxytocin for cesarean delivery, with a clear advantage in reducing the need for additional uterotonics. In resource-limited settings such as Bangladesh, where consistent oxytocin quality and cold-chain maintenance remain challenging, carbetocin, particularly in heat-stable form, offers a practical and potentially superior alternative for optimizing maternal outcomes.

**Limitations:**
This single-center study may not reflect outcomes in other healthcare settings. Hemodynamic data were recorded intermittently rather than continuously, and oxytocin potency was not independently verified. The sample size may have been insufficient to detect rare adverse events, and postoperative outcomes were only assessed for the first 24 hours.

**Conclusion:**
In conclusion, this study demonstrated that both carbetocin and oxytocin are safe and effective uterotonic agents for the prevention of postpartum hemorrhage during cesarean deliveries, exhibiting comparable hemodynamic stability, minimal adverse effects, and similar postoperative renal perfusion outcomes. Notably, carbetocin significantly reduced the requirement for additional uterotonics, suggesting improved sustained uterine contractility compared to oxytocin. Given its single-dose administration and potential advantages in resource-limited settings, carbetocin represents a valuable alternative to oxytocin for postpartum hemorrhage prophylaxis, particularly in the context of Bangladesh, where logistical challenges such as cold-chain maintenance are prevalent. Incorporating carbetocin into national obstetric protocols could enhance clinical practice and maternal outcomes in similar settings.

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# Association of ACR with Serum Creatinine in Diabetic Patients in a Secondary Hospital of Bangladesh

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Submission Date : 25 Dec 2025
Accepted Date : 05 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.89951

**Abstract**

**Background:**
Albuminuria and serum creatinine are key markers of diabetic kidney involvement, yet their relationship in routine secondary-care settings in Bangladesh is not well characterized.

**Objective:**
This study aimed to evaluate the association between albumin-to-creatinine ratio (ACR) and serum creatinine among diabetic patients.

**Methods:**
This cross-sectional study was conducted among 70 diabetic patients at Bangladesh Institute of Health Sciences (BIHS) General Hospital, Dhaka, from July 2024 to June 2025. Spot urine ACR, serum creatinine, fasting blood sugar, and post-breakfast blood sugar were analyzed using standard cut-offs and appropriate comparative tests.

**Results:**
Mean ACR was 655.75±1023.99 mg/g, and mean serum creatinine was 1.32±0.49 mg/dL. Moderately increased ACR was observed in 50.0% and severely increased ACR in 40.0%, while 44.3% had elevated creatinine (>1.3 mg/dL). Although the ACR category was not significantly associated with creatinine status (p=0.067), serum creatinine rose significantly across ACR categories (p=0.001). Glycaemic parameters showed no significant differences by creatinine status.

**Conclusion:**
Routine ACR screening alongside creatinine may improve early DKD detection in secondary care.

**Keywords:** Albumin-to-creatinine ratio, Serum creatinine, Diabetic kidney disease, Renal function

**Citation:** Azad A,Rohan KMI,Imrana F. Association of ACR with Serum Creatinine in Diabetic Patients in a Secondary Hospital of Bangladesh.J Rang Med Col.2026 Mar;11(1):45-50.doi: https://doi.org/10.3329/jrpmc.v11i1.89951

## Introduction:

Diabetes mellitus represents a major global public health challenge, with prevalence rising sharply over recent decades, particularly in low and middle-income countries, driven by urbanization, lifestyle transitions, and population aging.[1] South Asia carries a disproportionate share of this burden, and Bangladesh is projected to experience one of the steepest increases in diabetes prevalence. A meta-analysis by Akhtar et al reported a pooled national prevalence of 7.8%, while subsequent studies have shown a wide range, from 4.5% to 35%, likely reflecting heterogeneity in urbanization, healthcare access, and case detection.[2,3] Despite improving diagnostic and treatment capacity in metropolitan areas, diabetic complications remain a substantial source of morbidity and mortality, increasing pressure on secondary and tertiary hospitals. Among chronic complications, diabetic kidney disease (DKD) is one of the most consequential, contributing substantially to chronic kidney disease (CKD) and end-stage renal disease (ESRD) worldwide, exceeding one-third of CKD cases and more than half of ESRD in some populations.[4,5] The burden of DKD has increased over the last three decades, with the steepest growth in

resource-limited settings where structured screening and early intervention are often inconsistent.[6] In Bangladesh, hospital-based evidence indicates diabetes is now a dominant driver of CKD and ESRD, and many patients present at advanced stages due to limited routine surveillance and restricted access to nephrology services.[7,8] This late detection worsens renal outcomes and amplifies health-system costs.DKD pathogenesis reflects intertwined metabolic and hemodynamic mechanisms: persistent hyperglycemia promotes non-enzymatic protein glycation, oxidative stress, inflammatory signaling, and activation of the renin angiotensin aldosterone system, progressively disrupting glomerular structure and function.[9,10] These processes lead to glomerular basement membrane thickening, mesangial expansion, and podocyte loss, increasing permeability to proteins, often remaining clinically silent until measurable biochemical changes appear.[11] Urinary albumin excretion is among the earliest detectable abnormalities, and the albumin-to-creatinine ratio (ACR) is the preferred quantitative marker because it corrects for urine dilution and enables reliable assessment from spot samples.[12] Guideline-based categories define ACR as normal to mildly increased (<30 mg/g), moderately increased (30–300 mg/g), and severely increased (>300 mg/g).[13] Importantly, ACR elevation can precede declines in GFR by years, supporting its value for early risk stratification and treatment adjustment.[14] Serum creatinine, in contrast, is a functional marker that typically rises only after substantial nephron loss, and it is influenced by factors such as muscle mass, diet, and medications, limiting sensitivity for early DKD.[15-17] Clarifying how ACR relates to serum creatinine can illuminate DKD progression, including clinically relevant discordance patterns, and can guide pragmatic screening in secondary hospitals where comprehensive renal profiling may be constrained.[14,18,19] Therefore, this study aims to investigate the association between albumin-to-creatinine ratio and serum creatinine among diabetic patients attending a secondary hospital in Bangladesh.

**Methods:**

This cross-sectional observational study was conducted in the Department of Clinical Biochemistry Laboratory, BIHS General Hospital, Dhaka, Bangladesh, from July 2024 to June 2025. Seventy consecutive adult patients with diabetes mellitus (N=70) attending outpatient or inpatient services during routine care were enrolled to assess theassociation between urinary albumin-to-creatinine ratio (ACR) and serum creatinine as complementary markers of diabetic renal involvement. Eligible participants were aged ≥18 years and had complete laboratory data for spot urinary ACR (mg/g), serum creatinine (mg/dL), fasting blood sugar (FBS, mmol/L), and post-breakfast blood sugar (ABF, mmol/L). Spot urine samples were collected for albumin and creatinine estimation, and fasting venous blood was obtained for biochemical analysis in the hospital's central diagnostic laboratory.Patients were excluded if they had documented non-diabetic kidney disease (e.g., chronic glomerulonephritis, obstructive uropathy, structural renal abnormalities), acute urinary tract infection or hematuria at sampling, pregnancy, acute febrile illness, heart failure, severe dehydration, or other conditions likely to cause transient proteinuria, and if key laboratory variables were missing.

ACR was calculated as urinary albumin (mg) divided by urinary creatinine (g), categorized as <30, 30–300, and >300 mg/g. Serum creatinine was classified as normal (≤1.3 mg/dL) or elevated (>1.3 mg/dL). FBS (<7.0 vs ≥7.0 mmol/L) and ABF (<10.0 vs ≥10.0 mmol/L) were categorized using ADA-aligned thresholds. Data were analyzed in SPSS v26.0. Descriptive statistics were reported as mean±SD. Mann–Whitney U, one-way ANOVA, independent t-test, and chi-square tests were applied as appropriate, with $p<0.05$ considered significant. IRB approval was obtained, and de-identified routine clinical data were analyzed with strict confidentiality.

**Results:**

Among 70 diabetic participants, the mean age was 56.17±13.17 years (range: 20 to 93). Marked variability was observed in renal and glycemic measures, with mean ACR 655.75±1023.99 mg/g (10 to 5275.7), mean serum creatinine 1.32±0.49 mg/dL (0.5 to 2.86), mean fasting blood sugar 9.78±3.95 mmol/L (3.7 to 24.6), and mean post-breakfast blood sugar 13.11±5.48 mmol/L (6.05 to 35.2) (Table-I).

**Table-I: Baseline characteristics among the participants (N=70)**

| Baseline characteristics | Mean±SD | Range |
|---|---|---|
| Age | 56.17±13.17 | 20-93 |
| ACR (mg/gm) | 655.75±1023.99 | 10-5275.7 |
| S. Creatinine (mg/dl) | 1.32±0.49 | 0.5-2.86 |
| Fasting Blood sugar (mmol/L) | 9.78±3.95 | 3.7-24.6 |
| After Breakfast Blood Sugar (mmol/L) | 13.11±5.48 | 6.05-35.2 |

Half of the patients had moderately increased ACR (30 to 300 mg/g, 50.0%), while 40.0% had severely increased ACR (>300 mg/g); only 10.0% were in the normal or mildly increased category (<30 mg/g) (Table-II).

Serum creatinine was elevated (>1.3 mg/dL) in 44.29% of participants, and glycemic control was poor overall, with 75.71% having uncontrolled fasting glucose (≥7.0 mmol/L) and 70.0% having uncontrolled post-breakfast glucose (≥10.0 mmol/L) [Table 2]. Across ACR strata, elevated creatinine was more frequent in the severely increased ACR category (54.8%) compared with the moderately increased category (35.5%) and the normal or mildly increased category (9.7%), showing a borderline association (p=0.067) (Table-III).

**Table-II: Distribution of patients according to variable categories (N=70)**

| Variable | no. (%) |
|---|---|
| **Albumin-to-Creatinine Ratio Category** | |
| Normal or mildly increased (<30 mg/g) | 7(100.00) |
| Moderately increased (30–300 mg/g) | 35(50.00) |
| Severely increased (>300 mg/g) | 28(40.00) |
| **Serum Creatinine Category** | |
| Normal (≤1.3 mg/dL) | 39(55.71) |
| Elevated (>1.3 mg/dL) | 31(44.29) |
| **Fasting Blood Sugar Category** | |
| Controlled (<7.0 mmol/L) | 17(24.29) |
| Uncontrolled (≥7.0 mmol/L) | 53(75.71) |
| **Post-breakfast Blood Sugar Category** | |
| Controlled (<10.0 mmol/L) | 21(30.00) |
| Uncontrolled (≥10.0 mmol/L) | 49(70.00) |

Mean serum creatinine differed significantly by ACR category, rising to 1.58±0.53 mg/dL in the severely increased group versus 1.14±0.37 mg/dL and 1.15±0.40 mg/dL in the lower ACR groups (ANOVA p=0.001) (Table-IV).

**Table-III: Distribution of serum creatinine status across acr categories (N=70)**

| ACR Category | Normal Creatinine (n=39) no. (%) | Elevated Creatinine (n=31) no. (%) | p-value |
|---|---|---|---|
| Normal / mildly increased (<30 mg/g) | 4(10.3) | 3(9.7) | 0.067 |
| Moderately increased (30–300 mg/g) | 24(61.5) | 11(35.5) | |
| Severely increased (>300 mg/g) | 11(28.2) | 17(54.8) | |

**Table-IV: Mean serum creatinine across ACR categories (N=70)**

| Albumin-to-Creatinine Ratio Category | Serum Creatinine (mg/dL) Mean±SD | p-value |
|---|---|---|
| Normal or mildly increased (<30 mg/g) | 1.14±0.37 | 0.001 |
| Moderately increased (30–300 mg/g) | 1.15±0.40 | |
| Severely increased (>300 mg/g) | 1.58±0.53 | |

**Table-V: Comparison of ACR and blood glucose parameters across serum creatinine categories (N=70)**

| Parameter | Normal Creatinine (n=39) no. (%) | Elevated Creatinine (n=31) no. (%) | p-value |
|---|---|---|---|
| ACR (mg/g) | 517.52±833.17 | 829.67±1215.04 | 0.112a |
| Fasting Blood Sugar (mmol/L) | 9.90±3.45 | 9.64±4.57 | 0.375b |
| Post-Breakfast Blood Sugar (mmol/L) | 13.27±5.14 | 12.91±5.97 | 0.786b |

a Mann–Whitney U test, b independent sample t-test

However, ACR, fasting glucose, and post-breakfast glucose did not differ significantly between normal and elevated creatinine groups (p=0.112, 0.375, and 0.786, respectively) (Table-V).

**Discussion:**

The present study assessed the relationship between urinary albumin-to-creatinine ratio (ACR) and serum creatinine among diabetic patients attending a secondary hospital in Bangladesh, and it demonstrates a substantial burden of renal involvement with wide heterogeneity in disease stage. The markedly elevated mean ACR (655.75±1023.99 mg/g) with an extremely broad range indicates that many patients had clinically meaningful albuminuria, spanning from early microvascular injury to advanced nephropathy, a pattern consistent with the continuum model of diabetic kidney disease (DKD) described in prior work.[7,20] In parallel, the mean serum creatinine of 1.32±0.49 mg/dL, with nearly half of the cohort classified as having elevated creatinine, suggests that a considerable proportion were already experiencing functional decline, which is plausible in secondary-care settings where patients frequently present later in the disease course.[21] The distribution across albuminuria categories further reinforces this interpretation: 50.0% had moderately increased ACR and 40.0% had severely increased ACR, aligning with regional reports indicating a high prevalence of albuminuria among diabetic patients in South Asia and Bangladesh.[7] Importantly, severely increased albuminuria was more common among those with elevated creatinine than among those with normal creatinine, whereas most patients with moderately increased albuminuria still had creatinine within the reference range. This pattern supports the established concept that albuminuria is often detectable earlier than creatinine elevation, with creatinine rising later after substantial nephron loss, and it mirrors observations that ACR and creatinine capture different but overlapping dimensions of DKD progression.[20]

Although the categorical association between ACR strata and creatinine status did not reach conventional statistical significance (p=0.067), the directional trend remained clinically coherent and comparable to prior reports noting only modest concordance between structural markers (albuminuria) and functional markers (creatinine) in diabetic nephropathy, particularly in heterogeneous clinical populations.[21] More compellingly, mean serum creatinine increased significantly across escalating ACR categories, with the highest creatinine observed in the severely increased ACR group (p=0.001). This dose-response pattern is consistent with evidence that higher albuminuria is associated with subsequent renal functional deterioration and worsening filtration indices in diabetes.[22,23] Taken together, the results support a biologically plausible linkage between worsening albuminuria and declining renal function, while also underscoring that these markers may not progress in parallel for every individual, which has been described in longitudinal studies where albuminuria may fluctuate, regress, or dissociate from measured renal function trajectories.[20,21] Glycaemic indices, including fasting and post-breakfast glucose, did not differ significantly between creatinine groups, suggesting that short-term glycaemic status alone did not explain the observed renal impairment in this cohort. This aligns with literature emphasizing that DKD progression reflects multiple drivers beyond glucose, including hemodynamic factors, oxidative stress, endothelial dysfunction, and coexisting cardiometabolic risk.[23] Overall, the study provides locally relevant evidence supporting the combined interpretation of ACR and serum creatinine for DKD detection and staging in Bangladeshi secondary-care practice, and it highlights the need for routine ACR screening alongside creatinine estimation to enable earlier identification of high-risk patients and timely risk-reduction interventions.[7,20-23]

**Limitations:**

This study was conducted at a single secondary-care hospital with a relatively small sample size, which may limit generalizability to broader diabetic populations. The cross-sectional design also restricts the ability to infer causality or assess long-term renal progression in relation to albuminuria and creatinine dynamics.

**Conclusion:**

This study shows a high burden of albuminuria among diabetic patients in a Bangladeshi secondary hospital, with serum creatinine increasing significantly as ACR worsened, indicating progressive renal involvement. ACR and creatinine provided complementary information for DKD detection and risk stratification,

supporting routine screening even in resource-limited settings.Routine ACR testing should be incorporated into standard diabetic care at secondary hospitals to enable early detection of renal involvement. Patients with moderately or severely increased ACR should receive closer follow-up, even when serum creatinine is normal. Larger multicentre longitudinal studies, including eGFR and HbA1c, are recommended to strengthen risk prediction and clarify progression patterns of diabetic kidney disease.

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# Assessment of Pulmonary Function Using Spirometry in Patients with Diabetes Mellitus: A Cross-Sectional Comparative Study

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Submission Date : 07 Jan 2026
Accepted Date : 19 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.89952

**Abstract**

**Background:**
Diabetes mellitus (DM) is a long-term metabolic disease that is becoming more common around the world. Its systemic complications affect more than just the usual target organs. However, pulmonary involvement in diabetes is still not well understood in everyday clinical practice.

**Objective:**
To evaluate pulmonary function via spirometry in patients with diabetes mellitus and to investigate the correlation between lung function deterioration and disease duration.

**Methods:**
A cross-sectional comparative study was performed from June to November 2013 at Rajshahi Medical College Hospital and Rajshahi Diabetic Association General Hospital in Bangladesh. There were 88 participants who did not smoke and were not obese. They had type 1 DM, type 2 DM, or were matched with non-diabetic controls. Spirometry was used to measure pulmonary function (FVC, $FEV_1$, $FEV_1$/FVC), and SPSS version 16.0 was used to look at the data.

**Results:**
Both type 1 and type 2 diabetic patients showed a significant drop in FVC and $FEV_1$ (measured and % predicted) when compared to controls ($p<0.01$). The $FEV_1$/FVC ratio stayed the same or went up, which means that the breathing pattern was mostly restrictive. Every person with type 1 diabetes and about 78–79% of people with type 2 diabetes had FVC values that were less than 80% of what was expected. A longer duration of diabetes (>10 years) was significantly correlated with greater decreases in FVC and $FEV_1$ ($r=-0.48$, $p=0.002$).

**Conclusion:**
Diabetes mellitus, especially of extended duration, is linked to considerable restrictive pulmonary dysfunction, underscoring the lungs as a critical target organ in diabetes.

**Keywords:** Type-1 DM, Type-2 DM, Pulmonary function, Spirometry, FVC, FEV

**Citation:** Rashid MB,Shahida SA,Mahmud RH,Ahmed KM,Haque MA.Assessment of Pulmonary Function Using Spirometry in Patients with Diabetes Mellitus: A Cross-Sectional Comparative Study.J Rang Med Col.2026 Mar;11(1):51-56.doi: https://doi.org/10.3329/jrpmc.v11i1.89952

## Introduction:

Diabetes mellitus is a long-term metabolic disease that causes high blood sugar levels because of problems with insulin secretion, insulin action, or both.[1] The International Diabetes Federation (IDF) says that the number of people with diabetes around the world went from 415 million in 2015 to 537 million in 2021. By 2030, it is expected to reach 643 million, and by 2045, it is expected to reach 783 million.[2] Bangladesh is one of the fastest-growing countries, and this disease is spreading quickly there. There were about 13.1 million adults in Bangladesh with diabetes in 2021. This number is expected to grow to more

than 22 million by 2045.[3] The growing burden is caused by a number of things, including rapid urbanisation, an ageing population, obesity, sedentary lifestyles, and unhealthy eating habits. This is especially true in low- and middle-income countries.[4]

Diabetes is widely acknowledged as a multisystemic disorder. In the past, its complications affected the kidneys, heart, eyes, and peripheral nerves. Nonetheless, growing evidence indicates that the respiratory system is also a major target organ.[5] Chronic hyperglycemia causes oxidative stress, systemic inflammation, and microangiopathy, which change the structure and function of lung tissues.[6] Too many reactive oxygen species (ROS) hurt the alveolar epithelium, pulmonary microvasculature, and respiratory muscles. This causes endothelial dysfunction and a slow loss of lung elasticity.[7]

A major mechanism underlying pulmonary impairment is the non-enzymatic glycation of structural proteins, particularly collagen and elastin, within the lung parenchyma, bronchial tree, and chest wall. The accumulation of advanced glycation end products (AGEs) increases lung stiffness, reduces compliance, and produces a restrictive ventilatory defect.[8] Additionally, glycosylation of basement membranes and plasma protein binding lead to thickening of the alveolar–capillary basal lamina, impairing pulmonary diffusion capacity and gas exchange.[9] Diabetes-induced pulmonary microangiopathy resembles pathological changes seen in diabetic nephropathy and retinopathy.[10] Since normal lung mechanics and gas exchange depend on intact connective tissue and microvasculature, these alterations result in measurable abnormalities on pulmonary function tests.[11]

Recent studies and meta-analyses (2015–2025) consistently demonstrate substantial decreases in forced vital capacity (FVC) and forced expiratory volume in one second ($FEV_1$), whereas the $FEV_1$/FVC ratio remains normal or slightly elevated, suggesting a primarily restrictive pattern of dysfunction.[12] The severity of impairment is associated with prolonged disease duration, inadequate glycaemic control, and microvascular complications.[13] Consequently, this study sought to assess the influence of diabetes mellitus, specifically its duration, on pulmonary function within the present study population.

**Methods:**

This cross-sectional comparative study was conducted at Rajshahi Medical College Hospital and Rajshahi Diabetic Association General Hospital, Bangladesh, from June to November 2013. A total of 88 participants were enrolled, including patients with diabetes mellitus of at least five years' duration and age-, sex-, and BMI-matched non-diabetic healthy controls. All participants were non-smokers, non-obese (BMI <25 kg/m ), and free from known cardiovascular or respiratory diseases. After obtaining informed consent, clinical evaluation and pulmonary function testing were performed using a digital spirometer (Spirolab III). Forced vital capacity (FVC), forced expiratory volume in one second ($FEV_1$), and $FEV_1$/FVC ratio were measured, with three acceptable manoeuvres recorded and the best value selected for analysis. Relevant laboratory investigations, including fasting and post-prandial blood glucose and HbA1c, were reviewed. Data were analyzed using SPSS version 16.0, and group comparisons were performed using Student's t-test, with $p<0.05$ considered statistically significant.

**Results:**

Table-I showed that out of 88 people, most of them (84.1%, n=74) had type 2 diabetes, and 15.9% (n=14) had type 1 diabetes. There were more females (n=48) than males (n=40) overall, especially in type 2 diabetes.

**Table-I: Distribution of study participants by diabetes status and sex**

| Diabetes Status | Male (n) | Female (n) | Total no. (%) |
|---|---|---|---|
| Type-1 DM | 7 | 7 | 14(15.9) |
| Type-2 DM | 33 | 41 | 74(84.1) |
| Total | 40 | 48 | 88(100) |

Table-II showed that both male and female type-1 diabetic participants (n=7 each) had FVC and FEV1 percentages that were much lower than those of the controls. This suggests that they had restrictive pulmonary impairment. The FEV1/FVC ratios were slightly higher in diabetics.

**Table-II: Spirometric results of type-1 diabetes mellitus and control groups**

| Variable | Diabetic (n=7) Mean±SD | Non-Diabetic (n=7) Mean±SD | p-value |
|---|---|---|---|
| **Male** | | | |
| FVC measured value | 2.48±0.517 | 3.27±0.507 | 0.013 |
| FVC% predicted | 58.14±10.38 | 89.57±3.50 | 0.001 |
| $FEV_1$ measured value | 2.25±0.479 | 2.68±0.518 | 0.127 |
| $FEV_1$% predicted | 61.00±10.89 | 84.85±5.42 | 0.001 |
| $FEV_1$/FVC % | 90.95±8.36 | 81.60±5.13 | 0.027 |
| **Female** | | | |
| FVC measured value | 2.00±0.566 | 2.87±0.295 | 0.004 |
| FVC% predicted | 62.71±13.18 | 93.71±3.45 | 0.000 |
| $FEV_1$ measured value | 1.80±0.497 | 2.41±0.242 | 0.013 |
| $FEV_1$% predicted | 64.57±12.17 | 89.57±3.59 | 0.001 |
| $FEV_1$/FVC % | 90.80±7.55 | 84.77±4.17 | 0.049 |

**Table-III: Spirometric results of type-2 diabetes mellitus and control groups**

| Variable | Diabetic (n=33) Mean±SD | Non-Diabetic (n=33) Mean±SD | p-value |
|---|---|---|---|
| **Male** | | | |
| FVC measured value | 2.53±0.573 | 3.37±0.556 | 0.002 |
| FVC% predicted | 69.30±11.27 | 89.00±6.77 | 0.001 |
| $FEV_1$ measured value | 2.34±0.507 | 2.82±0.511 | 0.003 |
| $FEV_1$% predicted | 81.03±11.54 | 91.70±9.50 | 0.001 |
| $FEV_1$/FVC % | 93.65±6.42 | 83.57±5.21 | 0.001 |
| **Female** | | | |
| FVC measured value | 1.77±0.350 | 2.20±0.377 | 0.003 |
| FVC% predicted | 68.78±11.41 | 84.87±3.18 | 0.001 |
| $FEV_1$ measured value | 1.65±0.338 | 1.91±0.304 | 0.004 |
| $FEV_1$% predicted | 75.90±13.96 | 86.70±5.67 | 0.001 |
| $FEV_1$/FVC % | 93.09±7.15 | 86.88±4.67 | 0.002 |

**Table IV: Univariate analysis of factors associated with FVC % predicted**

| Variable | Mean±SD/r | p-value |
|---|---|---|
| Diabetes status | 69.2±11.8 vs 88.9±6.8 | <0.001 |
| Duration of DM | r=−0.48 | 0.002 |
| Age | r=−0.21 | 0.087 |
| Sex | 73.5±12.1 vs 71.2±11.9 | 0.412 |
| BMI | r=−0.19 | 0.104 |

Table-III demonstrated that type-2 diabetic participants (n=33 for each sex) exhibited significantly diminished FVC and FEV1 values in comparison to controls, alongside elevated FEV1/FVC ratios, signifying a predominantly restrictive ventilatory pattern.

Table-IV showed that diabetes status and a longer duration of diabetes were both strongly linked to a lower FVC % predicted ($p<0.01$). Age, sex, and BMI, on the other hand, did not have a strong link to FVC.

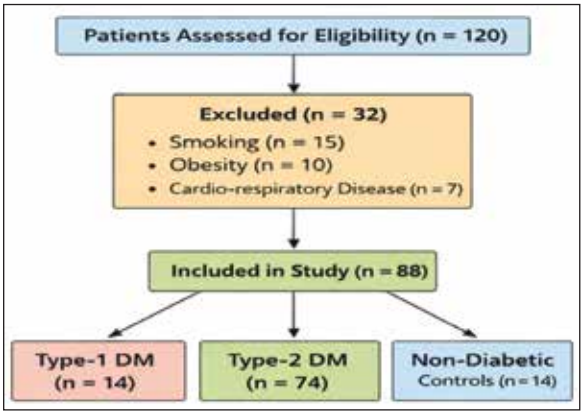



**Figure 1: Flow diagram showing selection and distribution of study participants**

Figure-1 illustrated the participant recruitment process. Out of 120 initially assessed individuals, 32 were excluded due to smoking, obesity, or cardio-respiratory disease, resulting in 88 enrolled participants: 14 with type-1 diabetes, 74 with type-2 diabetes, and 14 non-diabetic controls.



**Figure-2: Measurement of pulmonary function using spirometry (Spirolab III)**

This Figure demonstrated pulmonary function measurement using the digital Spirolab III spirometer. Standardized techniques were applied to assess forced vital capacity (FVC), forced expiratory volume in one second ($FEV_1$), and the $FEV_1$/FVC ratio, ensuring accuracy and reproducibility across all diabetic and non-diabetic participants.

This Figure presented a representative flow–volume loop from a diabetic participant, showing a restrictive ventilatory pattern. The curve highlighted reduced lung volumes while airflow is preserved, reflected by a normal or increased $FEV_1$/FVC ratio, confirming restrictive impairment rather than obstruction.

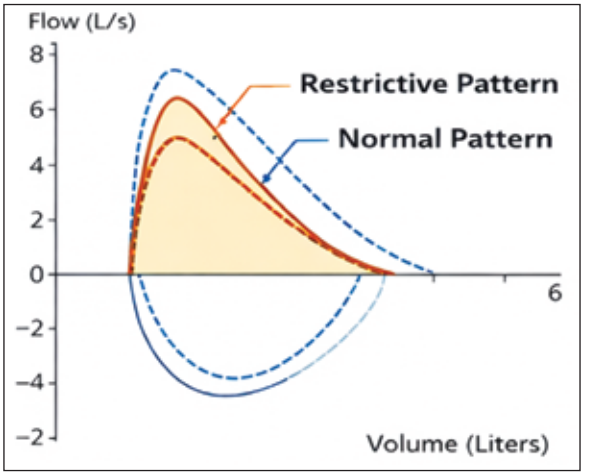



**Figure-3: Representative spirometric flow–volume curve showing restrictive ventilatory pattern**

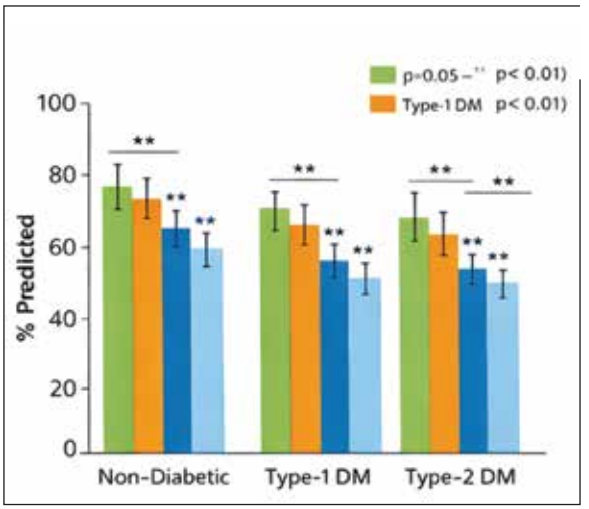



**Figure-4: Comparison of mean FVC and $FEV_1$ (% predicted) between diabetic and non-diabetic groups**

In This Figure compared mean percentage predicted FVC and $FEV_1$ values across groups. Both type-1 and type-2 diabetic patients exhibit significantly lower values than non-diabetic controls ($p<0.01$), indicating a predominant restrictive pulmonary pattern associated with diabetes mellitus.

Table-V showed that both type-1 and type-2 diabetes were linked to lower FVC and $FEV_1$, normal or higher $FEV_1$/FVC ratios, and mostly restrictive lung impairment that got worse the longer you have diabetes, with no big differences between men and women.

**Table-V: Pulmonary function findings in diabetes mellitus**

| Parameter | Non-Diabetic Controls | Type-1 Diabetes Mellitus | Type-2 Diabetes Mellitus | Key Interpretation |
|---|---|---|---|---|
| FVC (% predicted) | Normal ( 80%) | Markedly reduced (<80%) | Reduced in majority (<80%) | Indicates restrictive lung impairment in diabetics |
| $FEV_1$ (% predicted) | Normal | Significantly reduced | Significantly reduced | Decline proportional to diabetes presence |
| $FEV_1$/FVC ratio | Normal | Normal or increased | Normal or increased | Suggests restrictive (not obstructive) pattern |
| Sex difference | - | Similar in males & females | Similar in males & females | No significant sex-based variation |
| Duration effect | - | Greater reduction with >10 years | Greater reduction with >10 years | Longer duration worsens lung function |
| Prevalence of restrictive pattern | Absent | 100% | ~78–79% | Restrictive defect predominant in diabetes |

**Discussion:**

The current study shows that patients with either type 1 or type 2 diabetes mellitus have much worse pulmonary function than people who don't have diabetes. This is mostly due to a restrictive ventilatory pattern. This study found that all type 1 diabetic patients and about 78–79% of type 2 diabetic patients had restrictive impairment. These results align with the findings of Davis et al (2004), which indicated an 8–10% decrease in FVC and $FEV_1$ in diabetic individuals relative to controls.[14] Van den Borst et al (2010) conducted a meta-analysis that revealed significantly reduced FVC (−5.8%) and $FEV_1$ (−6.3%) in diabetic patients, while maintaining a stable $FEV_1$/FVC ratio, indicating a restrictive defect.[14] In India, Shah et al (2013) found restrictive abnormalities in 72% of type 2 diabetic patients, which is very close to the 78–79% prevalence found in this study.[15]

The significant negative correlation between diabetes duration and FVC% predicted ($r=-0.48$, $p=0.002$) further supports the progressive nature of pulmonary involvement. Walter et al (2003) demonstrated that longer diabetes duration was associated with gradual declines in FVC and $FEV_1$.[16] Similarly, Sayeed et al (2007) in Bangladesh reported significantly lower lung function among patients with disease duration exceeding 10 years.[17] These findings are comparable with the greater reduction in pulmonary parameters observed in participants with longer-standing diabetes in this study. Unlike some previous studies that suggested minor sex-related differences in lung function decline, no significant sex-based variation was identified in the current analysis.

**Limitations of the Study:**

The study's type-1 diabetic cohort was small (n=14), constraining generalisability and statistical power. Its cross-sectional design precludes the determination of causality between diabetes duration and the decline in pulmonary function.

**Conclusion:**

Individuals with type-1 and type-2 diabetes demonstrated markedly diminished FVC and $FEV_1$, accompanied by normal or elevated $FEV_1$/FVC ratios, signifying a predominance of restrictive pulmonary dysfunction. Longer diabetes duration, especially exceeding 10 years, correlated with a more significant decline in lung function, underscoring systemic pulmonary effects.

Healthcare professionals should acknowledge the lungs as a possible location for diabetic organ damage. It is recommended that diabetic patients undergo periodic spirometric testing to identify early pulmonary impairment and enhance management, thereby decreasing associated morbidity and mortality.

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Open access Original article

# Frequency and Severity of Drooling in Children with Cerebral Palsy– A Cross-Sectional Study

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Submission Date : 07 Jan 2026
Accepted Date : 19 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.89955

**Abstract**

**Background:**
Drooling is a common problem in children with cerebral palsy (CP), which has both physical and psychological impacts. So, this problem should be addressed among the CP patients.

**Objective:**
The aim of this study was to find out the frequency and severity of drooling in children with Cerebral palsy.

**Methods:**
This was a cross-sectional study conducted in the Pediatric Neurology outpatient department of the National Institute of Neurosciences and Hospital (NINS), Dhaka, from January to December 2022. A total of 100 children aged 3–14 years with a primary diagnosis of cerebral palsy who had drooling were included. The severity and frequency of drooling were assessed by Thomas Stonell and the Greenberg drooling rating scale. This Scale was used to measure the drooling severity and frequency. Data were collected via a structured questionnaire and analyzed using SPSS (version 25), with $p<0.05$ considered statistically significant. Ethical approval was obtained, and informed consent was secured from parents/caregivers.

**Results:**
Among the 100 participants, 54% were male and 46% were female, and about half of them were under five years of age. Spastic quadriplegia was the most prevalent CP type (45%), followed by spastic hemiplegia (30%), diplegia (19%), and dyskinetic CP (6%). Constant (42.2%) and frequent (37.8%) drooling were observed predominantly in children with spastic quadriplegia ($p=0.007$). In terms of severity, severe drooling was most common (74.2%), followed by profuse (50%) and moderate drooling (34.7%) in quadriplegic CP children ($p=0.001$), then diplegic and hemiplegic children.

**Conclusion:**
This study highlighted that the drooling frequency and severity both had a significant association with the types of CP.

**Keywords:** Cerebral palsy, Drooling, Frequency, Duration, Children thomas stonell, Greenberg drooling rating scale

**Citation:** Happy RA,Debnath B,Rashid MA,Hussain S,Shahed MH,Rahman SM, et al.Frequency and Severity of Drooling in Children with Cerebral Palsy– A Cross-Sectional Study.J Rang Med Col.2026 Mar;11(1):57-62.doi: https://doi.org/10.3329/jrpmc.v11i1.89955

## Introduction:

Cerebral palsy (CP) is the most common cause of motor disability in children.[1] It is a heterogeneous syndrome resulting from a non-progressive brain lesion during the period of brain development, with consequences that include a motor dysfunction such as abnormal tone, posture, or movements, and other associated impairments. This can be visual or hearing problems, intellectual disability, epilepsy, or communication

issues.[2] Worldwide, the prevalence of CP is 1-5 per 1000 live births. In CP, drooling or anterior sialorrhoea is a common problem, which is the unintentional loss of saliva from the mouth.[1] In normal development, 'salivary continence' is usually achieved by 15-18 months as control of the tongue and musculature improves. Drooling is considered abnormal over 4 years of age and has a prevalence of 0.6% in the general population and is more common in children with developmental or neurological co- morbidities. In children with Cerebral Palsy (CP), the prevalence can be as high as 30 to 53%.[3] The most common cause of drooling is neuromuscular dysfunction; other causes are hypersecretion and sensory or anatomic dysfunction.[4] Others are open mouth position, a lack of lip sealing, and certain malocclusions.[5] In CP, drooling is caused by oral motor dysfunction, dysphagia, and/or intraoral sensitivity disorder, inefficient labial sealing, suction disorder, reduced intraoral sensitivity, reduced frequency of spontaneous swallowing, and dental malocclusion. Inadequate head posture, intellectual disabilities.[1] Complications of sialorrhoea can be both physical and psychological and can harm quality of life. Drooling can result in perioral chapping, irritation, and maceration, with secondary infection of the facial skin, dehydration due to chronic loss of fluids, and increased risk of recurrent aspiration pneumonia.[4] Oral cavity should be examined for sores on the lip and chin, dental problems, tongue size and movement, and tonsillar hypertrophy; nasal blockage, malocclusion, and jaw stability should be assessed. A neurological examination should be carried out to investigate the level of alertness, swallowing ability, motor skills, and sensory dysfunction of the patient.[6,] Assessment of drooling severity and frequency is crucial for effective management. The Thomas-Stonell and Greenberg Drooling Rating Scale is a standardized tool used to evaluate these parameters. This scale assesses the severity of drooling on a scale from 1 (dry) to 5 (profuse drooling) and frequency from 1 (never drools) to 4 (constant drooling).[7] Treatment of sialorrhea is a multidisciplinary team approach. Treatment aims to reduce the excessive salivary flow while maintaining a moist and healthy oral cavity. Treatment options are conservative, including pharmacological therapy, photocoagulation of the salivary gland ducts, botulinum toxin injections, surgery, and radiotherapy.[2,6]

This study is carried out to understand the severity and frequency of drooling among cerebral palsy children which will in turn help to find out effective treatments, improving the quality of life of children with cerebral palsy.

**Methods:**

This cross-sectional study was conducted among children with cerebral palsy attending the Pediatric Neurology outpatient department of the National Institute of Neurosciences and Hospital (NINS), Dhaka, from January 2022 to December 2022. Children aged 3–14 years with a primary diagnosis of cerebral palsy who had drooling were screened. Children previously receiving any medical/surgical treatment for drooling, poorly controlled seizures (defined as daily seizures), and who had any local pathology that causes sialorrhea (oral ulcerations, stomatitis, dental caries, dental malocclusion, tonsillitis, any gum deformity, inefficient labial sealing) were excluded from the study. A total of 100 cases were enrolled in this study. The Thomas-Stonell and Greenberg Drooling Rating Scale was used to measure drooling severity and frequency. This scale classifies the frequency of drooling from never to frequently, as well as the severity of drooling, ranging from dry (never drools) to profuse (wet hands, trays, clothing, and things within reach). Data were collected via a structured questionnaire and analyzed using SPSS (version 25), with $p<0.05$ considered statistically significant. Ethical approval was obtained, and informed consent was secured from parents/caregivers.

**Result:**

Among 100 patients, the majority were under 5 years of age and male. Most children were delivered normally and had a history of perinatal asphyxia. In addition to drooling, the associated problems were feeding, chewing, swallowing difficulty, nasal regurgitation, and epilepsy. (Table-I)

About 45% children had spastic quadriplegia. Spastic hemiplegia, spastic diplegia, and dyskinetic type CP were found in 30%, 19% and 6% respectively (Table-II).

**Table-I: Demographic characteristics of the study populations (N=100)**

| Demographic characteristics | no. (%) |
|---|---|
| Mean age (year)±SD | 6.15±3.13 |
| **Age distribution (Years)** | |
| <5 | 45(45) |
| ≥5-10 | 39(39) |
| ≥10 | 16(16) |
| **Sex** | |
| Male | 54(54) |
| Female | 46(46) |
| **Birth weight (gm)** | |
| <1500 | 12(12) |
| 1500-2499 | 35(35) |
| >2500 | 53(53) |
| NVD | 84(84.0) |
| LUCS | 16(16.0) |
| Perinatal asphyxia | 94(94.0) |
| Feeding difficulty | 85(85.0) |
| Chewing difficulty | 73(73) |
| Nasal regurgitation | 1(1) |
| Swallowing difficulty | 11(11) |
| Epilepsy | 57(57) |

**Table-II: Types of cerebral palsy among the study population (N=100)**

| Types of CP | no. (%) |
|---|---|
| Spastic hemiplegia | 30(30.0) |
| Spastic diplegia | 19(19.0) |
| Spastic quadriplegia | 45(45.0) |
| Dyskinetic | 6(6.0) |

Occasional and frequent drooling was more common among children under 5 years of age**.** Whereas constant drooling was more between 5- and 10-year-old children which was statistically not significant (Table-III).

Moderate and profuse drooling was more common in children under 5 years of age. Severe drooling was more common in 5 to 10-year-old children. (Table IV)

Constant and frequent drooling was significantly higher in the spastic quadriplegic CP (p 0.007). Occasional drooling was more in hemiplegic CP (Table-V).

All modalities of drooling, except mild drooling, were more common in spastic quadriplegic CP.

**Table-III: Drooling frequency among different age groups based on thomas stonell & greenberg drooling rating scale (N=100)**

| Types of CP | Age | | | | p-value |
|---|---|---|---|---|---|
| | Total n=100 no. (%) | <5 year n=45 no. (%) | >5-10year n=39 no. (%) | >10year n=16 no. (%) | |
| Occasionally drools | 10(10) | 19(42.2) | 15(38.5) | 6 (37.5) | |
| Frequently drools | 49(49) | 17(37.8) | 12(30.8) | 5(31.3) | 0.812 |
| Constantly drools | 41(41 ) | 9(20.0%) | 12(30.8) | 5(31.3) | |

**Table-IV: Drooling severity among different age groups based on thomas stonell & greenberg drooling rating scale (N=100)**

| Types of CP | Age | | | | p-value |
|---|---|---|---|---|---|
| | Total N-100 no. (%) | <5 year n=45 no. (%) | >5-10year n=39 no. (%) | >10year n=16 no. (%) | |
| Mild | 7(7) | 5(11.1) | 2(5.1) | 0(0.0) | |
| Moderate | 51(51) | 25(55.6) | 18(46.2) | 8(50.0) | 0.714 |
| Severe | 26(26) | 7(15.6) | 13(33.3) | 6(37.5) | |
| Profuse | 16(16) | 8(17.8) | 6(15.3) | 2(12.5) | |

**Table-V: Relationship between drooling frequency and types of CP among the studied population (N=100)**

| Drooling frequency | Spastic Hemiplegia no. (%) | Spastic Diplegia no. (%) | Spastic Quadriplegia no. (%) | Dyskinetic no. (%) | p-value |
|---|---|---|---|---|---|
| Occasionally drools | 17(56.7) | 11(57.9) | 9(20.0) | 3(50.0) | |
| Frequently drools | 8(26.7) | 7(36.8) | 17(37.8) | 2(33.3) | 0.007 |
| Constantly drools | 5(16.7) | 1(5.3) | 19(42.2) | 1(16.7) | |

**Table-VI: Relationship between drooling severity and types of CP among the studied population (N=100)**

| Types of CP | Mild no. (%) | Moderate no. (%) | Severe no. (%) | Profuse no. (%) | p-value |
|---|---|---|---|---|---|
| Spastic hemiplegia | 6(42.9) | 15(30.6) | 7(22.5) | 2(33.3) | |
| Spastic diplegia | 3(21.4) | 15(30.6) | 1(3.2) | 0(0.0) | 0.001 |
| Spastic quadriplegia | 2(14.3) | 17(34.7) | 23(74.2) | 3(50) | |
| Dyskinetic | 3(21.4) | 2(4.1) | 0(0.0) | 1(16.2) | |

The severity of drooling was found significant association with the types of CP. (Table-VI).

**Discussion:**

Drooling is one of the challenging problems in children with CP, which is often difficult to manage. This study was a hospital-based cross-sectional study among children having CP aged between 3 and 14 years. This study aimed to document the severity and frequency of drooling among these children. In this study, the mean age of the children was 6.15±3.13 years. It was observed that children under 5 years of age were more frequently enrolled. Previously, a study was done by Zeller et al with a similar age group (3-18 years) that included most children of 5-10 years in the experimental group and <5 years in the control group.[8] Other studies conducted by Mier et al. showed a similar mean age (7 years 10 months). But Rio et al showed a slightly higher mean age (10 years 9 months).[9,10]

Parr et al, Chavez et al, and Hedge et al have conducted a similar type of study and found males were predominant in their series (61%, 52%, 65.5% respectively).[11-13] The Present study also showed male predominance (54%). In the present study, most of the children had birth weight >2500g, most of them were delivered by NVD, and had a history of perinatal asphyxia. Development was delayed in all children, but Rio et al showed that developmental delay was only 31.6% which is contrary to our observation.[9] That may be due to the introduction of early developmental or effective therapy in developed countries.

In our study, about half of the children were found to have spastic quadriplegic CP (45%), followed by hemiplegic (30%), diplegic (19%), and dyskinetic (6%), which was similar to a previous study done by Rio et al. That study showed 62% quadriparesis, 22% hemiparesis, 8% diparesis, 6% triparesis, and 2% paraparesis.[9] Spastic quadriplegia was also the most prevalent form of CP among the subjects studied by Hedge et al[11] whereas spastic hemiplegia was the least common in that study, but we found hemiplegic CP as the 2nd frequent type of CP.

In the present study, 99% children had co-morbidities including speech delay (>90%), feeding difficulty (>80%), cognitive delay (>80%), and epilepsy (>50%). Rio et al. found that 74% cases had co-morbidities that were similar to the current study.[9]

Apraj et al found that drooling frequency was more frequent in spastic quadriplegic CP (45%), followed by diplegia (12%) and

hemiplegia (5%). Similarly, drooling severity was most pronounced in children with quadriplegic CP, with a significant proportion experiencing moderate (29%) to profuse drooling (26%).[7] This study found similar findings like drooling frequency (constant 42.2%, frequent drooling 37.8%) and severity (moderate, severe, and profuse 34.7%, 74.2%, 50% respectively), both were more frequent in spastic quadriplegic CP.
Kyuong-Chul Min et al showed that the frequency and severity of drooling were 60.8%, 35.6% in spastic quadriplegia, respectively, which was more than in other CP. Those findings match with this study's findings.[14]

**Conclusion:**

This study highlighted that drooling frequency and severity both had a significant association with types of CP. Although occasional and frequent drooling were more frequent in children under 5 years of age, constant and profuse drooling was more frequent between 5 and 10 years old. Children having spastic quadriplegia suffered significantly from constant to frequent and severe to profuse drooling than spastic diplegic and hemiplegic CP.

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# Doppler Echocardiographic Hemodynamic Changes Following Percutaneous Balloon Mitral Valvotomy

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Submission Date : 07 Jan 2026
Accepted Date : 19 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.89956

**Abstract**

**Background:**
Rheumatic mitral stenosis is a major cardiovascular burden in poorer nations, causing increasing hemodynamic compromise. Percutaneous balloon mitral valvotomy (PBMV) has emerged as the preferred treatment for symptomatic mitral stenosis with a healthy valve shape.

**Objective:**
This study aimed to assess the doppler echocardiographic hemodynamic changes following PBMV in individuals with rheumatic mitral stenosis.

**Methods:**
This prospective observational analysis comprised 24 patients with severe rheumatic mitral stenosis who received PBMV between January and July 2021 at the National Institute of Cardiovascular Diseases in Dhaka, Bangladesh. Patients aged 21-50 years with a Wilkins score ≤10 were enrolled. Transthoracic doppler echocardiography was performed 24 hours before and 24-48 hours after PBMV to measure peak transmitral pressure gradient, mean transmitral pressure gradient, and pulmonary artery systolic pressure. A paired Student's t-test was used for statistical analysis, with a significance level of p≤0.05.

**Results:**
The study cohort was largely female (70.8%), with a mean age range of 21-50 years. All patients complained of shortness of breath, and additional prevalent symptoms included palpitation (87.5%) and paroxysmal nocturnal dyspnea (83.33%). After PBMV, peak transmitral pressure gradient decreased from 18.04±5.23 mmHg to 12.42±5.87 mmHg (31.2% reduction, p=0.0001), mean transmitral pressure gradient decreased from 10.75±3.15 mmHg to 7.04±4.53 mmHg (34.5% reduction, p=0.0001), and pulmonary artery systolic pressure decreased from 33.50±17.41 mmHg to 25.63±13.83 mmHg (23.5% reduction, p=0.003).

**Conclusion:**
In individuals with rheumatic mitral stenosis, PBMV immediately improves doppler hemodynamic parameters such as transmitral pressure gradients and pulmonary artery pressure. These data show PBMV's efficacy in improving hemodynamic outcomes and support its use as the recommended strategy for appropriate patients with mitral stenosis.

**Keywords:** Percutaneous balloon mitral valvotomy, Doppler echocardiography, Mitral stenosis, Hemodynamic changes

Citation: Gaffar MA,Ferdous J,Suchi SS.Doppler Echocardiographic Hemodynamic Changes Following Percutaneous Balloon Mitral Valvotomy.J Rang Med Col.2026 Mar;11(1):63-68.doi: https://doi.org/10.3329/jrpmc.v11i1.89956

## Introduction:

Rheumatic heart disease is a significant cause of cardiovascular morbidity and mortality in developing countries, and the most common valve affected is the mitral valve.[1] The burden of rheumatic heart disease worldwide is approximately 33 million people, and the prevalence is highest in South Asia, Africa, and the Middle East.[2] As the severity of the mitral stenosis progresses, left atrial pressure increases, which

leads to pulmonary hypertension and ultimately compromises the right ventricle, thereby affecting the quality of life and survival.[3] The treatment of rheumatic mitral stenosis has been revolutionised by the introduction of percutaneous balloon mitral valvotomy (PBMV), which was first described by Inoue in the 1980s.[4] PBMV splits the fused commissures mechanically, thereby increasing the valve area immediately and reducing the gradient across the valve.[5] Several randomised trials have proven that the results obtained by PBMV are comparable to those obtained by surgical commissurotomy, but the morbidity, hospital stay, and cost are less in PBMV, making it the treatment of choice for symptomatic patients with favourable valve morphology.[6] Doppler echocardiography is of critical importance in the comprehensive evaluation of the severity and hemodynamic consequences of mitral stenosis.[7] It is a useful tool in measuring transmitral pressure gradients, pulmonary artery pressure, and cardiac chamber sizes, which are essential in planning and evaluation of the procedure and its outcomes.[8] The immediate hemodynamic effects of PBMV can be quantitatively assessed by Doppler echocardiography, which is an important predictor of successful outcomes.[9] The pathophysiology of mitral stenosis is associated with a gradually narrowing mitral valve area, usually due to rheumatic inflammation of the valve, which causes thickening of the valve leaflets and fusion of the commissures, along with involvement of the subvalvular apparatus.[10] As the valve area is reduced to less than 1.5cm, a significant interatrial pressure gradient is created, causing an increase in left atrial size and pulmonary venous pressure. Prolonged pulmonary venous hypertension causes a reactive vasoconstriction of the pulmonary arteries, leading to pulmonary hypertension, which is irreversible if untreated.[11] Although many studies have demonstrated the long-term clinical efficacy of PBMV, there is still interest in understanding the immediate hemodynamic effects that occur post-procedure. Analysis of these early effects can provide information on the mechanism of efficacy, assist in the identification of patients at risk for poor outcomes, and inform post-procedure management strategies. The degree of reduction in transmitral gradients and pulmonary artery pressure post-PBMV has been demonstrated to correlate with symptomatic improvement and event-free survival in follow-up analysis. Thus, the assessment of Doppler hemodynamic parameters in the early post-procedure period continues to be an important aspect of patient management and further supports the efficacy of PBMV as a therapeutic modality for patients with mitral stenosis.

**Methods:**

This prospective observational study was carried out at the Department of Cardiology, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh, from January to July 2021. Ethical permission for conducting this study was obtained from the Institutional Ethical Review Committee, and consent was obtained from all the participants before the study. Patients with chronic rheumatic heart disease with severe mitral stenosis undergoing PBMV during the index hospitalisation were included in the study. The inclusion criteria for the patients were an age group between 15 and 45 years, a suitable valve for PBMV, and chronic rheumatic heart disease with severe mitral stenosis. The exclusion criteria for the patients included mild mitral stenosis, unfavorable valve for PBMV, coronary artery disease, left ventricular ejection fraction less than 50 percent, moderate to severe associated valvular disease, left ventricular ejection fraction less than 50 percent, right heart failure, and atrioventricular conduction abnormality. Baseline evaluation consisted of a detailed clinical history and examination, and the collection of demographic data using a case record form. All patients underwent a comprehensive evaluation, including routine laboratory investigations, a 12-lead electrocardiogram, and a chest X-ray. Transthoracic echocardiography using standard protocols assessed mitral valve anatomy, dimensions, and function. Mitral valve area measurement using planimetry in the parasternal short-axis view and mitral valve scoring using the Wilkins scoring system were performed. Doppler echocardiography measured peak and mean transmitral gradients and pulmonary artery systolic pressure from tricuspid regurgitant velocity. Echocardiographic evaluation was performed one day before PBMV and after 24 to 48 hours using the same technique and the same experienced operator, unaware of the clinical outcomes. Data analysis was performed using SPSS software version 26.0. Data were expressed as mean and

standard deviation, and categorical data were expressed in terms of numbers and percentages. Paired student 't' test was applied to compare pre and post-procedure data. $p<0.05$ was considered statistically significant.

**Results:**

The cohort included 24 patients, with the 31-40 years age group accounting for 45.8%, followed by 41-50 years (29.2%) and 21-30 years (25.0%). Female patients made up the majority (70.8%) which is consistent with the known gender distribution of rheumatic mitral stenosis in endemic areas (Table-I).

All patients had dyspnea (100%), showing severe mitral stenosis. Common symptoms included palpitations (87.5%) and paroxysmal nocturnal dyspnea (83.33%). Most had rheumatic fever (87.5%), but only one-third received preventive antibiotics (Table-II).

The average pulse rate was 80.46±9.08 bpm, while blood pressure averaged 127.14±15.75/80.70±9.16 mmHg. Despite significant valve stenosis, the jugular venous pressure of 8.94±0.296 cm was normal, indicating compensatory hemodynamics (Table-III).

**Table-I: Distribution of studied samples by demographic profiles (N=24)**

| Demographics | no.(%) |
|---|---|
| **Age (years)** | |
| 21-30 | 6(25.0) |
| 31-40 | 11(45.8) |
| 41-50 | 7(29.2) |
| **Gender** | |
| Female | 17(70.8) |
| Male | 7(29.2) |

**Table-II: Clinical features of the respondents (N=24)**

| Symptoms | no.(%) |
|---|---|
| Breathlessness | 24(100) |
| Palpitation | 21(87.5) |
| Chest pain | 9(37.5) |
| Cough | 9(37.5) |
| Paroxysmal nocturnal dyspnea | 20(83.33) |
| Orthopnea | 6(25) |
| History of rheumatic fever | 21(87.5) |
| History of rheumatic fever prophylaxis | 8(33.33) |

**Table-III: General examination findings of the respondents (N=24)**

| Variables | Mean±SD |
|---|---|
| Pulse (bpm) | 80.46±9.08 |
| Systolic blood pressure (mmHg) | 127.14±15.75 |
| Diastolic blood pressure (mmHg) | 80.70±9.16 |
| Jugular venous pressure (cm) | 8.94±0.296 |

Statistically substantial improvements were found across all the parameters assessed. The treatment effectively relieved mitral stenosis and improved hemodynamics. Peak transmitral gradient dropped by 31.2%, mean gradient by 34.5%, and pulmonary artery pressure by 23.5%, all with extremely significant p-values ($p\leq0.003$) (Table-IV).

**Table-IV: Comparison of doppler echocardiographic findings before and after PBMV (N=24)**

| Doppler parameter | Pre-PBMV mean±SD | Post-PBMV mean±SD | Absolute change | Percentage change | p-value |
|---|---|---|---|---|---|
| Peak transmitral pressure gradient (mmHg) | 18.04±5.23 | 12.42±5.87 | -5.62 | -31.2% | 0.0001 |
| Mean transmitral pressure gradient (mmHg) | 10.75±3.15 | 7.04±4.53 | -3.71 | -34.5% | 0.0001 |
| Pulmonary artery pressure (mmHg) | 33.50±17.41 | 25.63±13.83 | -7.87 | -23.5% | 0.003 |

**Discussion:**

This study showed the immediate hemodynamic benefit of PBMV in patients with rheumatic mitral stenosis, as reflected by the marked reduction in transmitral pressure gradients and pulmonary artery systolic pressures. These results are in keeping with those of Fawzy et al, who support PBMV as an effective percutaneous procedure for patients with symptomatic mitral stenosis.[12] The 31.2% reduction in peak transmitral gradient and 34.5% reduction in mean gradient noted in our study are in keeping with Silva et al, who documented similar degrees of hemodynamic benefit following successful balloon valvotomy.[13] The demographic distribution of our population, which predominantly consists of young females, is in keeping with the usual distribution of rheumatic mitral stenosis. Sharma et al found a similar gender ratio, with females contributing 60-75% of the population undergoing PBMV.[14] The age distribution of our patients in the third and fourth decades of life is in keeping with the study by Sampath et al, who showed that the natural history of rheumatic valve disease, where severe stenosis occurs 15-20 years after the acute episode of rheumatic fever.[15] The presence of breathlessness and paroxysmal nocturnal dyspnea in all our patients emphasises the advanced stage of symptoms, which requires strategies for earlier detection and intervention. The reduction in pulmonary artery pressures, as demonstrated by our results, to the extent of 23.5%, assumes special significance when viewed from a prognostic perspective. Pulmonary artery pressures are well recognised as an independent predictor of poor outcome in patients with mitral stenosis, and their reduction following PBMV has been correlated with improved survival and functional status of the patients.[15] Several factors are thought to contribute to the reduction of pulmonary artery pressures following successful valvotomy, including the immediate reduction of the increased pulmonary venous pressures, reflected as increased left atrial pressures, and the delayed reduction of reactive pulmonary vascular resistance, leading to pulmonary vasoconstriction, over a period of time following successful valvotomy.[16] This reduction of pulmonary artery pressures, compared to the reduction of the transvalvular gradient, can be appreciated by the fact that it takes weeks to months for the pulmonary vascular bed to undergo the process of reversibility, and some patients may already have irreversible pulmonary vascular disease at the time of successful valvotomy.In our study, Doppler echocardiography was used as a primary tool for hemodynamic evaluation. It is considered the current standard of care for evaluating the severity of mitral stenosis and outcomes following a procedure.[17] The correlation between Doppler-derived pressure gradients and invasively obtained hemodynamics has been validated extensively with good agreement in all clinical scenarios.[18] The immediate post-procedural evaluation at 24-48 hours also ensures hemodynamic stability and captures any effect of commissurotomy before any possible recoil or restenosis.[19] An interesting finding of our study is that though 87.5% of our population had a history of rheumatic fever, only 33.33% had undergone secondary prophylaxis. This is a reflection of a larger problem in resource-scarce settings and underlines the need for a comprehensive approach to primary and secondary prevention of rheumatic fever.[20] It is evident that if a robust program is put in place for preventing and managing rheumatic fever, a large number of cases of rheumatic heart disease and subsequent interventions like PBMV can be prevented in future generations.The successful hemodynamic results achieved in our population were made possible in carefully selected patients with favorable valve anatomy, as evident by the inclusion criterion of the Wilkins score. Patient selection is a crucial step in the success of PBMV, with valve anatomy, extent of calcification, and the presence of subvalvular fusion being key determinants of procedural success and the risk of complications.[21] The exclusion of patients with unfavorable anatomy, significant commissural calcification, and other adverse features in our study likely played a role in the excellent results achieved. The long-term durability of PBMV outcomes and freedom from reintervention are dependent on a variety of factors, including the initial adequacy of commissural opening, the extent of valve calcification, the presence of ongoing rheumatic activity, and compliance with antibiotic prophylaxis.[22] Although our study aimed to evaluate the immediate hemodynamic effects of PBMV, a systematic follow-up of these patients would offer important insights into the long-term benefits and predictors of restenosis in our patient population.

**Limitations:**
The study was limited by its small sample size and single-centre design, which may affect generalizability. Additionally, the absence of long-term follow-up data prevents assessment of the durability of hemodynamic improvement and clinical outcomes beyond the immediate post-procedural period.

**Conclusion:**
Percutaneous balloon mitral valvotomy (PBMV) significantly reduces the pressure gradient across the mitral valve and pulmonary artery pressure in patients with rheumatic mitral stenosis. This indicates that PBMV is an effective treatment for symptomatic rheumatic mitral stenosis with the right valve structure. The procedure is minimally invasive, making it suitable for areas with high rates of rheumatic heart disease. Future studies could focus on larger groups to assess long-term results and the effects of advanced imaging techniques.

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# Comparison of Serum Calcium Level Among Patients with Different Stages of Hypoxic Ischaemic Encephalopathy Due to Perinatal Asphyxia

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Submission Date : 07 Jan 2026
Accepted Date : 19 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.89957

**Abstract**

**Background:**
Perinatal asphyxia is a leading cause of neonatal hospital admission, particularly in low- and middle-income countries. It causes diminished oxygen supply to brain resulting hypoxic ischaemic encephalopathy with three distinct stages. Higher HIE grades have been associated with reduced calcium levels. This emergency condition can lead to multi-organ dysfunction and can affect the neonatal calcium profile causing mainly hypocalcemia.

**Objective:**
To compare the serum calcium level among different stages of Hypoxic ischaemic encephalopathy (HIE) in perinatal asphyxia

**Methods:**
This cross-sectional observational study was conducted in department of Paediatrics, Rangpur medical college hospital on 212 neonates with perinatal asphyxia with different stages of HIE.

**Results:**
Among 212 neonates birth asphyxia was predominant in male (56.5%). Birth asphyxia was predominant in vaginal delivery (64%). Majority of the neonates were in HIE stage II (58.5%) followed by stage III (21.7%) and stage I (19.8%). Serum calcium level was significantly lower in stage III to stage-II HIE (5.1±1.66 vs 6.1±1.1.54, p-value=0.0003) and stage II to stage-I (6.1±1.1.54 vs 7.2±1.35, p-value=.0003).

**Conclusion:**
Serum calcium level tends to decrease in asphyxiated neonate which is most subjacent in HIE stage III.

**Keywords:** Perinatal Asphyxia, Hypoxic Ischaemic Encephalopathy, Stages, Serum Calcium Level

**Citation:** Chowdhury MRB,Karim SB, Zaman MM, Shormin S,Islam MS,Nuren N.Comparison of Serum Calcium Level Among Patients with Different Stages of Hypoxic Ischaemic Encephalopathy Due to Perinatal Asphyxia.J Rang Med Col.2026 Mar;11(1):69-72.doi:https://doi.org/10.3329/jrpmc.v11i1.89957

## Introduction:

Perinatal asphyxia is a leading cause of neonatal hospital admission, particularly in low- and middle-income countries. It results from a lack of oxygen and/or inadequate blood flow (ischemia) to the foetus or newborn during the perinatal period. This emergency condition can lead to multi-organ dysfunction and can affect the neonatal calcium profile.[1] Neonatal hypocalcemia is a common biochemical abnormality occurred in asphyxiated neonates. It can occur early (within the first 72 hours) or late (after 72 hours) and often present without typical clinical symptoms, thus routine monitoring is often difficult.[2] Birth asphyxia generates a series of metabolic derangements, including hypoxia-induced acidosis and qualitative and quantitative alternance of parathyroid hormone. Furthermore, impaired calcium mobilization from bones and reduced intestinal calcium absorption also causes an increase in phosphate levels that further lowers calcium concentrations. The stress response to asphyxia, accompanied by elevated catecholamines and glucocorticoids, further aids to altered calcium metabolism.[3] Hypocalcemia in birth asphyxia may lead to seizure activity and cardiac dysfunction. Therefore, quantifying calcium offers a more comprehensive picture of

the neonate's calcium status and can serve as a useful prognostic indicator.[4] Sarnat and Sarnat classification aids in classifying the severity of asphyxia and can correlate with biochemical abnormalities. Higher HIE grades have been associated with lower calcium levels.[5] The pathophysiological mechanisms underlying neonatal hypocalcemia in asphyxiated infants are multifactorial. They include immature parathyroid hormone responses, increased phosphate levels due to cellular injury, magnesium deficiency, and renal losses of calcium.[6] Clinical studies conducted in different settings have registered a consistent association between birth asphyxia and decreased calcium concentrations, thereby reassuring the importance of biochemical screening in those neonates.[7]

**Method:**

A cross-sectional observational study was conducted in department of Paediatrics, Rangpur medical college hospital, Rangpur during March 2018 to October 2018 on 212 neonates with perinatal asphyxia with different stages of HIE. Preterm neonates (<37 weeks gestation), neonates with major congenital anomalies, sepsis or metabolic disorders, neonates born to mothers with known calcium metabolism disorders or whose mothers received magnesium sulfate before delivery were excluded. With aseptic precautions, 2 ml blood was drawn from peripheral vein. After removal of the needle from syringe blood sample was collected in a dry clean glass test tube. Within one hour of collection, blood was centrifuged and serum was separated. Serum calcium concentration was measured by auto analyzer machine (Dimension xpand plus) at the Department of Biochemistry & Department of Pathology, Rangpur Medical College, Rangpur, on the same day. Continuous variables were expressed as mean and standard deviation, while categorical variables were expressed as numbers and percentages. Unpaired t test was done as a test of significance, p-value <0.05 was considered statistically significant. The SPSS 22.0 for Windows was used for statistical computations.

**Results:**

Majority of the neonates were male accounting 56.5% and only 20% were low birth weight baby. NVD was the predominant mode of delivery at approximately 64% (Table-I).

**Table-I: Demographic characteristics of patients (N=212)**

| Demographic characteristics | no. (%) |
|---|---|
| **Gender** | |
| Male | 122(56.5) |
| Female | 90(43.5) |
| **Birth weight** | |
| ≥2.5 Kg | 170(80) |
| <2.5Kg | 42(20) |
| **Delivery** | |
| NVD | 135(64) |
| LUCS | 77(36) |

Most of the neonates were classified under HIE stage II (52.5%). Meanwhile HIE-I (19.8%) and, HIE-III (21.7%) were also documented.

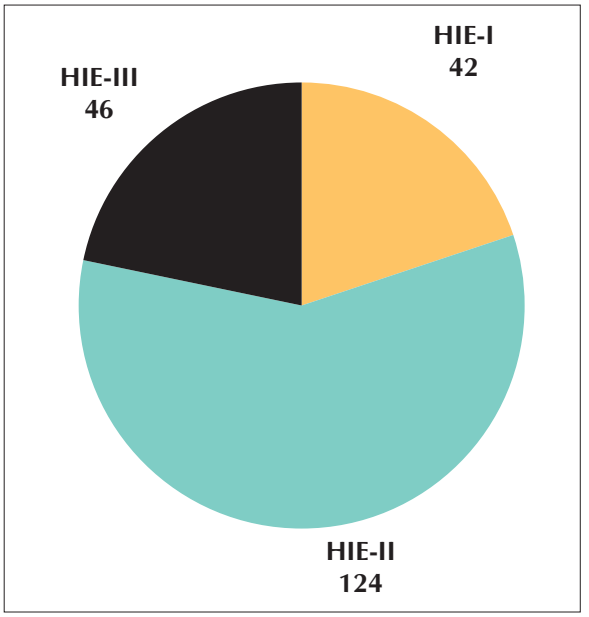



**Figure-1: Neonates of different HIE stage**

Mean serum calcium was lowest in HIE- III which was 5.1±1.66 mg/dl. Neonates with HIE-II had lower calcium level (6.1±1.54 mg/dl) than HIE-I (7.2±1.35 mg/dl) (Table-II).

**Table-II: Level of serum calcium of different stages of HIE**

| Stages of HIE | Serum calcium (mg/dl) (Mean±SD) |
|---|---|
| HIE-I | 7.2±1.35 |
| HIE-II | 6.1±1.54 |
| HIE-III | 5.1±1.66 |

Serum calcium level in HIE-II is significantly lower in comparison to HIE-I ( p-value <0.01) (Table-III).

**Table-III: Comparison of serum calcium level between HIE stage I (n=42) and stage II (n=124)**

| Serum calcium | HIE-I | HIE-II | p-value |
|---|---|---|---|
| Mean±SD (mg/dl) | 7.2±1.35 | 6.1±1.54 | <0.001 |

Serum calcium level in HIE-III is significantly lower in comparison to HIE-II (p-value=0.0003) (Table-III).

**Table IV: Comparison of serum calcium level between HIE stage II (n=124) and stage III (n=46)**

| Serum calcium | HIE-III | HIE-II | p-value |
|---|---|---|---|
| Mean±SD (mg/dl) | 6.1±1.54 | 5.1±1.66 | 0.0003 |

**Discussion:**

Perinatal asphyxia, is a clinical event characterized by the inadequate delivery of oxygen to a newborn during the intrauterine fetal period or birthing process which causes a wide range of complications, including HIE, multiorgan dysfunction, and finally death. HIE is primarily due to sudden or chronic insufficiency of oxygen to the body resulting in diminished blood flow to the brain. HIE is divided into three distinct stages according to the presentation of the affected neonate. HIE stage I is a mild form which exhibits only history of delayed crying with notably no significant bad prognostic sign. HIE stage II is a more complicated stage where convulsion is an inevitable feature. Stage III is more advanced stage with lethal involvement in nervous system and other various organs causing multifactorial effect.[8]

In our study the incidence rate of birth asphyxia was predominant in male neonates constituting 56.5% in comparison to female neonates which is similar but other studies registered more male predominance like 70%- 74%.[9,10] This may be due to transitory cerebral anoxia and decline in neurons related to respiratory control. This further reduces the emergency or auto resuscitation in male babies. Thus they become more prone to develop perinatal asphyxia and furthermore consequences of the fatal process. On contrary females exhibit greater resistance to hypoxia compared to males due to the existence of an extra X chromosome which allows them to tolerate more lower level of oxygen with less cerebral anoxia and qualitative functional derrangement in affected neuron.[11]

We have also observed predominance of birth asphyxia in vaginal delivery 64% in frequency which is similar to the findings of other studies notably 54% by Singh et al and a bit high like 71% by Onyiriuka. This probably due to the prolonged labour or obstructed labour terminating into NVD, less fetal monitoring during NVD, NVD done in home with low skilfull or traditional non medical person.[12,13]

In the present study, majority of the neonates were in HIE stage II (58.5%) compared to stage I (19.8%) and stage III (21.7%) which is identical to a study conducted by Acharya et al where 57.33% of infants were in the stage II. Most of the HIE I neonate is treated in home. When convulsion occurs along with other features of stage II they are admitted to SCANU. With proper support very few neonate advance to stage III. This is why Stage II is the predominant stage in our result.[14]

In this research, the serum calcium was compared among the different stage of HIE. The neonates in HIE stage III had significantly lower calcium level compared to HIE stage II (5.1±1.66 vs 6.1±1.1.54). Subsequently HIE stage II had lower calcium level than stage I(6.1±1.1.54 vs 7.2±1.35). Other studies have also documented similar comparison of serum calcium level in different stages of HIE. Those studies have listed few of their observation regarding this. Most of the HIE -III neonates suffer multiorgan dysfunction including parathyroid dysfunction, poor absorption of calcium from intestine as well as reabsorption from renal tubule.[15]

**Conclusion:**

Serum calcium level tends to decrease in asphyxiated neonate which is most subjacent in HIE stage III.

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Open access Original article

# Arthroscopic Meniscectomy Versus Meniscal Repair: A Comparative Functional Outcome Study

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Submission Date : 09 Jan 2026
Accepted Date : 19 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90008

**Abstract**

**Background:**
Meniscal tears are among the most common knee injuries, leading to pain, swelling, and functional limitations that can significantly affect daily activities and athletic performance.

**Objective:**
This study aimed to evaluate and compare the functional outcomes of arthroscopic partial meniscectomy and meniscal repair using validated clinical scoring systems.

**Methods:**
This prospective comparative study was conducted at the Department of Orthopaedic Surgery, National Institute of Traumatology & Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh, from July 2024 to June 2025 on 64 patients diagnosed with symptomatic meniscal tears requiring surgical intervention divided into two equal groups: arthroscopic partial meniscectomy (n=32) and meniscal repair (n=32). Patients were followed up at 3, 6, and 12 months postoperatively, and final functional outcomes were assessed using the same scoring systems applied preoperatively. Data were analyzed using SPSS version 25.0.

**Results:**
Preoperative IKDC, Lysholm, and Tegner scores were comparable between groups. At final follow-up, the repair group achieved higher mean IKDC (85.9 vs 78.4, p-value=<0.001), Lysholm (90.4 vs 82.6, p-value=<0.001), and Tegner (6.3 vs 5.1, p-value=0.002) scores. Excellent functional outcomes were observed in 62.5% of repair patients versus 37.5% of meniscectomy patients. Complications were low in both groups, with slightly higher reoperation rates in the repair group (9.4% vs 3.1%).

**Conclusion:**
Although both arthroscopic partial meniscectomy and meniscal repair lead to significant improvements in knee function for patients with meniscal tears,meniscal repair provides superior functional outcomes, higher activity levels, and a greater proportion of excellent results at final follow-up.

**Keywords:** Arthroscopic meniscectomy, Meniscal repair, Longitudinal tear

**Citation:** Hossain MK,Alam MS,Rahman SMA,Hossain MS,Salauddin MA.Arthroscopic Meniscectomy Versus Meniscal Repair: A Comparative Functional Outcome Study.J Rang Med Col.2026 Mar;11(1):73-77.doi: https://doi.org/10.3329/jrpmc.v11i1.90008

## Introduction:

Meniscal injuries are among the most common causes of knee pain and functional limitation encountered in orthopaedic practice, affecting both young athletic populations and older individuals with degenerative joint disease. The medial and lateral menisci play a critical role in load transmission, shock absorption, joint congruity, and stability of the knee. Disruption of meniscal integrity alters normal knee biomechanics, leading to increased contact stresses on articular cartilage and predisposing the joint to early degenerative osteoarthritis.[1] Consequently, preservation of meniscal tissue has

become an important objective in modern knee surgery. When conservative management fails to relieve symptoms, arthroscopic intervention is often indicated. The two principal surgical options are arthroscopic partial meniscectomy and meniscal repair. Arthroscopic meniscectomy has historically been the most frequently performed procedure due to its technical simplicity, shorter rehabilitation period, and reliable short-term symptom relief. However, accumulating evidence suggests that resection of meniscal tissue compromises its biomechanical function and is associated with a higher risk of long-term osteoarthritic changes, particularly in younger and physically active patients.[2,3] In contrast, meniscal repair aims to preserve native meniscal tissue and restore its functional role within the knee joint. Advances in arthroscopic techniques—including inside-out, outside-in, and all-inside repair methods—have expanded the indications for repair, allowing treatment of a broader range of tear patterns. Several biomechanical and clinical studies have demonstrated that meniscal preservation is associated with improved load distribution, reduced cartilage degeneration, and better long-term joint health compared with meniscectomy.[4] Recent comparative clinical studies have reported superior functional outcomes following meniscal repair when compared to partial meniscectomy. Patient-reported outcome measures such as the International Knee Documentation Committee (IKDC) score, Lysholm knee score, and Tegner activity scale have consistently shown higher post-operative scores in patients undergoing meniscal repair.[5,6] In a comparative study with medium-term follow-up, patients treated with meniscal repair demonstrated significantly better functional outcomes and activity levels than those who underwent meniscectomy.[5] Systematic reviews and meta-analyses further support these findings. A large systematic review evaluating long-term outcomes reported that meniscal repair was associated with a lower incidence of radiographic osteoarthritis and superior functional scores compared with meniscectomy.[7] Similarly, a recent systematic review focusing on posterior medial meniscus injuries demonstrated that meniscal repair resulted in better knee function and reduced osteoarthritic progression compared with partial meniscectomy.[8] Despite these advantages, meniscal repair is not without limitations. The procedure is technically more demanding, requires longer rehabilitation, and has been associated with higher reoperation rates due to repair failure, particularly in avascular tear zones or degenerative tears.[7,9] Nevertheless, increasing emphasis on meniscal preservation has led to a global trend toward higher repair rates and reduced reliance on meniscectomy, especially in younger patients.[10] This study aimed to evaluate and compare the functional outcomes of these two surgical techniques using validated clinical scoring systems, thereby contributing to evidence-based decision-making in the management of meniscal injuries.

**Methods:**

This prospective comparative study was conducted at the Department of Orthopaedic Surgery, National Institute of Traumatology & Orthopaedic Rehabilitation, Dhaka, Bangladesh, from July 2024 to June 2025, including a total of 64 patients diagnosed with symptomatic meniscal tears requiring surgical intervention. Patients were divided into two equal groups: arthroscopic partial meniscectomy (n=32) and meniscal repair (n=32). Inclusion criteria encompassed patients aged 18–50 years with isolated meniscal tears confirmed on MRI and clinical examination. Exclusion criteria included patients with advanced osteoarthritis, ligamentous injuries requiring reconstruction, prior knee surgery, systemic inflammatory diseases. All patients underwent a detailed preoperative evaluation including demographic data, medical history, physical examination, and baseline functional assessment using International Knee Documentation Committee (IKDC) score, Lysholm knee score, and Tegner activity scale. Tear type and location were documented intraoperatively. Meniscal repair was performed for longitudinal tears located in the vascularized red-red or red-white zones using all-inside or inside-out techniques, while partial meniscectomy was performed for complex, degenerative, or irreparable tears. Postoperatively, all patients followed a structured rehabilitation protocol tailored to the surgical procedure. Weight-bearing and range-of-motion exercises were initiated according to the type of intervention, with gradual progression to full activity. Patients were followed up at 3, 6, and 12 months postoperatively, and final functional outcomes were assessed using the same scoring

systems applied preoperatively. Postoperative complications and reoperation rates were also recorded.Data were analyzed using SPSS version 25.0. Continuous variables were expressed as mean±standard deviation, and categorical variables as frequencies and percentages. Independent sample t-tests were used to compare continuous variables between groups, while chi-square tests were applied for categorical data. A p-value $p<0.05$ was considered statistically significant.

**Results:**

Patients in the meniscectomy group had a higher mean age (36.8±8.4 years) compared to the meniscal repair group (29.6±6.9 years). Male patients predominated in both groups, accounting for 65.6% in the meniscectomy group and 71.9% in the repair group. Right knee involvement was observed in 56.3% of meniscectomy patients and 59.4% of repair patients, while left knee involvement was seen in 43.7% and 40.6%, respectively (Table-I).

**Table-I: Demographic characteristics of the study population (N=64)**

| Variable | Meniscectomy (n=32) no. (%) | Meniscal Repair (n=32) no. (%) |
|---|---|---|
| Mean age (years) | 36.8±8.4 | 29.6±6.9 |
| Male | 21(65.6) | 23(71.9) |
| Female | 11(34.4) | 9(28.1) |
| Right knee involvement | 18(56.3) | 19(59.4) |
| Left knee involvement | 14(43.7) | 13(40.6) |

Medial meniscus tears were more common than lateral tears in both groups, occurring in 68.8% of the meniscectomy group and 62.5% of the repair group. Longitudinal tears were more frequent in the meniscal repair group (56.3%) compared to the meniscectomy group (28.1%). Complex or degenerative tears predominated in the meniscectomy group (53.1%), whereas tears in the vascular red–red or red–white zones were significantly more common in the repair group (75.0%) (Table-II).

**Table-II: Tear characteristics and meniscal involvement (N=64)**

| Variable | Meniscectomy (n=32) no. (%) | Meniscal Repair (n=32) no. (%) |
|---|---|---|
| Medial meniscus tear | 22(68.8) | 20(62.5) |
| Lateral meniscus tear | 10(31.2) | 12(37.5) |
| Longitudinal tear | 9(28.1) | 18(56.3) |
| Complex/degenerative tear | 17(53.1) | 6(18.8) |
| Red–red / red–white zone | 7(21.9) | 24(75.0) |

Preoperatively, the mean IKDC score was 46.3±8.1 in the meniscectomy group and 47.6±7.9 in the repair group. Mean Lysholm scores were 51.8±9.3 and 53.1±8.7, respectively. Tegner activity levels were comparable, with mean scores of 3.2±1.1 in the meniscectomy group and 3.4±1.2 in the repair group, indicating similar baseline functional status.At final follow-up, the mean IKDC score improved to 78.4±6.9 in the meniscectomy group and 85.9±5.8 in the meniscal repair group. Lysholm scores increased to 82.6±7.3 and 90.4±5.6, respectively. The Tegner activity score improved to 5.1±1.2 in the meniscectomy group and 6.3±1.1 in the repair group, with all differences reaching statistical significance (Table-III).

**Table-III: Preoperative and postoperative functional scores (N=64)**

| Surgical techniques | Functional Scores (Mean±SD) | | p-value |
|---|---|---|---|
| | Preoperative | Postoperative | |
| **IKDC score** | | | |
| Meniscectomy | 46.3±8.1 | 78.4±6.9 | <0.001 |
| Meniscal Repair | 47.6±7.9 | 85.9±5.8 | |
| **Lysholm score** | | | |
| Meniscectomy | 51.8±9.3 | 82.6±7.3 | <0.001 |
| Meniscal Repair | 53.1±8.7 | 90.4±5.6 | |
| **Tegner activity scale** | | | |
| Meniscectomy | 3.2±1.1 | 5.1±1.2 | 0.002 |
| Meniscal Repair | 3.4±1.2 | 6.3±1.1 | |

Excellent outcomes were achieved in 37.5% of patients undergoing meniscectomy compared to 62.5% in the meniscal repair group. Good outcomes were observed in 40.6% and 31.3% of patients, respectively. Fair outcomes were more frequent in the meniscectomy group (15.6%) than in the repair group (6.2%), while poor outcomes occurred only in the meniscectomy group (6.3%) (Table-IV).

**Table-IV: Functional outcome grading based on lysholm score (N=64)**

| Outcome | Meniscectomy (n=32) no. (%) | Meniscal Repair (n=32) no. (%) |
|---|---|---|
| Excellent | 12(37.5) | 20(62.5) |
| Good | 13(40.6) | 10(31.3) |
| Fair | 5(15.6) | 2(6.2) |
| Poor | 2(6.3) | 0(0) |

Persistent knee pain was reported in 9.4% of meniscectomy patients and 6.3% of repair patients. Knee stiffness occurred in 6.3% of the meniscectomy group and 9.4% of the repair group. Reoperation was required in 3.1% of meniscectomy patients compared to 9.4% in the repair group, while 81.2% and 75.0% of patients, respectively, experienced no postoperative complications (Table-V).

**Table-V: Postoperative complications and reoperation rates (N=64)**

| Complications and Reoperation | Meniscectomy (n=32) no. (%) | Meniscal Repair (n=32) no. (%) |
|---|---|---|
| Persistent knee pain | 3(9.4) | 2(6.3) |
| Knee stiffness | 2(6.3) | 3(9.4) |
| Reoperation | 1(3.1) | 3(9.4) |
| No complications | 26(81.2) | 24(75.0) |

**Discussion:**

Our results showed that the mean IKDC score improved from 46.3±8.1 to 78.4±6.9 in the meniscectomy group and from 47.6±7.9 to 85.9±5.8 in the meniscal repair group at final follow-up. In the retrospective study by Lee et al, a similar pattern was observed: IKDC scores improved from 46.6 to 81.7 after meniscectomy and from 45.9 to 84.4 after meniscal repair, with both procedures yielding significant functional gains, but with repair maintaining a slightly better long-term trajectory.[11] These parallel findings reinforce that, while both interventions are effective, meniscal repair tends to yield higher functional scores over time.In terms of Lysholm knee scores, our study demonstrated postoperative means of 82.6±7.3 for meniscectomy and 90.4±5.6 for meniscal repair. This pattern of better Lysholm outcomes following repair is supported by cohort data from the retrospective study by Nabiyev et al, where the meniscal repair group had a significantly higher average Lysholm score (87.48) compared to the meniscectomy group (81.73), reflecting better symptom relief and functional capacity.[12] These findings parallel our observation of a greater proportion of excellent and good outcomes in the repair group compared with meniscectomy.The Tegner activity scale in our series also favoured meniscal repair, with a mean postoperative score of 6.3±1.1 compared to 5.1±1.2 after meniscectomy. This is consistent with findings from meta-analytic evidence indicating that meniscal repair patients tend to achieve higher activity levels postoperatively, reflecting improved capacity to return to higher functional demands.[7] These comparisons help confirm that preserving meniscal integrity can better support activity resumption.Our functional grading, based on Lysholm categories, revealed that 62.5% of repair patients achieved excellent outcomes compared with 37.5% in the meniscectomy group. The retrospective cohort byNabiyevet al similarly found a higher proportion of good outcomes in the repair group compared with meniscectomy, reinforcing the notion that repair often results in greater proportions of clinically meaningful improvements.[12] Moreover, the systematic review by Hurmuz et al demonstrated that overall IKDC and Lysholm scores were higher on average among repair patients than those treated with meniscectomy, further substantiating our findings.[8] Although we observed a slightly higher reoperation rate in the meniscal repair group (9.4%) compared to meniscectomy (3.1%), this trend has been documented in previous analyses. Paxton et al reported that while meniscal repair may have a higher risk of reoperation or failure, it concurrently provides better long-term functional outcomes and

activity scores.[7] Therefore, the trade-off between a modestly higher reoperation rate and superior functional recovery should be considered when selecting the most appropriate surgical strategy.

**Limitations:**
The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

**Conclusion:**
This comparative study demonstrates that while both arthroscopic partial meniscectomy and meniscal repair significantly improve knee function in patients with meniscal tears, meniscal repair provides superior functional outcomes, higher activity levels, and a greater proportion of excellent results at final follow-up.It is recommended that meniscal repair should be preferred over partial meniscectomy whenever technically feasible, especially in younger and active patients, to achieve better long-term functional outcomes, higher activity levels, and preservation of knee joint integrity.

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# Short Term Neurocognitive and Behavioral Outcome of Acute CNS Infection in Children in a Tertiary Neurology Hospital

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Submission Date : 09 Jan 2026
Accepted Date : 19 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90009

**Abstract**

**Background:**
Acute central nervous system (CNS) infections remain a major cause of childhood morbidity and mortality worldwide. Although neurocognitive and behavioral sequelae are well recognized, data from Bangladesh are limited.

**Objective:**
This study evaluated short-term neurocognitive and behavioral outcomes among children hospitalized with acute CNS infections.

**Methods:**
A prospective cohort study was conducted in the Paediatric Neurology Department at the National Institute of Neuroscience and Hospital from July 2021 to June 2022 on 120 children with acute CNS infections. Demographic data, clinical features, neurological status, and neurocognitive and behavioral performance were assessed at discharge, 1–2 weeks, and 3 months post-discharge using structured questionnaires. Data were analyzed with SPSS 24.

**Results:**
The mean age was 6.3±4.3 years, with male predominance (71.7%); most children were from rural areas. Nearly half presented within one week of symptom onset, commonly with seizures (60.8%), fever (55%), Kering's sign (50.8%), and neck rigidity (41.6%). Encephalitis (50%) and meningitis (42.5%) were the predominant diagnoses, with Streptococcus pneumoniae and Neisseria meningitidis frequently identified. More than half had stage-II disease on admission. Moderate clinical outcomes were observed in 56.6% at discharge. Motor deficits were common in encephalitis, while seizures predominated in meningitis. Disease severity was strongly associated with final clinical outcome ($p<0.001$), and hospital stay varied significantly by infection type ($p<0.001$). Neurocognitive and behavioral scores were mostly impaired at baseline but improved across follow-ups. Disease severity did not significantly influence cognitive trajectories. Behavioral outcomes at discharge differed by disease stage ($p=0.020$) and were associated with clinical outcomes. Logistic regression showed no independent effect of meningitis, encephalitis, or hospital stay on cognitive or behavioral outcomes.

**Conclusion:**
Encephalitis and meningitis were the leading CNS infections, with most children experiencing moderate clinical improvement by discharge. Although disease severity predicted clinical outcomes, neither infection type nor hospital stay reliably predicted neurocognitive or behavioral recovery. Younger children showed poorer baseline functioning, but substantial improvement was observed over time. Clinical outcome at discharge emerged as the strongest correlation of short-term cognitive and behavioral progress.

**Keywords:** Acute CNS infection, Short term outcome, Neurocognitive, Behavioral

**Citation:** Rashid MA, Hussain S,Happy RA,Moniruzzaman MM,Rashed AJMKE,Debnath B, et al.Short Term Neurocognitive and Behavioral Outcome of Acute CNS Infection in Children in a Tertiary Neurology Hospital.J Rang Med Col.2026 Mar;11(1):78-84.doi:https://doi.org/10.3329/jrpmc.v11i1.90009

**Introduction:**

Acute central nervous system (CNS) infections are life-threatening conditions in children and continue to cause substantial global morbidity and mortality.[1] Their epidemiology varies widely due to geographic diversity of pathogens and challenges in achieving definitive microbiological diagnosis, especially in resource-limited settings.[2,3] The incidence of acute encephalitis syndrome in children is estimated at 10.5–13.8 per 100,000, with case fatality rates approaching 30% and neurological sequelae in one-third of survivors.[2,4,5] Major etiologies include N. meningitidis, H. influenzae type B, S. pneumoniae, Japanese Encephalitis Virus- which causes ~68,000 cases and 13,600–20,400 deaths annually[6] and other bacterial, parasitic, and fungal pathogens.[2,7-9] Clinical presentations in young children are often nonspecific, requiring high diagnostic vigilance.[10] Survivors frequently experience neurological, cognitive, and behavioral complications such as reduced IQ, learning and behavioral difficulties, and internalizing or externalizing disorders.[11-13] Short-term neuropsychological outcomes are understudied, although evidence shows early developmental delays after Human Parechovirus infection[14] and reduced quality of life following encephalitis or aseptic meningitis.[15] Neuroinflammatory mechanisms, including cytokine-mediated injury, contribute to long-term neurobehavioral and psychiatric risks.[16,17] Given the large burden in low- and middle-income countries and significant developmental and socioeconomic consequences,[9,18] short-term cognitive and behavioral sequelae following childhood CNS infections warrant systematic evaluation. This study therefore aimed to assess early neurocognitive and behavioral outcomes in children with acute CNS infections admitted to a tertiary neurology hospital.

**Methods:**

This longitudinal observational study was conducted in the Paediatric Neurology Department of the National Institute of Neuroscience and Hospital, Dhaka, over 12 months (July 2021–June 2022). Children aged 1 month–14 years presenting with clinical features of acute CNS infection (e.g., fever, seizures, altered sensorium, focal deficits) or diagnosed as meningitis, encephalitis, brain abscess, or subdural empyema were screened; 166 were evaluated and 120 were enrolled through purposive sampling after written informed consent. Children with CNS tuberculosis, autoimmune encephalitis, neuro-metabolic or psychiatric disorders, CNS tumors, or systemic disease–related CNS manifestations were excluded. Clinical, neurological, laboratory (including CSF), EEG, and neuroimaging findings were documented using structured forms. Disease severity was graded on admission using the BMRC staging system,[19] and discharge outcomes were categorized as good, moderate, or poor.[20] Neurocognitive and behavioral assessments were performed at discharge, 1–2 weeks, and 3 months using age-appropriate standardized tools (WISC-IV, WPPSI-III, Bayley-III, SDQ)[21-24] by a trained child psychologist. All data were quality-checked, coded, and analyzed using SPSS version 24.

**Results:**

The mean age of the participants was 6.29±4.32 years with a range from 0.17 years to 14 years. Around half of the participants belonged to 1 year to <6 years age group, followed by 6 years to 10 years age (26.3%), 11 years to 14 years (23.7%), and <1 year (6.8%) group (Figure-1).

Most of the participants had a duration of symptoms <1 week (48.3%) followed by 1-<2 weeks (27.7%), 2 to <3 weeks (14.5%) and ≥3 weeks (10.5%).

Among the participants studied majority were in stage II (57.5%) followed by stage III & I (Figure-3). Encephalitis (50%) and Meningitis (42.5%) were the most common diagnoses, followed by brain abscess (4.1%) and subdural empyema (3.3%) (Table-I)

Among the participants, 56.6% had a moderate outcome, followed by good (30.8%) and poor outcome (12.5%) (Figure-4).

Children with good outcomes were mostly in stage I (51.4%), while those with poor outcomes were mainly in stage III (80.0%). The severity of the disease was significantly linked to the final clinical outcome at discharge (p<0.001) (Table-II).

**Table-I: Types of acute CNS infection among the respondents (N=120)**

| Diagnosis | no. (%) |
|---|---|
| Encephalitis | 60 (50) |
| Meningitis | 51 (42.5) |
| Brain abscess | 5 (4.1) |
| Subdural empyema | 4 (3.3) |

**Table-II: Relationship between severity of disease and clinical outcome at discharge (N=120)**

| Severity | Good (n=37) no. (%) | Moderate (n=68) no. (%) | Poor outcome (n=15) no. (%) | p-value |
|---|---|---|---|---|
| Stage I | 19(51.4) | 5(7.4) | 0(0) | <0.001 |
| Stage II | 16(43.2) | 49(72.1) | 3(23.1) | |
| Stage III | 2(5.4) | 14(20.6) | 12(80.0) | |

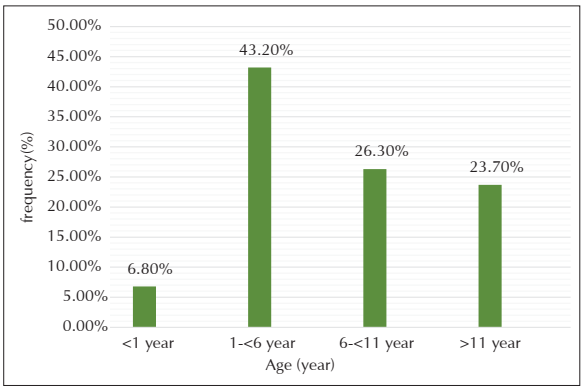



**Figure-1: Age distribution of the study participants (N=120)**

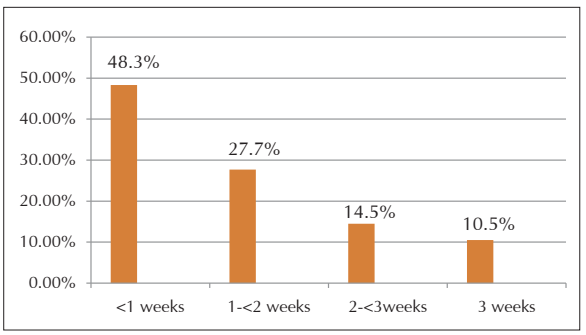



**Figure-2: Duration of symptoms before admission among the studied participant (N=120)**

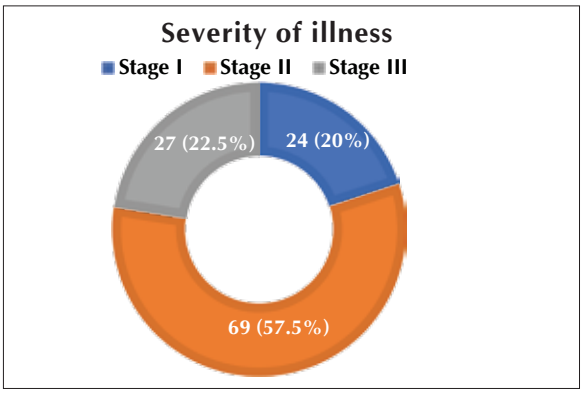



**Figure-3: Severity of illness on admission of the studied population according to BMRC staging of severity of illness (N=120)**

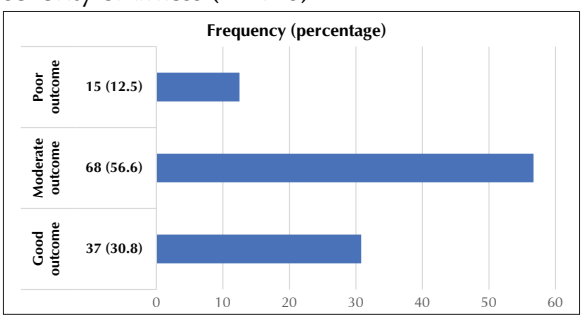



**Figure-4: Clinical outcome at discharge among the studied population (N=120)**

**Table-III: Level of cognitive function and behavior function among the studied population aged 1 to 42 months (n=49)**

| Variable | Extremely low no. (%) | Border-line no. (%) | Low average no. (%) | Average no. (%) | High average no. (%) | Superior no. (%) | Very superior no. (%) | Lost of follow up / death no. (%) |
|---|---|---|---|---|---|---|---|---|
| **Cognitive function** | | | | | | | | |
| Baseline | 47(95.9) | 2(4.1) | - | - | - | - | - | 2(4) Death |
| 1st follow-up | 44(89.8) | 4(8.1) | - | - | - | - | - | 1(2) |
| 2nd follow-up | 35(71.45) | 9(18.3) | 1(2) | - | - | - | - | 4(8.1) |
| **Behavior function** | | | | | | | | |
| Baseline | 49(100) | - | - | - | - | - | - | 2(4) Death |
| 1st follow-up | 47(95.9) | 1(2) | - | - | - | - | - | 1(2) |
| 2nd follow-up | 43(87.7) | 2(4.1) | - | - | - | - | - | 4(8.1) |

The Bayley III Scales of Infant and Toddler Development were used for assessment. Initially, 95.9% of patients had extremely low cognitive scores, improving to 89.8% and 71.45% in follow-ups. All patients had low social behavior scores, which also improved. Two patients died before assessment, and four were lost to follow-up later (Table-III).

Scales used for assessment include the Wechsler Preschool and Primary Scale of Intelligence, Third Edition, and the Wechsler Intelligence Scale for Children, Fourth Edition. At discharge, 95.6% of children had extremely low cognitive function. Follow-ups showed slight improvement, with 10.1% showing borderline function and 1.4% average function (Table-IV).

After adjusting for age, sex, and disease severity, neither meningitis, encephalitis, nor hospital stay showed an independent association with cognitive or behavioral outcomes at any time point (all p>0.05), except a mild association between shorter hospital stay and better behavioral outcome at 1st follow-up (p=0.008) (Table-V).

**Table-IV: Cognitive function of the study participants ≥42 months of age (n=69)**

| Cognitive function | Extremely low no. (%) | Border-line no. (%) | Low average no. (%) | Average no. (%) | Loss to follow up no. (%) |
|---|---|---|---|---|---|
| Baseline | 66(95.6) | 3(4.3) | - | | - |
| 1st follow-up | 61(88.4) | 7(10.1) | - | | 1(1.4) |
| 2nd follow-up | 59(85.5) | 7(10.1) | - | 1(1.4) | 2(2.8) |

**Table-V: Possible predictors of cognitive and behavioral outcome among the studied population in relation to types of CNS infection and hospital stay (n=118) (Adjusted for age, sex, and disease severity; n=118)**

| Predictor | At Discharge Adjusted OR (95% CI) | p-value | 1st Follow-up Adjusted OR (95% CI) | p-value | 2nd Follow-up Adjusted OR (95% CI) | p-value |
|---|---|---|---|---|---|---|
| **A. Cognitive Function** | | | | | | |
| Meningitis | 0.081 (0.594–2.009) | 0.998 | 0.415 (0.067–2.574) | 0.345 | 0.611 (0.136–2.740) | 0.520 |
| Encephalitis | 2.05 (0.228–18.51) | 0.552 | 1.315 (0.217–7.970) | 0.766 | 1.03 (0.284–3.782) | 0.956 |
| Hospital stay | 1.09 (0.594–1.723) | 0.776 | 0.797 (0.446–1.420) | 0.445 | 1.05 (0.753–1.460) | 0.767 |
| **B. Behavioral Function** | | | | | | |
| Meningitis | 0.793 (0.193–3.25) | 0.747 | 0.560 (0.122–0.617) | 0.339 | 1.00 (0.231–4.38) | 0.992 |
| Encephalitis | 0.523 (0.159–1.723) | 0.287 | 0.659 (0.345–1.360) | 0.195 | 1.46 (0.439–4.900) | 0.534 |
| Hospital stays | 0.891 (0.647–1.227) | 0.480 | 0.592 (0.402–0.872) | 0.008 | 0.806 (0.567–1.146) | 0.230 |

**Discussion:**

Central nervous system (CNS) infections in children continue to pose a major health burden, contributing significantly to morbidity and mortality. These infections often lead to severe neurological sequelae, including cognitive and behavioral impairments. In this prospective cohort study, we aimed to assess the short-term neurocognitive and behavioral outcomes of children with acute CNS infections. A total of 120 children from the Paediatric Neurology Department of the National Institute of Neuroscience and Hospital, Dhaka, were enrolled in this study. Two patients died, and six were lost to follow-up.

Baseline characteristics of the study participants revealed a mean age of 6.29±4.32 years. most participants were in the 1 to <6 years age group, consistent with previous studies by Shilo S et al.[25] The majority of children in this study presented with symptoms for less than one week before admission, which mirrors findings from Vasavada HJ et al.[26] Seizures, fever, and altered sensorium were the most common presenting symptoms,

aligning with prior research by Vasavada HJ et al and Page AL et al.[26, 27]

Regarding the severity of illness, most patients were admitted with stage II disease severity, followed by stage III and stage I. This distribution of disease severity reflects the challenging nature of CNS infections in this cohort, with a substantial number of patients presenting in more severe stages. Similar findings have been reported in previous studies by Aida M. Salonga et al[19] The most common diagnoses in this cohort were encephalitis (50%) and meningitis (42.5%), consistent with studies by Bozzola et al[13] and Sumpter et al[11] who also identified these infections as predominant causes of childhood CNS infections.

Despite efforts to identify pathogens, the organisms responsible for CNS infections were not always clearly identified, due to the limited sensitivity of CSF cultures and PCR tests.

In terms of clinical outcomes, the majority of children experienced moderate outcomes at discharge, with disease severity playing a significant role in predicting outcomes. Children with stage I disease were more likely to have a good outcome, while those with stage III disease had a higher likelihood of poor outcomes, which is consistent with findings from Michaeli et al.[20] These results underscore the critical role of early intervention in improving clinical outcomes.

Neurocognitive and behavioral recovery was assessed using standardized tools such as the Bayley-III, WPPSI, and WISC IV. At baseline, most children exhibited extremely low cognitive and behavioral scores. There was notable improvement in cognitive function over time, with 71.45% of children still having extremely low scores at the second follow-up, compared to 95.9% at discharge. In contrast, 30.4% of children showed normal behavioral function at the second follow-up, a significant improvement from baseline (26% normal behavioral function in older children ≥42 months). However, a substantial portion of children still exhibited cognitive and behavioral deficits, suggesting that full recovery was not achieved within the 3-month follow-up period.

The severity of illness significantly affects children's behavior, with those having more severe disease at discharge more likely to show poor behavioral function. Even after cognitive improvements, severe illness impacts ongoing behavioral recovery, leading many children to have low behavioral function at follow-up. Logistic regression shows that encephalitis patients are 2.05 times more likely to have very poor cognitive and behavioral outcomes than meningitis patients, indicating greater neurocognitive impairments. However, factors such as infection type, hospital stay, motor deficits, cranial nerve issues, seizure disorders, and speech problems do not independently predict outcomes.

**Conclusion:**

This study found that encephalitis and meningitis were the most prevalent acute CNS infections, with the majority of survivors experiencing moderate clinical outcomes at discharge. Disease severity was significantly associated with clinical outcomes, but the type of CNS infection did not influence recovery. At discharge, most children exhibited extremely low cognitive function, while younger children had significantly impaired behavioral outcomes. Cognitive function at the first follow-up and behavioral outcomes at discharge were strongly linked to clinical outcomes. However, factors such as CNS infection type, disease severity, hospital stay, and neurological impairments were not significant predictors of cognitive and behavioral recovery in the short term. Future research should include larger cohort studies with long-term follow-up to better assess cognitive and behavioral outcomes in children with acute CNS infections. Multi-center studies across the country are needed to provide a comprehensive understanding of disease patterns and outcomes.

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# Prescribing Antibiotics Among Post-operative Patients in Obstetrics and Gynecology Department of Two Tertiary Care Hospitals of Bangladesh

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Submission Date : 12 Jan 2026
Accepted Date : 19 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90011

**Abstract**

**Background:**
Antibiotics are important in obstetrics and gynecology for preventing and treating infections, inappropriate use contributes to antimicrobial resistance.

**Objective:**
To evaluate the prescribing pattern of the antibiotics in postoperative patients admitted in gynaecology and obstetrics at Dhaka Medical College Hospital (DMCH) and Rangpur Medical College Hospital (RpMCH).

**Methods:**
This cross-sectional observational study was carried out among the post-operative patients admitted in Obstetrics and Gynecology Departments of Dhaka Medical College Hospital & Rangpur Medical College Hospital from July 2017 to June, 2018. A total of 500 sample; 250 from Dhaka center (DMCH) and 250 from Rangpur center (RpMCH), was enrolled through purposive sampling. Sociodemographic data of the participants, diagnosis, number of prescriptions containing antibiotic, numberof antibiotic per prescription, name of drugs in generic or in trade name were recorded.

**Results:**
Among 500 subjects, 250 were from gynaecological cases and 250 from obstetrical cases. The average age was29.88±11.29 years (range: 18-70 years), with most participants (56.6%) from rural areas. Among 3978 prescribed drugs, average number of drugs per prescription was 7.91±1.49 with 28.43 % being antibiotics. 34.23% drugs were prescribed by generic names and hospital supplied drugs were 39.64%. After surgery, 72.6% of patients received two injectable antibiotics, with higher rates in Dhaka (77.2%) compared to Rangpur (68%). The average number of injectable antibiotics was similar in both centers (2.17±0.48), but oral antibiotics were more common in Dhaka (2.22±0.48 vs 2.03±0.8). Most used injectable antibiotic was ceftriaxone (Dhaka center vs Rangpur center, 88.8%, vs 82.4%) and metronidazole (Dhaka center vs Rangpur center 95.2% vs 55.6%), while cefixime(Dhaka center vs Rangpur center 64% vs 44.4%) and metronidazole (Dhaka center vs Rangpur center 82.8% vs 22.8%) were the most common oral antibiotics at discharge.

**Conclusion:**
Ceftriaxone and Metronidazole were frequently administered to postoperative patients. This indicates a trend of polypharmacy that could be reduced by selecting broad-spectrum antibiotics after culture and sensitivity.

**Keywords:** Antibiotics, Gynecology, Obstetric, Rangpur, Dhaka, Bangladesh

**Citation:** Zaman T,Mondol ASMR,Anwar MMU,Rahman MZ,Miah MH,Hasan MK, et al.Prescribing Antibiotics among Post-operative Patients in Obstetrics and Gynecology Department of Two Tertiary Care Hospitals of Bangladesh.J Rang Med Col.2026 Mar;11(1): 85-91.doi:https://doi.org/10.3329/jrpmc.v11i1.90011

**Introduction:**

Antibiotics in obstetrics and gynecology are used both to treat infections and to prevent postoperative wound infections, a major cause of morbidity and mortality after surgery.[1] Despite careful procedures, infections can still occur. Antimicrobial resistance (AMR) is a growing global health problem,[2] particularly severe in Southeast Asia due to weak regulations and poor control of antibiotics.[3] In Bangladesh, antibiotics are accessible without prescriptions, leading to irrational use by unqualified providers.[4] The issue is aggravated by aggressive marketing and insufficient government oversight, [5] with many doctors relying on clinical judgment for antibiotic prescriptions.[1] Multiple antibiotics are often prescribed simultaneously, especially in hospitals where diagnostic facilities are inadequate facilities.[6,7] In many patients, the use of systemic antibiotics is often unnecessary or inappropriate regarding the drug or dosage. Studies in Europe and the United States show that 23 to 38% of inpatients receive systemic antibiotics. In Turkey, antibiotics are the most used drug, making up 20% of the market. In India, they represent over 50% of drug sales, and one study found that 75% of prescriptions include antimicrobials, though their necessity is uncertain.[8] Studies conducted in Bangladesh during last decade revealed that there is polypharmacy, high use of antimicrobials and injectables in hospitals and very low generic name prescribing.[9] Studies indicate that Ceftriaxone (62.9%), Metronidazole (17.2%), and Ciprofloxacin (9.5%) are the most used antibiotics, often in combination therapies (23.3%).[10] Ceftriaxone is frequently prescribed after caesarean sections to reduce maternal infections.[11] Third-generation cephalosporins are widely used for their broad-spectrum coverage. [12] Brand-name antibiotics are prescribed more than 80% of the time, with low rates of generic prescribing.[8,13] Most antibiotics are given through injections (48%), orally (26.9%), or topically (24.7%). [14,15] The study aims to evaluate antibiotic use patterns among postoperative patients in Obstetrics and Gynaecology at Dhaka and Rangpur Medical college.

**Methodology:**

This cross-sectional observational study was conducted on post-operative patients in the Obstetrics and Gynecology Departments at Dhaka Medical College Hospital (DMCH) and Rangpur Medical College Hospital (RpMCH) from July 2017 to June 2018 after the approval of Ethical review Committee (ERC) of Dhaka Medical College. A total of 500 patients were enrolled by purposive sampling. Participants were informed about the study's aims, procedures, and benefits before giving their written consent. They were told there would be no financial benefits and that they could withdraw at any time without affecting their treatment. Data was collected through face-to-face interviews using structured questionnaires that gathered socio-demographic details and information on medication used after surgery, including antibiotics. Besides these, data regarding diagnosis, number of prescriptions containing antibiotic, number of antibiotic per prescription, name of drugs in generic or in trade name, number of drugs written in each prescription were also recorded. The generic names and the pharmacological class of each drug prescribed to patients were identified by a drug data base published every year in Bangladesh. Moreover, snapshots of prescription or photocopy of the discharge sheet were collected. All the prescribers were blinded to reduce biases. Patients who withdrew or provided incomplete information were excluded from the study. All relevant information was collected using a prescription checklist and analyzed with SPSS version 19.0. Each question was given a code, and different responses were recorded for statistical analysis. Descriptive statistics were generated to ensure data homogeneity, with demographic variables shown as percentages. Age was reported as means ± standard deviations. The study estimated the number of drugs per sheet and presented results in tables, charts, or diagrams, highlighting key findings as needed.

**Results:**

Among 500 participants, 250 were from Dhaka Medical College Hospital and 250 from Rangpur Medical College Hospital. The study involved equal numbers of gynecological and obstetric surgeries. The average age was around 30 years, with most patients aged 21 to 30. A majority were married, had low education levels, and were housewives (Table-I).

Among the surgeries lower uterine caesarian section was the most common surgery performed in this study 50% (250) in both the centers followed by Laparotomy with salphingo-oophorectomy (33.6%) and hysterectomy (12.8%) in DMCH. But in Rangpur Medical College Hospital dilatation and curettage (19.6%) was the most common Gynecological operation conducted (Table-II).

Among 3978 prescribed drugs, average number of drugs per prescription was 7.91±1.49 with 28.43 % drugs was antibiotics. 34.23% drugs were prescribed by generic names and hospital supplied drugs were 39.64% (Table-III).

Majority (72.6%) of the patients were given 2 injectable antibiotics after surgery, in Dhaka center 77.2% and in Rangpur center 68%. Average

**Table-I: Socio-demographic characteristics of the participants (N=500)**

| Socio-demographics | DMCH (n=250) no. (%) | RpMCH (n=250) no. (%) | Total (n=500) no. (%) |
|---|---|---|---|
| Mean age (years) | 29.80±10.99 | 30.00±11.03 | 29.88±11.29 |
| **Major age group** | | | |
| 21 to 30 years | 132(52.8) | 131(52.4) | 263(52.6) |
| **Residence** | | | |
| Urban | 92(36.8) | 125(50) | 217(43.4) |
| Rural | 158(63.2) | 125(50) | 283(56.6) |
| **Educational status** | | | |
| Illiterate | 22(8.8) | 15(6.0) | 37(7.4) |
| Below SSC | 135(62.4) | 160(64) | 295(63.2) |
| SSC | 36(14.4) | 26(10.4) | 62(12.4) |
| HSC | 15(6.0) | 30(12) | 45(9) |
| Graduate and above | 21(8.4) | 19(7.6) | 40(8) |
| **Occupation** | | | |
| Housewives | 220(88.0) | 230(92.0) | 450(90) |
| NGO service | 10(4.0) | 9(3.6) | 19(3.8) |
| Government Service | 9(3.6) | 9(3.6) | 18(3.6) |
| Business | 8(3.2) | 2(0.8) | 10(2) |
| Unemployed | 3(1.2) | 0(0) | 3(0.6) |

**Table-II: Details of the surgeries of the participants (N=500)**

| Type of surgery | DMCH (n=250) no. (%) | RpMCH (n=250) no. (%) | Total (n=500) no. (%) |
|---|---|---|---|
| LUCS | 125(50) | 125(50) | 250 (50) |
| Laparotomy with salphingectomy | 42(16.8) | 3(1.2) | 58(11.6) |
| Hysterectomy | 32(12.8) | 14(35) | 67(13.4) |
| TAH | 16(6.4) | 3(1.2) | 19(3.8) |
| TAH with BSO | 1(0.4) | 21(8.4) | 22(4.4) |
| VH | 15(6) | 11(4.4) | 26(5.2) |
| D & C | 22(8.8) | 49(19.6) | 71(14.2) |
| Cystectomy | 2(0.8) | 6(2.4) | 10(02) |
| Exploratory laparoscopy | 12(4.8) | 10(4) | 22(4.4) |
| Myomectomy | 7(2.8) | 2(0.8) | 9(1.8) |
| Posterior colpoperineorrhaphy | 5(2) | 3(1.2) | 8(1.6) |
| Uterus repair | 3(1.2) | 4(1.6) | 7(1.4) |

number of injectable antibiotics given were similar both centers. At the time of discharge 53.8% of the patients were given 2 oral antibiotics (Table-IV).
Most used injectable antibiotic was ceftriaxone (Dhaka vs Rangpur center, 88.8%, vs 82.4%) and metronidazole (Dhaka vs Rangpur center 95.2% vs 55.6%). On the other hand, cefixime (Dhaka vs Rangpur center 64% vs 44.4%) and metronidazole was the most commonly used oral antibiotic used at discharge (Dhaka vs Rangpur center 82.8% vs 22.8%) (Figure-1 & 2).
The most common antibiotic combination used was ceftriaxone and metronidazole followed by ceftriaxone combined with gentamicin or amikacin (Table-V).

**Table-III: WHO drug use prescribing indicators (N=500)**

| WHO prescribing indicator | DMCH (n=250) | RpMCH (n=250) | Total (n=500) |
|---|---|---|---|
| Total number of drugs prescribed | 2023 | 1955 | 3978 |
| Average number of drugs per prescription (Mean±SD) | 8.0±1.42 | 7.82±1.55 | 7.91±1.49 |
| % of drugs prescribed by generic name | 40.6% | 27.7% | 34.23% |
| % of injections prescribed | 61.9% | 63.0% | 62.45% |
| % of drugs prescribed from hospital supply | 41.8% | 37.4% | 39.64% |
| % of antibiotics prescribed | 27.76% | 28.52% | 28.43% |
| % of drugs prescribed from essential drug list- 2017 | 74.24% | 73.20% | 73.73% |

**Table-IV: Details of the antibiotic use after surgery (N=500)**

| Antibiotic used | DMCH (n=250) no. (%) | RpMCH (n=250) no. (%) | Total (n=500) |
|---|---|---|---|
| **Number of injectable antibiotics used after surgery** | | | |
| 1 | 8(3.2) | 21(8.4) | 29(5.8) |
| 2 | 193(77.2) | 170(68) | 363(72.6) |
| 3 | 46(18.4) | 55(22) | 101(20.2) |
| 4 | 3(1.2) | 4(1.6) | 7(1.4) |
| 5 | 5(2) | 6(2.4) | 11(2.2) |
| Mean±SD | 2.17±0.48 | 2.16±0.58 | 2.17±0.53 |
| **Number of oral antibiotics used at discharge** | | | |
| 1 | 33(13.2) | 89(35.6) | 122(24.4) |
| 2 | 147(58.8) | 122(48.8) | 269(53.8) |
| 3 | 53(21.2) | 31(12.4) | 84(16.8) |
| 4 | 15(6.0) | 6(2.4) | 21(4.2) |
| 5 | 2(0.8) | 2(0.8) | 4(0.8) |
| Mean±SD | 2.22±0.48 | 1.84±0.79 | 2.03±0.80 |

**Table-V: Pattern of commonly usedcombined injectable antibiotics according to types of surgery**

| Type of surgery | Ceftriaxone + Metronidazole | | Ceftriaxone+ Metro+ Gentamicin/amikacin | | Ciprofloxacin+ Metronidazole | | Meropenem+ Metronidazole | |
|---|---|---|---|---|---|---|---|---|
| | DMCH no. (%) | RpMCH no. (%) | DMCH no. (%) | RpMCH no. (%) | DMCH no. (%) | RpMCH no. (%) | DMCH no. (%) | RpMCH no. (%) |
| LUCS | 10 (40) | 70 (28) | 25 (10) | 40 (16) | - | - | - | 15 (6) |
| Laparotomy with salphingectomy | 50 (20 | 20 (8) | 4 (1.6) | 6 (2.4) | - | - | - | - |
| Hysterectomy | 20 (8) | 15 (6) | 10 (4) | 10 (4) | - | - | 2 (0.8) | 10 (4) |
| Other surgeries | 10 (4) | 9 (3.6) | 5 (2) | - | 2 (0.8) | 40 (16) | - | - |
| D & C | 8 (3.2) | 10 (4) | - | 3 (1.2) | 12 (4.8) | 2 (0.8) | - | - |

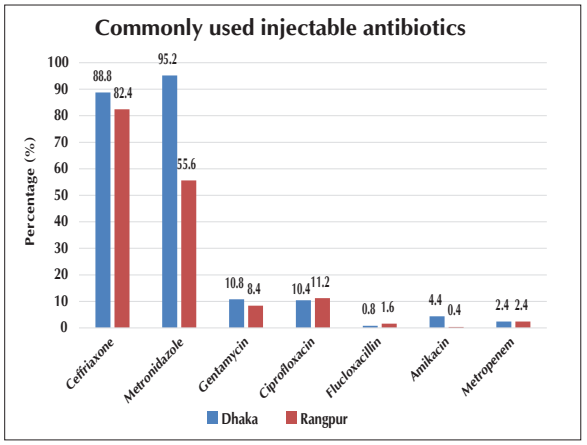



**Figure-1: Commonly used injectable antibiotics (N=500)**

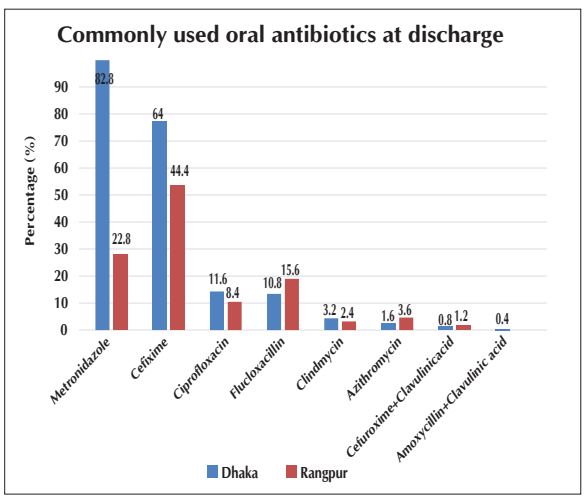



**Figure-2: Most commonly used oral antibiotic at discharge (N=500)**

## Discussion:

The tertiary level hospitals have been chosen because the prescribing patterns of the postoperative department of tertiary level hospitals are often copied by community practitioners. Mean age of all study subjects were 29.88±11.29 years with majority in the age group of 21-30 years. As both Gynecological and Obstetric surgical cases were included in this study, the mean age differed from other studies. In a study on 1807 patients, maximum number of patients were in age group of 18 to 30 yrs (980; 54.2%).[8] Jowarder RJ reported the majority aged 31–45 years (48.9%; mean age 38.5±9.3 years).[16] These findings are consistent with previous studies where 54.2% of patients were aged 18–30 years in one series of 1807 cases, Sharma et al,[17] reported a mean age of 37.86±15.51 years, Latha et al,[18] observed 86% in the 20–30-year group, and Balla et al,[19] found a mean age of 28.88±9.32 years.

The types of surgeries differed based on study design and sampling. In this study, lower uterine caesarian sections (LUCS) were most common at 50%. Other studies reported higher rates of LUCS by 56.5%,[20] 127 cases[17] and 93.7%[21] while Divyashree et al[22] focused only on gynecological cases and found hysterectomy was most common (87%).

In the study, average number of drugs per prescription was 7.91±1.49 with 28.43 % being antibiotics, which exceeds the WHO recommendation of 2.0 drugs per prescription.[23] Other studies noted averages of 9.8 and 12 drugs per visit.[21,24] The Dhaka center had more prescribed drugs than the Rangpur center, likely due to complex cases and drug availability. Keeping the number of prescribed drugs low is crucial to avoid drug interactions, prevent bacterial resistance, and reduce hospital costs. The average number of injectable antibiotics was 2.17±0.53 and oral antibiotics at discharge was 2.03±0.80. Previous studies indicated an average of 2.3 antibiotics per prescription. [8,13] Sawhney N et al found that most patients received medications in injectable forms (48%) and 26.9% as oral preparations.[8] Devi et al had similar findings, with 63.01% of antibiotics given parenterally and 29.14% orally.[14]

The predominant antibiotic combination used was ceftriaxone and metronidazole, with some patients also receiving ceftriaxone in combination with gentamicin or amikacin. At discharge, ceftriaxone was frequently replaced by oral cefixime, particularly in Dhaka, where more oral antibiotics were prescribed compared to Rangpur, where metronidazole was administered injectably for 2 to 3 days without transitioning to oral forms. Neither center adhered to the BSMMU guidelines or the Standard Clinical Management Protocols from the Directorate General of Health regarding antibiotic usage. Jowarder RJ et al highlighted that metronidazole (55.7%) and ceftriaxone (45.6%) were the most prescribed antibiotics, followed by gentamicin (13.7%), cefuroxime (14.1%), ciprofloxacin (11.9%), and flucloxacillin (5.7%).[16]

Sawhney et al also reported Cefuroxime (17.3%) and Framycetin (24.7%) being common, [8] and a study in Bangladesh reported Ceftriaxone (30.19%), Cefixime (18.87%), and Amoxicillin (16.98%) as the most used agents.[25] additionally, Gor et al, found Amoxicillin+Clavulanic acid (6.59%) to be the most common fixed-dose combination.[26] Ceftriaxone-based regimens remained prevalent post-caesarean section, aligning with WHO guidelines for antibiotic prophylaxis against maternal infections.[18] A recent survey indicated that 55.57% of Bangladeshi physicians prescribed antibiotics empirically, favoring cephalosporins (26.9%).[10]

In Bangladesh, the practice of prescribing drugs by generic name is quite low,[20] with an average of three drugs prescribed by generic name, especially in Dhaka. Drug availability in government hospitals may affect this rate. Brand-name prescribing was notably high (>80%), while generic prescribing remained low (37.71%) in other studies.[8,13,16]

**Conclusion:**

Ceftriaxone and Metronidazole were frequently administered to postoperative patients. The use of 2 to 3 antibiotics indicates a trend of polypharmacy that could be reduced by selecting broad-spectrum antibiotics after culture sensitivity testing. A nationwide study is advised to accurately assess the situation across the country.

**Limitations:**

The antibiotics utilization pattern was limited to express two tertiary care center and therefore not representative of generalized countrywide and rationality of prescriptions was not checked.

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# Analyzing The Challenges and Opportunities Related to Biomedical Waste Management in District-Level Hospitals

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Submission Date : 12 Jan 2026
Accepted Date : 19 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90012

**Abstract**

**Background:**
Effective biomedical waste management is crucial for safeguarding healthcare personnel, patients, and the environment from the dangers posed by toxic hospital waste. District-level hospitals in Bangladesh continue to have difficulties in establishing efficient waste management systems.

**Objective:**
This study aimed to examine the difficulties and opportunities associated with biomedical waste management practices among healthcare professionals in designated district-level hospitals in Bangladesh.

**Methods:**
A descriptive cross-sectional study was performed from March 2025 to November 2025 in designated district-level hospitals in Bangladesh. A total of 130 healthcare practitioners, encompassing physicians, nurses, custodians, and administrators, engaged in the study. Data were gathered through structured questionnaires and analysed using SPSS version 26. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were employed.

**Results:**
A moderate level of awareness of biomedical waste management among healthcare professionals was observed. Approximately 73.1% were cognizant of BWM regulations, and 60% had undergone training. Nonetheless, fewer than 50% continuously implemented waste segregation at the source. Incineration (26.9%) was the predominant treatment modality. Significant issues comprised insufficient staff awareness or training (26.9%), poor infrastructure (23.1%), and deficient monitoring (19.2%). Participants recommended consistent training, enhanced infrastructure, sufficient PPE provision, and increased oversight to improve biomedical waste management methods in hospitals.

**Conclusion:**
Results from this study suggested enchaining training, infrastructure, and proper supervision is essential to improve biomedical waste management in district levels hospitals to mitigate the health and environmental hazards in Bangladesh.

**Keywords:** Biomedical Waste Management, Healthcare Waste, Hospital Waste, District Hospitals, Healthcare Workers

**Citation:** Amin MN,Hassan P,Islam SMS.Analyzing The Challenges and Opportunities Related to Biomedical Waste Management in District-Level Hospitals.J Rang Med Col.2026 Mar;11(1):92-98.doi: https://doi.org/10.3329/jrpmc.v11i1.90012

## Introduction:

Biomedical waste management (BWM) is a critical aspect of hospital operations, as healthcare activities invariably produce waste that may be infectious, poisonous, or otherwise detrimental to human health and the environment. Proper handling of these wastes safeguards patients, healthcare personnel, waste handlers, and the adjacent community from various health hazards, including blood-borne illnesses, chemical exposure, and injury from sharps.[1] Moreover, effective BWM mitigates environmental pollution of air, water, and soil that may arise from hazardous disposal methods such as open burning or unregulated landfilling. Thus, effective BWM underpins the essential goal of health-care




**Figure-1: Biomedical waste management in a hospital**

institutions by mitigating secondary harms linked to health-care delivery.[2]

Bangladesh has experienced a significant rise in biomedical waste due to the proliferation of healthcare facilities. The government established the Medical Waste (Management and Processing) Rules, 2008 to address this issue. The Government of Bangladesh (2008) states that these regulations delineate the legal procedures for the segregation, transportation, treatment, and disposal of medical waste.[3] Despite the existence of these regulations, numerous healthcare facilities, particularly district-level hospitals, continue to encounter issues such as inadequate infrastructure, insufficient staff training, inadequate monitoring, and weak enforcement of rules.[4]

Recent research shows that not properly handling biomedical waste can spread infectious diseases, pollute the environment, and put healthcare workers at risk.[5] The Biomedical Waste Management Rules in India, first put into effect in 1998 and updated in 2016, require healthcare facilities to follow strict rules for separating and treating waste. Studies show that healthcare workers don't always know about or follow the rules.[6] Pakistan, Nepal, and Bhutan are all developing nations that have problems such as not receiving enough money, not having enough treatment facilities, and not educating their staff well enough.[7] Southeast Asian countries including Malaysia, Vietnam, and Thailand have put in place regulations and mechanisms for managing healthcare waste, although problems with inappropriate separation and insufficient monitoring still exist.[8]

In Iran, healthcare waste management has advanced due to national regulations and heightened awareness, issues persist in rural and district hospitals.[9] Biomedical waste management is still a big problem for the environment and public health in many parts of the world, especially in developing countries. To make biomedical waste management systems better, especially in district-level hospitals that serve a lot of people, it is important to improve policy enforcement, infrastructure, and staff training. This study aims to explore the challenges and opportunities related to biomedical waste management in district-level hospitals. To guide this investigation, the following research questions have been formulated.

**Method:**

This descriptive cross-sectional study was conducted in selected district-level hospitals in Bangladesh, focusing on those providing secondary-level healthcare services. These hospitals serve a large population and generate considerable biomedical waste, making them ideal for assessing biomedical waste management systems. The study was conducted over a period of nine months, from March 2025 to November 2025 after the approval of the Institutional Ethics Committee. The study population consisted of 130 healthcare professionals directly or indirectly involved in biomedical waste management, including doctors, nurses, ward attendants, cleaners, and hospital administrative staff. The inclusion criteria were healthcare professionals working in the selected district hospitals, staff with

at least six months of work experience in the current hospital, and respondents who provided informed consent to participate. The exclusion criteria included staff on long-term leave during the study period, recruits with less than six months of experience, and individuals unwilling to participate. Collected data were coded, entered, and analysed using Statistical Package for the Social Sciences (SPSS) software version 26. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to present the findings. Qualitative data from open-ended responses were analysed thematically.

**Results:**

Table-I demonstrated that most respondents were aged 25–34 years (32.3%) and worked in government hospitals (53.8%). Nurses formed the largest group (31.5%), and many had 1–5 years of service (31.5%). Several demographic variables showed significant associations ($p<0.05$).

Figure-2 illustrated that 38.5% of respondents were very familiar with colour-coded waste segregation techniques, 34.6% were moderately knowledgeable, and 26.9% were unfamiliar, reflecting a reasonable level of general awareness among healthcare professionals.

46.15% of respondents utilized colour-coded bins or bags for biomedical waste segregation, whereas 34.62% employed standard bins or plastic bags, and 19.23% indicated the use of alternative containers (Figure-3).

Figure-4 demonstrated that a majority of respondents (73.1%) were cognizant of biomedical waste management regulations or standards. Furthermore, 60.0% indicated they had undergone training in biomedical waste management, although a significant number remained uninformed or untrained.

Table-II indicated that incineration was the most commonly reported method for infectious waste treatment (26.9%), followed by autoclaving (21.5%) and chemical disinfection (18.5%). Some respondents reported open burning (16.9%), while 16.2% did not know the treatment method.

Table-III illustrated that the biggest problem with biomedical waste management was that staff didn't know enough about it or weren't trained (26.9%). The next biggest problem was that there weren't enough infrastructures (23.1%) and that there wasn't enough monitoring (19.2%). People didn't talk about money problems and other problems as much.

**Table-I: Demographic information of respondents (N=130)**

| Variable | no (%) | p-value |
|---|---|---|
| **Age (years)** | | |
| Below 25 | 18 (13.8) | 0.041 |
| 25–34 | 42 (32.3) | |
| 35–44 | 36 (27.7) | |
| 45–54 | 22 (16.9) | |
| 55 and above | 12 (9.3) | |
| **Type of hospital** | | |
| Government | 70 (53.8) | 0.032 |
| Private | 40 (30.8) | |
| NGO/Charitable | 20 (15.4) | |
| **Gender** | | |
| Male | 70 (53.8) | 0.065 |
| Female | 55 (42.3) | |
| Others | 5 (3.9) | |
| **Designation** | | |
| Doctor | 32 (24.6) | 0.027 |
| Nurse | 41 (31.5) | |
| Cleaner/Support Staff | 29 (22.3) | |
| Hospital Administrator/ Manager | 18 (13.8) | |
| Other | 10 (7.8) | |
| **Years of service** | | |
| 6 months -Less than 1 year | 22 (16.9) | 0.049 |
| 1–5 years | 41 (31.5) | |
| 6–10 years | 28 (21.5) | |
| More than 10 years | 39 (30.0) | |
| **Marital status** | | |
| Single | 45 (34.6) | 0.058 |
| Married | 75 (57.7) | |
| Divorced/Widowed | 10 (7.7) | |
| **Education level** | | |
| No formal education | 10 (7.7) | 0.036 |
| Primary | 18 (13.8) | |
| Secondary | 22 (16.9) | |
| Higher Secondary | 24 (18.5) | |
| Graduate | 27 (20.8) | |
| Postgraduate and above | 29 (22.3) | |
| **Monthly income (BDT)** | | |
| Less than 10,000 | 18 (13.8) | 0.12 |
| 10,000–20,000 | 36 (27.70) | |
| 21,000–30,000 | 30 (23.10) | |
| 31,000–50,000 | 26 (20.00) | |
| Above 50,000 | 20 (15.40) | |

*Chi-square test was performed

**Table-II: Distribution of study participants based on the methods used for infectious waste treatment before final disposal**

| Response option | no (%) |
|---|---|
| Incineration | 35(26.90) |
| Autoclaving | 28(21.50) |
| Chemical disinfection | 24(18.50) |
| Open burning | 22(16.90) |
| Don't know | 21(16.20) |
| Total | 130(100) |

**Table-III: Distribution of respondents based on major challenges faced in biomedical waste management**

| Challenges | no (%) |
|---|---|
| Lack of awareness/training among staff | 35(26.90) |
| Insufficient infrastructure (bins, bags, equipment) | 30(23.10) |
| Lack of monitoring and supervision | 25(19.20) |
| Financial constraints | 20(15.40) |
| Irregular collection/disposal services | 10(7.70) |
| Occupational health hazards | 8(6.20) |
| Others | 2(1.50) |
| Total | 130(100) |

Table-IV showed that the most recommended ways to improve biomedical waste management were regular staff training (19.2%) and installing modern disposal equipment (16.9%). After that, providing enough PPE and properly separating waste at the source were also recommended.

**Table-IV: Distribution of the study population according to measures suggested for improving biomedical waste management (n=130)**

| Measures to improve biomedical waste management | no (%) |
|---|---|
| Regular staff training | 25(19.20) |
| Adequate supply of PPE | 20(15.40) |
| Proper waste segregation at source | 18(13.80) |
| Installation of modern disposal equipment (autoclave/incinerator) | 22(16.90) |
| Stronger monitoring and supervision | 15(11.50) |
| More government support/funding | 17(13.10) |
| Community awareness programs | 13(10.0) |
| Total | 130(100.0) |

53.8% of respondents perceived biomedical waste to be intermixed with general garbage, 30.8% disagreed, and 15.4% were uncertain, highlighting apprehensions about inadequate waste segregation measures in healthcare settings (Figure-5).

The majority of respondents (53.85%) acknowledged engaging in waste segregation. However, 26.9% indicated inconsistent practices. Furthermore, 30.77% identified deficiencies in waste management techniques, whereas 15.38% conveyed doubt, indicating varied perspectives among respondents.

Table-V clarified that 50% of people who answered the question always separated their trash. People used PPE differently, but many said they used it all the time. Awareness of monitoring and readiness for refresher training were moderate, with several variables demonstrating significant associations ($p<0.05$).

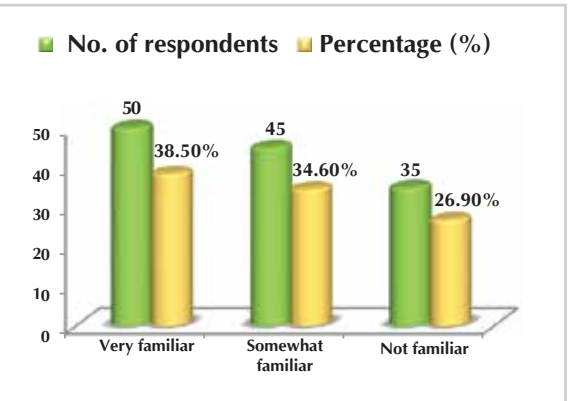



**Figure-1: Familiarity with color-coded waste segregation practices (N=130)**

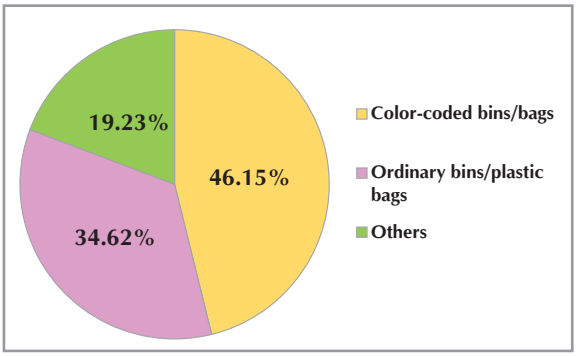



**Figure-2: Types of containers/bags used for biomedical waste segregation (N=130)**

**Table-V: Distribution of respondents according to practices and awareness of biomedical waste management**

| Questions | no. (%) | p-value |
|---|---|---|
| **Respondents' opinions regarding biomedical waste management policy** | | |
| Biomedical waste management Policy | | |
| Yes | 55(42.30) | 0.11 |
| No | 43(33.10) | |
| Don't know | 32(24.60) | |
| Practicing segregation of waste at the point of generation | | |
| Always | 65(50.00) | 0.03 |
| Sometimes | 45(34.60) | |
| Never | 20(15.40) | |
| Personal protective equipment | | |
| Always | 55(42.30) | 0.41 |
| Sometimes | 45(34.60) | |
| (PPE) is used while handling biomedical waste | | |
| Rarely | 20(15.40) | 0,001 |
| Never | 10(7.70) | |
| **Responses on biomedical waste management awareness** | | |
| Does your hospital conduct regular monitoring or auditing of biomedical waste management practices? | | |
| Yes | 55(42.3) | 0.03 |
| No | 40(30.8) | |
| Sometimes | 35(26.9) | |
| Would you be willing to participate in refresher training sessions on biomedical waste management? | | |
| Yes | 70(53.8) | 0.02 |
| No | 40(30.8) | - |
| Maybe | 20(15.4) | - |
| How satisfied are you with the current biomedical waste management system in your hospital? | | |
| Very satisfied | 20(15.38) | 0.01 |
| Satisfied | 40(30.77) | |
| Neutral | 30(23.08) | |
| Dissatisfied | 25(19.23) | |
| Very dissatisfied | 15(11.54) | |

*Chi-square test was performed

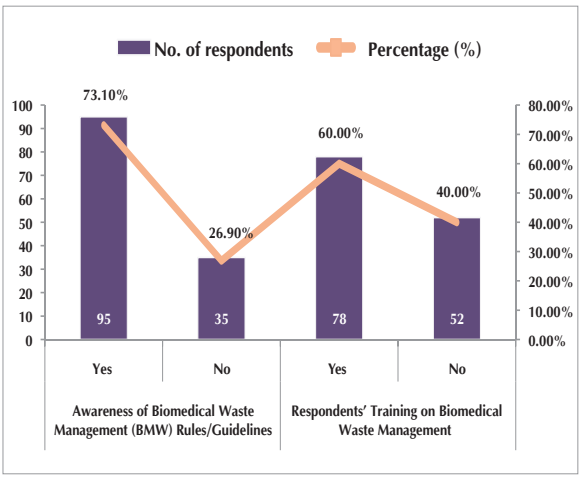



**Figure-3: Awareness and training on biomedical waste (BMW) management among respondents**

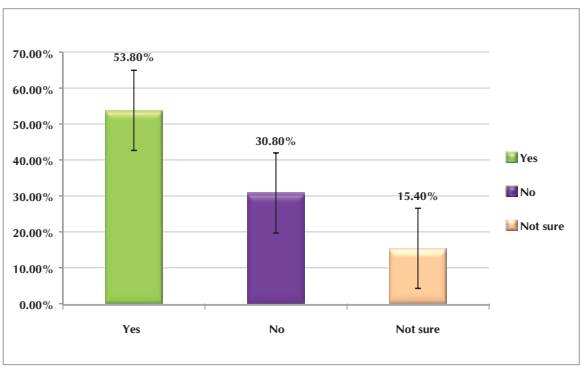



**Figure-4: Respondents' views on mixing biomedical waste with general waste (N=130)**

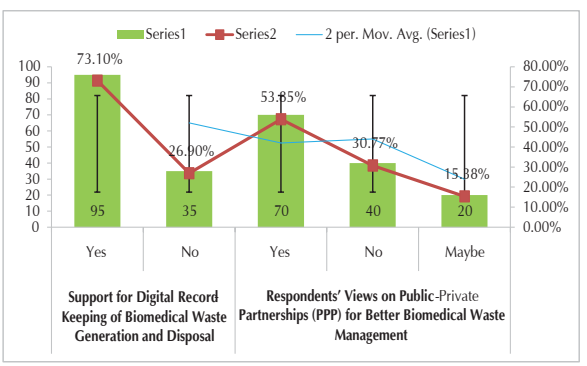



**Figure-5: Responses on waste management practices and perceptions (N=130)**

## Discussion:

The current study examined the challenges and opportunities associated with biomedical waste management (BWM) in district-level hospitals in Bangladesh. The results show that healthcare workers' awareness and training were only

moderate, which was not enough to make sure that waste was managed properly. In this study, 73.1% of participants were cognizant of biomedical waste management regulations, and 60.0% had undergone training. Deress, Teshiwal et al (2019) reported similar results, finding that about 62% of healthcare workers in Ethiopian hospitals knew about waste segregation guidelines.[10] This shows that healthcare workers have a moderate level of knowledge. The study also found gaps between what people knew and what they did to keep themselves safe, which is similar to this study.

In the current study, 50% of respondents indicated that they consistently practiced waste segregation at the point of generation, whereas 34.6% reported doing so only occasionally. A study conducted by Morteza Dehghani et al (2008) in Iran indicated that 58% of healthcare personnel possessed sufficient knowledge; however, only 45% consistently adhered to proper waste segregation practices, underscoring a divergence between knowledge and practice akin to the results of this research.[11]Tudor et al (2005) found that about 70% of hospitals in developing countries used incineration to get rid of infectious waste.[12] This supports what this study found. The study also found that the main problems with BWM were a lack of staff awareness or training (26.9%), a lack of infrastructure (23.1%), and a lack of monitoring (19.2%).

I think that district-level hospitals need regular training programs, better supervision, better infrastructure, and strict enforcement of national rules to improve how they handle biomedical waste. Dealing with these problems would make safe waste handling much better and lower the risks to health and the environment.

**Limitation:**

This study was limited by its focus on certain district hospitals, lack of resources, and reliance on self-reported data. Limited access to facilities, policy differences, changing practices, and not including community perspectives may impact generalisability and comprehensiveness.

**Conclusion:**

The study shows that managing biomedical waste in district-level hospitals is hard because of a lack of training, infrastructure, and monitoring. Healthcare workers are somewhat aware of the issue but putting it into practice is still hit-or-miss. The study also found gaps between what people knew and what they did to keep themselves of safe, which is similar. However, to improve safe biomedical waste management practices, it is important to improve training, infrastructure, the enforcement of rules and augment monitoring.

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# Early Enteral Feeding Strategies and Risk of Necrotizing Enterocolitis in Preterm Neonates: A Cohort Study

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Submission Date : 17 Jan 2026
Accepted Date : 19 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90013

**Abstract**

**Background:**
Necrotizing enterocolitis (NEC) is a serious inflammatory bowel disease that affects preterm newborns. It has a high rate of illness and death, especially in babies who are very low birth weight.

**Objective:**
To assess the correlation between exclusive human milk (EHM) feeding in the initial 14 days of life and the incidence of necrotizing enterocolitis (NEC) in preterm neonates.

**Methods:**
A prospective cohort study was conducted Bangladesh Shishu Hospital & Institute, Dhaka involving 95 preterm neonates (<37 weeks). The neonates were categorized into two groups: EHM and non-EHM. Feeding habits, probiotic use, parenteral nutrition, and clinical outcomes were recorded. NEC incidence (Bell stage II/III), late-onset sepsis, time to full feeds, and mortality were analyzed using risk ratios, Kaplan–Meier survival analysis, and multivariable Poisson regression.

**Results:**
Neonates who were fed EHM started eating earlier, took longer to finish their meals, and used more probiotics. The rate of NEC was lower in the EHM group (5.2%) than in the non-EHM group (18.9%; RR=3.65, 95% CI 1.01–13.16, p=0.041). Feeding without EHM, being born very early, and quickly moving up the feeding schedule all raised the risk of NEC. On the other hand, antenatal steroids and probiotics were protective. EHM babies also had fewer cases of late-onset sepsis, got full feeds faster, and lived longer.

**Conclusion:**
Feeding only human milk to preterm neonates for the first 14 days greatly lowers the risk of NEC and improves clinical outcomes.

**Keywords:** Necrotizing Enterocolitis, Preterm Neonates, Exclusive Human Milk, Enteral Feeding, Probiotics, Neonatal Outcomes

**Citation:** Chowdhury MH,Islam T.Early Enteral Feeding Strategies and Risk of Necrotizing Enterocolitis in Preterm Neonates: A Cohort Study.J Rang Med Col.2026 Mar;11(1):99-104.doi: https://doi.org/10.3329/jrpmc.v11i1.90013

## Introduction:

Necrotizing enterocolitis (NEC) is a severe inflammatory bowel disease that primarily affects preterm and very low birth weight (VLBW) infants, causing intestinal necrosis, systemic inflammation, and high mortality.[1] NEC-like conditions were described as early as the late 1800s, but it was only with modern neonatal intensive care in the 1960s that it was recognized as a distinct disease.[2] Pathophysiological models highlight how the interaction between immature intestines, microbial colonization, and feeding strategies contributes to NEC development.[3]

For the past 30 years, Neonatal Intensive Care Units (NICUs) worldwide have been striving to enhance enteral nutrition to provide early gut stimulation while reducing the risk of Necrotizing Enterocolitis (NEC).[4] Cohort studies indicate that initiating minimal enteral feeds within 72 hours (trophic feeding) and carefully increasing feed volumes promote intestinal adaptation, alleviate complications associated with parenteral nutrition, and do not increase the risk of NEC.[5] Meta-analyses reveal that delaying enteral feeding for more than 2–3 days does not prevent NEC and may increase the likelihood of sepsis and feeding

intolerance.[6] Current guidelines advocate for personalized feeding plans that prioritize human milk, structured progression rates (15–30 mL/kg/day), and diligent monitoring.[7] The evidence supports early, progressive feeding rather than ultra-slow advancement. Multicenter studies demonstrate that attaining full feeds more rapidly diminishes the risk of sepsis and reduces hospital stays, all without increasing the incidence of stage II–III NEC.[8] Systematic reviews confirm that rapid escalation protocols promote growth and nutritional intake while maintaining NEC safety.[9]

In South Asia, NEC remains a major contributor to preterm morbidity and mortality. In India, early maternal milk feeding and cautious feed progression are emphasized.[10] Pakistani NICUs report NEC rates up to 14% in VLBW infants, with early feeding strategies including probiotics and donor milk reducing severity.[11] Nepal and Bhutan promote early breastfeeding and skin-to-skin care, though formal cohort data are limited.[12] Southeast Asian countries such as Malaysia, Vietnam, and Thailand have implemented evidence-based feeding protocols with trophic feeds, milk fortification, and probiotics, lowering NEC incidence and improving growth.[13]

High-income countries adopt structured protocols, starting with small feed volumes, gradual advancement, and close monitoring.[14] The International Neonatal Nutrition Network recommends early trophic feeds, evidence-based advancement, and probiotics to minimize NEC risk. Early, carefully advanced enteral feeding prioritizing human milk, guided by standardized protocols, remains a key strategy for reducing NEC while ensuring adequate nutrition. Continued research, regional collaboration, and adherence to evidence-based guidelines are essential for improving neonatal outcomes globally.

**Method:**

This prospective cohort study was conducted at the Department of Neonatology, Bangladesh Shishu Hospital & Institute, Dhaka, from January to May 2024. A total of 95 preterm neonates (gestational age <37 weeks) were enrolled at birth and followed until discharge or death. Exclusion criteria included major congenital anomalies, gastrointestinal malformations, chromosomal abnormalities, or early transfer before enteral feeding initiation. The primary exposure was Exclusive Human Milk (EHM) feeding during the first 14 days, defined as feeding with only mother's milk or donor milk, without formula supplementation. Neonates receiving formula during this period were categorized as non-EHM. Feeding practices, enteral feeding initiation timing, feed advancement, use of probiotics, parenteral nutrition duration, and fortification were documented. The primary outcome was the development of necrotizing enterocolitis (NEC), defined as Bell stage II or III.[15] Secondary outcomes included late-onset sepsis, time to full enteral feeding, and in-hospital mortality.

Data analysis involved descriptive statistics, risk ratios (RR) for NEC incidence, Kaplan-Meier survival analysis for NEC-free survival, and multivariable Poisson regression for adjusted risk ratios. Statistical significance was set at $p<0.05$. Ethical approval was obtained from the institutional review board, and informed consent was secured from parents or guardians. Data was analyzed using SPSS version 26.

**Results:**

Table-I showed baseline characteristics of 95 neonates by feeding group. Exclusive human milk and non-exclusive groups were similar in gestational age, birth weight, sex, delivery mode, Apgar scores, respiratory distress, and PDA prevalence, with slight variations.

Exclusive human milk recipients initiated feeds earlier (<24h) and received fewer rapid advancements or prolonged parenteral nutrition, while probiotic use was slightly higher compared to non-EHM infants(Table-II).

Table-III indicated that exclusive human milk feeding during the first 14 days was associated with lower incidence of NEC (5.2% vs 18.9%), reduced late-onset sepsis, shorter time to full feeds, and lower in-hospital mortality compared to non-EHM.

Non-exclusive human milk feeding during the first 14 days was associated with a significantly higher risk of NEC (RR=3.65, 95% CI: 1.01–13.16, p=0.041) compared to exclusive human milk (Table-IV).

Table-V showed that non-exclusive human milk, gestational age <28 weeks, and rapid feed advancement significantly increased NEC risk, whereas antenatal steroid and probiotic use were protective. Delayed feed initiation showed a non-significant trend toward higher risk.

**Table-I: Baseline characteristics by feeding group (N=95)**

| Baseline characteristics | Exclusive Human Milk, first 14 days (n=58) no. (%) | Non-Exclusive Human Milk (n=37) no. (%) | Total (N=95) no. (%) |
|---|---|---|---|
| Gestational age <28 weeks | 8(13.8) | 7(18.9) | 15(15.8) |
| Birth weight <1000g | 9(15.5) | 9(24.3) | 18(18.9) |
| Male sex | 31(53.4) | 21(56.8) | 52(54.7) |
| Antenatal steroids | 41(70.7) | 22(59.5) | 63(66.3) |
| Caesarean delivery | 32(55.2) | 22(59.5) | 54(56.8) |
| 5-min Apgar <7 | 11(19.0) | 10(27.0) | 21(22.1) |
| Respiratory distress syndrome | 32(55.2) | 23(62.2) | 55(57.9) |
| Hemodynamically significant PDA | 9(15.5) | 9(24.3) | 18(18.9) |

**Table-II: Early feeding strategy and NICU feeding practices (N=95)**

Exposure definition:Exclusive Human Milk (EHM)=mother's own milk and/or donor human milk only, with no formula, during the first 14 days of life.

| Feeding variable | EHM, first 14 days (n=58) no. (%) | Non-EHM (n=37) no. (%) | Total (N=95) no. (%) |
|---|---|---|---|
| Enteral feeds started <24h | 32(55.2) | 14(37.8) | 46(48.4) |
| Enteral feeds started 24–72h | 18(31.0) | 15(40.5) | 33(34.7) |
| Enteral feeds started >72h | 8(13.8) | 8(21.6) | 16(16.8) |
| Feed advancement >20 mL/kg/day | 18(31.0) | 20(54.1) | 38(40.0) |
| Probiotics use | 29(50.0) | 15(40.5) | 44(46.3) |
| Parenteral nutrition >14 days | 9(15.5) | 10(27.0) | 19(20.0) |

**Table-III: Incidence of NEC and other clinical outcomes (prospective follow-up) (N=95)**

| Outcome | EHM, first 14 days (n=58) no. (%) | Non-EHM (n=37) no. (%) | Total (N=95) no. (%) |
|---|---|---|---|
| NEC (Bell stage II/III) | 3(5.2) | 7(18.9) | 10(10.5) |
| NEC Stage II (among NEC) | 2(66.7) | 5(71.4) | 7(70.0) |
| NEC Stage III (among NEC) | 1(33.3) | 2(28.6) | 3(30.0) |
| Late-onset sepsis, no. (%) | 10(17.2) | 10(27.0) | 20(21.1) |
| Time to full enteral feeds >14 days | 12(20.7) | 14(37.8) | 26(27.4) |
| In-hospital mortality | 3(5.2) | 4(10.8) | 7(7.4) |

**Table-IV: Unadjusted association between EHM (first 14 days) and NEC (n=95)**

| Exposure group | NEC n/N (%) | Risk Ratio (RR) | 95% CI | p-value |
|---|---|---|---|---|
| EHM (first 14 days) | 3/58(5.2) | Reference | - | - |
| Non-EHM | 7/37(18.9) | 3.65 | 1.01–13.16 | 0.041 |

*Fisher's exact test

**Table-V: Multivariable model for NEC risk (Adjusted risk ratios) (n=95)**

Outcome: NEC (Bell stage II/III)

Recommended model: Modified Poisson regression with robust standard errors (prospective cohort → RR is preferred)

| Predictor | Adjusted RR | 95% CI | p-value |
|---|---|---|---|
| Non-EHM (vs EHM first 14 days) | 3.10 | 1.02–9.40 | 0.046 |
| Gestational age <28 weeks | 2.60 | 1.01–6.70 | 0.048 |
| Feed initiation >72 h (vs <24 h) | 2.20 | 0.92–5.40 | 0.078 |
| Feed advancement>20 mL/kg/day | 2.40 | 1.01–5.80 | 0.049 |
| Antenatal steroids (Yes vs No) | 0.62 | 0.22–0.98 | 0.043 |
| Probiotics use (Yes vs No) | 0.58 | 0.21–0.97 | 0.041 |

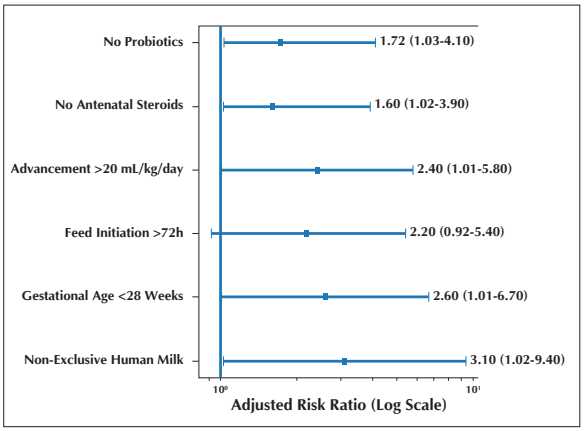



**Figure-1: Adjusted risk ratios for necrotizing enterocolitis in preterm neonates: multivariable cohort analysis (n=95)**

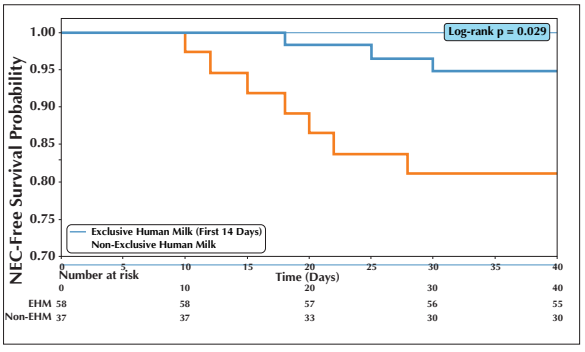



**Figure-2: Kaplan–meier curve for necrotizing enterocolitis–free survival according to feeding**

Figure 1 illustrated adjusted risk ratios for NEC in 95 preterm neonates. Non-exclusive human milk, gestational age <28 weeks and rapid feed advancement increased NEC risk. whereas antenatal steroids and probiotics were protective, with feed initiation>72 h non-significant.

Figure 2 presented the Kaplan–Meier survival analysis comparing NEC-free survival between neonates fed EHM and those fed non-EHM. The EHM group consistently demonstrated a higher probability of remaining free from NEC, with the curves diverging early and maintaining a statistically significant difference throughout the follow-up period.

**Discussion:**

In this prospective cohort study, exclusive human milk (EHM) feeding during the first 14 days of life was associated with a significantly lower incidence of Necrotizing Enterocolitis (NEC) at 5.2%, compared with 18.9% in non-exclusive human milk (non-EHM) feeding. This aligns with Sullivan et al. (2010), who reported NEC rates of 4.9% in predominantly human milk-fed preterm infants versus 17.8% in formula-fed infants (p<.05).[16] Similarly, Schanler et al (1999) found that very low birth weight neonates receiving ≥ 90% human milk had a markedly lower NEC rate (2.9% vs. 15.8%) than mostly formula-fed infants.[17] These studies, conducted in

resource-rich neonatal units, support the strong protective effect of human milk against NEC.

The data suggest a dose-dependent protective effect of EHM. Meinzen-Derr et al. (2009) reported that a 10% increase in human milk intake reduced NEC risk by 13%.[18] Hylander et al. (1998) observed a smaller reduction (12.4% to 8.7%), likely reflecting differences in feeding protocols, milk fortification, and probiotic use.[19] Such variations highlight the impact of clinical practices and resource settings on the relationship between feeding patterns and NEC outcomes.

Secondary outcomes also support the benefits of human milk. Infants in the non-EHM group had higher late-onset sepsis rates (27% vs. 17.2%), longer times to reach full enteral feeds (>14 days), and higher mortality. Regional comparisons show both similarities and differences. Soans et al. (2022) reported a 14.5% NEC incidence in very preterm Indian neonates fed mixed milk, higher than in our EHM and non-EHM groups.[20] Overall, this study reinforces global evidence that exclusive human milk feeding significantly reduces NEC risk and improves clinical outcomes. Variations across studies likely reflect differences in initiation timing, milk handling, fortification, probiotic use, and healthcare resources.

**Limitations:**

This study faced some limitations due to its execution at a single center, a small sample size, and a brief follow-up period.

**Conclusion:**

Feeding preterm babies only human milk for the first 14 days made it much less likely that they would get necrotizing enterocolitis, late-onset sepsis, delayed full enteral feeding, or die in the hospital. Starting early, slowly giving the baby more food, giving the baby steroids before birth, and using probiotics all made the protective effects even stronger. Structured EHM protocols are very important for making premature babies healthier.NICUs should put exclusive human milk feeding first in the first 14 days, use standardized feeding protocols with careful progress, and encourage the use of probiotics. It is suggested that multicenter studies be done to confirm these results in different populations and resource settings.

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# Emerging Role of COL10A1 in Breast Cancer Pathogenesis and its Potential as a Clinical Biomarker

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Submission Date : 17 Jan 2026
Accepted Date : 19 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90014

**Abstract**

**Background:**
Breast cancer is a leading malignancy worldwide, with high morbidity and mortality among women. Despite advances in therapy, metastasis, recurrence, and resistance remain challenges. Collagen type X alpha-1 (COL10A1) is normally expressed in cartilage but is increasingly implicated in tumorigenesis. Overexpression of COL10A1 in breast cancer correlates with higher grade, invasiveness, and poor prognosis.

**Objective:**
To evaluate COL10A1 expression in breast cancer and its association with tumor characteristics, receptor status, and potential biomarker utility.

**Methods:**
A hospital-based cross-sectional study was conducted at department of Surgery, Dhaka Medical College Hospital from July 2022 to June 2023, including 40 breast cancer patients. Data on demographics, clinical features, and reproductive history were collected, and tissue samples were analyzed for COL10A1 expression. Inclusion required histopathological confirmed breast cancer in women ≥40 years. Statistical analysis used SPSS for frequencies, percentages, means, and chi-square tests. Ethical approval and informed consent were obtained, ensuring confidentiality and voluntary participation.

**Results:**
The study of 40 breast cancer patients revealed a mean age of 47.41 years. The majority had invasive ductal carcinoma (70%), Grade II (50%) or III (35%) tumors, and hormone-sensitive disease (60% ER-positive, 50% PR-positive). HER2-positivity was 25%. Critically, 80% exhibited moderate-to-high COL10A1 expression, which was strongly associated with high-grade tumors, as 10 of 14 Grade III patients showed high expression.

**Conclusion:**
COL10A1 overexpression correlates with aggressive breast cancer, highlighting its potential as a prognostic biomarker.

**Keywords:** Breast cancer, COL10A1, Collagen type X alpha-1, Biomarker, Tumor grade

**Citation:** Roy NR,Narju SP,Hoque F,Barman S.Emerging Role of COL10A1 in Breast Cancer pathogenesis and its Potential as a Clinical Biomarker.J Rang Med Col.2026 Mar;11(1):105-110.doi: https://doi.org/10.3329/jrpmc.v11i1.90014

## Introduction:

Breast cancer remains one of the most prevalent malignancies worldwide, with substantial morbidity and mortality, particularly among women.[1] Despite advances in diagnosis and therapy, issues such as metastasis, recurrence, and therapeutic resistance continue to challenge clinical management.[2] Therefore, identification of novel molecular drivers and biomarkers is critical to improve prognosis and guide more precise treatment strategies. One promising candidate is Collagen type X alpha-1 chain (COL10A1), a non-fibrillar collagen normally expressed during cartilage development that has increasingly been implicated in tumorigenesis.[3] Recent bioinformatics analyses have demonstrated that COL10A1 is overexpressed in breast cancer tissues compared to normal breast tissue, and its elevated

expression correlates with unfavorable clinicopathologic variables, including higher grade, nodal involvement, and poorer patient survival.[4] For example, Yang et al showed that COL10A1 promotes breast cancer cell proliferation, migration, and invasion via interaction with prolyl 4-hydroxylase β subunit (P4HB), suggesting a functional, oncogenic role.[5] Knockdown of COL10A1 in in vitro models significantly impairs tumor cell aggressiveness, indicating its potential as a driver of malignancy.[5] Mechanistically, COL10A1 has been linked to several tumor-promoting pathways. A recent review detailed how COL10A1 can activate TGF-β 1/Smad, MEK/ERK, and focal adhesion kinase (FAK) signaling, thereby inducing epithelial–mesenchymal transition (EMT), invasion, and proliferation.[3] Mechanistically, COL10A1 has been shown to interact with the discoidin domain receptor 2 (DDR2), resulting in the phosphorylation of focal adhesion kinase (FAK) and the subsequent enhancement of cell motility.[6] Such interactions not only remodel the extracellular matrix (ECM) but also contribute to a pro-metastatic microenvironment.Beyond breast cancer, elevated COL10A1 has been reported in other malignancies such as gastric, colorectal, pancreatic, and lung cancers, where its expression often correlates with advanced disease and poor prognosis.[7-9] In gastric cancer specifically, COL10A1 overexpression has been shown to activate MAPK/JNK signaling and drive EMT by upregulating mesenchymal markers such as N-cadherin and Snail while downregulating epithelial markers like E-cadherin.[7] In colorectal cancer, COL10A1 is enriched in cancer-associated fibroblasts (CAFs) and is associated with immune cell infiltration, supporting a role in modulating the tumor stroma and immune microenvironment.[8] Given the accumulating evidence, COL10A1 emerges as a potential clinical biomarker in breast cancer: it not only reflects tumor aggressiveness but may also help stratify patients for targeted therapy. However, despite compelling preclinical and bioinformatic data, the precise clinical utility and molecular mechanisms of COL10A1 in breast cancer remain underexplored. This study therefore aimed to investigate the role of COL10A1 in breast cancer pathogenesis, examine its expression in patient samples, and assess its potential as a prognostic or diagnostic biomarker.

**Methods:**

The hospital-based cross-sectional observational study was conducted in the Department of General Surgery and the Breast Clinic of Dhaka Medical College Hospital (DMCH), Dhaka, Bangladeshfrom July 2022 to June 2023 on 40 breast cancer patients.Data were collected using a structured, pre-tested questionnaire and review of hospital records. After obtaining ethical approval for the study was obtained from the Institutional Review Board (IRB) of Dhaka Medical College Hospital (DMCH) and informed consent, demographic information, reproductive history, clinical features, imaging findings, and histopathological reports were recorded. Tissue samples were collected during biopsy or surgery and processed for the assessment of COL10A1 gene expression using standard laboratory techniques (immunohistochemistry or molecular assays depending on availability). Each participant was followed through diagnostic evaluation to confirm tumor type, grade, and receptor status. All information was obtained directly from patients or their medical records, ensuring accuracy and completeness.

The study included female patients aged 40 and above with newly diagnosed breast cancer confirmed by histopathology, recruited from General Surgery Department and Breast Clinic of Dhaka Medical College Hospital. Patients with previous breast cancer treatment, chemotherapy or radiotherapy before tissue sampling, or incomplete information were excluded to ensure accurate data.

All collected data were entered into a spreadsheet and analyzed using Statistical Package for Social Sciences (SPSS) version 26.0. Descriptive statistics such as frequency, percentage, mean, and standard deviation were calculated to summarize demographic and clinical variables. Associations between COL10A1 expression and tumor characteristics were evaluated using chi-square tests or Fisher's exact test where appropriate. A p-value $<0.05$ was considered statistically significant. Data were presented in tables and charts for clarity.

**Results:**

The study involved 40 patients, mainly aged 41–50 years (47.5%), with a mean age of 47.41±2.52 years. Most had a normal BMI (55%), with a mean of 21.07±1.17 kg/m . Nearly half

had higher secondary education (47.5%), lived in urban areas (65%), and were mostly from middle-income families (50%) (Table-I).

**Table-I: Demographic characteristics of the study participants (N=40)**

| Demographic characteristics | no (%) |
|---|---|
| **Age Group (years)** | |
| ≤40 | 12(30.0) |
| 41–50 | 19(47.5) |
| >50 | 9(22.5) |
| Mean Age±SD (years) | 47.41±2.52 |
| **Body Mass Index (BMI)** | |
| Normal (18.5–24.9) | 22(55.0) |
| Overweight (≥25.0) | 18(45.0) |
| Mean BMI±SD (kg/m) | 21.07±1.17 |
| **Educational Level** | |
| Primary or below | 7(17.5) |
| Secondary | 14(35.0) |
| Higher Secondary & above | 19(47.5) |
| **Residence** | |
| Urban | 26(65.0) |
| Rural | 14(35.0) |
| **Socioeconomic Status** | |
| Lower | 11(27.5) |
| Middle | 20(50.0) |
| Upper | 9(22.5) |

Among 40 breast cancer patients, 30% had a family history, and 70% did not. Early menarche was reported by 60% at or before 13 years, while 35% used contraceptives. Most patients were multiparous (80%) (Table-II).

**Table-II: Distribution of reproductive and clinical history (n=40)**

| Variable | no (%) |
|---|---|
| **Family history of Breast Cancer** | |
| Present | 12(30.0) |
| Absent | 28(70.0) |
| **Age at Menarche** | |
| ≤13 years | 24(60.0) |
| >13 years | 16(40.0) |
| **Contraceptive Use** | |
| Yes | 14(35.0) |
| No | 26(65.0) |
| **Parity** | |
| Multipara | 32(80.0) |
| Primipara | 8(20.0) |

(IDC) was the most common tumor, present in 70% of cases, followed by invasive lobular carcinoma (ILC) at 15%, and mixed carcinoma (10%) (Figure-1)

Half of the tumors were Grade II (moderately differentiated) in 20 patients. Grade III (poorly differentiated) tumors were in 14 patients, and Grade I (well-differentiated) tumors in 6 patients. Most had moderate to high aggressiveness (Figure-2)

Out of 40 patients, 24 were estrogen receptor-positive, 20 were progesterone receptor-positive, and 10 were HER2/neu positive, showing more hormone-sensitive breast cancer subtypes (Table-III)

In the study of COL10A1 expression, 45% of patients showed high levels, 35% moderate, and 20% low or no expression.Overall, a significant proportion (80%) had either moderate or high expression, suggesting that COL10A1 may play a biologically relevant role in breast cancer tissue changes (Table-IV).

High COL10A1 expression linked to aggressive tumors; 10 Grade III patients and 8 Grade II patients showed high expression, while Grade II had 10 moderate and Grade I had 4 low expressions (Table-V).

**Table-III: Hormone receptor positivity status of participants**

| Receptor positivity Status | Positive no.(%) |
|---|---|
| ER (Estrogen Receptor) | 24(60.0) |
| PR (Progesterone Receptor) | 20(50.0) |
| HER2/neu | 10(25.0) |

**Table-IV: COL10A1 expression levels (based on tissue analysis)**

| Expression Category | no.(%) |
|---|---|
| High Expression | 18(45.0) |
| Moderate Expression | 14(35.0) |
| Low/Negative Expression | 8(20.0) |

**Table-V: Association between COL10A1 expression and tumor grade**

| COL10A1 Expression | Grade I (no.) | Grade II (no.) | Grade III (no.) |
|---|---|---|---|
| High | 0 | 8 | 10 |
| Moderate | 2 | 10 | 2 |
| Low/Negative | 4 | 2 | 2 |

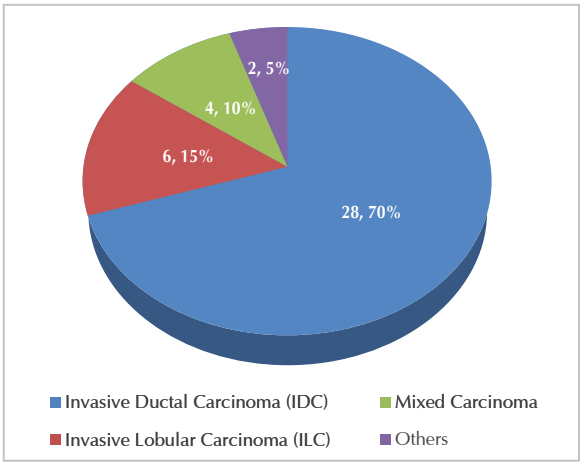



**Figure-1: Tumor characteristics (Histopathology)**

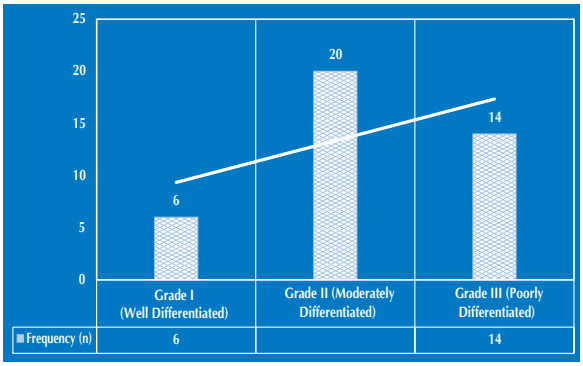



**Figure-2: Tumor grade distribution**

**Discussion:**

The present study provides a comprehensive clinicopathological and molecular profile of 40 breast cancer patients. Our analysis revealed that a significant majority of the study population presented with moderate to high-grade tumors and hormone receptor-positive disease, with a notable overexpression of COL10A1, a potential marker of tumor aggressiveness. First, the demographic profile of our cohort, with a mean age of 47.41 years and the largest proportion (47.5%) in the 41-50 year age group, aligns with the global pattern of breast cancer being a disease of middle-aged women, particularly in developing nations where the peak incidence occurs a decade earlier than in Western countries.[9] This underscores the significant health burden of breast cancer in the economically productive age group. Regarding histopathological types, our finding that Invasive Ductal Carcinoma (IDC) was the most prevalent (70%) is consistent with the established literature, which reports that IDC constitutes approximately 70-80% of all breast cancers, making it the most common histological subtype worldwide.[10] This reaffirms the representative nature of our study sample in the broader context of breast cancer pathology.The distribution of tumor grades in our study, with 50% being Grade II and 35% Grade III, indicates a preponderance of moderately to poorly differentiated tumors. This is a critical finding as it correlates with a more aggressive disease course and a potentially worse prognosis. A similar study by[11] also reported a high frequency of Grade II and III tumors in their cohort, highlighting a common clinical challenge in managing these aggressive variants.Our molecular subtyping data showed that 60% of patients were Estrogen Receptor (ER)-positive and 50% were Progesterone Receptor (PR)-positive, while HER2/neu positivity was observed in 25% of cases. This pattern, where hormone-sensitive subtypes are most common, is well-documented. For instance, a large population-based study confirmed that the Luminal A and B subtypes (which are ER/PR-positive) collectively account for the majority of breast cancer cases, which is in direct agreement with our receptor status findings.[12] The most significant finding of our study pertains to the expression of COL10A1. We observed that 80% of the patients exhibited moderate to high expression of this protein. This high prevalence suggests that COL10A1 is not an isolated phenomenon but may play a widespread and biologically relevant role in the tumor microenvironment of breast cancer. This aligns with the growing body of evidence implicating aberrant extracellular matrix remodeling in cancer progression.[13] Furthermore, our data established a strong association between high COL10A1 expression and aggressive tumor characteristics, specifically Grade III tumors. Among the 14 patients with Grade III disease, 10(71.4%) showed high COL10A1 expression. This finding is strongly supported by a study by,[14] which demonstrated that COL10A1 is a key mediator of tumor invasion and metastasis, and its upregulation is a hallmark of poorly differentiated carcinomas across multiple cancer types.The role of COL10A1 in promoting a more aggressive phenotype can be explained by its function in the tumor microenvironment. It is primarily produced by cancer-associated fibroblasts and facilitates tumor cell migration,

invasion, and epithelial-mesenchymal transition. Research by[15] provided mechanistic insight, showing that COL10A1 secretion activates integrin-mediated signaling pathways in cancer cells, ultimately leading to enhanced metastatic potential.The correlation between COL10A1 and high-grade tumors also suggests its potential utility as a prognostic biomarker. Patients with elevated COL10A1 expression may be at a higher risk for disease recurrence and progression. A prior investigation by[16] found that high serum levels of COL10A1 degradation products were independently associated with reduced overall survival in breast cancer patients, reinforcing its prognostic value.From a therapeutic perspective, the overexpression of COL10A1 in aggressive tumors presents a potential novel target. While direct targeting of collagen proteins is challenging, understanding its upstream regulators and downstream effectors could unveil new therapeutic avenues. Preclinical models have shown that silencing COL10A1 expression can significantly reduce tumor growth and metastasis, as evidenced in the work of.[17]

**Limitations:**

This study has limitations, including a small sample size and a design that cannot assess long-term outcomes such as disease recurrence, metastasis, or survival or causal relationships.

**Conclusion:**

The present study highlights the emerging role of COL10A1 in breast cancer pathogenesis. The findings suggest that COL10A1 is frequently overexpressed in breast cancer tissues and that its expression is closely associated with tumor aggressiveness and histopathological grade. These observations indicate that COL10A1 may serve as a valuable biomarker for diagnosis and prognosis, providing insight into tumor behavior and potentially guiding personalized therapeutic strategies.

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# Socio-demographic Determinants of Appropriate Utilization of Oral Rehydration Solution Therapy in Under Five Children with Acute Watery Diarrhoea: A Hospital Based Study

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Submission Date : 18 Jan 2026
Accepted Date : 19 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90015

**Abstract**

**Background:**
Acute watery diarrhea (AWD) continues to be a primary cause of morbidity and mortality in children under five. Oral rehydration solution (ORS) is a simple and affordable technique demonstrated to minimize the complications and death associated with dehydration.

**Objective:**
The effective use of ORS is frequently affected by parental socio-demographic factors.

**Methods:**
The cross-sectional study was carried out at the Department of Paediatrics, Jalalabad Ragib - Rabeya Medical College Hospital (JRRMCH), Sylhet. All children under the age of 5 years with AWD admitted to the paediatrics ward comprised the study population. Among them, a total of 300 children were selected with purposive sampling. The duration of the study was 6 months. A questionnaire was used to collect data on the sociodemographic characteristics of the study population, as well as maternal knowledge and practices regarding oral rehydration solution (ORS) and their impact on appropriate utilization of ORS were documented.

**Results:**
Most of the mothers (67%) correctly prepared ORS but only 54.3% utilized it appropriately. Among the 300 children, most of them belonged to 1 to 2 years of age group and male children were affected by diarrhoea more (61.7%), but inappropriate utilization of ORS was also predominant in male children ($p < 0.05$). Most of the mothers were in 20 to 30 years of age (75%), resided in rural areas (77%) and were home makers (95.3%). Parents with higher education and better financial condition were associated with improved utilization of ORS ($p<0.05$). Fathers having business or in service were found utilizing ORS more efficiently than farmers ($p < 0.05$). Apart from sociodemographic factors, maternal knowledge regarding ORS also influenced appropriate use of it. More than 97% of mothers knew about ORS while only 10.7% accurately knew its purpose of replacing salt and water and this group had used ORS significantly better than other groups. Approximately half of the mothers were advised by doctors and good number of them used ORS appropriately ($p<0.05$). Only 48 % of mothers knew the preservation time of ORS. Majority of the mothers (38%) used cup- spoon for providing ORS to their children, and 75.3% mothers also took ORS along with their children. Food restriction was also a common practice during diarrhoealillness including both babies (59.7%) and mothers (45.7%).

**Conclusion:**
This study showed that most of the mothers were familiar with ORS and its preparation. There were several factors which influenced the appropriate utilization of ORS including gender, parental education, monthly income, source of information and knowledge regarding function of ORS.

**Keywords**: ORS, Appropriate utilization, Education, Diarrhoea

**Citation:** Hasan MR,Chowdhury TJ,Akther N,Rahman Z,Ullah GS.Socio-demographic Determinants of Appropriate Utilization of Oral Rehydration Solution Therapy in Under Five Children with Acute Watery Diarrhoea: A Hospital Based Study.J Rang Med Col.2026 Mar;11(1):111-118.doi: https://doi.org/ 10.3329/jrpmc.v11i1.90015

**Introduction:**
Diarrhoea is characterized by the passage of three or more loose or liquid stool within a 24-hour period. Acute watery diarrhea (AWD) continues to be one of the main causes of morbidity and mortality among children under five in developing countries, despite the existence of basic, effective, and affordable interventions.[1] Worldwide, each year, diarrhea results in the death of approximately 443,832 children under the age of five and approximately 1.7 billion cases of childhood diarrhoeal disease are reported annualy. [1] In Bangladesh, diarrhea mortality rates among children under five has declined from 15.1 per 1,000 to 6.0 per 1,000 live births from 1980 to 2015. Comparable decrease was noted in the incidence of diarrheal illnesses also.[2] Highest rate of advice for diarrhoeal disease in children taken from health care facility was in Dhaka division (50.7 %).[3] Sylhet was at the bottom (25.5%) only second to Rajshahi Division (23.8%).[3]

Oral rehydration solution (ORS) is widely acknowledged as the fundamental approach to managing diarrhoeal diseases, considerably decreasing complications and death associated with dehydration.[4] The World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) clearly recommend oral rehydration solution (ORS) as the primary treatment for diarrhoea in children. The proper use of ORS involves correct preparation, adequate volume, appropriate frequency, and suitable administration methods. But inappropriate utilization of ORS, such as inaccurate dilution, insufficient consumption, or replacement with alternative fluids diminish its efficacy.[1,5] In many low and middle-income countries, inappropriate utilization of ORS remains affected by various socio-demographic factors, including parental education, socioeconomic status, residence, social traditions, and access to health information and healthcare services.[6] Caregivers' knowledge, attitudes, and practices are essential factors in ensuring the proper use of ORS during episodes of diarrhea.[7] Understanding the socio-demographic determinants linked to proper ORS utilization is essential for developing targeted interventions and enhancing health education initiatives. Though diarrhoea is common in children and ORS is the cornerstone, very few studies were conducted in this part of the country. Therefore, this hospital-based study was carried out with an aim to find out baseline understanding of mothers regarding ORS use and factors affecting appropriate use of ORS by them.

**Method:**
This cross-sectional study was conducted at the Department of Paediatrics of Jalalabad Ragib -Rabeya Medical College Hospital (JRRMCH), Sylhet. All under 5 children with AWD who were admitted to the paediatrics ward were study population. Among them, total 300 children were selected by purposive sampling. Duration of the study was September 2024 to February 2025. Children with diarrhoea with severe acute malnutrition, with severe illness (like pneumonia, acute kidney injury, heart disease etc.), dysentery, persistent diarrhoea, hospital acquired diarrhoea and those who were not willing to continue in the study were excluded from the study. A preformed questionnaire was used to take data of sociodemographic variables of study population along with maternal knowledge and practice of ORS and their utilization of ORS at home before hospitalizing their babies. After taking verbal permission, mothers were queried with easily understandable local language. Mothers who dissolved one packet of ORS in 500 ml of water were considered to have appropriately prepared ORS. Mothers who accurately prepared ORS and administered it to their sick child after each episode of loose stool were considered to be utilized ORS appropriately. Statistical Package for Social Sciences (SPSS) version 27 was used to analyze data. Results are presented in tables and charts. P value <0.05 was considered statistically significant.

**Results:**
Two-thirds of participants (201 or 67%) correctly prepared Oral Rehydration Solution (ORS). Most respondents (228 or 76%) gave ORS after each loose stool, while 52 (17.33%) did so only when the baby asked, and 20 (6.67%) did not know when to give it. Overall, 163 participants (54.3%) used ORS appropriately, while 137 (45.7%) did not (Table-I).

**Table-I: Proper preparation and utilization of ORS among participants (N=300)**

| Variables | no.(%) |
|---|---|
| **Preparation of ORS** | |
| Correct | 201 (67) |
| Incorrect | 99 (33) |
| **ORS given to child** | |
| After each loose stool | 228 (76) |
| If baby wanted occasionally | 52 (17.3) |
| Don't know | 20 (6.7) |
| **Appropriate utilization of ORS** | |
| Yes | 163 (54.3) |
| No | 137 (45.7) |

The study showed that 127 participants (42.3%) were aged 1-2 years, and 99 (33%) were 6-12 months. Male children numbered 185 (61.7%), while females were 115 (38.3%). Inappropriate ORS use was higher among males (70.8%) (p=0.0031) (Table-II).

The study included 69 urban residents (23%), with 44 (27%) using ORS properly, compared to 231 rural residents, where 73% had appropriate use of ORS (p=0.073). Half of the 300 respondents came from nuclear families, with the rest from joint families, showing no significant difference in ORS use (p=0.728). Most mothers (75%) were aged 20-30, while fewer were above 30 (16.7%) or under 20 (8.3%) (p=0.728). Educated mothers utilized ORS better than less educated ones, with 71 (23.67%) least educated mothers showing inappropriate use (p=0.003) Most mothers were homemakers (95.3%) (p=0.062). Families earning over 20,000 takas had the highest proper ORS use, while those earning under 10,000 takas had more incorrect use (p=0.039). Fathers with higher education also supported better ORS utilization than fathers with just primary education or no formal schooling (p=0.001). Fathers in business sectors used it properly, while improper use was common among and individuals in "other" jobs (p=0.033) (Table-III).

Most mothers (292, 97.3%) knew about ORS, with 162 using it correctly. Only 8 were unaware of ORS, and incorrect usage was higher among them[7] (p=0.043). Just 32 (10.7%) recognized ORS for replacing lost salt and water, with 22 using it correctly. Additionally, 145 (48.3%) knew ORS corrects water loss, while only 89 used it appropriately. Those who thought ORS stopped diarrhea (49) or were unaware of its purpose (74) had more inappropriate use (p=0.016). Most mothers learned about ORS from doctors (146, 48.7%), and the largest appropriate utilization occurred among individuals who obtained information from doctors (82, 50.3%) (p=0.003). 144 (48%) mother knew ORS can be stored for 12 hours, with 85 using it properly and out of 156 mothers who had improper knowledge 78 used ORS appropriately (p=0.053) (Table-IV).

Most women used a cup and spoon to give ORS to their children (114 or 38%), while 98 (32.67%) used other methods, and 88 (29.33%) used feeding bottles. The best proper use was with cup-and-spoon (22.67%) (p=0.099). Among the respondents, 74 (24.67%) stated that only the baby took ORS, whereas 226 (75.33%) reported both mother and baby consumed it. Food limitation during diarrhea was noted for both mother and baby, affecting ORS use (p=0.862) (Table-V).

**Discussion:**

**Table-II: Age and gender distribution of the participants (N=300)**

| Variables | Total (N=300) no. (%) | Appropriate utilization Frequency (n=163) no. (%) | Inappropriate utilization Frequency (n=137) no. (%) | p-value |
|---|---|---|---|---|
| **Age of baby** | | | | |
| <6 months | 26 (8.7) | 16 (9.8) | 10 (7.3) | 0.339 |
| 6-12 months | 99 (33) | 47 (28.8) | 52 (38) | |
| 1-2 years | 127 (42.3) | 71 (43.6) | 56 (40.9) | |
| 2-5 years | 48 (16) | 29 (17.8) | 19 (13.8) | |
| **Gender** | | | | |
| Male | 185 (61.7) | 88 (54) | 97 (70.8) | 0.0031 |
| Female | 115 (38.3) | 75 (46) | 40 (29.2) | |

**Table-III: Sociodemographic features associated with appropriate ORS utilization (N=300)**

| Variables | Total (N=300) no. (%) | Appropriate utilization Frequency (n=163) no. (%) | Inappropriate utilization Frequency (n=137) no. (%) | p-value |
|---|---|---|---|---|
| **Residence** | | | | |
| Rural | 231(77) | 119(73) | 112(81.8) | 0.073 |
| Urban | 69(23) | 44(27) | 25(18.2) | |
| **Type of family** | | | | |
| Nuclear | 150(50) | 83(50.9) | 67(48.9) | 0.728 |
| Joint | 150(50) | 80(49.1) | 70(51.1) | |
| **Age of mothers** | | | | |
| <20 years | 25(8.3) | 13(8) | 12(8.8) | 0.728 |
| 20-30 years | 225(75) | 122(74.8) | 103(75.2) | |
| >30 years | 50(16.7) | 28(17.2) | 22(16) | |
| **Maternal education** | | | | |
| Illiterate to primary | 129(43) | 58(35.6) | 71(51.8) | 0.003 |
| Up to SSC or Dakhil | 70(23.3) | 37(22.7) | 33(24.1) | |
| Up to HSC/ Alim | 58(19.3) | 36(22.1) | 22(16.1) | |
| Graduate/ Above | 43(14.3) | 32(19.6) | 11(8) | |
| **Maternal occupation** | | | | |
| Home maker | 286(95.3) | 152(93.3) | 134(97.8) | 0.062 |
| Working mother | 14(4.7) | 11(6.7) | 03(2.2) | |
| **Monthly income** | | | | |
| <10 thousand | 54(18) | 21(12.9) | 33(24.1) | 0.039 |
| 10-20 thousand | 84(28) | 50(30.7) | 34(24.8) | |
| >20 thousand | 162(54) | 92(56.4) | 70(51.1) | |
| **Father's education** | | | | |
| Illiterate to primary | 160(53.3) | 76(46.6) | 84(61.3) | 0.001 |
| Up to SSC or Dakhil | 67(22.3) | 42(25.8) | 25(18.3) | |
| Up to HSC/ Alim | 34(11.3) | 20(12.3) | 14(10.2) | |
| Graduate/ Above | 39(13) | 25(15.3) | 14(10.2) | |
| Father's occupation | | | | |
| Farmer | 32(10.7) | 14(8.6) | 18(13.1) | 0.033 |
| Work abroad | 86(28.7) | 41(25.2) | 45(32.9) | |
| Small business | 57(19) | 36(22.1) | 21(15.3) | |
| Service | 26(8.6) | 17(10.4) | 09(6.6) | |
| Others | 99(33) | 55(33.7) | 44(32.1) | |

**Table-IV: Maternal knowledge of ORS (N=300)**

| Variables | Total (N=300) no. (%) | Appropriate utilization Frequency (n=163) no. (%) | Inappropriate utilization Frequency (n=137) no. (%) | p-value |
|---|---|---|---|---|
| **Heard of ORS** | | | | |
| Yes | 292 (97.3) | 162 (99.4) | 130 (94.9) | 0.043 |
| No | 08 (2.7) | 01 (0.6) | 07 (5.1) | |
| **Purpose of ORS use** | | | | |
| Stop diarrhoea | 49 (16.3) | 16 (9.8) | 33 (24.1) | 0.016 |
| Replace water loss | 145 (48.3) | 89 (54.6) | 56 (40.9) | |
| Replace salt and water loss | 32 (10.7) | 22 (13.5) | 10 (7.3) | |
| Don't know | 74 (24.7) | 36 (22.1) | 38 (27.7) | |
| **Source of information** | | | | |
| regarding ORS | | | | |
| Doctor | 146 (48.7) | 82 (50.3) | 64 (46.7) | 0.003 |
| Health assistant or nurse | 30 (10) | 16 (9.8) | 14 (10.2) | |
| Family members | 109 (36.3) | 60 (36.8) | 49 (35.8) | |
| Medicine shop | 15 (5) | 05 (3.1) | 10 (7.3) | |
| **ORS can be preserved for 12 hours** | | | | |
| Know | 144 (48) | 85 (52.1) | 59 (43.1) | 0.053 |
| Don't know | 156 (52) | 78 (47.9) | 78 (56.9) | |

**Table-V: Maternal practice of ORS (N=300)**

| Variables | Total (N=300) no. (%) | Appropriate utilization Frequency (n=163) no. (%) | Inappropriate utilization Frequency (n=137) no. (%) | p-value |
|---|---|---|---|---|
| **ORS given with** | | | | |
| Feeding bottle | 88 (29.3) | 49 (30.1) | 39 (28.5) | 0.099 |
| Cup spoon | 114 (38) | 68 (41.7) | 46 (33.6) | |
| Others | 98 (32.7) | 46 (28.2) | 52 (37.9) | |
| **ORS taken by (at home)** | | | | |
| Baby only | 74 (24.7) | 38 (23.3) | 36 (26.3) | 0.484 |
| Both mother and baby | 226 (75.3) | 125 (76.7) | 101 (73.7) | |
| **Food restriction during diarrhoea and ORS therapy** | | | | |
| To baby | 179 (59.7) | 92 (56.4) | 87 (63.5) | 0.862 |
| To mother | 137 (45.7) | 69 (42.3) | 68 (49.6) | |

The study focused on how mothers of children under five use ORS. It found that 67% prepared it correctly, while 33% did not, showing a lack of practical knowledge. Anne et al reported that 48.6% of mothers could prepare ORS properly.[8] Yimenu et al noticed that roughly 94.1% of the caregivers did the appropriate steps when making ORS solution.[9] Rahman et al conducted a study revealing that, 47% of mothers inappropriately prepare ORS.[10] Khatun et al observed that 95.1% of the mothers knew how to make ORS correctly, but only 42.8% of them used it correctly when their infants had diarrhea.[11]

In this study, appropriate use of ORS involves correct preparation and administration after each loose motion revealed 67% of mothers prepared ORS accurately, while 76% administered it after each episode. However, the overall appropriate utilization rate was only 54.3%. A 2022 survey in Bangladesh showed a decline in ORS therapy from 85% in 2017-18 to 76% in 2021.[3] Anne et al reported that 60% of mothers gave their babies as

much ORS as they wanted. [8]

Yimenu et al revealed that approximately 65% of caregivers possessed enough knowledge regarding the use of ORS and zinc for diarrhea treatment.[9] Yusuf, Junaidu, and Abubakar stated that the majority of respondents possessed information regarding the utilization of ORT.[12] A study by Rani et al. found that 40% of mothers knew how to properly prepare ORS and 60% knew how much ORS to give their child.[7] As per the study conducted by Benzamin and Hoque, around 6% of women were unsure about how to prepare ORS and ended up feeding their infant concentrated ORS.[13]

Most mothers (97.3%) knew about ORS, but only about half used it correctly. Believing ORS stops diarrhea led to more inappropriate use. Anne et al found 98.3% awareness among mothers.[8] Rani et al showed that 73% of mothers were aware of ORS.[7]

The results indicated no significant relationship between a child's age and the correct use of ORS (p=0.339). Most children studied were 1–2 years old, but usage rates were similar across ages. Kamal et al noted younger children are more vulnerable to diarrhea due to various factors during this developmental stage.[14]

On the other hand, gender was statistically significantly linked to ORS use (p=0.0031). Male children used ORS inappropriately more than females. Kamal et al[14] showed that more boys than girls had diarrhea. This may be due to boys playing outside in dirty areas and having less immune maturity in early life compared to girls.[15,16] Female children predominantly suffered from diarrhoea in Yimenu et al. (53.3% of the subjects were female and 47.7% were male).[9]

The study looked at sociodemographic factors affecting the use of ORS among mothers. It found no significant link between ORS use and factors like residence, family type, or maternal age. Most mothers in the sample were aged between 25 and 35, with most being under 36 years old.[12] This matches our data, which demonstrated that most mothers were under 30 years old. One of the most critical factors that affects a child's health is maternal education.[7] The educational status of women significantly influences the health status of their children, as it is closely correlated with their levels of awareness. Mothers lacking formal education are more prone to have children suffering with diarrheal disorders in contrast to educated mothers.[17]Maternal education is strongly linked to the correct use of oral rehydration solution (ORS), with educated mothers using it more effectively (p=0.003). A study found that 65% of mothers had primary education or less, while another showed 88% were educated, with over half graduating high school.[7] According to Yimenu et al, 42.5% of caregivers possess a higher educational status, with over 90% residing in urban areas.[9] Chowdhury et al. found that those who lived in areas with a greater prevalence of educated people were less likely to have diarrhea.[18] Education has a positive impact on health seeking behaviour of mothers. It was found that literate mothers have better knowledge and awareness to accept and initiate ORS therapy during the course of the disease.[19] This study found a significant correlation between monthly household income and appropriate ORS use (p=0.039). Families with more money used ORS more often and more accurately. [7] In Yimenu et al, over half of the caregivers (55.6%), earned a high monthly salary, consistent with our findings.[9] Similar findings was also observed in Bangladesh demographic and health survey of 2022 where ORS was used more accurately in wealthier households.[3] Rani et al reported that 61% of children came from homes living below the poverty level.[7] Father's education significantly impacted the study (p=0.001). Fathers with higher education and better jobs had more opportunities and awareness. Additionally, individuals in small businesses or service roles demonstrated better utilization patterns compared to farmers.

Only 10.7% of mothers understood that ORS replaces lost salt and water, leading to better use of ORS. About 45% of mothers knew ORS helps replace fluids lost in diarrhea.[8] In the study, 48.7% of mothers got information from doctors, linking this to better usage. This contrasts with Chowdhury et al, where 80% relied on nonprofessionals.[18] Anne et al found that 54.3% of mothers learned about ORS from doctors.[8] Yimenu et al found that 86.9% of caregivers learn about using ORS and zinc from health workers. Better knowledge of ORS among mothers leads to improved attitudes and practices.[9] Yusuf, Junaidu, and Abubakar noted that the majority had learned about ORS from community health care facilities.[12] In Rani et al, the majority of mothers (34.3%) indicated that their primary source of knowledge regarding diarrhea was from doctors. Other sources included

television (20%), other mothers (22%), media (21%), and health care providers (2.9%).[7]

ORS can be stored for up to 12 hours.[1] In the current study, around 48% of mothers were aware of the appropriate storage time; yet, incorrect storage practices remained prevalent. Anne et al. found that just 38% of mothers knew how to store ORS correctly, which was a lot less than what we found.[8]

The results showed mothers used different methods to give ORS to their children, with cup-and-spoon feeding being the most common and associated with the highest correct use, although not statistically significant. Approximately 29.3% of mothers used bottles, which can easily become contaminated.[17]

A significant number of mothers reported using ORS at home, with 75.3% indicating both they and their children consumed it. Benzamin and Hoque found that in 22% of cases, both took ORS, while only the mother took it in 4%. Some mothers believed ORS would benefit their babies through breast milk.[13] Food restriction during diarrheal episodes was common among infants and mothers, but it didn't significantly affect proper ORS use. Rani et al found that 34.3% of cases offered solid food to children.[7] Traditionally many people in our country recommend delaying or reducing solid food during diarrhoeal illness but numerous studies have shown that continuing feeding is safe and beneficial.[20] These data show that people still have wrong ideas about feeding during diarrhea. In Bangladesh, it is an old tradition to limit dietary intake during episodes of diarrhea.[13]

**Limitation:**

This study's limitations include a small group from one center and potential recall bias in home management data during diarrheal disease.

**Conclusion:**

This study revealed that ORS use in acute watery diarrhoea in children under five is affected by several socio-demographic characteristics, like male children, families with lower parental education and income were more susceptible. Despite the fact that nearly all mothers heard of ORS, there were significant variations in knowledge and appropriate utilization. Although two-thirds of mothers accurately prepared ORS and the majority gave it following each episode of diarrhoea, its proper utilization was still inadequate. The insufficient understanding of the physiological function of ORS and the lack of knowledge concerning its appropriate preservation underscore errors in its effective utilization. Health professionals served as the principal source of information for over half of the respondents. Enhancing focused health education, particularly for less-educated parents, is crucial for ensuring proper ORS usage and decreasing diarrhoea-related morbidity in children under five.

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# Demographic and Renal Histopathological Profile of Rapidly Progressive Glomerulonephritis in Children

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Submission Date : 18 Jan 2026
Accepted Date : 19 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90017

**Abstract**

**Background:**
Rapidly progressive glomerulonephritis (RPGN) is an uncommon but severe pediatric renal disorder, and its incidence and etiological patterns remain poorly defined.

**Objective:**
This study examined demographic features and renal histopathology among affected children.

**Methods:**
A prospective observational study was conducted in the Department of Paediatric Nephrology, BICH and Dhaka Shishu Hospital from July 2018 to June 2020, enrolling 28 pediatric cases displaying features of rapidly progressive glomerulonephritisthrough non-probability sampling.

**Results:**
The mean age was 9.1±1.9 years in children with more than 50% crescents and 8.7±2.2 years in those with fewer crescents. Males predominated in the high-crescent group, and most participants (82%) were from rural areas. Increased cellularity, mesangial expansion, and interstitial inflammation were frequent in both histological categories. Most children presented with acute kidney injury stage 3, with no significant difference between groups.

**Conclusion:**
RPGN in children appears to predominantly affect rural male patients in late childhood, with severe renal dysfunction and similar histopathological patterns across crescentic categories.

**Keywords:** Crescentic glomerulonephritis, Pediatric nephrology, Fibrocellular crescents, Acute kidney injury

**Citation:** Hasnat MA,Afroz S.Demographic and Renal Histopathological Profile of Rapidly Progressive Glomerulonephritis in Children.J Rang Med Col.2026 Mar;11(1):119-123.doi: https://doi.org/10.3329/jrpmc.v11i1.90017

## Introduction:

Rapidly Progressive Glomerulonephritis (RPGN) or Crescentic Glomerulonephritis (CsGN) is a rare condition in children, accounting for approximately 5% of reported renal biopsies.[1] While the precise incidence remains unknown, studies indicate a lower frequency in children, except in specific geographic regions like Arabia and Asia, where incidence rates range from 7.2-11.6/100,000 per year in Arabia and 6.2-15.6/100,000 per year in Asia.[2] Diseases leading to Glomerulonephritis are typically categorized as primary (where the kidney is the primarily affected organ) or secondary (involving the kidneys along with other organs, such as systemic lupus erythematosus - SLE).[1] Glomerulonephritis is further classified into acute and chronic types based on the duration or nature of the illness.[3] In the United States, RPGN is estimated to have an incidence rate of 7 cases per one million per year. At the same time, a 2010 Saudi Arabian study reported a 3.2% incidence of crescentic glomerulonephritis among 233 renal biopsies in patients aged 17 to 43 years old.[2] Different forms of crescentic Glomerulonephritis (GN) share a similar histology, characterized by crescents, defined as accumulations of two or more layers of cells wholly or partially filling the Bowman space.[4] These crescents can be entirely cellular, demonstrating the proliferation of neutrophils, macrophages, and epithelial cells, or they may exhibit varying degrees of scarring and fibrosis.

Fibrous crescents consist mainly of collagen, while fibrocellular crescents display features of both cellular and fibrous types. Changes in the interstitium range from acute inflammation to chronic interstitial scarring, fibrosis, and tubular atrophy.[5] The compression of glomerular capillary loops by crescents can lead to ischemic changes in the tubules relying on blood flow from the affected efferent arteriole. Vasculitis often manifests as episodic inflammation, as evidenced by crescents at different stages of progression.[5] In early lesions, there may be segmental fibrinoid necrosis with or without an adjacent crescent. Severe acute lesions can display focal or diffuse necrosis, accompanied by circumferential crescents.[6] The presence, location, and nature of immune deposits are crucial for identifying the cause of crescentic GN. For instance, IgA nephropathy and HSP exhibit mesangial deposits of IgA, post-infectious GN is characterized by granular, subepithelial deposits of IgG and C3, MPGN presents with mesangial, subendothelial, and intramembranous deposits of both IgG and C3, and SLE shows "full house" capillary wall and mesangial deposits of granular IgG, IgA, IgM, C3, C4, and C1q. Patients with vasculitis, with or without ANCA positivity, typically have few or no immune deposits in the glomeruli. Anti-GBM disease is characterized by linear staining of the GBM with IgG (rarely IgM and IgA) and C3.[7-9] This study aimed to analyze the demographic and renal histopathological profile of pediatric rapidly progressive glomerulonephritis.

**Methods:**

This prospective observational study took place at the Department of Paediatric Nephrology, Bangladesh Institute of Child Health (BICH) & Dhaka Shishu (Children) Hospital, Bangladesh. The research spanned from July 2018 to June 2020, involving a total of 28 pediatric cases displaying features of rapidly progressive glomerulonephritis as the study subjects. Approval was taken from the ethical committee of the Bangladesh Institute of Child Health (BICH) at the commencement of the study. The study included patients aged 2 to 18 years who presented with glomerulonephritis exhibiting clinical features consistent with rapidly progressive glomerulonephritis, particularly those demonstrating a rapid rise in serum creatinine beyond the upper limit of the age-matched normal range, and who provided informed consent. Patients were excluded if they had pre-renal or post-renal causes of acute kidney injury, had previously received methylprednisolone therapy, had an established diagnosis of chronic kidney disease, or declined to provide consent for participation.In this study, a non-probability sampling technique was employed. Data were gathered from parents or legal guardians utilizing a structured questionnaire encompassing all the variables of interest. Ethical approval was obtained from the institutional review committee (IRC), and informed written consent was secured from parents or legal guardians prior to data collection. The process included detailed history-taking, thorough clinical examinations, laboratory investigations, and renal biopsy. Subsequently, all the data were input into a computer and analyzed using Statistical Package for Social Science (SPSS) 20.0. Quantitative observations were presented in frequencies and percentages. Associations between variables were assessed using Fisher's exact test for categorical variables and a one-sample t-test for continuous variables, with a p-value of $<0.05$ considered statistically significant.

**Results:**

In this observational study, the majority of patients (61%) were male, and a significant proportion were younger than 10 years (75%). The majority (82%) hailed from rural areas. The mean age was 9.1±1.9 years and 8.7±2.2 years in the >50% crescent and <50% crescent groups, respectively. Although there was a male preponderance (88%) in the >50% crescent group, the p-value was not statistically significant (Table-I & Table-II).

**Table-I: Demography of study subjects (N=28)**

| Demography | no. (%) |
|---|---|
| **Age (Year)** | |
| 2-10 | 21(75) |
| 11-18 | 7(25) |
| **Gender** | |
| Male | 17(61) |
| Female | 11(39) |
| **Residence** | |
| Urban | 5(18) |
| Rural | 25(82) |

**Table-II: Association of demographic profile of RPGN with >50% and <50% crescent (N=28)**

| Variables | With >50% crescent | | p-value |
|---|---|---|---|
| | Mean±SD/ no. (%) | Mean±SD/ no. (%) | |
| Age (Year) | 9.1±1.9 | 8.7±2.2 | 0.328 |
| Male | 7(88) | 10(50) | 0.066 |
| Female | 1(12) | 10(50) | 0.066 |

Regarding the light microscopic findings of renal histopathology, increased cellularity, increased mesangial matrix, and interstitial inflammation were observed in most cases in both groups (Table-III).

**Table-III: Renal histopathology of the studied patient (N=28)**

| Light microscopic findings | RPGN with>50% crescent | | p-value |
|---|---|---|---|
| | (n=8) no. (%) | (n=20) no. (%) | |
| **Glomerular Crescent** | | | |
| Cellular | 2(25) | 9(45) | 0.328 |
| Fibro cellular | 5(63) | 7(35) | 0.184 |
| Fibrous | 1(12) | 4(20) | 0.558 |
| **Cellularity** | | | |
| Increased | 7(88) | 16(80) | 0.528 |
| Normal | 1(12) | 4 (20) | |
| **GBM thickness** | | | |
| Increased | 1(12) | 10(50) | 0.066 |
| Normal | 7(88) | 10(50) | |
| **Matrix** | | | |
| Increased | 8(100) | 19(95) | 0.52 |
| Normal | 0 | 1(5) | |
| **Tubular necrosis/ atrophy** | | | |
| Yes | 3(37) | 7(35) | 0.901 |
| No | 5(63) | 13(65) | |
| **Interstitial inflammation/edema** | | | |
| Yes | 6(75) | 19(95) | 0.122 |
| No | 2(25) | 1(5) | |

In analyzing kidney length by age, we observed that kidney size was larger in all cases, but the difference between groups was not significant (Table-IV).

**Table-IV: Comparison of kidney size in >50% and <50% crescentic groups as per age (N=28)**

| Characteristics | Crescent (%) | | p-value |
|---|---|---|---|
| | >50% (n=8) | <50% (n=20) | |
| | Mean±SD (cm) | | |
| **4<6yr** | | | |
| Right Site | 8.1±0.2 | 8.5±0.1 | 0.127 |
| Left Site | 8.6±0.1 | 9.4±0.1 | 0.992 |
| **6<8 yr** | | | |
| Right Site | 8.2±0.1 | 8.41±1.7 | 0.439 |
| Left Site | 8.8±0.1 | 8.51±1.8 | 0.42 |
| **8<10 yr** | | | |
| Right Site | 9.2±0.6 | 8.75±1.2 | 0.301 |
| Left Site | 9.3±0.13 | 8.85±1.1 | 0.223 |
| **10<12 yr** | | | |
| Right Site | 9.1±0.23 | 8.9±0.5 | 0.281 |
| Left Site | 9.13±0.46 | 9.1±0.4 | 0.468 |
| **12<18 yr** | | | |
| Right Site | 10.9±0.1 | 9.1±0.1 | 0.998 |
| Left Site | 10.6±0.1 | 9.7±0.3 | 0.148 |

When analyzing the association of AKI severity with >50% and <50% crescents, we observed that the majority of the patients were in AKI stage 3, but there were no significant differences between the groups (Table-V). Cortical echogenicity was increased in all the patients in both groups (Table-VI).

Regarding sonographic kidney size measurements in the patients studied, there was no significant difference in kidney size between the two groups.

**Table-V: Association of AKI severity with >50% crescents and <50% crescents of RPGN (N=28)**

| Severity | With >50% Crescent no. (%) | With <50% Crescent no. (%) | p-value |
|---|---|---|---|
| AKI stage 2 | 2(25) | 5(25) | 1.000 |
| AKI stage 3 | 6(75) | 15(75) | 1.000 |

**Table-VI: Association of sonographic measurement with >50% and <50%crescent cases (N=28)**

| Variables | With >50% Crescent no. (%) | With <50% Crescent no. (%) | p-value |
|---|---|---|---|
| Right kidney size (cm) mean±SD | 9.06±0.98 | 9.12±1.1 | 0.447 |
| Left kidney size (cm) mean±SD | 9.3±0.8 | 9.36±1.18 | 0.448 |
| Increased echogenicity no. (%) | 8(100) | 20(100) | 1 |

**Discussion:**

In this study, all patients underwent renal biopsy, and the age at disease onset ranged from 2 to 18 years. The mean age was 9.1±1.9 years and 8.7±2.2 years in the >50% crescent and <50% crescent groups, respectively. The demographic characteristics of the study group revealed that the majority of patients were male (61%). A significant proportion of children (75%) were younger than 10 years, and 82% were from rural areas. Post-infectious glomerulonephritis continues to be the most common etiology in developing countries like ours, often affecting children residing in overcrowded places with poor hygiene. The demographic profile found in this study aligns with the findings of Dewan et al.[10] In a study conducted by Chaudhury et al in Bangladesh, which included 34 cases divided into two groups (50% crescents), demographic characteristics also showed a male predominance (61.7%), consistent with our study.[11] Ultrasonographic evidence showed enlarged kidneys with increased echogenicity in both groups, without any significant difference. The present study revealed a high incidence of advanced renal failure, with AKI stage 3 observed in 75% (6/8) of RPGN cases with >50% crescents and 75% (15/20) in RPGN cases with <50% crescents. All patients required dialysis, and histopathological correlation revealed a high frequency of fibrocellular crescents in the majority of patients with crescentic GN, consistent with the findings of the Southwest Pediatric Nephrology Study Group.[12] The light microscopic study demonstrated increased cellularity, mesangial matrix, and interstitial inflammation in both groups. Fibro cellular and fibrous crescents were more prevalent, accounting for 61% (17/28), compared to cellular crescents, which constituted 39% (11/28) in this series. These observations are consistent with previous studies conducted by the Southwest Pediatric Nephrology Study Group and Dewan et al.[10,12] The higher percentages of fibrocellular crescents in this study may be attributed to the greater severity of AKI in both groups. The majority of patients in this study were in stage 3 AKI. Although there were no significant differences between the groups, this finding aligns somewhat with the study conducted by Wu KY et al.[13] In the study by Chaudhury et al, the proportions of glomeruli displaying cellular crescents, fibrous crescents, and fibro cellular crescents were reported as 21%, 7.1%, and 35%, respectively. Interstitial fibrosis and tubular atrophy were noted in 3.5% and 32.1% of biopsies.[11] Zent et al stated in their study that all patients had crescentic nephritis, with crescents ranging from 54% to 86%. Three patients had less than 80% crescents, and the anuric patient had 17 of 37 glomeruli sclerosed, with 100% of the remaining glomeruli having crescents in the biopsy report. This patient had a moderate chronic infiltrate and no evidence of acute tubular necrosis on histology. The immunofluorescence showed classical linear IgG staining.[14] In this study, all patients demonstrated immune deposition on immunofluorescence, indicating immune-complex glomerulonephritis. None of the cases showed pauci-immune glomerulonephritis or anti-GBM glomerulonephritis. This finding contrasts with the study by Sinha et al, which reported that pauci-immune glomerulonephritis constituted one-half of patients with crescentic glomerulonephritis.[15] Therefore, based on the discussion above, crescentic glomerulonephritis should be regarded as a genuine emergency. It is essential to raise awareness of this disease among referring paediatricians to facilitate early diagnosis and prompt treatment.

**Limitations:**

The study's limitations include its single-hospital setting and a small sample size, which may limit the generalizability of the results to the broader community.

**Conclusion:**

Male pediatric individuals in rural areas may be mainly prone to rapidly progressive glomerulonephritis. The prevalence of such incidents may be higher between 7 and 9 years of age. The presence of AKI (Acute Kidney Disease) stage 3 may be a common phenomenon. Rapidly progressive glomerulonephritis patients in the >50% crescent and <50% crescent groups exhibit similar mean ages, with a slight numerical increase observed in the former. There is a noticeable male preponderance in the >50% crescent group, although the difference does not reach statistical significance. The majority of participants come from rural areas. Renal histopathological findings indicate increased cellularity, elevated mesangial matrix, and interstitial inflammation in the majority of cases in both crescent groups. Notably,

most patients are in AKI stage 3, with no significant disparity observed between the two groups. These qualitative observations emphasize the need for further investigation into the factors influencing renal health in this demographic.

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# Acid Fly or Paederus Dermatitis Among Foreign Medical Students Residing in Institutional Hostels in Rangpur, Bangladesh

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Submission Date : 20 Jan 2026
Accepted Date : 19 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90024

**Abstract**

**Background:**
Paederus dermatitis is a form of irritant contact dermatitis triggered by pederin, a toxin released when rove beetles are crushed against the skin. Outbreaks of this condition are frequently observed in residential institutions, particularly during rainy seasons.

**Objective:**
The study utilized line-listing to summarize cases by person, place, and time, supplemented by environmental walk-through assessments to identify risk factors.

**Methods:**
We performed a descriptive cross-sectional study of an outbreak among foreign medical students residing in three hostels at Rangpur Community Medical College (RCMC) in Bangladesh, covering the period from January to December 2025.

**Results:**
A total of 76 clinical cases and 79 attack episodes were identified. The majority of affected students were Nepalese (34/76) and Indian (33/76), and female students accounted for 40 of the 76 cases. Clustering was evident at the room level, with 13 rooms reporting two or more cases, and 91.1% (72/79) of attack episodes occurred during the monsoon months of July and August. Among 74 cases with available risk-factor data, the most frequently documented associated factors were seasonal occurrence during the monsoon (72/74, 97.3%), sleeping with windows open (59/74, 79.7%), shared exposure within rooms (49/74, 66.2%), crushing the insect on the skin (48/74, 64.9%), and bed placement near windows (42/74, 56.8%).

**Conclusion:**
The outbreak demonstrated strong seasonality and room-level clustering. Preventing future occurrences requires synchronized environmental management and student awareness strategies intensified during the monsoon.

**Keywords:** Paederus dermatitis, foreign medical students, hostel, Bangladesh.

**Citation:** Mehedi K,Rahman M,Shamsuzzman M,Imran SMA, Afrose T.Acid Fly or Paederus Dermatitis Among Foreign Medical Students Residing in Institutional Hostels in Rangpur, Bangladesh.J Rang Med Col.2026 Mar;11(1):124-129.doi: https://doi.org/10.3329/jrpmc.v11i1.90024

## Introduction:

Paederus dermatitis, also known as "acid fly" dermatitis or dermatitis linearis, is an acute irritant condition resulting from skin contact with pederin, a potent vesicant released when a beetle of the genus Paederus is brushed or crushed on the body. Clinical lesions typically appear within hours of exposure, presenting as vesicles, bullae, or erythematous plaques, often on exposed skin surfaces.[1-4] It's also observed that post-inflammatory hyper-pigmentation following these lesions can persist for several weeks.[4] These beetles are widely distributed across subtropical and tropical regions. Outbreaks are commonly reported during humid, warm, and rainy seasons[5] and are exacerbated by factors such as the insects' attraction to artificial light, the presence of vegetation near sleeping quarters, and high-rise

accommodations.[6-8] While Bangladesh possesses climatic and agricultural conditions that favor Paederus proliferation, peer-reviewed documentation of outbreaks in institutional residential settings remains rare.[6] Reported environmental and behavioral risk factors include bright artificial lights at night, open windows near light sources, defective window or door screens, upper-floor or well-ventilated rooms that permit insect entry, nearby vegetation and agricultural land, damp organic debris around buildings, and crushing the beetle on the skin rather than brushing it away.[6-10,13,15] These factors can substantially increase exposure in residential institutions during the monsoon season. This study investigated a cluster of clinically diagnosed cases among foreign medical students at Rangpur Community Medical College (RCMC) hostels to characterize the outbreak and identify practical preventive strategies.

**Methods:**

This cross-sectional descriptive study was conducted involving foreign BDS and MBBS students living in three multi-story hostels (Ranga, Hakim, and Shahid) affiliated with Rangpur Community Medical College (RCMC) Hospital, Rangpur, Bangladesh. The study analyzed 76 cases of clinically diagnosed Paederus dermatitis between 1 January and 31 December 2025. The hostels are concrete multi-storey blocks, Corridors and rooms are illuminated with bright fluorescent tube lights and other artificial lighting in the evening and at night, and many windows lack intact insect-proof screening situated near peri-urban and mixed residential areas surrounded by agricultural land and vegetation suitable for Paederus proliferation.[6-10] A case was defined as any foreign medical or dental student residing in the specified hostels during the study period who developed acute irritant dermatitis clinically consistent with Paederus exposure. Clinical consistency included linear or streaky erythema accompanied by pustulation, vesiculation, or a burning sensation, as diagnosed by a dermatologist of Rangpur Community Medical College Hospital. A line list was compiled using clinic documentation, hostel records& structured risk-factor summary sheet. Variables analyzed included sex, nationality, hostel, academic batch, room number, month of onset, and history of recurrence. Associated environmental and behavioral factors available in the raw dataset included seasonal occurrence, bed near window, lack of bed net, sleeping with window open, room facing vegetation or open field, insect crushed on the skin, floor sleeping, and shared exposure. The investigation team performed walk-through inspections of the hostel premises. These assessmentsfocused on night-time lighting in rooms and corridors, the condition of door and window screens, ventilation openings, housekeeping practices, and proximity to drainage or damp organic debris. Informal interviews were conducted with hostel staff and residents regarding insect sightings and lighting habits. One live insect specimen was captured from the environment and presumptively identified as Paederus based on external morphology.[5,13] Descriptive statistics (percentages and counts) were used to summarize cases by person (sex, nationality), place (batch, hostel, room clustering), and time (month of attack)and associated risk factors.

**Results:**

During the study period, 76 cases of clinically diagnosed Paederus dermatitis were recorded. As shown in Table-1, students from Nepal (44.7%) and India (43.4%) comprised the majority of cases. Females accounted for 52.6% (40/76) of the total cases.

Cases were reported across all three hostels. Batch information was available for 74 cases, with the 14th, 15th, and 16th batches accounting for the majority (89.2%) of affected students. Batch wise distributions are summarized in Table-II. Two cases (2.6%) had missing batch information and are not included in this table.

Clustering at the room level was evident. Out of 48 total rooms affected, 22 rooms reported two or more cases. The highest concentration was in Room 506 of Ranga Hostel, which reported four cases. Room-level clusters are summarized in Table-III.

**Table-I: Distribution of cases by nationality and sex (N=76)**

| Nationality | Male (n) | Female (n) | Total no. (%) |
|---|---|---|---|
| Indian | 17 | 16 | 33(43.4) |
| Nepalese | 19 | 15 | 34(44.7) |
| Bhutanese | 0 | 9 | 9(11.8) |
| Total | 36 | 40 | 76(100) |

**Table-II: Distribution of cases by academic batch and hostel (N=74)**

| Batch | Ranga Hostel (n) | Hakim Hostel (n) | Shahid Hostel (n) | Total no. (%) |
|---|---|---|---|---|
| 11th MBBS | 0 | 3 | 0 | 3(3.9) |
| 12th MBBS | 6 | 0 | 0 | 6(7.9) |
| 13th MBBS | 8 | 2 | 0 | 10(13.2) |
| 14th MBBS | 3 | 2 | 6 | 11(14.5) |
| 15th MBBS | 8 | 4 | 0 | 12(15.8) |
| 16th MBBS | 8 | 13 | 0 | 21(27.6) |
| 17th MBBS | 2 | 4 | 0 | 6(7.9) |
| 24th MBBS | 1 | 0 | 0 | 1(1.3) |
| 25th MBBS | 3 | 0 | 0 | 3(3.9) |
| BDS | 1 | 0 | 0 | 1(1.3) |
| Total | 40 | 28 | 6 | 74(97.4) |

**Table-III: Rooms with two or more cases and associated batches (N=74)**

| Hostel | Room Number | Number of Cases | Affected Batches |
|---|---|---|---|
| Ranga | 506 | 4 | BDS, 15th, 16th, 24th |
| Ranga | 204 | 3 | 12th, 16th |
| Ranga | 405 | 3 | 13th, 16th, 17th |
| Ranga | 606 | 3 | 25th |
| Ranga | 201 | 2 | 13th |
| Ranga | 203 | 2 | 15th, 16th |
| Ranga | 404 | 2 | 13th, 14th |
| Ranga | 503 | 2 | 15th |
| Ranga | 508 | 2 | 15th |
| Hakim | 206 | 2 | 16th |
| Hakim | 207 | 2 | 16th |
| Hakim | 605 | 2 | 11th, 16th |
| Hakim | 704 | 2 | 16th |
| Hakim | 705 | 2 | 16th |
| Hakim | 707 | 2 | 16th |
| Hakim | 708 | 2 | 16th, 17th |
| Hakim | 801 | 2 | 15th, 17th |
| Hakim | 802 | 2 | 15th |
| Hakim | 805 | 2 | 14th |
| Hakim | 806 | 2 | 13th, 17th |
| Hakim | 901 | 2 | 16th |
| Shahid | 402 | 2 | 14th |

Analysis of the timing of attacks revealed a sharp seasonal pattern. A total of 79 attack episodes were recorded (including recurrences). As shown in Table-IV, the outbreak peaked intensely during the monsoon season, with 91.1% (72/79) of episodes occurring in July and August. Dates of first attack were available for 74 of 76 cases. The earliest recorded case occurred on 8 January 2025, followed by sporadic cases in March, May and June. A modest increase was observed in July (13 first attacks), but a pronounced surge occurred in August (59 first attacks).

**Table-IV: Month-wise distribution of recorded attack episodes (N=79)**

| Month | no. (%) |
|---|---|
| January | 1(1.4) |
| March | 1(1.4) |
| May | 1(1.4) |
| June | 1(1.4) |
| July | 13(17.6) |
| August | 59(79.7) |
| October | 1(1.4) |
| November | 1(1.4) |
| December | 1(1.4) |
| Total | 79(100) |

During the environmental assessment, one live rove beetle specimen consistent with the genus Paederus was captured inside the hostel premises, supporting the suspected outbreak agent. No laboratory confirmation of pederin exposure was performed.

Risk-factor information was available for 74 cases. Seasonal occurrence during the monsoon was the most frequent associated factor, identified in 72 cases (97.3%). Other commonly reported factors were sleeping with window open in 59 cases (79.7%), shared exposure in 49 cases (66.2%), insect crushed on skin in 48 cases (64.9%), and bed near window in 42 cases (56.8%). Lack of bed net was documented in 29 cases (39.2%), while room facing vegetation/open field and floor sleeping were reported in 18 (24.3%) and 14 (18.9%) cases, respectively. The distribution of associated environmental and behavioral risk factors is shown in Table-V.

**Table-V: Distribution of associated risk factors among cases (N=74)**

| Risk factors | no. (%) |
|---|---|
| Seasonal Occurrence | 72(97.3) |
| Sleeping with window open | 59(79.7) |
| Shared Exposure | 49(66.2) |
| Insect Crushed on Skin | 48(64.9) |
| Bed near window | 42(56.8) |
| Lack of bed net | 29(39.2) |
| Room facing vegetation/open field | 18(24.3) |
| Floor sleeping | 14(18.9) |

Note: Multiple responses were possible. Percentages were calculated using 74 cases with available risk-factor data.

**Discussion:**

This investigation documents an institutional outbreak of clinically diagnosed Paederus dermatitis among foreign medical students in northern Bangladesh. The outbreak showed a clear temporal concentration during the monsoon period and substantial clustering within specific rooms, indicating that both seasonal environmental conditions and localized residential exposure played important roles. These observations are consistent with previous reports from hostels and residential institutions in South Asia and globally. In the present study, the marked concentration of cases and attack episodes during the monsoon supports the established ecological association between rainy humid periods and increased beetle activity around human dwellings.[6,8-10,15,16]

The risk-factor distribution provides a clearer picture of the exposures commonly present among affected students. Seasonal occurrence during the monsoon was the most prominent associated factor, identified in 97.3% of cases. This finding is compatible with the known ecology of Paederus beetles, which proliferate during warm and humid rainy months and are more likely to enter residential buildings during such periods. Sleeping with windows open was reported in 79.7% of cases and bed near window in 56.8%, suggesting that nocturnal beetle entry into sleeping spaces was an important route of exposure. This interpretation is supported by previous studies. In the Kerala hostel outbreak, bright illumination at night, higher floors, open doorways, and unscreened windows were described as important risk factors for insect entry into dwellings.[9] Similarly, the Sikkim case-control study linked the outbreak to heavy rainfall, dense surrounding vegetation, fluorescent lights, and inadequate window screening.[15]

Comparison with published reference values also shows that the behavioral profile of the present outbreak is highly plausible. In our study, 64.9% of affected students reported crushing the insect on the skin. This is very close to the value reported by Toppo et al in central India, where 65.7% of affected hostel residents gave a history of contact in the form of crushing or brushing the insect.[8] The Sikkim case-control study provided even stronger analytic evidence, showing that crushing the insect was independently associated with disease with an adjusted odds ratio of 19.37 (95% CI: 5.72-80.91). The same study found that keeping lights on after 10 pm and not clearing insects from the bed before sleeping were also independently associated with becoming a case.[15]

Shared exposure was documented in 66.2% of cases, reinforcing the room-level clustering demonstrated elsewhere in the Results. This pattern suggests that exposure was not random, but related to common micro-environmental conditions within particular rooms, such as lighting, airflow, window position, and proximity to surrounding vegetation. Similar clustering has been described in hostel-based outbreaks from India and Malaysia, where room location and shared living conditions influenced exposure risk.[8-10,16]

Other associated exposures in the present study, including lack of bed net (39.2%), room facing vegetation or open field (24.3%), and floor sleeping (18.9%), were less frequent but remain epidemiologically relevant. These factors were likely contributory rather than primary, acting in combination with the more dominant drivers of seasonality, window-related exposure, and crushing behavior. In the Sikkim study, non-use of mosquito nets was common in both cases and controls and was not identified as an independent risk factor, suggesting that bed-net status alone may be less important than the broader residential exposure setting.[15]

While no severe systemic outcomes were recorded and most cases were managed clinically, the outbreak affected student well-being and hostel

functioning. The presence of repeat episodes further suggests that exposure risks may persist unless environmental and behavioral drivers are addressed. As this study was descriptive, the identified factors should be interpreted as associated exposures rather than independent predictors; however, their consistency with previous outbreak investigations adds strength to their probable epidemiologic importance.[6,8,9,15,16]

**Limitations:**

Several limitations must be acknowledged. First, the study was descriptive and lacked a comparison group, so the reported factors should be understood as associated exposures among cases rather than independent causal predictors. Second, risk-factor information was available for 74 cases, not all 76 clinically diagnosed cases. Third, entomological confirmation relied on a single captured specimen without specialist identification or laboratory confirmation. Despite these limitations, the study provides an important operational description of an institutional outbreak and identifies several modifiable environmental and behavioral factors.

**Conclusion:**

Paederus dermatitis can lead to disruptive outbreaks in educational residential institutions, particularly during the monsoon months. This outbreak among foreign medical students in Rangpur demonstrated strong seasonality, room-level clustering, and frequent exposure to modifiable environmental and behavioral factors such as open windows during sleep, bed placement near windows, shared room exposure, and crushing insects on the skin. Sustainable prevention requires a combination of improved physical barriers, reduced night-time light attraction, student awareness, and routine environmental management around hostel premises. Prevention strategies should focus on reducing insect attraction by using low-attractant lighting and minimizing unnecessary night-time lighting. Physical barriers must be improved by repairing screens and sealing cracks. Environmental management should include trimming vegetation and removing organic debris near buildings. Furthermore, student education is critical; residents should be advised to wash exposed skin immediately if contact occurs and to blow or flick insects away rather than crushing them.

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# Proteinuria as a Marker of Cochlear Microvascular Damage and Functional Hearing Deficit in Presbycusis: A Cross-Sectional Study

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Submission Date : 20 Jan 2026
Accepted Date : 19 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90039

**Abstract**

**Background:**
Presbycusis is the most prevalent sensory deficit in older adults, its metabolic subtype involves progressive strial microvascular degeneration. Proteinuria, a systemic marker of endothelial dysfunction, may reflect parallel cochlear microvascular damage.

**Objective:**
To investigate the association between proteinuria and cochlear dysfunction in elderly patients with presbycusis.

**Methods:**
In this cross-sectional study, 340 adults aged ≥60 years with clinically confirmed presbycusis were enrolled and classified by proteinuria status (urine albumin-creatinine ratio [ACR] ≥30 mg/g). The Hearing Handicap Inventory for the Elderly–Screening Version (HHIE-S) and the Absolute Bone Conduction (ABC) test were used to assess functional hearing deficit.

**Results:**
Of 340 participants, 112 (32.9%) had proteinuria. The proteinuria group showed significantly higher mean HHIE-S scores (20.4±8.6 vs. 8.2±6.4; $p<0.001$) and a greater prevalence of markedly reduced ABC results (42.9% vs. 14.0%; $p<0.001$). A moderately strong positive correlation was found between ACR and HHIE-S scores ($r=0.58$, $p<0.001$).

**Conclusion:**
Proteinuria is strongly associated with cochlear dysfunction and functional hearing handicap in presbycusis, supporting a shared renal–cochlear microvascular pathology.

**Keywords:** Presbycusis, Proteinuria, Albuminuria, Cochlear microvascular damage, HHIE-S

**Citation:** Antor AP,Chowdhury A,Tasnim A,Chowdhury AM,Marwa A,Tousif M, et al.Proteinuria as a Marker of Cochlear Microvascular Damage and Functional Hearing Deficit in Presbycusis: A Cross-Sectional Study.J Rang Med Col.2026 Mar;11(1):130-135.doi: https://doi.org/10.3329/jrpmc.v11i1.90039

## Introduction:

Presbycusis, or age-related hearing loss (ARHL), is the most common sensory deficit among older adults and a leading cause of disability-adjusted life years worldwide.[1,2] Approximately one-third of adults aged 65 years and above are affected by disabling hearing loss, and the World Health Organization projects that by 2050 more than 700 million people globally will be affected—the majority being older adults.[3,4]

Presbycusis is classified into sensory, neural, metabolic (strial), and cochlear conductive

subtypes.[1,5] The metabolic subtype is characterised by progressive atrophy of the stria vascularis—the highly vascularised lateral cochlear wall that maintains the endocochlear potential (EP) through the blood-labyrinth barrier (BLB).[5,6] The EP provides the electromotive force essential for sound transduction; its decline produces a flat, sensorineural hearing loss across all frequencies.[2,7] The BLB and the renal glomerular filtration barrier share critical structural and molecular features, including dependence on the α3α4α5 network of type IV collagen for integrity and permselectivity.[8-10] This parallelism is compellingly demonstrated in Alport syndrome, a genetic collagen IV disorder that causes simultaneous progressive glomerulonephritis and sensorineural hearing loss.[9-11] In the broader aging population, systemic microvascular stressors chronic hypertension, diabetes mellitus, and oxidative stress cumulatively damage these shared basement membranes.[12]

Proteinuria, specifically albumin leakage through the glomerular basement membrane, is an established clinical surrogate for generalised endothelial dysfunction and microvascular damage.[12,13] The Kidney Disease: Improving Global Outcomes (KDIGO) guidelines classify albuminuria by urine albumin-creatinine ratio (ACR) into A1 (<30 mg/g), A2 (30–300 mg/g), and A3 (>300 mg/g) categories.[14] Nitric oxide (NO) regulates vascular tone in both the spiral modiolar artery and renal afferent arterioles; reduced NO bioavailability causes chronic vasoconstriction and hypoperfusion in both organs.[6] Cross-sectional and prospective cohort data from Japan have demonstrated a statistically significant association between dipstick proteinuria and hearing impairment in working-age adults, suggesting that renal microvascular markers may predict auditory dysfunction.[13,15]

The Hearing Handicap Inventory for the Elderly–Screening Version (HHIE-S) is a validated 10-item questionnaire quantifying the social and emotional impact of hearing impairment on daily life.[16,17] Hearing loss in older adults contributes to social isolation, cognitive decline, and depression; albuminuria itself independently predicts hospitalisation, frailty, and functional decline in this population.[3,18-20] Despite this converging evidence, no study has comprehensively evaluated proteinuria in relation to functional hearing deficit in elderly patients with established presbycusis. This study investigates that association using the HHIE-S and ABC test in 340 adults aged ≥60 years.

**Methods:**

This cross-sectional clinical study was conducted at outpatient geriatric and audiology clinics. Ethical approval was obtained from the Institutional Review Board, and written informed consent was secured from all participants. A total of 340 participants aged ≥60 years with presbycusis defined as slowly progressive, bilateral, symmetrical sensorineural hearing loss without an identifiable alternative cause were enrolled.[1,5] Exclusion criteria included: sudden sensorineural hearing loss; ototoxic medications (aminoglycosides, high-dose loop diuretics); chronic middle ear disease or prior otologic surgery; noise exposure exceeding 85 dB for prolonged periods; cognitive impairment precluding questionnaire completion; and active urinary tract infection, fever, or recent intense exercise that could confound proteinuria results.[13,21]

The sensorineural nature of hearing loss was confirmed with a 512 Hz tuning fork.[22,23] The Rinne test was performed bilaterally; a positive result (air conduction > bone conduction) was required for inclusion, confirming absence of a significant conductive component.[22] The Weber test was conducted by placing the vibrating fork on the midline vertex; participants with lateralisation were excluded.[22] The Absolute Bone Conduction (ABC) test assessed cochlear sensitivity by comparing bone conduction duration between the participant (with occluded external auditory canal) and a normal-hearing examiner; results were categorised as normal, reduced, or markedly reduced.[23,24]

Functional hearing difficulty was quantified using the HHIE-S, a validated 10-item instrument assessing emotional (5 items) and social (5 items) dimensions of hearing handicap.[16,17] Responses were scored as: Yes (4 points), Sometimes (2 points), No (0 points), yielding a total of 0–40. Scores were categorised as: no handicap (0–8), mild-to-moderate (10–24), and significant handicap (26–40).[25,26]

All participants provided an early morning spot urine sample for dipstick testing.[13,21] Participants

with a positive dipstick result underwent confirmatory ACR testing.[14,27] Results were classified per KDIGO standards: A1 (normal, <30 mg/g), A2 (moderately increased, 30–300 mg/g), and A3 (severely increased, >300 mg/g).[14] Participants with ACR ≥30 mg/g were assigned to the proteinuria group.

Data were analysed using SPSS version 26.0. Continuous variables are expressed as mean ± SD and compared by independent samples t-test. Categorical variables are expressed as frequencies and percentages and compared by chi-square test. Pearson's correlation coefficient assessed the relationship between log-transformed ACR and HHIE-S scores. A p-value of <0.05 was considered statistically significant.

**Results:**

Of 340 enrolled participants with confirmed presbycusis, 112 (32.9%) had proteinuria (ACR ≥ 30 mg/g) and 228 (67.1%) did not. The proteinuria group was significantly older (73.5±7.1 vs. 70.1±6.2 years; p<0.001) and had higher prevalence of hypertension (73.2% vs. 50.9%; p<0.001) and diabetes mellitus (42.9% vs. 23.7%; p<0.001). Sex distribution did not differ significantly between groups (Table-I).

The proteinuria group demonstrated significantly higher mean HHIE-S scores compared to the non-proteinuria group (20.4±8.6 vs. 8.2±6.4; p<0.001), indicating a substantially greater perceived hearing handicap. Among participants with proteinuria, 87.5% reported some degree of hearing handicap (HHIE-S ≥10), compared to 36.0% in the non-proteinuria group. Significant handicap (HHIE-S 26–40) was found in 35.7% versus 8.8% of the non-proteinuria group (Table-II).

Both HHIE-S subscales were significantly higher in the proteinuria group (Table-III): the emotional subscale mean was 10.8±4.5 versus 4.2±3.1 (p<0.001), and the social subscale mean was 9.6±4.8 versus 4.0±3.6 (p<0.001).

**Table-I: Demographic and clinical characteristics of the study population**

| Variable | Total (N=340) no. (%) | Proteinuria (+) (n=112) no. (%) | Proteinuria (-) (n=228) no. (%) | p-value |
|---|---|---|---|---|
| Age (years), Mean±SD | 71.2±6.8 | 73.5±7.1 | 70.1±6.2 | <0.001 |
| Male sex | 186(54.7) | 64(57.1) | 122(53.5) | 0.523 |
| Hypertension | 198(58.2) | 82(73.2) | 116(50.9) | <0.001 |
| Diabetes mellitus | 102(30.0) | 48(42.9) | 54(23.7) | <0.001 |
| Mean ACR (mg/g) | 42.8±58.4 | 98.6±72.3 | 15.5±8.2 | <0.001 |

**Table-II: Distribution of Functional Hearing Deficit (HHIE-S Scores) by proteinuria status**

| HHIE-S Category | Proteinuria (+) (n=112) no. (%) | Proteinuria (-) (n=228) no. (%) | Total (N=340) no. (%) |
|---|---|---|---|
| No handicap (0–8) | 14(12.5) | 146(64.0) | 160(47.1) |
| Mild-moderate (10–24) | 58(51.8) | 62(27.2) | 120(35.3) |
| Significant (26–40) | 40(35.7) | 20(8.8) | 60(17.6) |
| Mean HHIE-S Score±SD | 20.4±8.6 | 8.2±6.4 | 12.2±9.4 |

**Table-III: HHIE-S emotional and social subscale scores by proteinuria status**

| HHIE-S Subscale | Proteinuria (+) (n=112) | Proteinuria (-) (n=228) | p-value |
|---|---|---|---|
| Emotional (Max 20) | 10.8±4.5 | 4.2±3.1 | <0.001 |
| Social (Max 20) | 9.6±4.8 | 4.0±3.6 | <0.001 |

Chi-square analysis revealed a significant association between proteinuria status and ABC test results ($\chi$ =38.6, p<0.001). Markedly reduced cochlear function was found in 42.9% of the proteinuria group versus 14.0% of the non-proteinuria group, while normal bone conduction was observed in only 16.1% versus 50.0% (Table-IV).

A dose-response relationship was observed between ACR severity and hearing handicap (Table-V). Mean HHIE-S scores increased progressively from 8.2±6.4 (A1) to 26.8±6.2 (A3), and the proportion with significant handicap rose from 8.8% to 53.8%. Pearson's correlation coefficient between log-transformed ACR and HHIE-S score was r=0.58 (p<0.001), indicating a moderately strong positive correlation.

**Table-IV: Absolute Bone Conduction (ABC) test results by proteinuria status**

| ABC Test Result | Proteinuria (+) (n=112) no. (%) | Proteinuria (-) (n=228) no. (%) | p-value |
|---|---|---|---|
| Normal | 18(16.1) | 114(50.0) | <0.001 |
| Reduced | 46(41.1) | 82(36.0) | |
| Markedly reduced | 48(42.9) | 32(14.0) | |

**Table-V: ACR severity categories and hearing handicap outcomes**

| ACR Category | no. | Mean HHIE-S±SD | Significant Handicap, no. (%) |
|---|---|---|---|
| A1 (Normal, <30 mg/g) | 228 | 8.2±6.4 | 20(8.8) |
| A2 (Moderate, 30–300 mg/g) | 86 | 18.6±7.8 | 26(30.2) |
| A3 (Severe, >300 mg/g) | 26 | 26.8±6.2 | 14(53.8) |

**Discussion:**

The principal finding of this study is that proteinuria is significantly associated with functional hearing deficits and reduced cochlear sensitivity in older adults with presbycusis. This association was consistent across all outcome measures total HHIE-S score, both subscales, and the ABC test and the dose-response gradient between ACR severity and hearing handicap strengthens the inference of a biological link between renal and cochlear microvascular pathology.

The biological plausibility of this association rests on the shared structural and molecular characteristics of the renal glomerulus and the stria vascularis.[6,8,9] Metabolic presbycusis results from progressive strial atrophy leading to decline in the endocochlear potential.[2,5,7] Both the BLB and the glomerular filtration barrier rely on the α3α4α5 type IV collagen network for their permselectivity.[6,10] In individuals with proteinuria, loss of permselectivity of the glomerular basement membrane likely reflects parallel deterioration of the BLB, disrupting the ionic gradients required for normal cochlear function.[12,14]

Our findings are consistent with prior reports. Umesawa et al demonstrated a significant cross-sectional association between dipstick proteinuria and hearing impairment among Japanese workers after adjustment for age, sex, and cardiovascular risk factors.[13] The same group subsequently reported a prospective association in which proteinuria at baseline predicted incident hearing impairment over five years.[15] The present study extends these observations to an older cohort with established presbycusis and adds validated functional outcome measures—HHIE-S and ABC test—not previously employed in this context.

Nitric oxide (NO) is a potent vasodilator regulating blood flow in the spiral modiolar artery and strial capillaries.[6] Systemic diseases such as hypertension and diabetes mellitus—both significantly more prevalent in our proteinuria group—impair NO bioavailability, resulting in chronic cochlear hypoperfusion and ischaemic

strial degeneration.[6,12] This is consistent with our finding that proteinuria was associated with significantly lower ABC test scores, indicating reduced cochlear sensitivity.

Elevation of both HHIE-S subscales in the proteinuria group has important clinical relevance. High emotional subscale scores signify embarrassment and frustration, while high social scores reflect difficulty following conversations in noise or at social events.[16,25] Such functional impairments are associated with social withdrawal, depression, and accelerated cognitive deterioration in the elderly.[18,28] Albuminuria additionally predicts frailty and increased hospitalisation rates, reinforcing that proteinuric elderly individuals constitute a high-risk population warranting targeted audiological surveillance.[19,20]

These findings carry several clinical implications. Urine dipstick screening is inexpensive and non-invasive, and can be readily integrated into primary care and audiology practice.[13,21] Detection of proteinuria in an elderly patient should prompt clinicians to consider a metabolic component to hearing loss and to anticipate greater difficulty with speech understanding in noise than audiometric thresholds alone might suggest.[2,28] Management of underlying microvascular disease through blood pressure and glycaemic control may potentially slow strial presbycusis progression, though longitudinal evidence is needed.[12,14]

This study has certain limitations. The cross-sectional design precludes causal inference. Pure-tone audiometry was not employed, limiting precision in hearing threshold quantification. The study population was derived from clinical outpatient settings, which may not fully represent the community-dwelling elderly population. Future prospective studies incorporating audiometric testing and longitudinal follow-up are warranted to confirm these findings.

**Conclusion:**

This cross-sectional study demonstrates that proteinuria is strongly associated with cochlear microvascular damage and functional hearing deficit in elderly adults with presbycusis. Proteinuric participants (ACR ≥30 mg/g) had significantly higher HHIE-S scores, worse ABC test outcomes, and a clear dose-response gradient across ACR severity categories—findings consistent with a shared renal–cochlear microvascular susceptibility. Proteinuria screening may serve as a useful diagnostic and prognostic adjunct in the evaluation of presbycusis, and a multidisciplinary approach integrating vascular risk management with auditory rehabilitation should be considered to optimise quality of life in this vulnerable population.

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# Reconstruction of Soft Tissue Defect with Exposed Spine by Latissimus Dorsi Myocutaneous Flap–reconstructive Challenge and our Experience

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Submission Date : 20 Jan 2026
Accepted Date : 19 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90040

**Abstract**

**Background:**
Reconstructive surgeons face challenges when repairing soft tissue defects with exposed spine due to the curved contour and strong skin tension of the back. Implant and metal exposure complicates coverage, and patients are often malnourished and fragile.

**Objective:**
The purpose of this study was to share our experience regarding reconstruction of soft tissue defects with exposed spine using Latissimus dorsi (LD) myocutaneous flap.

**Methods:**
This was a prospective observational study, conducted in the Burn & Plastic Surgery department of Rangpur medical college hospital, Rangpur over a period of three years July 2019 to June 2022. Here 15 patients with soft tissue defect in posterior midline with exposed spine were reconstructed with Pedicled Latissimus dorsi (LD) flap. Patient demographics, clinical details, reconstructive procedures, outcome, and complications were analyzed.

**Results:**
Among 15 patients, 12 were male and 03 were females, with male to female ratio of 4:1. The lowest age was 18 years and the highest age was 66 years. The major cause (80%) was post operative soft tissue defect and in 20 % case it was due to high voltage electric burn. In 8 cases there were exposed implants. The standard myocutaneous flap was harvested in all cases. The donor site was closed primarily in all cases. In 03 cases skin graft was placed over transferred muscle. The outcome of reconstruction was satisfactory in all cases. Four patients had minor complications (managed non operatively), one of the patients had surgical site infection which was controlled according to culture-specific antibiotics, and another two patients had partial dehiscence of donor site wound which healed spontaneously. One patient developed seroma in donor site which resolved in time with local care.

**Conclusion:**
Pedicled Latissimus dorsi muscle flap is a straight forward and versatile option for reconstruction of soft tissue defect with exposed spine with minimal donor site morbidity.

**Keywords:** Latissimus dorsi myocutaneous flap–reconstruction, Exposed spine, Soft tissue defect

**Citation:** Shah MS,Mishkatuzzaman M.Reconstruction of Soft Tissue Defect with Exposed Spine by Latissimus Dorsi Myocutaneous Flap – Reconstructive Challenge and our Experience.J Rang Med Col.2026 Mar;11(1):136-140. doi: https://doi.org/10.3329/jrpmc.v11i1.90040

## Introduction:

Reconstruction of posterior midline soft tissue defect is challenging for all reconstructive surgeons especially in the case of exposed vertebral hardware, spinal cord and cerebrospinal fluid leakage. Because they are difficult to reconstruct due to the low degree of vascularity in this area, strong skin tension, lack of tissue, and the curved contour of the back.[1] Defects can derive from trauma, tumor resection or debridement following postoperative infections or electric burn. The standard procedure for addressing soft tissue defect with exposed spine is wound excision followed by

tensionless stable coverage with well padded vascularized muscle flap that obliterates dead space. The Latissimus dorsi (LD) flap as well as the Trapezius myocutaneous flap or sliding paraspinous muscle flaps are common treatment options for posterior midline soft tissue defect.[2,3] To date, there is no gold standard for the treatment of dorsal midline defects with exposed spinal hardware.[4] Considering the bulk, vascularity and arc of rotation, Latissimus dorsi (LD) muscle flap can be a reasonable option for reconstruction of soft tissue defect with exposed spine. Moreover it is easy to harvest with minimum donor site morbidity.

**Methods:**

A prospective, observational study design was used in the Department of Burn & Plastic Surgery, Rangpur medical college hospital, Rangpur over a period of three years July 2019 to June 2022. Here 15 patients with posterior mid line soft tissue defect of variable sizes with exposed spine underwent coverage with pedicled Latissimus dorsi (LD) flap. We reviewed the prospectively collected data of the patients who underwent reconstruction of soft tissue defects with pedicled LDMF between July 2019 to June 2022. By analyzing the clinical scenarios, the location of flap inset, the arc of rotation, reach of the flap, and associated complications, we put forward few significant findings from our experience.

**Surgical technique:**

Design and Marking: All patients were operated under general anesthesia in the lateral position. Latissimus dorsi (LD) muscle flap is marked in a standard fashion (Figure-2c) the medial border at the mid-line in the back, upper border at the tip of scapula, lower border at the iliac crest, and later border at the posterior axillary line. The skin paddle design should overlie the muscle for reliable perfusion. There are two Basic designs depending on the recipient site requirements and donor site scar location. The largest skin island can be harvested in an oblique fashion. The inferior marking of a skin paddle is generally placed 8cm superior to the posterior superior iliac crest.

Flap dissection: After wound excision the defect was measured, and skin paddle was designed accordingly. The skin incision was made around the paddle down to dermis. Dissection proceeds over the epimyseum towards the posterior axillary line to identify the lateral border of the muscle. Similar technique used to identify the medial and inferior border of the muscle. The plane between the LD muscle and Serratus anterior muscle was dissected. The myocutaneous flap was dissected and islanded on all sides (Figure-2d). The insertion of LD was divided along with the thoracoacromial vessels & thoracodorsal nerve, the flap made completely islanded based on thoracodorsal vessels. Flap donor-site wound was closed primarily keeping a negative suction drain insitu (fig 2e). Postoperatively, shoulder was immobilized in 45 degrees abduction to avoid pedicle compression.

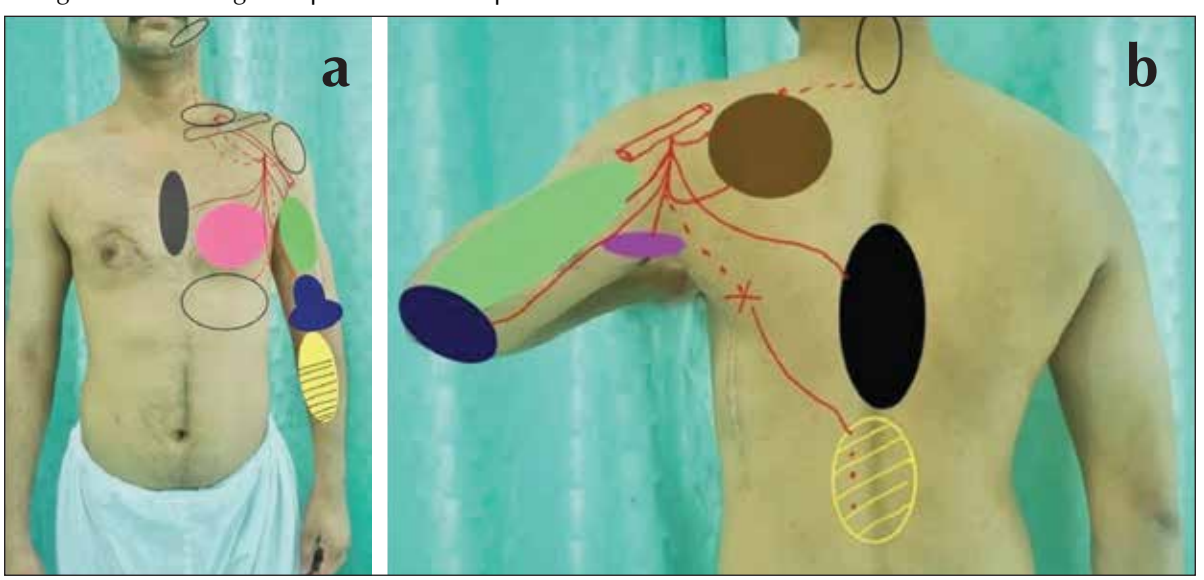



**Figure-1(a-b): Arc of rotation of LD flap**

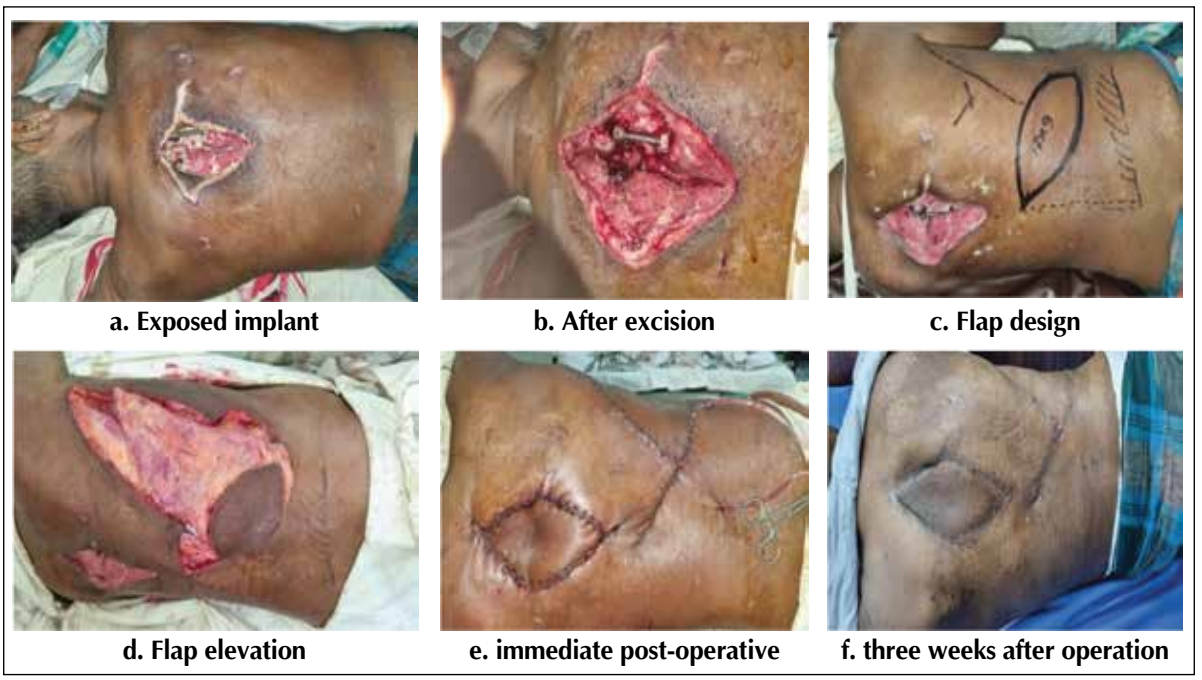



**Figure-2 ( a-f): Soft tissue defect with exposed implant reconstructed with LD myocutaneous flap**




**Figure-3 (a-c): Post electric burn wound with exposed spine covered with pedicled LDMF**

**Results:**

Fifteen patients underwent LDMF for the reconstruction of posterior midline soft tissue defect of variable sizes with exposed spine during July 2019 to June 2022. The mean age was 35.60 years (range: 18–66 years), male: female ratio was 4:1. The most common cause of the soft tissue defect was post-surgical defect (80 %). The flap was used to reconstruct the soft tissue defect over post-surgical wound in 12(80%) cases and post electric burn wound in 03(20%) cases. The LDMF could resurface the defect over cervical spine (Fig.3c). In 80% case the defect was over the dorsolumbar region and in 20 % cases defect was over cervical region (Table I).

Donor site was closed primarily in all patients. This is due to the fact that these defects are more often longitudinally oriented, and skin paddle was designed so as the donor-site closure was facilitated. There was no major complication like

**Table-I: Anatomical location and causes of soft tissue defect of the posterior midline soft tissue defects reconstructed with pedicled LD flap (N=12)**

| Variable | no. (% |
|---|---|
| **Anatomical location** | |
| Dorsal region | 12(80) |
| Cervical region | 03(20) |
| **Causes of defect** | |
| Post operative | 12(80) |
| High voltage electric burn | 03(20) |

partial or total flap necrosis in our study. Four patients (Table II) had minor complications (managed non operatively), one of the patients had surgical site infection which was controlled according to culture-specific antibiotics, and another two patients had partial dehiscence of donor site wound which healed spontaneously. One patient developed seroma in donor site which resolved in time with local care.

**Table-II: Complications and management**

| Name of complication | no. (% | Management of complication |
|---|---|---|
| Surgical site infection | 01 (8.33) | Culture specific antibiotics |
| Partial dehiscence of donor site | 02 (16.67) | Secondary healing with regular dressing |
| Seroma | 01 (8.33) | Resolved spontaneously |

**Discussion:**

Reconstructive surgery is always a magnificent combination of classical principles of surgical technique, critical anatomical assessment and application with innovative formulation of newer options.[5,6] In these consequences Latissimus dorsi muscle flap is verified with different techniques & combination, in variable body parts with different purposes required by the recipient site.[7,8] A variety of flaps are available for reconstruction of posterior midline soft tissue defects like Latissimus dorsi muscle flap, Trapezius flap, perforator based paraspinal flap and free flaps.[9-12] Latissimus dorsi muscle /myocutaneous flap can provide abundant tissue which can cover extensive soft tissue defects providing stable vascularized cover. The donor-site morbidity is very minimal compared with the other flaps in the region. In fact, Tansini originally described LDMF for resurfacing anterior chest wall deformity following radical mastectomy. To date no concrete reconstructive treatment algorithm is present for this complex defect.[13] Classic approaches for defect coverage of the spine describe flap choice dependent on spine levels, such as upper, middle and lower third. Casas and Lewis et al reported a successful systematic regionalized approach for the reconstruction of acquired midline defects of the back using Latissimus dorsi, Trapezius, gluteus maximus, and paraspinous muscle flaps.[14] Here we used pedicled Latissimus dorsi muscle flap for reconstruction of soft tissue defect with exposed spine involving upper and middle part of posterior midline. It is important to remember that some defects located within the middle and high thoracic levels could be managed with either the Trapezius or Latissimus dorsi flaps. In our case, we favored the use of the Latissimus dorsi flap because of the greater morbidity reported with functional loss of the trapezius.[15]

Very few flap options exist for reconstruction of large midline lower back defects.[16] various perforator based fasciocutaneous flap have been described but these flaps do not provide sufficient bulk to fill in such large defects. When used for an extensive defect in the lumbosacral area the pedicled Latissimus dorsi flap is restricted by its pedicle at the axilla.[17] The reversed Latissimus dorsi flap is not reliable in this situation because the paralumbar perforator vessels might have been destroyed.[18] As an alternative, the Latissimus dorsi flap can be transplanted into the defect by lengthening the pedicle with an interpositional vein graft or by transferring the muscle as a free flap to new recipient vessels.[19,20] Reverse LD has been considered as the first option in reconstructing large lower back composite defect.[21] One of the limitations of our study was we have not use LD flap for this indication. The other limitation is small sample size.

**Conclusion:**

The pedicled Latissimus dorsi muscle flap proved to be a valuable and reliable tool for Reconstruction of posterior midline soft tissue defect with exposed spine with minimal complications. It provides sufficient bulk to fill up the dead space. Flap is easy to dissect, anatomical variation is rare, long pedicle length which favor greater arc of rotation.

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# Outcome of Botulinum Toxin Therapy for Management of Chronic Anal Fissure: A Prospective Study of 60 Patients

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Submission Date : 22 Jan 2026
Accepted Date : 19 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90041

**Abstract**

**Background:**
Chronic anal fissure (CAF) is a common anorectal disorder characterized by severe pain during defecation and impaired quality of life. While lateral internal sphincterotomy remains the standard treatment, it carries the risk of incontinence. Botulinum toxin (BTX) injection has emerged as a minimally invasive alternative.

**Objective:**
To evaluate the efficacy and safety of BTX therapy in the management of CAF in a cohort of 60 patients.

**Methods:**
This prospective study included 60 patients diagnosed with CAF at department of colorectal surgery, Bangladesh Medical University from January 2024 to December 2025. BTX-A was administered via injection into the internal anal sphincter. Patients were followed for 12 weeks, with outcomes assessed in terms of pain relief, fissure healing, and adverse events.

**Results:**
Complete fissure healing was observed in 46 (76.7%) patients, while 10 (16.7%) showed partial healing, and 4 (6.6%) showed no response. Significant reduction in pain scores was reported at 2,4, and 8weeks post-treatment. Minor adverse events included transient incontinence in 4 patients (6.6%) and mild perianal discomfort in 8 patients (13.3%). No serious complications occurred.

**Conclusion:**
BTX therapy is a safe, effective, and minimally invasive treatment for CAF, providing substantial pain relief and high healing rates with minimal complications. It represents a viable alternative for patients at high risk of postoperative incontinence.

**Keywords:** Chronic anal fissure, Botulinum toxin, Fissure healing, Anal pain

**Citation:** Islam MS,Hossain MA,Ara MI.Outcome of Botulinum Toxin Therapy for Management of Chronic Anal Fissure: A Prospective Study of 60 Patients.J Rang Med Col.2026 Mar;11(1):141-145.doi: https://doi.org/10.3329/jrpmc.v11i1.90041

## Introduction:

Chronic anal fissure (CAF) is a common anorectal disorder characterized by a longitudinal tear in the anoderm, typically distal to the dentate line, that fails to heal within 6–8 weeks. It often presents with severe pain during defecation, bleeding, and spasm of the internal anal sphincter, which contributes to delayed healing. The incidence of CAF is estimated to be 0.1–0.7% in the general population, affecting both males and females, with a slight predominance in middle-aged adults.[1,2] The condition significantly impacts patients' quality of life, leading to social discomfort, fear of defecation, and chronic pain. The pathophysiology of CAF is primarily related to hypertonicity of the internal anal sphincter, ischemia at the posterior midline, and impaired local blood flow. Persistent sphincter spasm results in high resting anal pressures, further hindering fissure healing.[3,4] Conventional management begins with conservative measures, including dietary modification, topical anesthetics, and stool softeners. While these interventions are effective in acute fissures, chronic lesions frequently require

procedural intervention due to persistent pain and non-healing.[5]

Lateral internal sphincterotomy (LIS) is considered the gold standard surgical treatment for CAF, achieving healing rates exceeding 90%.[6] However, despite its efficacy, LIS carries the risk of postoperative complications, particularly anal incontinence, which can range from minor flatus incontinence to significant fecal incontinence in up to 14% of patients.[7] Consequently, minimally invasive therapies have gained attention as alternatives for patients at higher risk of incontinence or those seeking non-surgical management.

Botulinum toxin (BTX) injection into the internal anal sphincter has emerged as a promising nonsurgical therapy for CAF. BTX, a neurotoxin produced by Clostridium botulinum, induces temporary chemical denervation of the internal anal sphincter, leading to reduced resting anal pressures, relief of sphincter spasm, and facilitation of fissure healing.[8,9] Multiple studies have demonstrated variable healing rates ranging from 60% to 90%, depending on dose, injection site, and patient selection.[10-12] The procedure is typically well-tolerated, minimally invasive, and associated with a low risk of incontinence, making it suitable for both primary treatment and for patients who are poor surgical candidates. Despite encouraging reports, the optimal dose, technique, and long-term outcomes of BTX therapy remain areas of ongoing research. Comparative studies with LIS have shown slightly lower healing rates but significantly fewer complications, supporting BTX as an effective alternative in select populations.[13] Furthermore, studies suggest that repeat injections can enhance success rates without increasing adverse effects.[14] The present study aimed to evaluate the clinical outcomes, healing rates, and safety profile of BTX therapy in the management of chronic anal fissure in a cohort of 60 patients, thereby contributing further evidence on its efficacy as a minimally invasive therapeutic option.

**Methods:**

This prospective study was conducted at department of colorectal surgery, Bangladesh Medical University, Dhaka, Bangladesh from January 2024 to December 2025. The study protocol was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants prior to enrollment. A total of 60 patients diagnosed with chronic anal fissure were included. Inclusion criteria were age ≥18 years, presence of a chronic fissure persisting for more than six weeks, failure of conservative therapy (including dietary modifications, topical anesthetics, and stool softeners), and absence of previous anal surgery. Patients with inflammatory bowel disease, anal malignancy, coagulopathy, pregnancy, or known allergy to botulinum toxin were excluded. Botulinum toxin type A (BTX-A) was used for chemical sphincterotomy. Each patient received a total dose of 20 units of BTX-A, divided into two injections of 10 units each, administered into the internal anal sphincter at the 3 and 9 o'clock positions relative to the anal verge. Injections were performed under local anesthesia in the prone jackknife position using a 25-gauge needle. Care was taken to avoid subcutaneous injections to prevent local tissue reaction. Patients were evaluated at 2, 4, 8, and 12 weeks post-injection. Primary outcomes included fissure healing and pain reduction. Fissure healing was assessed by visual inspection during anoscopy and classified as complete (full epithelialization), partial (reduction in fissure size without full epithelialization), or no healing. Pain was quantified using a 10-point visual analogue scale (VAS), with scores recorded at each follow-up visit. Secondary outcomes included treatment-related adverse events such as transient fecal incontinence, perianal discomfort, bleeding, and local infection. Any need for repeat BTX injection or surgical intervention was documented. Data were analyzed using SPSS version XX (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. Comparisons of pain scores over follow-up periods were performed using repeated measures ANOVA. The association between patient characteristics and fissure healing was analyzed using chi-square or Fisher's exact test as appropriate. A p-value $<0.05$ was considered statistically significant. This methodological framework ensured standardized BTX administration, objective assessment of healing, and systematic documentation of safety outcomes, allowing reliable evaluation of BTX efficacy in chronic anal fissure management.

**Results:**

A total of 60 patients were included, comprising 35 males (58.3%) and 25 females (41.7%), with a mean age of 39.8±10.5 years (range 21–62). The majority of patients (70%) had posterior midline fissures, while the remaining 30% had anterior or lateral fissures. The mean duration of symptoms prior to BTX therapy was 11.2±3.4 weeks. Baseline VAS pain score was 8.2±1.1.

Table-I presented the week-wise outcomes of Botulinum Toxin (BTX) therapy for the treatment of chronic anal fissures over a 12-week follow-up period. At 2 weeks, 5 patients (8.3%) achieved complete healing, with the number increasing to 46 patients (76.7%) by 12 weeks ($p<0.01$). Partial healing was observed in 15 patients (25%) at 2 weeks, but this decreased to 10 patients (16.7%) at 12 weeks ($p=0.03$), indicating a reduction in partial healing over time. The proportion of patients with no healing was 40 (66.7%) at 2 weeks, which dropped significantly to 4 patients (6.6%) by 12 weeks, showing a clear trend of improvement. These findings demonstrate that BTX therapy is highly effective, with statistically significant improvements in healing outcomes as patients progress through the follow-up period. The p-values for complete healing and partial healing support the significance of these results, confirming the therapy's efficacy in managing chronic anal fissures.

Pain scores showed a statistically significant decrease at each follow-up visit ($p<0.001$). By 12 weeks, the majority of patients (88%) reported minimal or no pain (Table-II).

BTX therapy was well-tolerated. Four patients experienced transient incontinence, which resolved spontaneously within 2–4 weeks. Mild perianal discomfort was reported in 8 patients, and minor bleeding occurred in 2 patients. No serious complications or infections were noted (Table-III).

Of the 14 patients who did not achieve complete healing at 12 weeks, 10 opted for a repeat BTX injection, while 4 underwent lateral internal sphincterotomy. Repeat BTX injections resulted in complete healing in 7 of the 10 patients (70%), while the remaining 3 still had partial healing. All 4 patients who underwent surgical sphincterotomy achieved complete healing. This demonstrates that repeat BTX therapy can effectively salvage non-responders before resorting to surgery (Table-IV).

**Table-I: Fissure healing at 2, 4, 8 & 12 weeks Post-BTX therapy (N=60)**

| Outcome | 2 Weeks (n=60) no. (%) | 4 Weeks (n=60) no. (%) | 8 Weeks (n=60) no. (%) | 12 Weeks (n=60) no. (%) | p-value |
|---|---|---|---|---|---|
| Complete Healing | 5(8.3) | 20(33.3) | 35(58.3) | 46(76.7) | <0.01 |
| Partial Healing | 15(25) | 20(33.3) | 25(41.7) | 10(16.7) | 0.03 |
| No Healing | 40(66.7) | 20(33.3) | 10(16.7) | 4(6.6) | - |

**Table-II: Mean VAS pain score at follow-up**

| Follow-up (Weeks) | Mean VAS ± SD | p-value |
|---|---|---|
| Baseline | 8.2±1.1 | |
| 2 | 5.6±1.3 | |
| 4 | 3.2±1.0 | <0.001 |
| 8 | 1.8±0.9 | |
| 12 | 0.9±0.7 | |

**Table-III: Adverse events following BTX therapy**

| Adverse Event | no. (%) |
|---|---|
| Transient fecal incontinence | 4(6.6) |
| Mild perianal discomfort | 8(13.3) |
| Local bleeding | 2(3.3) |
| Infection | 0(0) |

**Table-IV: Outcomes of patients requiring repeat intervention**

| Intervention Type | Number of Patients | Complete Healing | Partial/No Healing | Success Rate (%) |
|---|---|---|---|---|
| Repeat BTX Injection | 10 | 7 | 3 | 70 |
| Lateral Internal Sphincterotomy | 4 | 4 | 0 | 100 |
| Total | 14 | 11 | 3 | 78.6 |

**Discussion:**

Chronic anal fissure (CAF) is a debilitating condition associated with significant pain and impaired quality of life. In the present study, botulinum toxin (BTX) therapy demonstrated favorable outcomes, with 76.7% of patients achieving complete healing and substantial pain

reduction over a 12-week follow-up. These findings align with prior reports, highlighting BTX as an effective minimally invasive alternative to surgical intervention.[1,2]

The pathophysiology of CAF involves hypertonicity of the internal anal sphincter, resulting in ischemia and impaired wound healing.[3] BTX induces temporary chemical denervation of the sphincter, reducing resting pressure and promoting blood flow to the anoderm, facilitating fissure repair.[4,5] Our results confirm the efficacy of this mechanism, as evidenced by significant reductions in VAS pain scores from 8.2±1.1 at baseline to 0.9±0.7 at 12 weeks. This progressive decline reflects both symptomatic relief and restoration of sphincter function, consistent with prior studies reporting pain reduction following BTX injection.[6,7]

Complete healing in 46 patients (76.7%) is comparable to previous studies, where healing rates ranged from 60% to 90% depending on dose, injection site, and patient characteristics. [8–10] Partial or non-healing cases were primarily associated with longer symptom duration (>12 weeks), suggesting that early intervention may enhance therapeutic success. Repeat BTX injections facilitated complete healing in 70% of initially non-responsive patients, supporting the utility of multiple sessions for refractory fissures.[11]

The safety profile of BTX therapy was favorable. Transient fecal incontinence occurred in 6.6% of patients, resolving spontaneously within 2–4 weeks. Mild perianal discomfort and minor bleeding were reported in 13.3% and 3.3% of patients, respectively, with no infections or serious complications. These findings are consistent with literature demonstrating minimal adverse events compared to lateral internal sphincterotomy (LIS), which carries a higher risk of long-term incontinence.[12,13] Consequently, BTX may be particularly suitable for patients at increased risk of postoperative sphincter dysfunction, including multiparous women or elderly patients.

While LIS remains the gold standard with healing rates exceeding 90%, the slightly lower efficacy of BTX is offset by its safety and repeatable nature.[14] Our study reinforces that BTX can serve as a primary intervention in selected patients and as a bridge therapy for those unwilling or unfit for surgery. In addition, our findings highlight the importance of proper dosing (20 units, divided at 3 and 9 o'clock positions) and follow-up to monitor efficacy and adverse events, consistent with prior guidelines.[15]

Limitations of the present study include the single-center design, relatively short follow-up of 12 weeks, and lack of a control group for direct comparison with LIS. Long-term recurrence rates were not assessed, and objective anal manometry was not performed, which may have provided quantitative data on sphincter relaxation. Future multicenter studies with longer follow-up and randomized designs are warranted to confirm these results and establish standardized dosing protocols.

In BTX therapy offers an effective, safe, and minimally invasive treatment for chronic anal fissure, achieving substantial healing and symptomatic relief with minimal complications. Early intervention and the option of repeat injections enhance success rates, making BTX a viable alternative or adjunct to surgical management, particularly in high-risk populations.

**Conclusion:**

Botulinum toxin (BTX) therapy is a safe, effective, and minimally invasive option for the management of chronic anal fissure. In this study of 60 patients, BTX achieved complete healing in 76.7% of cases, significant pain reduction, and minimal adverse events. Early intervention, shorter symptom duration, and proper dosing were associated with higher success rates. Repeat injections proved beneficial for patients who did not respond initially, further enhancing overall outcomes. Compared to surgical alternatives such as lateral internal sphincterotomy, BTX offers the advantage of reduced risk of long-term incontinence, making it particularly suitable for high-risk or surgery-averse patients. Although slightly less effective than surgery in terms of absolute healing rates, its safety profile and repeatability position BTX as a viable first-line or adjunctive therapy. Further multicenter, long-term studies are warranted to optimize dosing, assess recurrence, and establish standardized treatment protocols.

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# Proximal Femoral Nail Versus Proximal Femoral Locking Compression Plate in the Treatment of Unstable Trochanteric Fracture in Adults

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Submission Date : 22 Jan 2026
Accepted Date : 28 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90042

**Abstract**

**Background:**
Unstable trochanteric fractures are common in adults and require stable fixation to enable early mobilization and reduce morbidity. Proximal femoral nail and proximal femoral locking compression plate are frequently used implants, but direct comparative data from local clinical settings remain limited.

**Objective:**
This study compared operative, radiological, and functional outcomes between these two fixation methods.

**Methods:**
This cross-sectional analytical study was conducted in the Department of Orthopaedic Surgery, Sylhet M.A.G. Osmani Medical College Hospital, Sylhet from January 2017 to December 2018. Twelve adults with unstable trochanteric fractures were enrolled and allocated equally to nail or plate fixation. After clinical assessment and informed consent, fixation was performed as per group allocation. Patients were followed for 24 weeks, assessing operative variables, mobilization milestones, radiological union, complications, and functional outcome using the Harris Hip Score. Statistical significance was set at $p<0.05$.

**Results:**
Operation time was slightly longer with the nail (137.5 min) than the plate (116.7 min). Incision length was significantly shorter with the nail (11.2 cm vs 17.5 cm). Hospital stay was similar in both groups (3 days). The nail allowed earlier mobilization, with partial weight bearing at 3.3 weeks versus 9 weeks, and full weight bearing at 11 weeks versus 20 weeks in the plate group. Radiological union was identical (20 weeks), with 66.7% in each group uniting by 18 weeks. Complication rates were comparable, including implant failure (1 per group) and varus deformity (2 per group). Limb length discrepancy occurred only in the nail group (33.3%). Functional recovery at 24 weeks was similar, with mean scores of 81.0 (nail) and 83.2 (plate).

**Conclusion:**
Both implants were effective, but PFN offered advantages in minimal surgical exposure and earlier mobilization, supporting its preference in most unstable fractures.

**Keywords:** Trochanteric fracture; Proximal femoral nail, Locking compression plate; Functional outcome

**Citation:** Paul R,Chakma SJ,Hossain AZ,Turja AC,Siddique MTA,Fattah IU.Proximal Femoral Nail Versus Proximal Femoral Locking Compression Plate in The Treatment of Unstable Trochanteric Fracture in Adults.J Rang Med Col.2026 Mar;11(1):146-152.doi: https://doi.org/10.3329/jrpmc.v11i1.90042

## Introduction:

Trochanteric fractures are extracapsular injuries occurring between the basilar neck and the lesser trochanter and represent one of the most common fracture patterns of the proximal femur in adults.[1]Proximal femoral fractures make up over half of all such fractures and are increasing globally due to an aging population. Estimates predict a significant rise in hip fractures in the future.[2] While such fractures commonly result from low-energy falls in older adults, high-energy trauma remains an important cause among younger patients.[3] Unstable trochanteric fractures, characterized by posteromedial comminution,

reverse obliquity, or subtrochanteric extension, present major challenges in orthopedic treatment. Inadequate stabilization can result in complications such as varus collapse, limb shortening, and implant failure.[4] Early mobilization after fixation is important to lower the chances of pulmonary complications, venous thromboembolism, and prolonged immobility in these typically frail patients. Choosing an implant that offers good stability for early weight bearing is essential. The dynamic hip screw (DHS) has been commonly used for intertrochanteric fractures, but it has risks in unstable fractures, including excessive sliding, medial migration of the femoral shaft, varus collapse, and a higher risk of screw cut-out, all of which may compromise fracture healing and functional outcomes.[5] These limitations have prompted the search for more biomechanically advantageous fixation strategies. Intramedullary fixation devices, particularly the Proximal Femoral Nail (PFN), have gained popularity due to their superior biomechanical properties. Positioned close to the weight-bearing axis of the femur, PFN offers better load-sharing capacity, a shorter lever arm, and greater resistance to deforming forces compared to extramedullary devices.[6] Further design modifications, such as improved proximal screw configuration and enhanced rotational stability, have strengthened PFN's role in managing unstable fracture patterns.[7] Additionally, PFN insertion typically requires minimal soft-tissue disruption, which may support quicker rehabilitation and reduce perioperative morbidity. Extramedullary angular-stable locking plates, such as the Proximal Femoral Locking Compression Plate (PFLCP), represent another viable treatment option. These plates provide fixed-angle stability through multiple locking screws, allowing secure fixation in osteoporotic and comminuted bone.[8] Their ability to buttress the lateral wall is particularly beneficial in unstable patterns where lateral support is compromised. Studies have highlighted the potential of locking plates to maintain reduction and minimize implant-related complications even in complex fracture configurations.[9] Despite the advantages offered by both PFN and PFLCP, current evidence remains inconclusive regarding which implant yields superior outcomes in unstable trochanteric fractures. Some comparative studies suggest better biomechanical performance and earlier mobilization with PFN, whereas others report similar or occasionally better results with PFLCP depending on fracture morphology and patient factors.[10]The study highlights the need for more clinical research in resource-limited areas like Bangladesh. It aims to compare Proximal Femoral Nail (PFN) and Proximal Femoral Locking Compression Plate (PFLCP) for treating unstable trochanteric fractures, focusing on operative variables, radiological outcomes, complications, and functional recovery to guide evidence-based implant selection.

**Methods:**

This cross-sectional analytical study was conducted in the Department of Orthopaedic Surgery, Sylhet M.A.G. Osmani Medical College Hospital, Sylhetfrom 1 January 2017 to 31 December 2018. The study population included all adult patients with trochanteric fractures admitted during this period. A total of 12 patients who fulfilled the selection criteria were enrolled and divided equally into Group A (PFN) and Group B (PFLCP), each comprising six patients. Allocation was done by lottery for the first patient and alternately for subsequent patients. The study included adults >18 years with traumatic, closed AO/OTA 31-A2 and 31-A3 trochanteric fractures involving one side at one segment. Patients with open fractures, pathological fractures (other than age-related osteoporosis), infection, polytrauma, bilateral fractures, pre-existing hip or knee deformity limiting activity, non-ambulant,severe comorbidities, or declined participation were excluded. Both qualitative and quantitative data were collected using a pre-designed questionnaire prepared through literature review and expert consultation after ethical approval. After admission, detailed history and clinical examination were performed, eligibility was confirmed, and informed written consent was obtained. Surgical fixation was performed using PFN or PFLCP as per group allocation. Patients were followed up for 24 weeks, and functional outcome was assessed using the Harris Hip Score.The primary variables included length of incision, operative time, postoperative hospital stay, time to partial and full weight bearing, radiological union, complications, and functional outcome, as specified in the study objectives. Data were analyzed using SPSS, with results expressed as mean and standard deviation or frequency and percentage. Appropriate statistical tests, including

t-tests and Fisher's exact test, were applied, with significance set at p<0.05.

**Results:**

The mean age of the PFN group was 60.83 ± 16.25 years, while the PFLCP group had a mean age of 49.83±28.02 years; (p=0.425). The age distribution showed 50% of PFN patients were above 60 years, compared to 33.3% in PFLCP. Both groups had the same sex distribution. Road traffic accidents caused 50% of injuries in PFN and 16.7% in PFLCP, while falls caused injuries in the remaining patients. Fractures were equally distributed (Table-I).

The operative time was longer for the PFN group (137.50±14.05 minutes) than the PFLCP group (116.67±25.43 minutes; (p=0.054). Incision length was shorter in the PFN group (11.17 cm) compared to the PFLCP group (17.50 cm) (p=0.009). Most PFLCP patients had incisions ≥11 cm (Table-II)

The average hospital stay after surgery was the same for both groups at 3.00±1.26 days (p>0.05). Two-thirds of patients were discharged within 2–3 days. Patients treated with PFN started partial weight bearing much earlier than those treated with PFLCP, with times of 3.33±2.07 weeks and 9.00±5.02 weeks, respectively. PFN patients also achieved full weight bearing sooner than PFLCP patients (11.00±7.97 weeks vs 20.00±3.10 weeks; p=0.028).Two-thirds of PFN patients achieved full weight bearing by 6 weeks, PFLCP patients

**Table-I: Demographic profile and fracture characteristics of the participants (N=12)**

| Demographic profile and fracture characteristics | PFN Group (n=6) no. (%) | PFLCP Group (n=6) no. (%) | p-value |
|---|---|---|---|
| Age, mean ± SD (years) | 60.83±16.25 | 49.83 ± 28.02 | 0.425 |
| **Age Category** | | | |
| Up to 60 years | 3(50.0) | 4(66.7) | |
| Above 60 years | 3(50.0) | 2(33.3) | |
| **Sex** | | | >0.05 |
| Male | 3(50.0) | 3(50.0) | |
| Female | 3(50.0) | 3(50.0) | |
| **Cause of Injury** | | | 0.545 |
| Road traffic accident | 3(50.0) | 1(16.7) | |
| Fall | 3(50.0) | 5(83.3) | |
| **Side of Involvement** | | | >0.05 |
| Right | 3(50.0) | 3(50.0) | |
| Left | 3(50.0) | 3(50.0) | |

**Table-II: Operative details comparing PFN and PFLCP procedures (N=12)**

| Operative details | PFN Group (n=6) | PFLCP Group (n=6) | p-value |
|---|---|---|---|
| Operation time (min), mean±SD | 137.50±14.05 | 116.67±25.43 | 0.054 |
| **Operation Time Distribution** | | | |
| 71–100 min | 0 | 2 | |
| 101–130 min | 2 | 3 | |
| 131–150 min | 4 | 1 | |
| Incision length (cm), mean±SD | 11.17±3.43 | 17.50±3.33 | 0.009 |
| **Incision Length Categories** | | | |
| 6–10 cm | 3 | 0 | |
| 11–15 cm | 3 | 2 | |
| 16–20 cm | 0 | 4 | |

required 18 weeks. The mean time to radiological union was identical in both groups at 20.00±3.10 weeks (p>0.05). In each group, 66.7% united by 18 weeks, while the remaining 33.3% achieved union by 24 weeks (Table-III).

In the PFN group, one patient had a wound infection (16.7%), two (33.3%) developed limb length discrepancies, and two (33.3%) had varus deformity, with one implant failure. In the PFLCP group, no wound infections or discrepancies occurred, but there were two (33.3%) varus deformities and one (16.7%)implant failure. No valgus deformity or persistent pain was reported in either group (Table-IV).

The mean Harris Hip Score (HHS) was similar in the PFN and PFLCP groups, with scores of 81.00±17.23 and 83.17±14.09 respectively (p=0.816). In the PFN group, HHS scores varied, with two patients in the lower range and none in higher categories. The PFLCP group had one patient in a middle range and one in a higher range. Overall, 66.7% of PFN participants had excellent outcomes, while 50% in PFLCP did, with no significant differences between groups (Table-V).

**Table-III: Postoperative recovery outcomes in PFN and PFLCP patients (N=12)**

| Postoperative outcomes | PFN Group (n=6) | PFLCP Group (n=6) | p-value |
|---|---|---|---|
| Length of hospital stay (days), mean±SD | 3.00±1.26 | 3.00±1.26 | >0.05 |
| **Hospital Stay Distribution** | | | |
| 2–3 days | 4 | 4 | |
| 4–5 days | 2 | 2 | |
| Time to partial weight bearing (weeks), mean±SD | 3.33±2.07 | 9.00±5.02 | 0.029 |
| **Partial Weight Bearing Categories** | | | |
| 2–6 weeks | 6 | 4 | 0.061 |
| 12–18 weeks | 0 | 2 | |
| Time to full weight bearing (weeks), mean±SD | 11.00±7.97 | 20.00±3.10 | |
| **Full Weight Bearing Categories** | | | |
| 6 weeks | 4 | 0 | 0.039 |
| 18 weeks | 0 | 4 | |
| 24 weeks | 2 | 2 | |
| **Time to Radiological Union** | | | |
| Mean ± SD (weeks) | 20.00±3.10 | 20.00±3.10 | >0.05 |
| 18 weeks | 4(66.7%) | 4(66.7%) | |
| 24 weeks | 2(33.3%) | 2(33.3%) | |

**Table-IV: Postoperative complications following PFN and PFLCP fixation (N=12)**

| Postoperative complications | PFN Group (n=6) no. (%) | PFLCP Group (n=6) no. (%) | p-value |
|---|---|---|---|
| Wound infection | 1(16.7) | 0(0) | >0.05 |
| Local pain | 0(0) | 0(0) | - |
| Implant failure | 1(16.7) | 1(16.7) | - |
| Limb length discrepancy >2 cm | 2(33.3) | 0(0) | >0.05 |
| Varus deformity | 2(33.3) | 2(33.3) | - |
| Valgus deformity | 0(0) | 0(0) | - |

**Table-V: Harris hip score at 24 weeks in PFN and PFLCP patients (N=12)**

| Harris Hip Score Category | PFN Group (n=6) no. (%) | PFLCP Group (n=6) no. (%) | p-value |
|---|---|---|---|
| 55–65 | 2(33.3) | 0(0) | |
| 66–75 | 0(0) | 1(16.7) | |
| 76–85 | 1(16.7) | 0(0) | |
| 86–95 | 0(0) | 1(16.7) | |
| Mean ± SD | 81.00±17.23 | 83.17 ± 14.09 | 0.816 |
| **Outcome Category** | | | |
| Excellent | 4(66.7) | 3(50.0) | |
| Good | 0(0) | 0(0) | |
| Fair | 0(0) | 2(33.3) | 0.545 |
| Poor | 2(33.3) | 1(16.7) | |

**Discussion:**

The present study compared the outcomes of Proximal Femoral Nail (PFN) and Proximal Femoral Locking Compression Plate (PFLCP) in the management of unstable trochanteric fractures, an injury pattern described by Russellet al[11] as one of the most complex extracapsular fractures of the proximal femur and emphasized by Rьedi et al[12] as increasingly prevalent due to global aging and osteoporosis. In our findings, the PFN group had a slightly longer operative time (137.50±14.05 minutes) than the PFLCP group (116.67±25.43 minutes), though the difference was not statistically significant, suggesting that both implants require similar technical effort. However, the significantly smaller incision length in PFN (11.17±3.43 cm) relative to PFLCP (17.50±3.33 cm; p=0.009) reflects the minimally invasive nature of intramedullary fixation, consistent with the observations of Kokoroghiannis et al and Simmermacher et al, who noted that PFN insertion requires less soft-tissue exposure, thereby lowering perioperative morbidity.[13,14] The wider exposure required for PFLCP aligns with the mechanical principles described by Floyd et al, who highlighted the need for greater visualization in plate placements to ensure alignment along the lateral cortex.[15] The most clinically meaningful difference in this study was the markedly earlier mobilization observed in PFN patients, with partial weight bearing beginning at 3.33±2.07 weeks compared to 9.00±5.02 weeks after PFLCP (p=0.029), and full weight bearing beginning at 11.00±7.97 weeks compared to 20.00±3.10 weeks (p=0.028). These results closely support the biomechanical superiority of intramedullary nails described by Kokoroghiannis et al, who emphasized the nail's favorable load-sharing characteristics and shorter lever arm, reducing varus forces that delay mobilization.[13] Simmermacher et al also reported enhanced resistance to rotational and axial deformation with PFN, further explaining why PFN patients in our study were able to mobilize earlier.[14] The delayed mobilization in the PFLCP group is consistent with the findings of Zha et al, who showed that PFLCP performance depends heavily on lateral wall integrity, which is often compromised in unstable fracture patterns.[16] Early weight bearing is particularly important in elderly patients because prolonged immobility greatly increases risks of pneumonia, venous thromboembolism, and muscle wasting, as emphasized by Kulkarni et al, underscoring the clinical advantage of PFN demonstrated in our results.[17] Radiological union occurred at a mean of 20.00±3.10 weeks in both groups, with identical distributions at 18 and 24 weeks, demonstrating that both implants provide adequate mechanical stability for bone healing. This parallels the findings of Singh et al, who reported no significant difference in radiological union between PFN and locking plates.[18] Our complication rates were low and similar between groups, with PFN showing one case each of wound infection, implant failure, and limb length discrepancy, while PFLCP showed comparable implant failure and varus deformity rates. These outcomes reflect the mechanical risks described by Haq et al, who reported that unstable patterns predispose to varus collapse irrespective of

implant choice, and highlight that both fixation methods are safe when applied with careful reduction. Functional outcomes measured by Harris Hip Score (HHS) were also comparable, with PFN achieving a mean HHS of 81.00±17.23 and PFLCP achieving 83.17±14.09 (p=0.816). This agrees with Singh et al, who found that although intramedullary nails often allow earlier functional recovery, long-term results tend to equalize between implants once union occurs.[18] The similarity in functional outcomes despite earlier mobilization in PFN suggests that both implants can restore sufficient mechanical stability to permit return of function, supporting the broader biomechanical observations of Rüedi et al and the clinical insights of Floyd et al regarding plate behavior in osteoporotic bone.[12,15] PFN offers clear advantages in terms of incision size and early mobilization, critical factors in elderly populations at risk of immobility-related complications, while PFLCP remains a valuable alternative in cases requiring anatomical reduction or when intramedullary fixation is contraindicated. Thus, although both implants achieved comparable union and functional outcomes, PFN may be the preferred option in most unstable trochanteric fractures due to its superior biomechanical profile and earlier rehabilitation potential.

**Limitation:**

Limitations include a small sample size, single-center focus, and a follow-up period of only six months, which may miss long-term issues.

**Conclusion:**

This comparative study demonstrates that both proximal femoral nail (PFN) and proximal femoral locking compression plate (PFLCP) are effective fixation methods for unstable trochanteric fractures, achieving similar rates of radiological union, complication profiles, and functional outcomes at 24 weeks. PFN, however, offers distinct perioperative advantages, including a significantly smaller incision and earlier initiation of partial and full weight bearing, which may enhance early rehabilitation. Despite these differences, operative time, hospital stay, and overall Harris Hip Score did not differ significantly between the two groups. Therefore, while both implants are viable options, PFN may be preferred when prioritizing minimally invasive surgery and accelerated postoperative mobilization.

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# Thrombocytopenia as a Predictor of Mortality in Neonatal Pulmonary Haemorrhage: A Cohort Study from a Tertiary Hospital in Bangladesh

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Submission Date : 24 Jan 2026
Accepted Date : 28 Feb 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90043

**Abstract**

**Background:**
Neonatal pulmonary haemorrhage carries a high fatality risk, and simple prognostic markers are crucial in low-resource environments.

**Objective:**
This study assessed whether thrombocytopenia predicts mortality among affected neonates in a tertiary hospital in Bangladesh.

**Methods:**
A prospective cohort of seventy neonates with pulmonary haemorrhage, admitted between July 2019 and June 2021, was evaluated. Platelet counts were recorded at admission and monitored every 12 hours; thrombocytopenia was defined as <150,000/μL. Mortality during hospitalization served as the primary outcome.

**Results:**
Overall mortality reached 88.6%. Non-survivors had markedly lower platelet levels than survivors, and this difference was statistically significant. Regression analysis confirmed that thrombocytopenia is an independent predictor of mortality. Survivors also exhibited an earlier onset of haemorrhage compared with non-survivors.

**Conclusion:**
Routine platelet assessment provides a practical, accessible prognostic measure and underscore the need for standardized transfusion and monitoring strategies to improve survival.

**Keywords:** Thrombocytopenia, neonatal pulmonary haemorrhage, mortality, platelet count

**Citation:** Liza S,Talukder D,Roy TC,Khan MTH.Thrombocytopenia as a Predictor of Mortality in Neonatal Pulmonary Haemorrhage: A Cohort Study from a Tertiary Hospital in Bangladesh.J Rang Med Col.2026 Mar;11(1):153-158.doi: https://doi.org/10.3329/jrpmc.v11i1.90043

## Introduction:

Thrombocytopenia represents a critical haematological parameter that may significantly influence mortality outcomes in neonates with pulmonary haemorrhage.Thrombocytopenia, defined as a platelet count below 150,000/μL, occurs in 22-35% of NICU admissions and carries particular significance when concurrent with hemorrhagic complications.[1] The mechanistic relationship between thrombocytopenia and mortality in pulmonary haemorrhage involves multiple pathways. Platelets play essential roles in primary hemostasis, and their deficiency directly impairs the body's ability to control bleeding. In pulmonary haemorrhage, where vascular integrity is compromised by stress failure of pulmonary capillaries,[2] adequate platelet function becomes crucial for the cessation of bleeding. Thrombocytopenic neonates experience prolonged bleeding times, increased blood loss, and subsequent hemodynamic instability. Platelet count serves as an independent predictor of mortality through several mechanisms. Low platelet counts correlate with the severity of underlying illness, as thrombocytopenia often results from increased consumption during systemic inflammatory responses or disseminated intravascular coagulation. Christensen et al[3]demonstrated that severe thrombocytopenia (platelets <50,000/μL) in neonates carries a mortality risk of 14-58%, significantly higher than that of those with normal platelet counts. The

predictive value of thrombocytopenia extends beyond simple bleeding risk. Platelets release vasoactive substances and growth factors that influence vascular permeability and endothelial repair. In pulmonary haemorrhage, where capillary filtration occurs due to elevated transcapillary pressure,[4] thrombocytopenia may impair the natural healing response, prolong the haemorrhage and increase the risk of mortality. Cohort studies examining thrombocytopenia as a predictor of mortality provide valuable epidemiological insights. Del Vecchio et al[5] reviewed thrombocytopenia management in the neonatal intensive care unit, emphasizing the significant impact of low platelet counts on neonatal outcomes. The temporal relationship between platelet declines and clinical deterioration offers prognostic information that can guide clinical decision-making. In the Bangladeshi healthcare context, resource limitations make simple, reliable predictors particularly valuable. Platelet count represents an accessible laboratory parameter that can be obtained with basic haematological equipment. Unlike complex coagulation studies or specialized biomarkers, platelet counting is feasible in tertiary hospitals across Bangladesh, making thrombocytopenia a practical predictor of mortality. The cohort study design allows for prospective evaluation of thrombocytopenia's predictive capacity while controlling for confounding variables such as gestational age, birth weight, and underlying conditions. Murray emphasized that platelet count trends, rather than single measurements, provide superior predictive accuracy for mortality outcomes.[6] Tertiary hospital settings in Bangladesh offer unique advantages for studying this relationship, as they care for high-risk neonates and provide comprehensive documentation. This study aimed to evaluate thrombocytopenia as an independent predictor of mortality in neonates with pulmonary haemorrhage in a tertiary hospital setting in Bangladesh.

**Methods:**

This prospective cohort study was conducted at the Department of Neonatology, Bangladesh Shishu Hospital & Institute, Dhaka, from July 2019 to June 2021, specifically examining thrombocytopenia as a predictor of mortality in neonatal pulmonary haemorrhage. Eighty neonates aged 28-42 weeks' gestational age with pulmonary haemorrhage were enrolled using purposive sampling after obtaining informed written consent. Thrombocytopenia was defined as a platelet count below 150,000/μL, with severity stratified as mild (100,000-149,000/μL), moderate (50,000-99,000/μL), and severe (<50,000/μL). Platelet counts were measured at admission and every 12 hours using automated haematologyanalyzers to assess temporal changes. The primary outcome was in-hospital mortality, with patients categorized into survival (n=10) and death (n=62) groups based on immediate outcomes during hospital stay. Thrombocytopenia's predictive capacity was evaluated through receiver operating characteristic curve analysis to determine optimal platelet count thresholds for mortality prediction. Additional laboratory investigations were performed in conjunction with platelet function testing.

Statistical analysis was performed using SPSS 26.0. Chi-square tests compared thrombocytopenia prevalence between outcome groups, while unpaired t-tests analyzed mean platelet counts. Multivariate logistic regression identified thrombocytopenia as an independent predictor of mortality, controlling for confounding variables. Area under the curve determined thrombocytopenia's discriminatory power for mortality prediction. Statistical significance was set at $p<0.05$.

**Results:**

Table-I showed that 70 neonates with pulmonary haemorrhage were included in this study. Of these, eight neonates survived, and 62 neonates died. The mean age of the surviving group was 3.00±1.69 days, and the death group was 8.12±7.07 days ($p<0.05$). The mean age of onset of pulmonary haemorrhage in the surviving group was early due to most of the neonates having neonatal sepsis and haemolytic diseases of the newborn (HDN) with elevated prothrombin time. These might be stimulating factors for pulmonary haemorrhage. The majority were male in the death group (59.7%). In the surviving group, male and female neonates were equally distributed. The sex difference between the two groups was not significant (p-value >0.05). The mean birth weight (2359±713 g) of the death group was lower than that of the survival group (2643±470 g), but the

difference was not statistically significant (p-value > 0.05).

Table-II showed the association of postnatal presentation between the survivors and the death group of pulmonary haemorrhage patients. A statistically significant difference was found in jaundice. Respiratory distress was present in 98.4% and 100% of the death and survival groups, respectively, without a substantial difference between them. Other presenting features included respiratory distress after birth, the baby's colour at birth, cephalohematoma, caput succedaneum, apnoea, convulsion, and poor feeding. No significant difference was found among these symptoms in both groups.

Platelet count was significantly lower in the death group compared to the survival group (p=0.002). Other haematological parameters (Hb, HCT, TLC) did not differ significantly between the groups (Table-III).

Table-IV presented logistic regression analysis for predictors of mortality. Platelet count was the only significant independent predictor of mortality in neonatal pulmonary haemorrhage (p=0.042). Although prothrombin time showed wide variability, it was not statistically significant (p=0.709). These further highlighted thrombocytopenia as a strong predictor of adverse outcomes.

**Table-I: Demographic and other basic characteristics of the studied subjects (N=70)**

| Variables | Death (n=62) no. (%) | Survived (n=8) no. (%) | p-value |
|---|---|---|---|
| Age at onset of pulmonary haemorrhage (days) | 8.12±7.07 | 3.00±1.69 | 0.046 |
| **Gender** | | | |
| Female | 25(40.3) | 4(50.0) | 0.601 |
| Male | 37(59.7) | 4(50.0) | |
| Weight (g) | 2359±713 | 2643±470 | 0.278 |
| Length (cm) | 46.22±5.02 | 48.13±2.36 | 0.297 |
| Occipitofrontal circumference (cm) | 32.86±2.51 | 33.25±1.36 | 0.668 |

**Table-II: Comparison of postnatal presentation of studied patients (N=70)**

| Variables | Death (n=62) no. (%) | Survived (n=8) no. (%) | p-value |
|---|---|---|---|
| **Respiration after birth** | | | |
| Normal | 53 (85.5%) | 8 (100.0%) | 0.584 |
| Delayed | 9 (14.5%) | 0 (0.0%) | |
| **Colour of the baby at birth** | | | |
| Pink | 48 (77.4%) | 6 (75.0%) | 1.000 |
| Blue | 14 (22.6%) | 2 (25.0%) | |
| **Birth injury** | | | |
| Cephalohematoma | 14 (22.6%) | 1 (12.5%) | 1.000 |
| Caput succedaneum | 5 (8.1%) | 1 (12.5%) | 0.531 |
| Respiratory distress | 61 (98.4%) | 8 (100.0%) | 1.000 |
| Apnoea | 11 (17.7%) | 1 (12.5%) | 1.000 |
| History of convulsion | 31 (50.0%) | 1 (12.5%) | 0.063 |
| **Associated problems** | | | |
| Jaundice | 11 (17.7%) | 5 (62.5%) | 0.013 |
| Poor feeding | 26 (41.9%) | 2 (25.0%) | 0.462 |

**Table-III: Comparison of haematological parameters between death and survived groups (N=70)**

| Variables | Death (n=62) no. (%) | Survived (n=8) no. (%) | p-value |
|---|---|---|---|
| Haemoglobin (g/dl) | 13.13±2.88 | 11.59±2.13 | 0.148 |
| Haematocrit (%) | 39.76±9.98 | 37.98±7.34 | 0.627 |
| Platelet count (/cumm) | 40,611±28,094 | 92285±84059 | 0.002 |
| Total Leukocyte Count (/cumm) | 12,428±6,284 | 14,041±2,795 | 0.478 |

**Table-IV: Logistic regression analysis of predictors of mortality in neonatal pulmonary haemorrhage (N=70)**

| Variables | p-value | OR | 95% CI (Lower–Upper) |
|---|---|---|---|
| Platelet count (/cumm) | 0.042 | 1.000 | 1.000 – 1.000 |
| Prothrombin Time (sec) | 0.709 | 0.302 | 0.001 – 160 |

**Discussion:**

Among 70 neonates with pulmonary haemorrhage, thrombocytopenia was evaluated as a mortality predictor, revealing a striking 88.6% mortality rate (62/70). Demographic analysis demonstrated significant differences in the timing of pulmonary haemorrhage onset between survivors (3.00 ± 1.69 days) and non-survivors (8.12 ± 7.07 days; p=0.046). Wang et al[7] and Ferreira, Carmona and Martinez[8] similarly documented haemorrhage occurrence within the first week of life. The earlier presentation observed in survivors was likely related to neonatal sepsis and hemorrhagic disease of the newborn, both established triggering factors for pulmonary haemorrhage. This pattern aligns with findings by Aziz et al[10] who reported early haemorrhage clustering in neonates with severe coagulopathy and sepsis-related instability.Birth weight was lower among non-survivors (2359 ± 713 g) than survivors (2643 ± 470 g), though not significantly different, consistent with Tomaszewska et al[9] who linked very low birth weight to structural pulmonary fragility and haemorrhage susceptibility. Male predominance characterised the death group (59.7%), whereas equal sex distribution was noted among survivors. Respiratory distress affected nearly all neonates (98.4% of deaths and 100% of survivors), reaffirming Lin et al's[11] findings that respiratory compromise is universal in pulmonary haemorrhage. Delayed respiration occurred exclusively among non-survivors (14.5%), suggesting an early-life hypoxic burden. This phenomenon is biologically plausible given the male disadvantage hypothesis, supported by Jain et al,[12] who reported higher respiratory morbidity and bleeding complications among male neonates due to developmental lung immaturity. Postnatal presentation patterns revealed clinically meaningful distinctions. Jaundice emerged as the only statistically significant factor, paradoxically higher among survivors (62.5%) than non-survivors (17.7%, p=0.013). This observation may reflect early recognition and treatment of vitamin K deficiency bleeding, a concept supported by Araki,[13] who highlighted improved survival when jaundice-associated coagulopathy was corrected promptly. Birth injuries, including cephalohematoma, did not show prognostic significance, echoing the conclusions of Ahmad et al.[14] Hematological parameters provided essential insights into mechanisms of mortality. Haemoglobin and hematocrit levels were slightly higher in deaths than in survivors, paralleling findings from Christensen et al,[3] indicating that red cell parameters are weak outcome markers. Platelet count, however, was markedly lower among non-survivors (40,611 ± 28,094/μL) compared with survivors (92,285 ± 84,059/μL; p=0.002). Severe thrombocytopenia is a well-established mortality determinant and may reflect consumption coagulopathy, pulmonary platelet sequestration, or sepsis-induced bone

marrow suppression. This trend supports earlier descriptions by Chakravorty and Roberts,[1] Del Vecchio et al,[5] and Murray.[6] Recent evidence by Roberts et al[15]also emphasises that platelet counts below 60,000/μL significantly increase fatal haemorrhage risk in neonates with pulmonary bleeding. Total leukocyte count did not differ significantly, suggesting that inflammatory markers are less predictive of outcomes than platelet indices. This aligns with the conclusions of Ahmad et al[14]who found no association between leukocyte count and mortality in pulmonary haemorrhage. Logistic regression confirmed thrombocytopenia as an independent predictor of mortality (p=0.042), consistent with global data demonstrating that platelet counts below 100,000/μL increase the risk of life-threatening haemorrhage by 2- to 3-fold.[5] Prothrombin time variability did not reach statistical significance, indicating that quantitative platelet deficiency outweighs coagulation cascade disruption in predicting mortality. This is consistent with observations by Narasimhan and Popworth,[4] who emphasized the dominant role of thrombocytopenia over coagulopathy markers in neonatal pulmonary bleeding. Collectively, these findings demonstrate that severe thrombocytopenia remains the most critical mortality determinant in neonatal pulmonary haemorrhage in resource-limited settings such as Bangladesh.

**Limitations:**

The study had limitations, including a skewed survivor-to-death ratio and a single-institution design. These limitations may impact precision and generalizability. Further research in diverse populations is needed.

**Conclusion:**

This study establishes thrombocytopenia as a robust independent predictor of mortality in neonatal pulmonary haemorrhage. Non-survivors demonstrated significantly lower platelet counts (40,611±28,094/μL) compared to survivors (92,285±84,059/μL, p=0.002), with logistic regression confirming its predictive value (p=0.042). These findings validate platelet count assessment as a practical, accessible prognostic indicator in resource-constrained settings.Clinical practice guidelines should integrate regular platelet monitoring as a prognostic tool for neonates with pulmonary haemorrhage. Healthcare facilities should formulate standardised platelet replacement strategies for thrombocytopenic neonates to reduce mortality. Collaborative multicenter investigations are required to substantiate thrombocytopenia's predictive capacity and identify evidence-based platelet thresholds for timely therapeutic intervention in resource-constrained healthcare environments.

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# Longitudinal Impact of Sleep Duration on Liver Stiffness Velocity in Metabolic Dysfunction-Associated Steatotic Liver Disease: A Five-Year Prospective Cohort Study

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Submission Date : 24 Jan 2026
Accepted Date : 03 March 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90044

**Abstract**

**Background:**
The clinical shift from non-alcoholic fatty liver disease (NAFLD) to metabolic dysfunction-associated steatotic liver disease (MASLD) emphasizes identifying modifiable drivers of fibrotic progression. While obesity and diabetes are established risk factors, the independent impact of sleep duration on the "velocity" of liver stiffness measurement (LSM)-the longitudinal rate of change-remains poorly characterized.

**Objective:**
This study aimed to quantify the 5-year relationship between sleep duration and liver stiffness velocity.

**Methods:**
We conducted a prospective cohort study of 1,076 participants in Bangladesh (Dhaka, Rangpur, Sylhet) from 2020 to 2025. Baseline and 5-year liver stiffness were measured using vibration-controlled transient elastography (VCTE). Sleep duration was assessed via the Pittsburgh Sleep Quality Index (PSQI). Multivariable regression and causal mediation analysis evaluated the impact of sleep on LSM change (Δ LSM).

**Results:**
Over 5 years, 19.7% of individuals were Progressors. Multivariable regression established sleep duration as a potent independent predictor of liver stiffness velocity (β=-0.20,95% CI: -0.28, -0.12, p<0.001), while BMI was not a significant longitudinal driver in adjusted models. Mediation analysis confirmed a significant direct effect of sleep on Δ LSM (ADE=-0.19, p<0.001), with negligible mediation by BMI. Survival analysis showed that individuals sleeping ≤6 hours had a significantly higher hazard for reaching advanced fibrosis compared to those sleeping ≥6 hours.

**Conclusion:**
Short sleep duration is a direct, primary driver of liver stiffness velocity in MASLD. Restorative sleep (≥7 hours) is associated with stability and is a prerequisite for fibrosis regression. Addressing sleep hygiene is a critical, independent therapeutic target for preventing advanced liver disease.

**Keywords:** MASLD, Liver Stiffness Measurement, Sleep Duration, Fibrosis Velocity, Circadian Rhythm, Bangladesh.

**Citation:** Chowdhury MS,Rahman MA,Saha M,Safiullah AMB,Rahman MZ,Hossain MS,Aurko MS,Hussen MD,Tabassum Z.Longitudinal Impact of Sleep Duration on Liver Stiffness Velocity in Metabolic Dysfunction-Associated Steatotic Liver Disease: A Five-Year Prospective Cohort Study.J Rang Med Col.2026 Mar;11(1):159-165.doi: https://doi.org/10.3329/jrpmc.v11i1.90044

## Introduction:

The clinical landscape of chronic liver disease underwent a paradigm shift in 2023 with the international multi-society consensus transitioning the nomenclature from non-alcoholic fatty liver disease (NAFLD) to metabolic dysfunction-associated steatotic liver disease (MASLD).[1] This shift represents a move toward a positive diagnostic framework where hepatic steatosis is defined by its metabolic associations-such as

obesity, hypertension, and impaired glucose metabolism-rather than the mere exclusion of alcohol consumption.[2] In South Asia, and specifically Bangladesh, the prevalence of MASLD has reached epidemic proportions, currently affecting approximately 33.8% of the adult population.[3-5] While traditional factors like body mass index (BMI) and Type 2 Diabetes (T2DM) are well-established drivers of the disease, the role of sleep duration as an independent determinant of the "velocity" of liver stiffness, the rate at which fibrosis accumulates over a multi-year periodremains insufficiently characterized.[6]

Chronic sleep deprivation is increasingly recognized as a potent orchestrator of metabolic dysfunction.[7] Short sleep duration (defined as ≤6 hours) has been epidemiologically linked to the incidence of steatosis, but its specific impact on the velocity of fibrotic progression, measured via serial vibration-controlled transient elastography (VCTE), requires rigorous longitudinal evaluation.[8-10] Existing evidence suggests that sleep disruption may act as a "second hit" that exacerbates existing metabolic stress, yet many clinical practitioners focus almost exclusively on weight loss and dietary modification.[11,12]

The liver is a highly circadian organ, and its metabolic homeostasis is gated by a complex molecular clock.[13] Disruption of this rhythm through shortened sleep is hypothesized to prime hepatic stellate cells for activation, thereby accelerating the accumulation of extracellular matrix.[14] We aimed to determine if sleep duration exerts a direct, weight-independent influence on hepatic fibrosis by modulating the circadian-hepatic axis.

**Method:**

This prospective cohort study was conducted between January 2020 and February 2025, adhering to the STROBE reporting guidelines for longitudinal observational research.[15] The study followed the standards set by the Declaration of Helsinki. Permission for this study was granted by the Institutional Review Board (IRB) of BMU and two other medical colleges. Informed consent was collected from all participants before collecting data and participation was completely voluntary.

We initially enrolled a representative sample of participants from community and tertiary health centers across Dhaka, Dinajpur, and Sylhet to capture the geographical and socioeconomic diversity of Bangladesh. Eligible 1,076 participants were adults aged 18-70 years with a diagnosis of MASLD, defined as radiological evidence of hepatic steatosis (via transabdominal ultrasonography) and the presence of at least one of five cardiometabolic risk factors: BMI ≥23 kg/m$^2$, hypertension, dyslipidemia, or impaired fasting glucose. Exclusion criteria included heavy alcohol consumption (>30 g/day for men, >20 g/day for women), chronic viral hepatitis (HBV/HCV), pregnancy, use of steatogenic medications, and other known etiologies of chronic liver disease.

Baseline clinical and demographic data were collected in 2020. Anthropometric measurements included height, weight, waist circumference, and blood pressure. Biochemical assessments included alanine aminotransferase (ALT), aspartate aminotransferase (AST), gamma-glutamyl transferase (GGT), HbA1c, and fasting lipid profiles. Sleep characteristics were quantified using the Pittsburgh Sleep Quality Index (PSQI).Daily sleep duration was self-reported and categorized into 1-hour increments (ranging from 5 to 9 hours) to allow for both threshold and linear trend analysis.

Hepatic fibrosis was assessed using VCTE (FibroScan, Echosens, France).To ensure technical accuracy, examinations were performed by trained operators with participants fasting for at least 3 hours. Measurements were deemed reliable following international quality criteria: at least 10 valid shots, a success rate ≥60%, and an interquartile range (IQR)/median ratio ≤30%.

The primary outcome was liver stiffness velocity, defined as the 5-year change in liver stiffness (Δ LSM). Based on the R-based analysis of the cohort, participants were categorized into three distinct trajectories: "Progressors" (ΔLSM >1.2 kPa or movement to a higher risk category), "Regressors" (ΔLSM p<-1.5 kPa), and "Stable" (fluctuation within±0.7 kPa).Statistical analysis was performed using R version 4.5.1. Continuous variables were presented as medians with IQRs and compared using Kruskal-Wallisrank-sum tests. Categorical variables were assessed via Pearson's Chi-square tests. We employed multivariable linear regression to identify independent predictors of liver stiffness velocity, adjusting for age, sex, BMI, and the presence of diabetes. Multicollinearity was evaluated using the Variance Inflation Factor (VIF).

Causal mediation analysis was conducted to decompose the effect of sleep duration into an average direct effect (ADE) and an indirect effect mediated by BMI. Finally, Cox proportional hazards models were utilized to estimate the time-to-event for progression to compensate for advanced chronic liver disease (LSM ≥10.0 kPa).

**Results:**

The study cohort comprised 1,076 participants with a mean age of 42.2 years and a moderate female predominance (56.8%). At the 2020 baseline, the median LSM was 6.0 kPa (IQR: 5.2, 6.8). Metabolic comorbidities were highly prevalent, with 56.5% of the population having diagnosed diabetes and a median BMI of 30.5 kg/m2. Over the 5-year follow-up, 212 individuals (19.7%) were identified as Progressors, exhibiting a significant increase in fibrotic markers. Conversely, only 9 individuals (0.8%) achieved significant regression, while the vast majority (855 individuals, 79.5%) remained Stable.

Analysis of sleep patterns revealed a critical relationship between rest and fibrotic outcomes. Significant regressors were entirely absent from the 5- and 6-hour sleep categories, appearing only in participants achieving ≥7hours of restorative sleep (p<0.001).In contrast, over 60% of Progressors were short sleepers (≤6 hours) (Table-I).

Multivariable linear regression, adjusted for age, sex, BMI, and diabetes, established sleep duration as the most potent independent predictor of liver stiffness velocity. For every one-hour increase in sleep duration, the 5-year ΔLSM decreased by 0.20 kPa (β=-0.20,95% CI: -0.28, -0.12, p<0.001) (Figure-1).

Notably, in this adjusted longitudinal model, BMI (β=-0.01, p<0.5) and diabetes status (β=-0.14, p<0.4) were not significant independent drivers of the rate of change. This suggests that while metabolic factors determine the baseline fibrosis stage, sleep duration acts as a primary modifier of the velocity of progression once MASLD is established. Diagnostics confirmed no significant multicollinearity between these variables, with a sleep VIF of 1.02 and a BMI VIF of 2.65.Causal mediation analysis was utilized to determine if

**Table-I: Basic characteristics of the respondents and association of sleep patterns with fibrosis (N=1076)**

| Characteristic | Stable N=783[1] | Progressor N=216[1] | Regressor N=77[1] | p-value[2] |
|---|---|---|---|---|
| Age (in years) | 38(32, 50) | 38(31, 49) | 39(30, 52) | 0.6 |
| **Sex** | | | | |
| Female | 407(52%) | 113(52%) | 42(55%) | >0.9 |
| Male | 376(48%) | 103(48%) | 35(45%) | |
| BMI(kg/m$^2$) | 34(26, 39) | 34(26, 39) | 34(27, 40) | 0.4 |
| DM | 438(56%) | 126(58%) | 47(61%) | 0.6 |
| **Duration of sleep (Hours)** | | | | |
| 5 | 170(22%) | 41(19%) | 0(0%) | |
| 6 | 316(40%) | 91(42%) | 0(0%) | |
| 7 | 89(11%) | 25(12%) | 25(32%) | <0.001 |
| 8 | 122(16%) | 37(17%) | 34(44%) | |
| 9 | 86(11%) | 22(10%) | 18(23%) | |
| lsm_2020 | 6.00(5.20, 6.80) | 6.00(5.30, 6.70) | 6.20(5.60, 6.70) | 0.2 |

[1]Median (Q1, Q3); n (%)

[2]Kruskal-Wallis rank sum test; Pearson's Chi-squared test

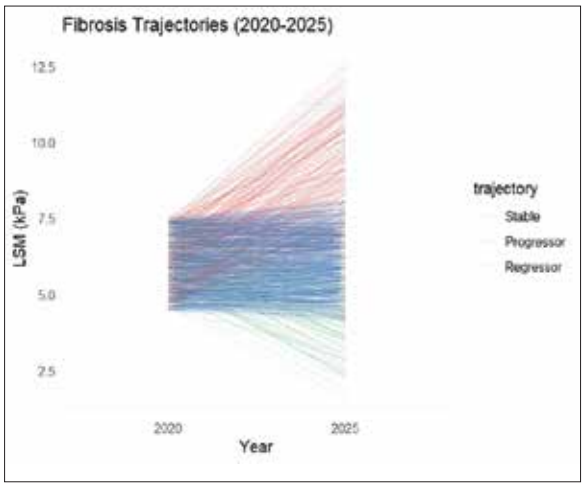



**Figure-1: Fibrosis trajectories (2020-2025)**

sleep influenced the liver via weight gain or direct hepatic mechanisms. The analysis revealed a significant direct effect of sleep on liver stiffness velocity (ADE=-0.191, p<0.001), while the proportion of the effect mediated by changes in BMI was negligible ($7.4\times10^{-6}$) and statistically non-significant (p=1.0). This provides robust evidence that the hepatoprotective role of sleep occurs independently of body weight fluctuations (Table-II).

**Table-II: Effects of basic characteristics on liver fibrosis (N=1076)**

| Characteristic | Beta | 95% CI | p-value |
|---|---|---|---|
| Age | -0.01 | -0.02, 0.00 | 0.2 |
| BMI | -0.01 | -0.03, 0.01 | 0.5 |
| DM | 0.14 | -0.19, 0.47 | 0.4 |
| Duration of sleep (Hours) | -0.20 | -0.28, -0.12 | <0.001 |

Abbreviation: CI=Confidence Interval

R=0.022; Adjusted R=0.018; Sigma=1.72; Statistic=5.91; p-value=<0.001; df=4; Log-likelihood=-2,107; AIC=4,225; BIC=4,255; Deviance=3,162; Residual df=1,071; No. Obs.=1,076

Integrated risk evaluation via a progression risk matrix demonstrated a synergistic interaction between metabolic status and rest. The highest velocity of progression (mean ΔLSM=+5.12 kPa) was observed in obese individuals with the shortest sleep duration (≤5 hours).In contrast, normal-weight individuals with adequate sleep (≥8 hours) were the only group to show mean regressive changes (-0.35 kPa) (Figure-2 & Figure-3).

Survival analysis further quantified the clinical impact over time. Participants with short sleep durations reached advanced fibrosis thresholds.

significantly faster than normal sleepers (p<0.05 by log-rank test). The cumulative risk of progression diverged significantly after the second year of follow-up. Interaction plots confirmed that while diabetes exacerbated the fibrotic response, the independent impact of sleep duration on liver stiffness velocity remained consistent across all subgroups, including both diabetic and non-diabetic participants (Figure-4).

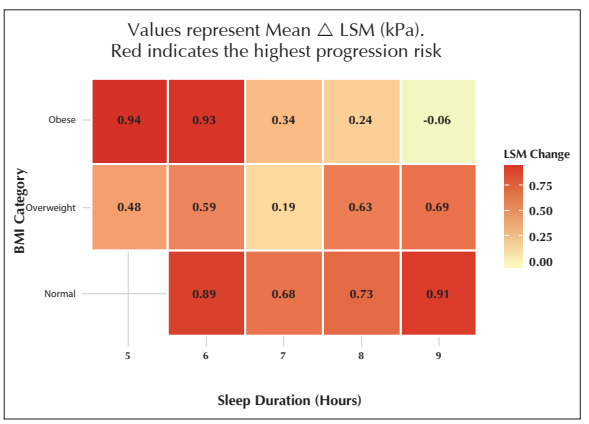



**Figure-2: 5 years fibrosis progression risk matrix**

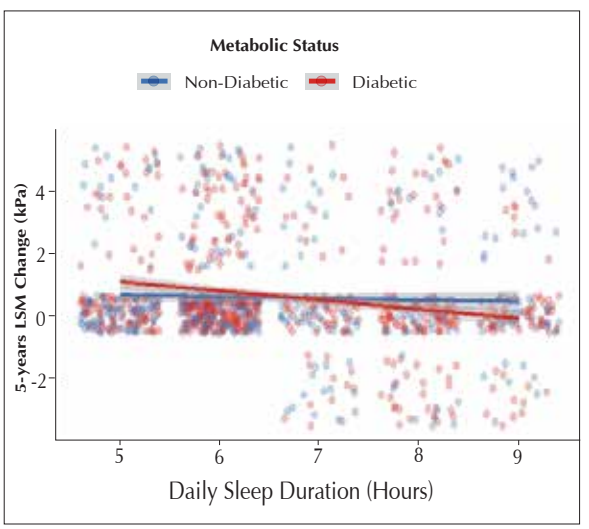



**Figure-3: Impact of sleep duration on fibrosis velocity**

Linear relationship between Sleep and Liver Stiffness Change (N=1077)

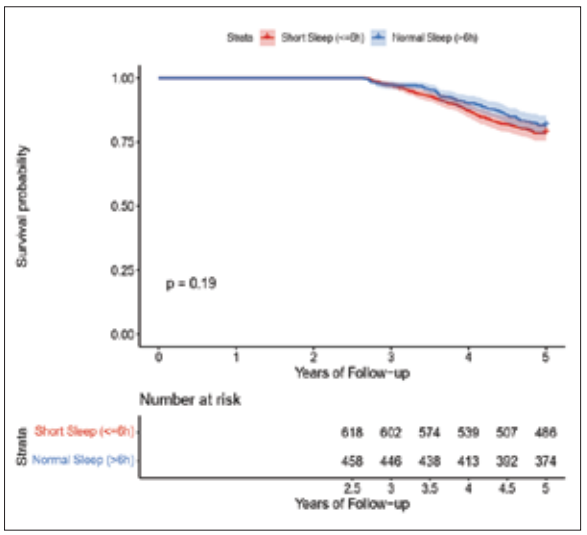



**Figure 4: Probality of remaining progression-fre**

## Discussion

This 5-year longitudinal evaluation identifies sleep duration as a primary determinant of liver stiffness velocity in MASLD. The finding that regression of liver stiffness was exclusively observed in individuals sleeping 7 or more hours suggests that restorative sleep is a physiological requirement for the reversal of hepatic fibrosis. Our results indicate that sleep duration is not merely a marker of metabolic syndrome but a direct, independent driver of fibrotic progression. This supports a "circadian-hepatic" axis model, where the liver's molecular clock gates the activation of the primary effector cells of fibrosis.[16]

The liver is a highly circadian organ, with nearly 15% of the hepatic transcriptome regulated by molecular clock genes such as CLOCK and BMAL1.[17] Disruption of this rhythm through short sleep duration "primes" hepatic stellate cells (HSCs) for accelerated activation.[14,18] In healthy states, HSCs are quiescent, but sleep deprivation leads to the downregulation of clock genes such as REV-ERBα, which normally inhibits pro-fibrotic signaling.[19,20] Reduced REV-ERBα activity promotes the cyclic GMP-AMP synthase (cGAS) pathway, creating a pro-inflammatory microenvironment that accelerates the transition of HSCs to collagen-producing myofibroblasts.[21,22] Furthermore, sleep loss enhances the Transforming Growth Factor-beta (TGF-β) pathway, the central orchestrator of fibrogenesis.[23,24] Chronic sleep deprivation increases cellular traction forces and the expression of integrins (e.g., αυβ1) that mechanically activate latent TGF-β stored in the extracellular matrix.[25] This drives the canonical Smad2/3 signaling cascade, resulting in the upregulation of Type I Collagen (COL1A1) and α-Smooth Muscle Actin (α-SMA).[26,27] Simultaneously, sleep loss truncates melatonin production, removing a natural antioxidant "brake" on the NLRP3 inflammasome and reactive oxygen species (ROS) production, both of which are critical for sustaining the fibrotic niche.[28,29]

Clinically, the divergence of progression-free survival curves beginning at Year 2.5 indicates that the cumulative stress of sleep deprivation manifests as detectable fibrotic accumulation over a relatively short clinical horizon.This highlights the utility of serial non-invasive monitoring. While a single LSM value provides a snapshot of current damage, tracking liver stiffness velocity identifies patients who are at high risk for future liver-related events even if their current stage is low.Our study suggests that sleep hygiene should be integrated as a core therapeutic pillar in MASLD management, particularly for "high-velocity" progressors.

Future therapeutic strategies may leverage these circadian pathways. For example, REV-ERB agonists and melatonin supplementation have shown potential in preclinical models to stabilize HSC quiescence and reduce oxidative stress.In clinical practice, addressing nocturnal hypoxemia via CPAP in patients with sleep apnea and advocating for consistent sleep-wake cycles could provide a synergistic benefit to existing weight-loss and pharmacological interventions.By recognizing the liver as a circadian organ, hepatologists can move beyond traditional risk factors toward a more holistic management of metabolic dysfunction-associated liver disease.

**Limitations:**

This study has limitations, including potential recall bias from self-reported sleep data and the use of vibration-controlled transient elastography instead of liver biopsy. It did not consider specific genetic variants like PNPLA3 or detailed nutrient compositions. Future research should focus on objective actigraphy and multi-omics integration to confirm these direct metabolic pathways and further refine our understanding of liver stiffness measurement velocity.

**Conclusion:**
Short sleep duration (≤6 hours) is an independent and direct driver of liver stiffness velocity in MASLD. Restorative sleep (≥7 hours) is a physiological prerequisite for the regression of fibrosis, while the combination of obesity and sleep deprivation significantly accelerates hepatic stiffening. These findings underscore the clinical importance of sleep hygiene in slowing the progression of metabolic liver disease. Clinicians should incorporate sleep duration as a modifiable risk factor in the standard MASLD workup. By identifying high-velocity progressors through serial VCTE monitoring and addressing sleep disruption, practitioners can improve long-term outcomes and mitigate the risk of cirrhosis.

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# Assessment of Flap Viability and Complication in Free Flap Reconstruction of Lower Third Leg and Foot Defects

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Submission Date : 25 Jan 2026
Accepted Date : 03 March 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90052

## Abstract

**Background:**
Composite defects of the lower third leg and foot present significant reconstructive challenges due to limited local tissue availability, poor vascularity, and the frequent presence of exposed bone, tendon, or implants. Free flap reconstruction has become the preferred method for achieving durable coverage in this region yet flap viability and complication patterns may vary depending on patient factors, defect characteristics, flap type, and recipient vessels. Evidence from Bangladesh is limited despite the increasing burden of lower limb trauma and oncologic resections requiring microsurgical reconstruction.

**Objective:**
This study evaluated flap viability and early postoperative complications following free flap reconstruction of distal lower limb defects in a tertiary hospital setting.

**Methods:**
This prospective observational study was conducted in the Departments of Orthopedics and Burn & Plastic Surgery at Sylhet M.A.G. Osmani Medical College Hospital, Bangladesh, from July 2015 to June 2017. Eleven patients with composite defects of the lower third leg or foot requiring free flap coverage were consecutively enrolled. Data on patient demographics, comorbidities, defect etiology and site, flap type, flap size, and recipient vessels were collected prospectively. All free flaps were performed using standard microsurgical techniques, with postoperative monitoring following institutional protocols. Flap outcomes were categorized according to the Srikant classification. Minor complications included wound infection and partial graft loss, while major complications required surgical intervention. Descriptive statistics were used for analysis.

**Results:**
All 11 free flaps demonstrated complete survival, resulting in a flap viability rate of 100%. According to the Srikant classification, 72.7% of flaps achieved Grade 1 outcomes, 18.2% achieved Grade 2 outcomes, and 9.1% were Grade 3, reflecting partial non-critical losses. No cases of Grade 4 or Grade 5 flap failure occurred. Minor complications were observed in 18.2% of cases, and one major complication (9.1%) required secondary surgical management. The anterolateral thigh (ALT) flap was most commonly used (72.7%), while the anterior tibial artery served as the primary recipient vessel (81.8%). Neither flap type nor vessel choice showed a clear association with flap loss due to the overall high survival rate.

**Conclusion:**
Free flap reconstruction demonstrated excellent viability and low complication rates in patients with composite defects of the lower third leg and foot. The consistent success across flap types and recipient vessels highlights the reliability of microsurgical reconstruction in this region.

**Keywords:** Free flap, Microsurgery, Lower limb, Reconstruction

**Citation:** Chakma SJ,Hossain AZ,Turja AC,Paul R,Talukder DN,Rahman H.Assessment of Flap Viability and Complication in Free Flap Reconstruction of Lower Third Leg and Foot Defects.J Rang Med Col.2026 Mar;11(1):166-171.doi: https://doi.org/10.3329/jrpmc.v11i1.90052

**Introduction:**

Composite soft-tissue defects of the lower third leg and foot represent one of the most complex challenges in reconstructive surgery. This region is anatomically vulnerable due to limited soft-tissue coverage, minimal local flap options, and a relatively poor vascular network compared with other parts of the lower limb.[1] As a result, injuries in this area frequently expose bone, tendon, or implants, necessitating robust and reliable coverage to prevent infection, preserve limb function, and avoid amputation. Conventional options such as skin grafts, local rotation flaps, and cross-leg flaps are often insufficient because they cannot provide the vascularity or tissue bulk required for durable reconstruction.[2] With the evolution of microsurgery, free flap reconstruction has become the preferred technique for managing these demanding defects, offering well-vascularized tissue capable of restoring coverage and facilitating eventual functional rehabilitation.[3]In recent years, there has been a global rise in high-energy trauma, particularly road traffic accidents, which account for a major proportion of distal lower limb defects requiring microsurgical reconstruction.[4,5] Tumor excisions, chronic infections, and sequelae of orthopedic procedures also contribute significantly. The complexity of these injuries makes flap viability and complication assessment crucial, as compromised vascularity, wound contamination, and comorbidities may predispose patients to flap loss or delayed healing. Although modern microsurgical techniques have improved outcomes substantially, flap-related complicationssuch as partial necrosis, vascular thrombosis, infection, and graft lossremain significant concerns.[6]The anterolateral thigh (ALT) flap has emerged as a workhorse flap for lower extremity reconstruction due to its long pedicle, large skin paddle, and low donor-site morbidity.[7] However, the type of flap is only one factor influencing flap success. Recipient vessel selection also plays an important role in flap viability. In the distal third of the leg and foot, the anterior tibial and posterior tibial arteries are commonly used, but trauma-related vessel damage may complicate anastomosis and affect perfusion.[8] Recent studies emphasize the need for careful vessel assessment and tailored flap selection to reduce complications and improve flap survival.[9] Despite substantial global literature, there is limited information from Bangladesh regarding flap viability and complications in lower leg and foot reconstruction. This lack of data is important due to differences in patient demographics and resources. Understanding flap outcomes is therefore essential for guiding clinical decision-making, improving patient safety, and benchmarking local performance against international standards. The study aims to evaluate flap viability and complications after free flap reconstruction in these areas.

**Methods:**

This prospective observational study was conducted in the Departments of Orthopaedics and Burn & Plastic Surgery at Sylhet M.A.G. Osmani Medical College Hospital, Bangladesh from July 2015 to June 2017 after ethical approval. Patients presenting with composite soft-tissue defects of the lower third of the leg or foot requiring free flap reconstruction were consecutively enrolled using a convenience sampling approach. Patients with defects amenable to simpler coverage, such as skin grafts or local flaps, absence of palpable distal arterial pulses, and medical unfitness or refusal to undergo microsurgical reconstruction were excluded. Demographic details, etiology of defects, anatomical site, flap type, flap size, recipient vessels, and comorbidities were recorded using a structured questionnaire. All surgeries were performed by the same reconstructive team using standard microsurgical techniques. End-to-end arterial anastomosis was performed in all cases, and postoperative monitoring followed institutional microsurgical protocols. Flap viability and complications were assessed daily during hospitalization. Outcomes were graded using the Srikant classification system, which categorizes flaps based on complete success, partial non-critical loss, partial critical loss, or complete failure. Minor complications included wound infection and partial graft loss, whereas major complications required additional surgical intervention. Data analysis was performed using SPSS version 21, with results presented descriptively as frequencies and percentages.

**Results**

Most patients were aged 51–60 years (45.5%), with 72.7% being male. Only two patients had significant comorbidities—diabetes and hypertension—affecting wound healing and complications (Table-I).

**Table-I: Demographics and comorbidities of the participants (N=11)**

| Variable | no. (%) |
|---|---|
| **Age (years)** | |
| 20–30 | 1(9.1) |
| 31–40 | 3(27.3) |
| 41–50 | 2(18.2) |
| 51–60 | 5(45.5) |
| **Sex** | |
| Male | 8(72.7) |
| Female | 3(27.3) |
| **Comorbidities** | |
| Diabetes mellitus | 1(9.1) |
| Hypertension | 1(9.1) |

Table-II outlined the causes and locations of composite defects and the types of free flaps used for repair. Most defects were from road traffic accidents (63.6%), with the lower leg mostly affected (36.4%). The anterolateral thigh (ALT) flap was the most commonly used for reconstruction (72.7%) making it the preferred reconstructive option due to its versatility and reliable vascularity. The anterior tibial artery was used in 81.8% of cases, while the posterior tibial artery was used in 18.2%. The anterior tibial artery's features make it ideal for lower limb reconstruction. Vascular selection affects flap viability and potential complications.

**Table-II: Defect characteristics, flap selection and recipient vessels used for microvascular anastomosis (N=11)**

| Variable | no. (%) |
|---|---|
| **Cause of Defect** | |
| Road traffic accident | 7(63.6) |
| Tumor excision | 3(27.3) |
| Assault | 1(9.1) |
| Exposed implant | 1(9.1) |
| **Defect Site** | |
| Lower leg | 4(36.4) |
| Foot dorsum | 2(18.2) |
| Heel | 1(9.1) |
| Sole & dorsum | 3(27.3) |
| Sole | 1(9.1) |
| **Flap Type** | |
| ALT | 8(72.7) |
| Rectus abdominis | 1(9.1) |
| Gracilis | 1(9.1) |
| Latissimus dorsi | 1(9.1) |
| **Recipient Vessel** | |
| Anterior tibial artery | 9(81.8) |
| Posterior tibial artery | 2(18.2) |

All 11 flaps had complete survival. Partial non-critical flap loss happened in 27.3% of patients, with no critical losses. Minor complications occurred in 18.2% of cases, and one patient had a major complication. No amputations were needed (Table-III).

Table-IV revealed the Srikant classification system to categorize flap outcomes. Grade 1 outcomes, indicating complete success, occurred in 72.7% of cases. Grades 2 and 3, showing partial losses needing management, were 18.2% and 9.1%, respectively. No critical losses were reported.

**Table-III: Flap viability and postoperative complication profile (n=11)**

| Parameter | no. (%) |
|---|---|
| **Flap Viability** | |
| Complete survival | 11(100) |
| **Partial Non-Critical Loss** | |
| Yes | 3(27.3) |
| No | 8(72.7) |
| Critical Loss / Total Loss | 0(0) |
| **Complications** | |
| Minor | 2(18.2) |
| Major | 1(9.1) |
| Amputation | 0(0) |

**Table-IV: Free flap viability categorized by srikant classification (n=11)**

| Grade | Description | no. (%) |
|---|---|---|
| Grade 1 | Complete success; uneventful healing | 8(72.7) |
| Grade 2 | Partial non-critical loss; minor complication | 2(18.2) |
| Grade 3 | Partial non-critical loss; major complication | 1(9.1) |
| Grade 4 | Partial critical loss | 0(0) |
| Grade 5 | Complete failure/amputation | 0(0) |

Among the 8 ALT flaps, 25% had complications; rectus abdominis and gracilis flaps had no complications. One latissimus dorsi flap had a major complication (Figure-1)

The anterior tibial artery group had two partial losses and one major complication, while the posterior tibial artery group had one partial loss with no major complications (Figure-2).

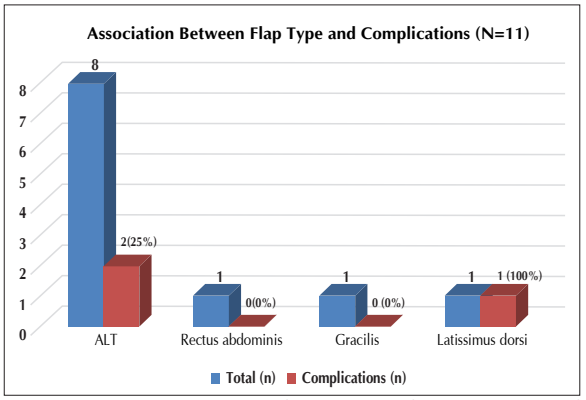



**Figure-1: Association between flap type and complications (N=11)**

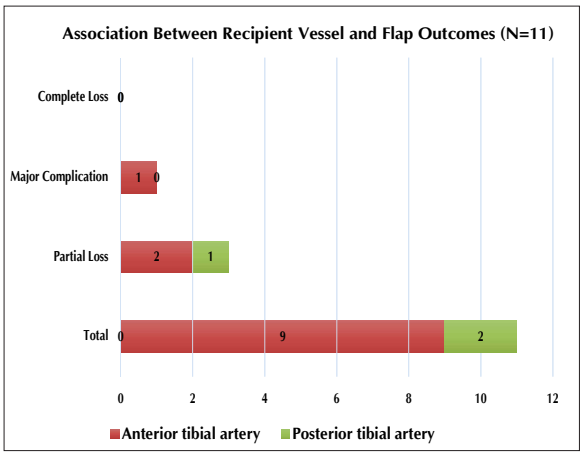



**Figure-2: Association between recipient vessel and flap outcomes (N=11)**

## Discussion:

In this study of free flap reconstruction for lower third leg and foot defects, outcomes were excellent, with 100% flap survival and no complete failures. Most flaps (72.7%) achieved Grade 1 viability per the Srikant classification, while 27.3% had partial non-critical loss (Grades 2–3) reflecting a high level of microsurgical success despite the anatomical challenges associated with distal lower limb reconstruction. The study predominantly included patients aged 51–60 years, demonstrating successful outcomes despite age-related challenges such as reduced vascularity and comorbidities. These findings are consistent with previous studies by Sayed et al and Khouri et al, highlighting high survival rates in middle-aged and older adults undergoing similar procedures.[10,11] Sex distribution reflected a male predominance (72.7%), consistent with trauma-related epidemiology reported across South and Southeast Asia. Previous studies reported male dominance, ranging from 70–85%, largely due to higher exposure to road traffic injuries and occupational hazards.[12]Flap survival was excellent in this study despite demographic risk factors, indicating that sex-related trauma patterns did not negatively impact microsurgical outcomes. The main cause of defects was road traffic accidents (63.6%), followed by tumor excision (27.3%), consistent with findings from Singh et al and Hassan et al in lower limb reconstruction cases.[4,5] Trauma cases often involve contaminated wounds or complex defects, heightening complication risks. However, our study indicates that trauma-associated defects can achieve excellent viability outcomes through careful debridement, meticulous planning, and appropriate flap selection. The anterolateral thigh (ALT) flap, used in 72.7% of cases, consistent with global trends supporting its reliability and versatility for reconstructive option for lower limb defects due to its vascular anatomy, versatility, and low donor-site morbidity.[12,13] The ALT flap demonstrated a low complication rate (25%), with all cases achieving survival. In contrast, the single latissimus dorsi flap case experienced a major complication, consistent with reports that muscle flaps may be more prone to postoperative edema and partial necrosis in the distal lower limb.[14] However, given the small sample size, these associations are descriptive rather than statistically conclusive. Recipient vessel selection was another key factor analyzed. The anterior tibial artery was most commonly used (81.8%), while the posterior tibial artery was used in 18.2%. Importantly, partial losses occurred across both vessel groups, suggesting that vessel choice alone did not dictate complications. This aligns with findings from Bendon et al and Jordon et al, who reported that both anterior and posterior tibial systems can provide adequate perfusion for free flaps, provided the vessels are healthy and not compromised by trauma.[15,16] The absence of complete failure in either group further reinforces that recipient vessel selection should be individualized based on vessel condition and location of the defect.Complication rates in this study were low, with only 18.2% experiencing minor complications and 9.1% experiencing major complications requiring a secondary procedure. No patients required amputation or experienced total flap failure. These

findings compare favorably with reported complication rates of 12–25% in similar lower limb free flap studies from high-volume centers.[17,18] Modern improvements in perforator-based flap harvest, intraoperative perfusion assessment, and postoperative monitoring likely contributed to this high success rate. A notable strength of this study is its consistent surgical technique, with all free flaps performed using end-to-end arterial anastomosis and standardized postoperative care. The uniform protocol likely contributed to the excellent viability outcomes observed.

**Limitations:**
The sample size was small (n=11), limiting the power to detect meaningful associations between flap type, vessel choice, and complications, also restricts the generalizability of the findings.

**Conclusion:**
This study demonstratesthat free flap reconstruction is an effective method for treating complex soft-tissue injuries in the lower leg and foot. All flaps in the study survived with no critical loss or total flap failure, proving the reliability of this surgical approach. Although Some patients experienced minor issues, but these were handled without affecting the survival of the flaps or the preservation of the limb. Anterolateral thigh (ALT) flaps were favored for their success in these cases, and both the anterior and posterior tibial arteries were reliable for connecting blood vessels. The results support using free flaps as a safe reconstructive option, even in limited-resource environments. Future research with larger multicenter cohorts and extended follow-up periods is needed to evaluate long-term flap durability and functional restoration.

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# Diagnostic Significance of Pleural Fluid ADA and Hematological Parameters in Pediatric Tubercular Versus Non-Tubercular Pleural Effusion

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Submission Date : 27 Jan 2026
Accepted Date : 03 March 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90053

**Abstract**

**Background:**
Pediatric pleural effusions arise from diverse etiologies, with tuberculous pleural effusion (TPE) and non-tuberculous causes being the most common. Early differentiation is essential for timely management.

**Objective:**
This study aimed to evaluate the diagnostic significance of pleural fluid ADA and hematological parameters in distinguishing pediatric tubercular versus non-tubercular pleural effusions.

**Methods:**
A cross-sectional study was conducted at Bangladesh Shishu Hospital and Institute from July 2019 to January 2022, including 47 children aged 1-18 years with pleural effusion. The diagnostic performance of pleural fluid ADA and key hematological parameters was analyzed using SPSS 26.

**Results:**
Pleural ADA was markedly higher in TPE than in non-TPE cases (90.6±52.0 vs. 36.0±11.5 U/L). TPE patients showed significantly lower total WBC counts and polymorph percentages, but higher lymphocyte percentages and ESR ($P<0.05$). Hemoglobin, platelet count, and CRP showed no significant group differences.

**Conclusion:**
Pleural fluid ADA, combined with selected haematological parameters, provides meaningful discrimination between tubercular and non-tubercular pediatric pleural effusions and supports clinical decision-making.

**Keywords:** Pleural fluid, ADA, Pediatric tuberculosis, Pleural effusion

**Citation:** Islam N,Kabir FL,Mahmud MA.Diagnostic Significance of Pleural Fluid ADA and Hematological Parameters in Pediatric Tubercular Versus Non-Tubercular Pleural Effusion.J Rang Med Col.2026 Mar;11(1):172-176.doi: https://doi.org/10.3329/jrpmc.v11i1.90053

## Introduction:

Pleural disease contributes substantially to illness and death in both adults and children[1] and represents about 4% of all cases seen in chest hospitals.[2,3] Pleural effusion occurs when excess fluid accumulates in the pleural space due to a disruption of the balance between vascular hydrostatic and oncotic pressures.[4] Pleural effusion in children poses significant diagnostic challenges, especially in distinguishing a tuberculous pleural effusion (TPE) from non-tuberculous causes, such as parapneumonic effusion (PPE), empyema, or other infections. Microbiological confirmation for TB in pleural fluid or tissue is hampered by low bacillary load in most pediatric TPE cases. Hence, much attention has focused on pleural fluid cytology and biochemical markers to improve diagnostic accuracy.[5] Adenosine deaminase (ADA) remains a widely used biomarker. For example, in a study of children with PPE and tuberculosis, pleural fluid ADA >40 IU showed sensitivity ≈ 87.5% and specificity ≈ 82.4% for diagnosing TPE in pediatric settings. Also, higher ADA levels have been demonstrated in TPE compared to PPE and other non-TB causes.[6] However, ADA alone is imperfect: false positive results can occur in parapneumonic infections, empyema, lymphomas, and other inflammatory conditions.[7] To enhance diagnostic

discrimination, several studies have evaluated ratio indices. In recent work from China, the 10Ч ADA/LDH ratio showed excellent performance in distinguishing TBPE from non-TBPE; at ADA >20 U/L, this index had a sensitivity ≈ 95% and specificity ≈ 94%.[8] Similarly, a 2024 study showed that the pfLDH/pfADA ratio has greater diagnostic value than ADA alone, with an area under the ROC curve (AUC) of 0.946, sensitivity of ~93.9% and specificity of 87.0% for differentiating TPE vs non-TPE.[9] Other laboratory parameters are also helpful. Differential cell count (lymphocytic vs neutrophilic predominance) is a classic discriminator. TPE is often lymphocyte-predominant, while non-tubercular effusions show neutrophils or mixed cells.[10] Pleural fluid glucose is often lower, and LDH markedly higher in PPE/empyema compared to TPE.[11] Further, factors associated with negative ADA in childhood TPE have been identified: lower pleural protein levels, lower LDH levels, and the absence of chest pain are associated with ADA ≤40 U/L, even in confirmed TB effusion.[12] Given variability in cut-off values, patient age, and the aetiology mix across settings, there is a need for locally validated marker combinations (ADA, LDH, cell counts, glucose, protein) to distinguish TPE from non-TPE efficiently.[13] This study aims to evaluate the diagnostic significance of pleural fluid ADA and hematological parameters in distinguishing pediatric tubercular versus non-tubercular pleural effusions.

**Methods:**

This cross-sectional study was conducted at the Department of Pediatric Respiratory Medicine at Bangladesh Shishu Hospital and Institute, Dhaka, from July 2019 to January 2022. Children aged 1 to 18 years who were admitted with pleural effusion during the study period were considered for inclusion. A total of 47 patients who met the defined inclusion and exclusion criteria were enrolled through convenience sampling. The study population comprised children and adolescents diagnosed with either tuberculous pleural effusion or parapneumonic effusion. Patients with transudative pleural effusion, malignancy, previously treated pleural effusion, empyema, loculated effusion, connective tissue disorders such as systemic lupus erythematosus, or those testing positive for COVID-19 were excluded. Following approval from the Ethical Review Committee (ERC) of the Bangladesh Institute of Child Health, children with clinically and radiologically confirmed pleural effusion underwent thoracocentesis for both diagnostic and therapeutic purposes. Effusions were categorized as exudative or transudative according to Light's criteria. The diagnosis of Tubercular pleural effusion based on detection of Mycobacterium tuberculosis was performed using Xpert MTB/RIF or Xpert MTB/RIF Ultra. Effusions were classified as exudate or transudate using Light's criteria. All collected data were entered into a personal computer, thoroughly checked for accuracy, and analyzed using SPSS version 26.0. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean±standard deviation (SD). The unpaired t-test was used for comparisons of continuous variables, and the chi-square ($\chi^2$) test was applied for categorical data. Statistical results were presented in tables and charts, and p-values <0.05 were considered statistically significant.

**Results:**

Table-I showed the demographic characteristics of the study population. It was observed that most patients (48.9%) were in the 1-5year age group with mean age 5.57±2.89 years. Regarding admitted patients, the proportion was higher among male children (31 [61.9%]), with a male: female ratio of 1.9:1. The Majority of patients (53.2%) were from the low socioeconomic group.

**Table-I: Demographic characteristics of the study patients (N=47)**

| Demographic characteristics | no. (%) |
|---|---|
| **Age group (years)** | |
| 1-5 | 23(48.9) |
| 6-10 | 21(44.7) |
| >10 | 3(6.4) |
| Mean±SD | 5.57±2.89 |
| **Gender** | |
| Male | 31(66.0) |
| Female | 16(34.0) |
| Male: female | 1.9:1 |
| **Socio-economic status** | |
| Low group | 25(53.2) |
| Middle group | 16(34.0) |
| High group | 6(12.8) |

Table-II summarized the vaccination and exposure status of the study children (N=47). Among the

participants, three children (17.7%) showed a tuberculin skin test (TST) induration of ≥10 mm, and all of them had previously received the BCG vaccine. Additionally, three children (17.6%) had a documented history of contact with known tuberculosis cases.

**Table-II: Active or passive vaccination status (N=47)**

| Characteristics | no. (%) | Notes |
|---|---|---|
| Tuberculin skin test induration ≥10 mm | 3(17.7) | All BCG vaccinated |
| History of contact with tuberculous cases | 3(17.6) | |

Among 58 patients, 36.2% pleural effusion was due to tuberculosis (Figure-1)

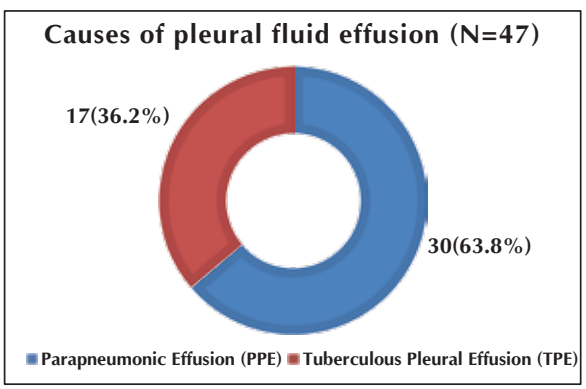



**Figure-1: Causes of pleural fluid effusion (N=47)**

**Table-III: Comparison of pleural fluid ADA between two groups (N=47)**

| Variables | TPE (n=17) | non-TPE (n=30) | p-value |
|---|---|---|---|
| Pleural fluid ADA (U/L) | 90.6±52.0 | 36.0±11.5 | <0.001 |

Pleural fluid ADA significantly increased in TPE (Table-III). The mean polymorph (%) of WBC in TPE was 49.8±14.0, and in non-TPE, 68.26±5.3. The mean difference was statistically significant (P<0.001). Mean Lymphocyte (%) of WBC in TB was 45.3±13.8, and non-TPE was 29.0±5.3. The mean difference was statistically significant (P<0.001). Mean total count of WBC was 11708.3±2936.7 and 16110.7±3722 in TPE and non-TPE cases, which was found statistically significant (P=0.001). ESR was statistically significant. Other parameters, Hb, platelet count, and CRP, were not statistically significant (Table-IV).

Table-V showed the pleural fluid parameters of the studied children. It was observed that the mean polymorph of pleural fluid in TPE was 22.9±19.4 % and in non-TPE was 72.7±12.2%. The mean difference in polymorphs was statistically significant (P<0.001). Mean Lymphocyte count of pleural fluid in TPE was 77.1±19.4 % and in non-TPE was 27.4±12.3%. The mean difference was statistically significant (p<0.001). The mean difference of the total count and sugar level was statistically significant.

**Table-IV: Laboratory parameters of the study patients (N=47)**

| Variables | TPE (n=17) | non-TPE (n=30) | p-value |
|---|---|---|---|
| Hb (gm/dl) | 9.9±1.1 | 10.21±0.8 | 0.272 |
| Total count WBC (/cumm) | 11708.3±2936.7 | 16110.7±3722.0 | 0.001 |
| Polymorph (%) | 49.8±14.0 | 68.3±5.3 | <0.001 |
| Lymphocyte (%) | 45.3±13.8 | 29.0±5.3 | <0.001 |
| Platelate count (/cumm) | 410916±150251 | 369000±203733 | 0.523 |
| ESR | 50.2±13.3 | 37.3±12.1 | 0.002 |
| CRP | 23.0±13.9 | 25.5±14.0 | 0.605 |

**Table-V: Pleural fluid parameters of the study patients (N=47)**

| Variables | TPE (n=17) | non-TPE (n=30) | p-value |
|---|---|---|---|
| Total count (/cumm) | 2152.9±816.5 | 4490.0±2564.5 | 0.001 |
| Polymorph (%) | 22.9±19.4 | 72.7±12.2 | <0.001 |
| Lymphocyte (%) | 77.1±19.4 | 27.4±12.3 | <0.001 |
| Protein (mg/dl) | 4.34±1.1 | 4.2±0.8 | 0.145 |
| Sugar (mg/dl) | 27.0±15.2 | 62.7±37.4 | <0.001 |
| Pleural fluid LDH (U/L) | 480.3±126.9 | 411.3±90.9 | 0.055 |

**Discussion:**

In this study, the majority (48.9%) of children were in the 1-5 years age group, followed by the 6-10 years age group (44.7%). The mean age was 5.57±2.89 years. Almost two-thirds (66.0%) of patients were male with a male: female ratio 1.9:1. This finding was consistent with the results shown in previous studies where the maximum number of children were in the age group 1-4 years (32%)[2,14] where as Saliya and Joshi[6] found 32% of children were in 6 -10 years. In this study, male children were more. This may be because male children are genetically more susceptible to disease than females. We observed significantly higher pleural fluid ADA levels in TPE patients (90.6±52.0 U/L) than in non-TPE patients (36.0±11.5 U/L; p<0.001). These findings align with previous studies, such as those by Hou et al,[15] who reported elevated pleural fluid ADA levels in TPE patients. Regarding haematological parameters, our study found that total white blood cell (WBC) counts were significantly higher in non-TPE patients (16,110.7±3,722.0 cells/μL) than in TPE patients (11,708.3±2,936.7 cells/μL; p=0.001). This contrasts with the findings of Zhao et al,[9] who reported higher WBC counts in TPE patients, suggesting variability in immune responses across populations. The percentage of polymorphonuclear cells (PMNs) was significantly higher in non-TPE patients (68.3±5.3%) compared to TPE patients (49.8±14.0%), with a p-value of <0.001. Conversely, the percentage of lymphocytes was significantly higher in TPE patients (45.3±13.8%) than in non-TPE patients (29.0±5.3%), with a p-value of <0.001. These findings are consistent with previous studies, such as those by Mercer et al,[16] who reported a higher lymphocyte percentage in TPE cases, and by Zhao et al,[9] who observed a higher PMN percentage in non-TPE cases. Our study also found that the erythrocyte sedimentation rate (ESR) was significantly higher in TPE patients (50.2±13.3 mm/h) than in non-TPE patients (37.3±12.1 mm/h; p=0.002). This is consistent with the findings of Lee et al,[17] who reported elevated ESR levels in TPE patients. However, parameters such as hemoglobin (Hb), platelet count, and C-reactive protein (CRP) levels did not show significant differences between TPE and non-TPE groups in our study. These results are consistent with those of Zhao et al,[9] who also found no significant differences in these parameters between the two groups.

**Limitations:**

This single-centre study had a small sample size, which may limit generalizability. Not all cases had microbiological confirmation of tuberculosis, and some classification depended on clinical judgment. Essential factors, such as nutritional status and prior treatment, were not fully controlled, which may have influenced the laboratory findings.

**Conclusion:**

Elevated pleural fluid ADA levels, along with hematological markers such as WBC count, lymphocyte and polymorph percentages, and ESR, are valuable in distinguishing tuberculous pleural effusion from non-tuberculous cases. These parameters can serve as useful adjuncts in the diagnostic evaluation of pediatric pleural effusions, though further research is warranted to identify additional biomarkers and improve diagnostic accuracy.

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# Relationship Between Thyroid Autoimmunity Status and Levothyroxine Dose in Hypothyroid Patients with or without Type 2 DM

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Submission Date : 27 Jan 2026
Accepted Date : 03 March 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90054

**Abstract**

**Background:**
Hypothyroidism is the most common thyroid problem in Bangladesh and worldwide. Autoimmune thyroid disease is the most common cause of hypothyroidism. Levothyroxine (LT4) dose requirements vary among patients and may be influenced by thyroid autoantibody status and metabolic comorbidities such as type 2 diabetes mellitus (T2DM) to achieve euthyroidism.

**Objective:**
To assess the relationship between thyroid autoantibody status and levothyroxine dose requirements in hypothyroid patients with or without T2DM.

**Methods:**
This cross-sectional study was conducted at the Department of Biochemistry, BIRDEM General Hospital, from July 2024 to June 2025 on 100 patients with hypothyroidism recruited from outpatient department of endocrinology, BIRDEM, Dhaka, and divided into two groups: Group 1 (Hypothyroid patients with T2DM, n=50) and Group 2 (Hypothyroid patients without T2DM, n=50). Data on demographic, physical, biochemical variables and dose of levothyroxine were collected. Thyroid peroxidase (TPO) antibody, thyroglobulin (Tg) antibody, TSH and HbA1c were measured. Statistical analysis was performed using SPSS version 29.0.

**Results:**
Among 100 patients with hypothyroidism, mean age was 49.66±11.19 years in Group 1 and 45.84±14.4 years in Group 2. TPO antibody positivity was significantly lower in hypothyroid patients with T2DM (36%) compared to those without T2DM (66%) (p=0.003).The mean levothyroxine dose was substantially higher among anti-TPO positive patients than anti-TPO negative patients (67.6±28.0 µg vs. 40.6±17.8 µg, p<0.001), with a similar pattern observed for anti-Tg positivity (74.1±32.3 µg vs. 46.7±20.3 µg, p<0.001).

**Conclusion:**
Thyroid autoantibody positivity is strongly associated with higher levothyroxine dose requirements in hypothyroid patients, irrespective of diabetes status. Recognition of thyroid autoimmunity is essential for individualized dose optimization.

**Keywords:** Hypothyroidism, Levothyroxine, Thyroid autoantibody, Type 2 diabetes mellitus.

**Citation:** Rahman M,Bakas MA,Ara R,Anwar MMU,Sultana N,Sarker A.Relationship Between Thyroid Autoimmunity Status and Levothyroxine Dose in Hypothyroid Patients with or without Type 2 DM.J Rang Med Col.2026 Mar;11(1):177-182.doi: https://doi.org/10.3329/jrpmc.v11i1.90054

## Introduction:

Hypothyroidism is a common endocrine disorder characterized by insufficient thyroid hormone production, leading to metabolic and systemic disturbances, most frequently caused by autoimmune thyroiditis.[1] Levothyroxine (LT4) remains the standard treatment, aimed at restoring euthyroidism with dosing traditionally based on body weight, age, and residual thyroid function. However, many patients require dose adjustments despite apparently adequate initial dosing.[2] Thyroid autoantibodies, particularly anti-thyroid peroxidase (anti-TPO) and anti- thyroglobulin (anti-Tg) antibodies, reflect ongoing autoimmune

destruction of thyroid tissue.[3] Persistent autoimmune activity may influence endogenous hormone production and peripheral thyroid hormone metabolism, potentially affecting LT4 requirements.[4] Type 2 diabetes mellitus (T2DM) commonly coexists with hypothyroidism, raising challenges for clinical care.[5] Insulin resistance, chronic inflammation, altered gastrointestinal absorption, and poly pharmacy in T2DM may further modify levothyroxine pharmacokinetics and pharmacodynamics.[6,7] Type 2 diabetes mellitus (T2DM) is frequently associated with hypothyroidism, and altered thyroid hormone metabolism in diabetics may further affect levothyroxine dosing.[6] The higher LT4 dose requirement in autoimmune hypothyroidism can be explained by progressive lymphocytic infiltration and destruction of thyroid follicular cells, leading to diminished endogenous hormone production and reduced thyroid reserve.[8,9] Anti-TPO antibodies, in particular, are known to mediate antibody-dependent cytotoxicity and complement activation, accelerating thyroid tissue damage.[10] Consequently, patients with higher antibody titers often experience a more severe and persistent form of hypothyroidism, necessitating higher replacement doses to maintain euthyroidism. Data on the combined impact of thyroid autoimmunity and T2DM on LT4 dose requirement are limited, particularly in Bangladesh. This study aimed to explore the relationship between thyroid autoantibody status and levothyroxine dose requirement in hypothyroid patients and to assess whether the presence of T2DM modifies this relationship.

**Methods:**

A cross-sectional study carried out in the Department of Endocrinology at BIRDEM general hospital, Dhaka from July 2024 to June 2025. Ethical clearance was obtained from Institutional Review Board of BIRDEM General hospital before starting the study. Informed written consent was taken from each eligible person. Adult patients (≥25 years) with hypothyroidism receiving stable LT4 therapy for at least 3 months, having recent thyroid function tests and available thyroid autoantibody profile (anti-TPO and/or anti-Tg) were included. Any other thyroid disorder including thyroid surgery, radioactive iodine ablation, thyroid cancer, hyperthyroidism etc., any type of acute and chronic illness like ESRD, COPD, CVD, IHD etc., Type 1 diabetic patients, pregnancy and lactation, malignancy, use of drugs interfering with LT4 absorption (e.g., cholestyramine, rifampicin) unless dose stable were excluded. The demographic data of the patients include age, gender, weight, height, blood pressure, body mass index (BMI), waist-hip circumference (WHC) were recorded. The disease duration, smoking status and drug usage affecting levothyroxine absorption like proton pump inhibitors (PPI) were noted. All patients were receiving levothyroxine sodium tablets. The patients were on a standard fixed dose. After 8 to 10 hours overnight fasting blood sample were collected. Completion of sample collection, serum TSH and $FT_4$ levels was estimated at Hormone Laboratory and thyroid antibody (Anti TPO antibody and Anti Tg antibody) levels was estimated at Immunology Laboratory of BIRDEM General Hospital. TSH ,TPOAb and TgAb levels were measured by the same assay using the chemiluminescent microparticle immunoassay (CMIA) method. The serum TSH level for a euthyroid state was between 0.47-5.01μIU/L. The level of TPOAb was <60 U/mL and TgAb<4.5 IU/ml respectively. Values above these levels were considered positive for antibodies. All the results were compiled, and then statistical analysis was performed with the help of SPSS 29.0 version. Descriptive statistics were presented as Mean±SD, median and frequency (%). Group comparisons were performed using Chi-square test or Fisher exact test for categorical variables and Mann–Whitney U test for continuous variables. Correlations between thyroid autoantibodies and levothyroxine dose were analyzed using Spearman's rank correlation coefficient. A p-value <0.05 was considered statistically significant.

**Results:**

Among 100 hypothyroid patients, 50 had coexisting type 2 diabetes mellitus (Group 1) and 50 had hypothyroidism without T2DM (Group 2). The mean age of hypothyroid patients with T2DM was 49.66±11.19 years, while those without T2DM averaged 45.84±14.4 years. BMI was higher in the T2DM group (27.77±4.65 kg/m$^2$) compared to the non-T2DM group (26.04±3.78 kg/m$^2$), though this difference was not significant. There were no significant differences between the groups in terms of mean age, BMI or waist-hip ratio. Female patients predominated in both groups, and gender distribution was comparable (Table-I).

Anti-TPO antibody positivity was significantly higher in Group 2 compared to Group 1(66% vs 36%, p=0.003). Although anti-thyroglobulin antibody positivity was also more frequent in Group 2(36% vs 20%), this difference did not reach statistical significance (p=0.075) (Table-II).

Mean serum TSH and free T4 levels were comparable between the two groups (p >0.05). As expected, fasting blood glucose and HbA1c levels were significantly higher in Group 1 than in Group 2(p<0.001 for both).No significant correlations were observed between anti-TPO or anti-Tg antibody levels and glycemic or thyroid function parameters in patients with T2DM. In patients without T2DM, anti-Tg antibody showed a weak positive correlation with TSH (r=0.199, p=0.048). Patients with positive anti-TPO antibodies required significantly higher doses of levothyroxine compared to antibody-negative patients (67.6±28.0 µg vs 40.6±17.8 µg, p<0.001). Similarly, anti-Tg- positive patients required higher doses than anti-Tg-negative patients (74.1±32.3 µg vs 46.7±20.3 µg, p<0.001). Patients with overall positive thyroid autoimmunity status also required significantly higher levothyroxine doses than those without autoimmunity (66.5±28.1 µg vs 40.7±18.0 µg, p<0.001) (Table-III).

**Table-I: Comparison of demographic variables among study subjects (N=100)**

| Variables | Group-1 (n=50) Mean±SD no. (%) | Group-2 (n=50) Mean±SD no. (%) | p-value |
|---|---|---|---|
| Age (years) | 49.66±11.19 | 45.84±14.4 | 0.064[a] |
| BMI (kg/m ) | 27.77±4.65 | 26.04±3.78 | 0.071[a] |
| Waist-Hip Ratio | 0.86±0.027 | 0.86±0.025 | 0.735[a] |
| **Gender** | | | |
| Female | 45(90) | 44(88) | 0.749[b] |
| Male | 5(10) | 6(12) | |

Values are expressed as Mean±SD, Frequency (%) shows within parenthesis.
[a]Mann-Whitney U test, [b]Chi-square test. p-value is significant <0.05.

**Table-II: Comparison of thyroid autoantibodies among study population (N=100)**

| Variables | Group-1 (n=50) no.(%) | Group-2 (n=50) no. (%) | p-value* |
|---|---|---|---|
| **Thyroid peroxidase (TPO) antibody** | | | |
| Positive | 18(36) | 33(66) | 0.003 |
| Negative | 32(64) | 17(34) | |
| **Thyroglobulin (Tg) antibody** | | | |
| Positive | 10(20) | 18(36) | 0.075 |
| Negative | 40(80) | 32(64) | |

Values are expressed as Frequency (%) shows within parenthesis.
*p-values are obtained by Chi-square test. p-value is significant <0.05.

**Table-III: Dose of thyroxin by antibody and autoimmunity status of study population (N=100)**

| Variables | Category | Dose of Thyroxin (µgm) (Mean±SD) | Median (µg) | p-value* |
|---|---|---|---|---|
| Anti-TPO | Negative | 40.6±17.8 | 50.0 | <0.001 |
| | Positive | 67.6±28.0 | 50.0 | |
| Anti-Tg | Negative | 46.7±20.3 | 50.0 | <0.001 |
| | Positive | 74.1±32.3 | 75.0 | |
| Thyroid Autoimmunity Status | Negative | 40.7±18.0 | 50.0 | <0.001 |
| | Positive | 66.5±28.1 | 50.0 | |

Values are expressed as Mean±SD, Median.
*Mann-Whitney U test. p-value is significant <0.05.

**Discussion:**

In this study, the mean age of hypothyroid patients with T2DM was 49.66±11.19 years, while those without T2DM averaged 45.84±14.4 years, with no statistically significant difference (p=0.064). BMI was higher in the T2DM group (27.77±4.65 kg/m$^2$) compared to the non-T2DM group (26.04±3.78 kg/m$^2$), though this difference was not significant. A case-control study of 302 T2DM patients and 310 non-diabetic controls, observing no significant age differences but a notable difference in BMI, which contrasts with the current study.[11] The waist-hip ratio in this study showed no intergroup differences, another study found central obesity more frequent in diabetics.[11] Gender distribution was similar between the groups (female 90% vs. 88%, p=0.749), consistent with other study, who reported no significant gender differences (58.9% vs. 58.4%, p=0.95).[11]

The present study found that the prevalence of TPO antibody positivity was significantly lower in hypothyroid patients with T2DM (36%) than in those without T2DM (66%) (p=0.003). Thyroglobulin antibody (Anti-Tg) positivity was higher in non-diabetic hypothyroid patients (36%) compared to T2DM patients (20%), but this difference was not statistically significant. This finding suggests that chronic hyperglycemia and insulin resistance in T2DM may modulate immune activity, resulting in attenuated thyroid autoimmunity.[12,13] Similar studies indicate that while hypothyroidism is common in T2DM, thyroid autoantibody expression may vary.[13,14] These findings align with reports that autoimmune markers, particularly TPO Ab, serve as reliable indicators of thyroid autoimmunity, but their prevalence may be attenuated in diabetic populations due to immune dysregulation.[5] The higher autoimmune positivity in non-diabetic hypothyroid patients highlights the importance of screening for thyroid autoantibodies, particularly in this group. Another study reported that 23.3% of T2DM patients with hypothyroidism were positive for thyroid autoantibodies.[15] Only a few studies have explored thyroid autoimmunity in hypothyroid patients with or without T2DM.

This study demonstrates a significant association between thyroid autoantibody positivity and increased levothyroxine dose requirements in hypothyroid patients. Patients with positive anti-TPO, anti-Tg, or overall thyroid autoimmunity required substantially higher doses of levothyroxine compared to antibody negative patients. These findings highlight the clinical importance of autoimmune status when managing hypothyroidism. Autoimmune thyroiditis leads to progressive destruction of thyroid tissue, resulting in diminished endogenous hormone production. Persistent autoimmune activity, reflected by the presence of thyroid autoantibodies, may explain the increased reliance on exogenous levothyroxine.[16]

In this study, the mean levothyroxine dose was substantially higher among anti-TPO positive patients than anti-TPO negative patients (67.6±28.0 µg vs. 40.6±17.8 µg, p<0.001), with a similar pattern observed for anti-Tg positivity (74.1±32.3 µg vs. 46.7±20.3 µg, p<0.001). Furthermore, patients classified as having positive thyroid autoimmunity (both antibody) required significantly higher LT4 doses than those without autoimmune thyroid disease (66.5±28.1 µg vs. 40.7 ±18.0 µg, p<0.001). These results strongly suggest that the autoimmune process itself, rather than thyroid hormone levels alone, influences levothyroxine requirements.

A previous study done in Turkey of about 303 patients (273 females and 30 males with the mean [SD] age of 46.6 [13.2] years), and had found antibody-positive group (n=210) average daily levothyroxine dose was significantly higher than in the antibody-negative group (n=93) (mean of 78.8 [36.7] vs 64.2 [27.1] mg/day, P=.001, respectively). There was a low but significant positive relationship between the TPOAb (r=0.217, P<.01) and TgAb levels (r=0.158, P<.05) and levothyroxine doses in the antibody-positive group.[17]

Although thyroid autoimmunity was significantly more prevalent among hypothyroid patients without T2DM in this study, the relationship between antibody positivity and levothyroxine dose remained consistent across the entire study population. This suggests that diabetes status does not substantially modify the impact of thyroid autoimmunity on LT4 requirements. Notably, serum TSH and FT4 levels did not differ significantly between antibody-positive and antibody-negative groups, indicating that higher LT4 doses were required to achieve comparable biochemical control in autoimmune hypothyroidism.

From a clinical perspective, these findings highlight the importance of assessing thyroid

autoimmunity at the time of diagnosis of hypothyroidism. Identification of anti-TPO and anti-Tg antibodies may help clinicians anticipate higher levothyroxine dose requirements, closer monitoring, and more frequent dose adjustments. This is particularly relevant in resource-limited settings, where delayed achievement of euthyroidism can contribute to persistent symptoms and increased cardiovascular risk.

In summary, the study provides robust evidence that thyroid autoimmunity is a key determinant of levothyroxine dose requirement in hypothyroid patients. Positive thyroid autoantibodies and autoimmune thyroid status are associated with significantly higher LT4 doses, independent of T2DM status. Incorporating thyroid autoantibody testing into routine evaluation may facilitate more individualized and effective management of hypothyroidism.

**Limitations:**

This study has some limitations. All the patients were already under LT4 replacement therapy. Our study has fewer sample and hence cannot be generalized. Cross-sectional design limits causal inference.Single-center study may reduce generalizability. Lack of longitudinal follow-up for dose adjustments.

**Conclusion:**

Thyroid autoimmunity and T2DM independently contribute to higher levothyroxine requirements in hypothyroid patients. Individualized dosing strategies considering these factors may optimize treatment outcomes. The findings of this study suggest that clinicians should consider both autoimmunity status and comorbid diabetes when titrating levothyroxine in Bangladeshi patients. Personalized dosing may improve symptom control and reduce the risk of under- or over treatment.

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# Neurodevelopmental and Growth Outcomes Among Low-Birth-Weight Infants Receiving Early Kangaroo Mother Care: A Cross-Sectional Study

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Submission Date : 29 Jan 2026
Accepted Date : 03 March 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90056

**Abstract**

**Background:**
Infants with low-birth-weight face heightened risks of mortality, growth retardation, and neurodevelopmental deficits, especially in resource-limited environments. Kangaroo Mother Care (KMC) enhances survival and growth. However, data concerning its long-term neurodevelopmental effects in Bangladesh is still insufficient.

**Objective:**
To evaluate neurodevelopmental and growth outcomes in low-birth-weight children receiving early Kangaroo Mother Care and to identify predictors of developmental delay.

**Methods:**
This cross-sectional analytical study was conducted at Bangladesh Shishu Hospital & amp; Institute, Dhaka from June 2023 to November 2023, involving 65 low-birth-weight children aged 12 to 36 months who received early Kangaroo Mother Care there. The ASQ-3 was used to look at neurodevelopment, and WHO standards were used to look at anthropometric measurements. Chi-square tests, independent t-tests, pearson correlation, and multivariable logistic regression were used to identify predictors of developmental delay.

**Results:**
In general, 67.9% of children demonstrated age-appropriate growth across all areas, with early initiation of Kangaroo Mother Care within 24 hours (AOR=0.38, p=0.026) and daily practice exceeding eight hours (AOR=0.41, p=0.045) serving as protective factors. A longer duration of KMC was positively associated with elevated ASQ-3 scores (r=0.18–0.29, p<0.05). Children with delays had much lower anthropometric measurements.

**Conclusion:**
Early and continuous Kangaroo Mother Care enhances neurodevelopment and growth in low-birth-weight children, underscoring its significance in conjunction with nurturing home environments in resource-constrained contexts.

**Keywords:** Low Birth Weight, KMC, Neurodevelopment, ASQ-3, Growth Outcomes, Developmental Delay.

**Citation:** Chowdhury MH,Islam T.Neurodevelopmental and Growth Outcomes Among Low-Birth-Weight Infants Receiving Early Kangaroo Mother Care: A Cross-Sectional Study.J Rang Med Col.2026 Mar;11(1):183-188.doi: https://doi.org/10.3329/jrpmc.v11i1.90056

## Introduction:

Low-birth-weight (LBW) infants, defined as those weighing less than 2,500 g at birth, remain a major global public health concern. Compared with normal-birth-weight infants, they face substantially higher risks of neonatal mortality, severe infections, impaired physical growth, and adverse neurodevelopmental outcomes.[1] Globally, an estimated 20 million infants are born with LBW each year, and more than 80% of these births occur in low- and middle-income countries (LMICs), where access to advanced neonatal intensive care services is often limited and the burden of prematurity is disproportionately high.[2] Kangaroo Mother Care (KMC) was first introduced in the late 1970s in Bogot6, Colombia, by Rey

Sanabria and colleagues as an innovative response to high neonatal mortality and shortages of incubators.[3] KMC consists of early, continuous skin-to-skin contact between the infant and caregiver, promotion of exclusive breastfeeding, and structured support for early discharge with appropriate follow-up.[4] Over the past decades, numerous systematic reviews and meta-analyses have demonstrated that KMC significantly reduces neonatal mortality, severe infections, and hypothermia, while improving weight gain, head circumference growth, and linear growth among preterm and LBW infants.[5] Emerging evidence also suggests potential neurodevelopmental benefits, including improved cognitive and neurobehavioral outcomes; however, heterogeneity in study design, assessment tools, and duration of follow-up limits definitive conclusions.[6]

In Bangladesh, neonatal mortality remains a pressing challenge, accounting for more than two-thirds of under-five child deaths.[7] The estimated prevalence of LBW ranges from 20% to 22%, placing a large proportion of newborns at risk of growth faltering, motor delay, and cognitive impairment.[8] These risks are further compounded by socioeconomic constraints, limited healthcare infrastructure, and inadequate early developmental screening and intervention services.[9] Since the early 2000s, KMC has been incorporated into facility-based newborn care programs in tertiary and district hospitals across Bangladesh.[10] Evidence from neonatal units in Dhaka and Chittagong indicates that infants receiving continuous KMC experience faster weight gain at discharge and higher rates of exclusive breastfeeding at six weeks compared with standard care.[11]

Regional evidence from India and Pakistan similarly highlights survival benefits and shorter hospital stays associated with KMC, although findings regarding long-term neurodevelopment remain inconsistent.[12] Studies from Southeast Asia emphasize improvements in growth and breastfeeding, yet comprehensive long-term developmental data remain scarce.[13] Therefore, further context-specific research is essential to clarify the sustained neurodevelopmental impact of KMC in Bangladesh and similar settings.

**Methods:**

This hospital-based cross-sectional analytical study was conducted at Bangladesh Shishu Hospital & Institute, Dhaka from June to November 2023, involving 165 low-birth-weight children aged 12–36 months who received early Kangaroo Mother Care (KMC)[14] within 24 hours of birth. Children with congenital anomalies, genetic syndromes, severe neurological disorders, or incomplete records were excluded from the study. Neurodevelopmental outcomes were assessed using the Ages and Stages Questionnaire, Third Edition (ASQ-3),[15] which evaluated communication, gross motor, fine motor, problem-solving, and personal-social domains. Anthropometric measurements, including weight, height/length, mid-upper arm circumference, and head circumference, were taken according to WHO growth standards.[16] Data were analyzed using SPSS software version 26. Adjusted odds ratios with 95% confidence intervals were calculated, and statistical significance was set at $p<0.05$. Ethical approval was obtained from Dhaka Shishu (Children) Hospital, and informed consent was secured from the caregivers prior to participation.

**Results:**

Table-I showed the socio-demographic and birth characteristics of 165 babies who were born with a low birth weight. The majority were 18 to 23 months old (33.9%) and male (52.7%). The weights of the babies at birth ranged from 1000 to 2499 grams, with 43.6% falling between 1500 and 1999 grams. Prematurity was common (74.5%), and 41.8% needed to go to the NICU, which shows that they were very vulnerable clinically.

Table-II showed the main features of Kangaroo Mother Care (KMC) for 165 babies. Most babies (59.4%) got KMC within 24 hours. Of those, 44.8% got it 4–8 hours a day and 39.4% got it more than 8 hours a day. A large number (67.9%) continued KMC at home, which shows that they followed the rules after they left the hospital.

Table-III showed anthropometric measurements of 165 kids between the ages of 12 and 36 months. The average weight was 9.8±1.4 kg, the average height was 79.6±5.3 cm, the average mid-upper arm circumference (MUAC) was 14.1±1.1 cm, and the average head circumference was 46.3±1.9 cm. The ranges show that the growth of the group was different.

**Table-I: Socio-demographic and birth characteristics (N=165)**

| Demographic and birth characteristics | no. (%) |
|---|---|
| **Age (months)** | |
| 12–17 | 52(31.5) |
| 18–23 | 56(33.9) |
| 24–29 | 35(21.2) |
| 30–36 | 22(13.3) |
| **Sex** | |
| Male | 87(52.7) |
| Female | 78(47.3) |
| **Birth Weight** | |
| 1000–1499 g | 38(23.0) |
| 1500–1999 g | 72(43.6) |
| 2000–2499 g | 55(33.4) |
| **Gestational Age** | |
| <37 weeks | 123(74.5) |
| ≥37 weeks | 42(25.4) |
| NICU Admission | |
| Yes | 69(41.8) |
| No | 96(58.2) |

**Table-II: Kangaroo mother care (kmc) characteristics (N=165)**

| Variable | no. (%) |
|---|---|
| **KMC Initiation** | |
| Within 24 hrs | 98(59.4) |
| 24–72 hrs | 45(27.3) |
| >72 hrs | 22(13.3) |
| **Daily KMC Duration** | |
| <4 hrs | 26(15.8) |
| 4–8 hrs | 74(44.8) |
| >8 hrs | 65(39.4) |
| **Continued at Home** | |
| Yes | 112(67.9) |
| No | 53(32.1) |

**Table-III: Anthropometric measurements at assessment (12–36 months)**

| Parameter | Mean±SD | Minimum | Maximum |
|---|---|---|---|
| Weight (kg) | 9.8±1.4 | 7.2 | 13.1 |
| Height (cm) | 79.6±5.3 | 69.4 | 92.8 |
| MUAC (cm) | 14.1±1.1 | 12.2 | 16.8 |
| Head Circumference (cm) | 46.3±1.9 | 42.5 | 50.1 |

Table-IV showed the neurodevelopmental results of 165 kids who were tested with the ASQ-3. Most of the kids were "on track" in all areas. The highest percentages were in Personal-Social (84.8%) and Fine Motor (83%). A smaller percentage fell into the Monitor Zone or Below Cutoff, which means they need help growing in those areas.

Table-V showed that early KMC initiation and >8 hours/day were protective against developmental delay, while preterm birth, recurrent illness, and low home stimulation significantly increased risk. Maternal education was not significantly associated in the adjusted model.

**Table-IV: Neurodevelopmental outcomes using ASQ-3 (N=165)**

| Domain | On Track no. (%) | Monitor Zone no. (%) | Below Cutoff no. (%) |
|---|---|---|---|
| Communication | 123(74.5) | 26(15.8) | 16(9.7) |
| Gross Motor | 132(80.0) | 21(12.7) | 12(7.3) |
| Fine Motor | 137(83.0) | 18(10.9) | 10(6.1) |
| Problem Solving | 126(76.4) | 24(5) | 15(9.1) |
| Personal-Social | 140(84.8) | 17(10.3) | 8(4.8) |

**Table-V: Multivariable logistic regression: predictors of developmental delay (N=165)**

Outcome: Suspected developmental delay (Yes=30, No=135)

| Variable | Adjusted OR | 95% CI | p-value |
|---|---|---|---|
| KMC initiation within 24 hrs | 0.38 | 0.16–0.89 | 0.026 |
| KMC >8 hrs/day | 0.41 | 0.17–0.98 | 0.045 |
| Preterm birth | 2.35 | 1.02–5.41 | 0.044 |
| Recurrent illness | 2.58 | 1.15–5.77 | 0.021 |
| Low home stimulation | 3.06 | 1.37–6.84 | 0.006 |
| Maternal education (secondary+) | 0.61 | 0.27–1.38 | 0.23 |

Figure-1 showed the developmental status of 165 low-birth-weight children aged 12 to 36 months, as measured by the ASQ-3. Most kids were "on track" in all areas, with the highest percentages in Personal-Social (84.8%) and Fine Motor (83%). A smaller number of kids were in the Monitor Zone or Below Cutoff, which means they needed extra help to develop.

Figure-II displayed adjusted odds ratios for predictors of developmental delay in children with low birth weight (n=165). KMC for 24 hours or less and more than 8 hours a day lowers the risk (ORs=0.38, 0.41). Preterm birth, recurrent illness, and low home stimulation elevate risk (ORs=2.35–3.06), whereas maternal education indicates a nonsignificant protective trend (OR=0.61).

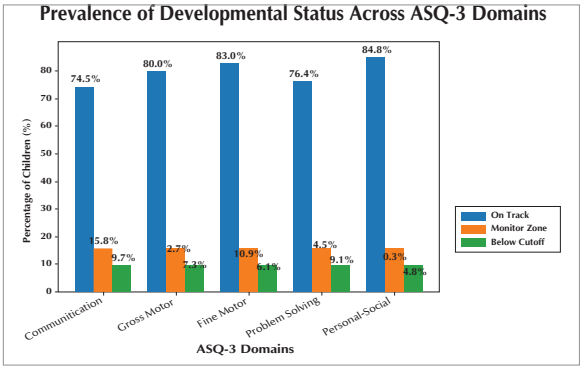



**Figure-1: Domain-wise prevalence of developmental status assessed by ASQ-3 among low-birth-weight children aged 12–36 months (N=165)**

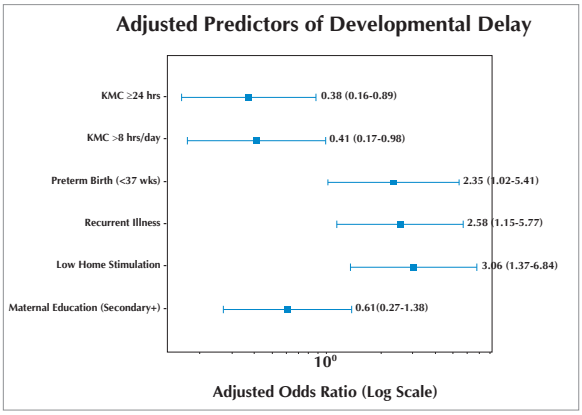



**Figure-II: Adjusted odds ratios for predictors of suspected developmental delay among low-birth-weight children (Multivariable logistic regression model, N=165)**

**Discussion:**

This study evaluated neurodevelopmental outcomes among 165 low-birth-weight (LBW) children aged 12–36 months who received early Kangaroo Mother Care (KMC). Overall, 18.2% of children showed suspected developmental delay, while 67.9% demonstrated age-appropriate performance across all ASQ-3 domains. These findings are broadly consistent with international evidence suggesting that early initiation and longer daily duration of KMC are associated with improved developmental outcomes. Vaidya et al (2018) reported lower rates of developmental delay among infants receiving early KMC compared to those who did not (15% vs. 28%).[17] Similarly, Charpak et al (2017) observed significantly higher cognitive and motor scores among infants exposed to KMC for at least eight hours per day.[4] In the present study, initiation of KMC within 24 hours (AOR=0.38, p=0.026) and continuation for more than eight hours daily (AOR=0.41, p=0.045) were independently protective, supporting a dose–response relationship between sustained KMC exposure and improved neurodevelopment.

Consistent with previous Bangladeshi research, preterm birth emerged as a significant risk factor for developmental delay. Khan et al (2018) reported increased odds of delay among preterm LBW children (OR=2.8),[18] closely aligning with the current findings (AOR=2.35, p=0.044). Recurrent illness was also significantly associated with higher risk, underscoring the importance of infection prevention and continuous health monitoring in early childhood. In contrast to some national studies, maternal education did not demonstrate a statistically significant protective effect in this cohort, possibly reflecting sample characteristics or variations in socioeconomic context.

Home stimulation was identified as a strong independent predictor of neurodevelopment. Grantham-McGregor et al (2007) demonstrated that inadequate psychosocial stimulation adversely affects cognitive and socio-emotional development.[19] Correspondingly, low home stimulation in this study significantly increased the likelihood of developmental delay (AOR=3.06, p=0.006), highlighting the interaction between biological vulnerability and environmental enrichment.

Anthropometric findings further reinforced the link between growth and development. Similar to observations by Bhutta et al (2014),[20] children with suspected delay exhibited significantly lower weight, height, mid-upper arm circumference, and head circumference, suggesting concurrent growth and neurodevelopmental vulnerability.

**Limitations:**

There are some limitations in this study; the cross-sectional design makes it hard to draw conclusions about the cause-and-effect relationship between KMC exposure and developmental outcomes. The fact that it was done in only one tertiary hospital makes it hard to generalize.

**Conclusion:**

This study shows that early initiation and prolonged Kangaroo Mother Care (KMC) are strongly linked to improved neurodevelopmental outcomes in low-birth-weight infants. Factors such as prematurity, frequent illness, and inadequate home stimulation increase the risk of developmental delay. The findings emphasize the importance of integrating KMC with supportive environments for optimal growth and brain development in resource-limited settings like Bangladesh.Health systems should make it easier for people to start and keep doing Kangaroo Mother Care in both hospitals and homes. Follow-up programs should include structured counseling for parents on how to stimulate their children at home and keep them from getting sick. Longitudinal multicenter studies are needed to look at long-term neurodevelopmental monitoring and what they mean for policy.

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Open access Original article

# Comparative Evaluation of Green Tea Pretreatment on Serum Biochemical Markers in Gentamicin-Induced Nephrotoxicity among Long Evans Rats

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Submission Date : 29 Jan 2026
Accepted Date : 03 March 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90057

**Abstract**

**Background:**
Aminoglycoside antibiotic gentamicin is a widely used clinical agent with nephrotoxicity that is dose related. The pathogenesis of kidney injury that occurs due to drugs is based on oxidative stress.

**Objective:**

**Methods:**
The experimental in vivo study was carried out from 1st July 2019 to 30th June 2020 in Sir Salimullah Medical College, Dhakawhere 30 healthy male Long Evans rats aged between 90-120 days. Statistical analysis was done using SPSS v22 with ANOVA and post hoc Bonferonni test ($p \leq 0.05$).

**Results:**
Green tea pretreatment significantly reduced the gentamicin-induced increases in serum creatinine (1.02±0.12 vs 1.54±0.16 mg/dL, $p<0.001$), serum urea(46.2±4.9 vs 72.3±6.1mg/dL, $p<0.001$), and BUN (22.1±2.4 vs 33.7±3.1mg. The pretreatment group had an intermediate weight of the kidneys (1.14-0.20g) compared to the control group and the gentamicin-treated group.

**Conclusion:**
The green tea extract is effective in providing meaningful nephroprotective effects in gentamicin-induced kidney injury, which is probably due to antioxidant effect.

**Keywords:** Green tea extract, Gentamicin, Nephrotoxicity, Nephroprotection

**Citation:** Nishat RJ,Halim MR.Chowdhury R,Das TN,Rahman AR.Comparative Evaluation of Green Tea Pretreatment on Serum Biochemical Markers in Gentamicin-Induced Nephrotoxicity among Long Evans Rats.J Rang Med Col.2026 Mar;11(1):189-195.doi:https://doi.org/10.3329/jrpmc.v11i1.90057

## Introduction:

The life-saving agents worldwide to rescue patients with life-threatening gram-negative bacterial infections are amino glycoside antibiotics, such as gentamicin and they have surfaced to be active against a wide range of microorganisms.[1] Gentamicin is a routine in intensive care of life-threatening infections like sepsis, peritonitis, respiratory and urinary tract infections, as it has a wide-range of antimicrobial activity and bactericidal effects. Although it is highly effective, therapeutic gentamicin is highly restricted due to its nephrotoxicity which remains a serious issue in clinical practice.[2] Nephrotoxicity has been observed in 10–25% of patients who have received gentamicin, depending on dose, duration of exposure, and inbuilt susceptibility, making it one of the biggest clinical challenges to antimicrobial therapy.[2] Gentamicin nephrotoxicity is reversible, dose-dependent acute renal damage manifested by hyperserotonemia, rising blood urea nitrogen (BUN), and decreasing glomerular filtration rate.[3] The underlying pathophysiological mechanism is largely the selective intracellular accumulation of gentamicin in kidney proximal tubular epithelial cells. This accumulation triggers an imbalance in ROS formation and removal, thus triggering the pathways of oxidative stress towards lipid peroxidation, mitochondrial injury, and apoptosis of tubular cells of the kidney.[2]Oxidative

stress, therefore, becomes critical in the pathogenesis of drug-induced renal injury, and it is a most significant imbalance between ROS formation and antioxidant body defense mechanisms.[4] Lipid peroxidation in renal tissues induced by gentamicin leads to cellular membrane integrity disruption, destabilization of mitochondrial and endoplasmic reticulum structure, and ultimately tubular necrosis and functional decline.[5] At present, clinical treatment for gentamicin-induced nephrotoxicity remains inadequate, primarily involving reduction or withdrawal after the onset of renal impairment. Regrettably, as of today, there are no pharmacologic products, which can be proven to prevent or reverse the renal toxicity of aminoglycoside therapy.[3] This highlights the necessity of new strategies especially those that apply natural products with antioxidant and cytoprotective properties. Natural antioxidants have become a subject of an increased interest in the recent past due to the emergence of novel methods of treatment against oxidative stress-induced tissue damage. Among them, there is green tea, a ubiquitous extract of Camellia sinensis, which is full of polyphenolic compounds, such as epigallocatechin gallate (EGCG) and catechin and epicatechin, which have a strong radical scavenging and antioxidant properties.[6] These bioactive compounds are found to inhibit oxidative stress in liver, heart, and nervous system and in chemical induced organ toxicities.[7,8] This has been notwithstanding the lack of experimental studies that specifically describe the nephroprotective effects of pre-treating animals with gentamicin induced renal injury with green tea.[9] The present study, therefore, sought to discuss the protective effects of green tea extract pretreatment in gentamicin induced nephrotoxicity by estimating the serum renal function markers and relating these biochemical changes with the histopathological changes. The pretreatment treatment with green tea must lower the increase in the serum creatinine, urea, and BUN levels caused by gentamicin by a significant margin due to its strong antioxidant and membrane-stabilizing effects. The identification and clarification of the green tea protective mechanisms shall be used to come up with supportive adjuvant treatment strategies to prevent or reduce drug-induced renal injury in the clinic.

**Methods:**

The experimental in vivo study was carried out from 1st July 2019 to 30th June 2020 in the Department of Physiology, Sir Salimullah Medical College, Dhaka, with the help of an ethical clearance of the Institutional Ethics Committee (IEC). Purposive sampling was used to select 30 healthy Long Evans male rats between the age of 90 to 120 days and 150-200 g, after which they were randomized. The sample size was determined according to the level of serum creatinine in the study and control groups and it was estimated to 10 rats/group. The rats were all acclimatized for 14 days of standard conditions (23±2 C, 12-hour light-dark cycle) with access to food and water in a free environment. The animals were then put into control (Group A) and experimental (Group B) groups. Group A was a baseline control (A1) that was treated with saline and a gentamicin-treated control (A2) that was administered 80 mg/kg/day intraperitoneally in the final three days. Group B was administered with extract of green tea (300mg/kg/day orally over 28 days) and on the final three days, gentamicin was injected. The feasibility of the study was a pilot study aimed at establishing the most effective dose of gentamicin as a nephrotoxic. At the end of the research, rats were sacrificed and kidney and blood sampled. Kidney tissue was also evaluated to determine the content of MDA and histopathological changes, and the measurements of serum creatinine, urea and BUN were performed using automated analyzers. Preparation of histology slides and visualization under a microscope were carried out and photomicrographs obtained. The SPSS v22 was used to run statistics and the results reported as mean±SD. Where applicable, ANOVA with post hoc Bonferonni, paired t-test and Fisher exactly test were used with $p \leq 0.05$ being the criterion of statistical significance.

**Results:**

The text describes a study on three groups of rats: Group A1 (baseline control), Group A2 (gentamicin control), and Group B (gentamicin and green tea). The groups were similar in age and body weight, confirming randomization. There were no differences in body weight changes ($p=0.07$), but kidney weight varied significantly ($p<0.001$), with Group A2 showing the highest weight at 1.32 g, followed by Group B at 1.14 g,

**Table-I: Baseline characteristics of study population (N=30)**

| Baseline characteristics | A1 (Baseline Control) | A2 (Gentamicin Control) | B (Green Tea + Gentamicin) | p-value |
|---|---|---|---|---|
| Number of rats | 10 | 10 | 10 | - |
| Age (days, mean±SD) | 104±8 | 106±7 | 105±6 | 0.72 |
| Initial body wt (g) | 175.8±9.8 | 182.0±13.2 | 179.1±7.8 | 0.43 |
| Final body wt (g) | 212.3±7.4 | 211.8±9.2 | 220.2±9.1 | 0.07 |
| % Change in body wt | 21.1±6.3 | 16.7±5.4 | 23.1±6.3 | 0.07 |
| Kidney wt (g) | 0.87±0.07 | 1.32±0.18 | 1.14±0.20 | <0.001 |

**Table-II: Serum renal function markers across groups**

| Parameter | A1 (mean±SD) | A2 (mean±SD) | B (mean±SD) | ANOVA p |
|---|---|---|---|---|
| Serum creatinine (mg/dL) | 0.74±0.09 | 1.54±0.16 | 1.02±0.12 | <0.001 |
| Serum urea (mg/dL) | 30.4±2.9 | 72.3±6.1 | 46.2±4.9 | <0.001 |
| BUN (mg/dL) | 14.1±1.4 | 33.7±3.1 | 22.1±2.4 | <0.001 |

and Group A1 at 0.87 g (Table-I).

Table-II showed important serum renal function measurements from three test samples. Serum creatinine was higher in the gentamicin-treated group (1.54±0.16 mg/dL) compared to the baseline control (0.74±0.09 mg/dL), indicating severe kidney damage (ANOVA p<0.001). Green tea pretreatment lowered creatinine to 1.02±0.12 mg/dL. Serum urea levels were also high in the gentamicin group (72.3±6.1 mg/dL) but reduced to 46.2±4.9 mg/dL with green tea (p<0.001). Blood urea nitrogen increased to 33.7±3.1 mg/dL in gentamicin-treated rats, reduced to 22.1±2.4 mg/dL with green tea pretreatment (p<0.001).

Table-III shows comparisons of renal function among different experimental groups. Significant differences were found, especially with green tea pretreatment, which affected kidney function compared to control groups (p=0.001 or p=0.002). The gentamicin-treated group had notable kidney damage. Green tea did not fully inhibit this damage but offered strong protection against gentamicin effects.

**Table-III: Pairwise post-hoc (bonferroni) comparisons among groups**

| Parameter | A1 vs A2 | A1 vs B | A2 vs B |
|---|---|---|---|
| Serum creatinine | <0.001 | 0.002 | <0.001 |
| Serum urea | <0.001 | <0.001 | <0.001 |
| BUN | <0.001 | <0.001 | <0.001 |

Figure-2 showed the correlations among key renal function and morphological parameters in experimental rats. Good positive values were obtained between serum urea and creatinine (r=0.89), between BUN and creatinine (r=0.85), and between serum urea and BUN (r=0.91), in the fact that the two tended to increase in parallel during nephrotoxicity. Serum creatinine was moderately correlated with kidney weight (r=0.66), which supports the idea of hypertrophic alteration to accompany biochemical injury, whereas, percentage change in body weight was associated negatively (r=0.58), which supports loss of weight in more severely impaired rats.

Table-IV revealed the post-hoc comparisons involving all the renal function markers with the Bonferonni correction that is a rigorous statistical test of the differences between the experimental groups with multiple tests. The results indicate that the serum creatinine levels were not equal between all groups of pairwise comparison: baseline control group and gentamicin-treated control group (A1 vs A2, p<0.001), baseline control group and green tea-pretreated group (A1 vs B, p=0.002), as well as, there was significant difference between pretreated and gentamicin-treated group (A2 vs B, p<0.001). The patterns of serum urea and BUN levels were also similar in all three comparisons with p<0.001, i.e. highly

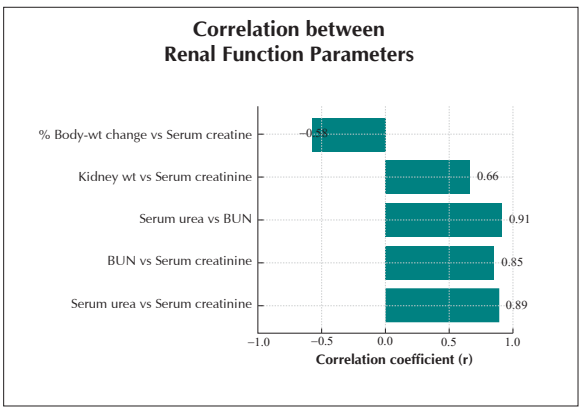



**Figure-1: Correlation between renal function parameters. Good positive correlations were found between serum urea and creatinine (r=0.89), BUN and creatinine (r=0.85), and serum urea and BUN (r=0.91) during nephrotoxicity. Serum creatinine had a moderate correlation with kidney weight (r=0.66),whereas, percentage change in body weight was associated negatively (r=0.58), which supports loss of weight in more severely impaired rats.**

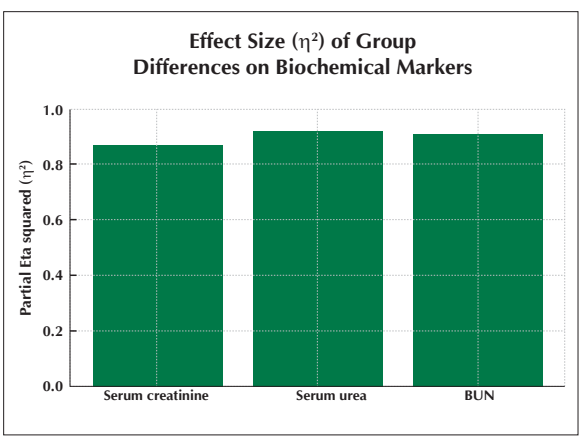



**Figure-2: Showed the correlations among key renal function and morphological parameters in experimental rats. Good positive values were obtained between serum urea and creatinine (r=0.89), between BUN and creatinine (r=0.85), and between serum urea and BUN (r=0.91), in the fact that the two tended to increase in parallel during nephrotoxicity. Serum creatinine was moderately correlated with kidney weight (r=0.66), which supports the idea of hypertrophic alteration to accompany biochemical injury, whereas, percentage change in body weight was associated negatively (r=0.58), which supports loss of weight in more severely impaired rats.**

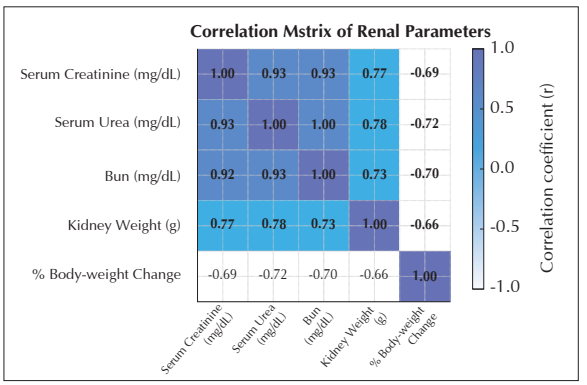



**Figure-3: The correlation matrix shows relationships between renal function indices, like serum creatinine and urea, and kidney morphological parameters. It notes positive correlations with nephrotoxicity and highlights that kidney weight increases in severely injured kidneys, while body-weight change is negatively correlated with serum creatinine.**

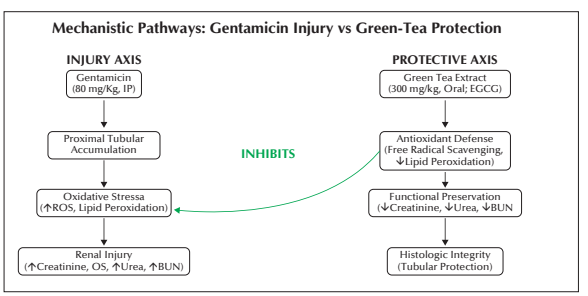



**Figure-4: The text discusses how green tea helps protect against kidney damage caused by gentamicin. It notes strong positive relationships between kidney function markers (serum creatinine, urea, BUN) and kidney weight, while body-weight change showed a negative correlation with serum creatinine, indicating weight loss in more affected rats.**

**Table-IV: Post-hoc pairwise comparisons (bonferroni-adjusted p)**

| Parameter | Comparison | Bonferroni p |
|---|---|---|
| Serum Creatinine (mg/dL) | A1 vs A2 | <0.001 |
| | A1 vs B | 0.002 |
| | A2 vs B | <0.001 |
| Serum Urea (mg/dL) | A1 vs A2 | <0.001 |
| | A1 vs B | <0.001 |
| | A2 vs B | <0.001 |
| BUN (mg/dL) | A1 vs A2 | <0.001 |
| | A1 vs B | <0.001 |
| | A2 vs B | <0.001 |

significant differences in all pairwise comparisons.

**Discussion:**

In this article, the experiment shows that pretreatment with green tea extract significantly attenuates gentamicin-induced nephrotoxicity in rats, as indicated by the unbelievable levels of serum urea, creatinine, and BUN levels in the experimental group compared to the control group. The results confirm the previously established nephrotoxicity profile of gentamicin and expand the existing understanding of antioxidant molecules of plant origin in the prevention of kidney damage associated with drug administration.[10] The difference in serum creatinine increase in gentamicin-treated controls (1.54±0.16mg/dL) and baseline controls (0.74±0.09mg/dL) is about two times, which is directly related to the intensive impairment of glomerular filtration that is characteristic of the pathophysiology of acute kidney injury.[11] It was interesting to note that green tea pretreatment reduced serum creatinine levels by a significant value of about 34% as compared to gentamicin-treated controls indicating that polyphenolic agents induce inherent renal protective systems. The subsequent rise in serum urea and BUN in animals treated with gentamicin is indicative of a blocked glomerular filtration process and tubular injury typical of nephrotoxicity induced by aminoglycosides. The fact that high and positive correlations have been set between these biochemical indicators (r=0.89 between urea and creatinine, r=0.85 between BUN and creatinine) indicates that a combination of these lessens indicates an increase in renal damage and confirms the use of multiple indicators in assessing extensively the nephrotoxic effect.[12] The pretreatment with green tea always reduced all three biomarkers, including serum urea (72.3 mg/dl to 46.2mg/dl) and BUN (33.7mg/dl to 22.1mg/dl), and indicated comprehensive broad-spectrum protection against functional renal derangement. These biochemical advantages refer to the fact that the green tea polyphenols, specifically, epigallocatechin gallate (EGCG), are effective in combating the cases of oxidative stress cascades which are induced by accumulation of gentamicin within proximal tubular cells.[13] Morphological findings on kidney weight provide additional evidence towards nephroprotection. Controls treated with gentamicin exhibited widespread renal hypertrophy (1.32±0.18 g), a defensive reaction against tubular damage and impairment in function. Intermediate kidney weight in the green tea group (1.14±0.20 g) suggests partial preservation of normal architecture and reduced structural remodeling.[14] The presence of moderate positive correlation between kidney weight and serum creatinine (r=0.66) suggests that the biochemical damage was followed by hypertrophic changes, and partial inhibition of the latter in the pretreatment group suggests that it acted protectionally at the structural and functional levels. These are the negative relationships between the change in body weight and the serum creatinine (r=-0.58) in severely diseased animals which are the systemic effects of advanced damage to the kidney such as metabolic imbalance and impaired absorption of nutrients. The pretreatment with green tea did not alter body weight significantly, which indicates the superiority of metabolic homeostasis and low body toxicity when compared to the control.This result is consistent with Asbaghi et al, that antioxidant polyphenols of plant origin provide multi-organ protection rather than local nephroprotection.[15] The mechanistic protection is demonstrated to include direct free-radical scavenging by green tea catechins, activation of endogenous antioxidant enzymes, and stabilization of cellular membrane integrity in proximal tubular cells that are vulnerable to gentamicin-induced lipid peroxidation.[16] However, despite significant protective effects, green tea pretreatment did not normalize renal function markers to baseline levels completely. This partial protection is a reflection either of the severity of the injury induced by gentamicin at the dose used or of potential constraints to polyphenol bioavailability and renal tissue penetration.[17] Further research ought to be done on dose-response relationships, the most appropriate time of intervention, and the possibility of combination nephroprotective drug synergies. In conclusion, this paper presents a significant rationale that green tea extract is an effective adjunctive therapy that could be used in preventing drug-induced nephrotoxicity and should be subject to further translational research in order to be applied in clinical practice in patients who need aminoglycoside therapy.

**Limitations:**
The study used only Long Evans rats, which may not apply to human kidney toxicity. Green tea extract's optimal dose and duration are unclear.

**Conclusion:**
Pretreatment with green tea extract prevents gentamicin nephrotoxicity significantly with respect to its better antioxidant effects of reducing serum creatinine, urea, and BUN by approximately 34, 36, and 34 percent, respectively, when compared to the untreated gentamicin-treated rats. The study examines how certain plant compounds, particularly polyphenols from green tea, can protect against kidney damage caused by gentamicin, an antibiotic. It found that pre-treatment with these compounds helps restore kidney function and reduces damage. The results suggest these compounds could be useful in preventing renal injury from nephrotoxic drugs. Future research will explore the best dosage and timing for green tea use and test these effects in other animal models to confirm their protective benefits.

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# Intraoperative Findings and Difficulties Encountered During Laparoscopic Cholecystectomy: An Observational Study

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Submission Date : 02 Feb 2026
Accepted Date : 03 March 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90059

**Abstract**

**Background:**
Laparoscopic cholecystectomy is the standard intervention for symptomatic gallstone disease; however, intraoperative challenges can prolong surgery or increase complications.

**Objective:**
This study evaluated the frequency and determinants of operative difficulties.

**Methods:**
A prospective observational study was conducted among 67 patients undergoing laparoscopic cholecystectomy at Green Life Medical College Hospital between January 2022 and December 2023. Patients with cirrhosis, malignancy, prior upper abdominal surgery, or coagulation disorders were excluded. Intraoperative variables, including gallbladder wall thickness, adhesions, anatomical variations, and dissection complexity, were documented.

**Results:**
Standard procedures were completed in 76.1% of cases, whereas 14.9% were classified as difficult. Distended or congested gallbladder (32.8%) and omental wrapping (20.9%) were common findings. Thick gallbladder wall ≥3 mm, dense adhesions, and difficult Calot's triangle dissection independently predicted operative difficulty.

**Conclusion:**
Preoperative identification of gallbladder wall thickening, adhesions, and complex Calot's triangle anatomy may help anticipate a challenging laparoscopic cholecystectomy.

**Keywords:** Laparoscopic cholecystectomy, operative difficulty, gallstones, Calot's triangle

**Citation:** Khanduker N,Haroon Or-Rashid M,Uddin SS,Ishrat M,Haque MM.Intraoperative Findings and Difficulties Encountered During Laparoscopic Cholecystectomy: An Observational Study.J Rang Med Col.2026 Mar;11(1):196-201.doi: https://doi.org/10.3329/jrpmc.v11i1.90059

## Introduction:

Laparoscopic cholecystectomy (LC) has evolved as the gold standard for the surgical management of symptomatic gallstone disease since its introduction in the late 1980s and is now well established worldwide.[1] The surgery has numerous advantages compared to traditional open cholecystectomy, like reduced postoperative pain, less hospitalization, faster recovery, better cosmetic outcome, and earlier return to full activity.[2] Despite these advantages and the widespread use of minimally invasive techniques, LC remains technically challenging in some patients, with conversion rates to open surgery ranging from 2% to 15% across studies.[3] The technical difficulty with LC can be attributed to a variety of causes, including patient factors, extent of disease, anatomical abnormalities, and gynaecological technical challenges.[4] Dense pericholecystic adhesions, gallbladder wall thickening, distorted anatomy of Calot's triangle,

and intrahepatic gallbladder position are among the most common intraoperative issues that raise operative difficulty.[5] They can contribute to increased operative time, enhanced risk of bile duct injury, hemorrhage, gallbladder perforation, and, consequently, conversion to an open operation. The incidence of bile duct injury, though uncommon at 0.3-0.7%, is one of the most feared of LC complications and typically happens in the case of challenging dissection failing in obtaining a critical view of safety.[6] Several preoperative scoring systems have been developed that predict difficult LC based upon clinical, laboratory, and radiological factors.[7] However, intraoperative results are not always as anticipated preoperatively, which underscores the utility of systematic intraoperative documentation and analysis of intraoperative parameters. Preoperative ultrasonographic assessment of gallbladder wall thickness has consistently been identified as a potent predictor of operative complexity, with a correlation with increased rates of conversion and complications in patients with thickness > 3-4 mm.[8] Similarly, the presence and number of adhesions, particularly at Calot's triangle and the gallbladder bed, significantly affect the dissection challenge and surgical outcomes.[9] Understanding intraoperative causes of difficult LC is crucial for several reasons. Firstly, it helps surgeons provide improved preoperative counseling regarding the likelihood of conversion and complications. Second, it facilitates successful surgical planning, such as arranging adequate operating time, ensuring the availability of experienced surgical teams, and preparing for possible conversion.[10] Third, proper systematic assessment of intraoperative findings helps identify individuals who will benefit from early referral to advanced centres with expertise in hepatobiliary surgery. This study aimed to assess intraoperative complications encountered during laparoscopic cholecystectomy in symptomatic gallstone disease patients. The primary objectives were to determine the incidence and characteristics of intraoperative issues, to correlate gallbladder wall thickness and condition with the difficulty of the operation, and to identify independent predictors of difficult LC through multivariate analysis.

**Methods:**

This prospective observational study was conducted at Green Life Medical College Hospital from January 2022 to December 2023. A total of 67 patients underwent laparoscopic cholecystectomy over a defined study period. All consecutive patients diagnosed with symptomatic gallstone disease and scheduled for elective laparoscopic cholecystectomy were included after obtaining informed written consent. Cases with cirrhosis, malignancy, or prior upper abdominal surgery were excluded to ensure uniform intraoperative conditions. The institutional ethics committee approved the study.

Preoperative data, including age, gender, body mass index (BMI), comorbidities, and residential background, were recorded. During surgery, operative findings, including gallbladder size, wall thickness, presence and extent of adhesions, and anatomical variations, were carefully noted. Intraoperative difficulties such as dense adhesions, dissection challenges in Calot's triangle, difficulty in holding the gallbladder, gallbladder perforation, and intraoperative bleeding were documented. Wall thickness and gallbladder condition were assessed visually and correlated with dissection complexity. The type of cholecystectomy was also noted. All procedures were performed by experienced laparoscopic surgeons following the standard four-port technique under general anesthesia.Collected data were analyzed using SPSS Statistics version 26.0. Descriptive statistics were presented as frequencies and percentages for categorical variables and as mean±standard deviation for continuous variables. Univariate, bivariate, and multiple logistic regression analyses were performed to identify significant associations and independent predictors of difficult laparoscopic cholecystectomy.

**Results:**

The findings presented across Tables-I to V collectively describe the demographic distribution, intraoperative conditions, and determinants of surgical difficulty among 67 patients undergoing laparoscopic cholecystectomy. As shown in Table-I, the study consisted predominantly of females (65.7%), with most patients either overweight (41.8%) or obese (31.3%). Older age groups were well represented, with 28.4% above 60 years, and common comorbidities included hypertension (28.4 per cent) and diabetes mellitus (22.4 per cent), while 13.4 per cent had both, suggesting a metabolic risk profile.

**Table-I: Baseline demographic and clinical characteristics (N=67)**

| Variable | no. (%) |
|---|---|
| **Gender** | |
| Male | 23(34.3) |
| Female | 44(65.7) |
| **Age Group (years)** | |
| 18–30 | 15(22.4) |
| 31–40 | 9(13.4) |
| 41–50 | 15(22.4) |
| 51–60 | 9(13.4) |
| >60 | 19(28.4) |
| **BMI Category** | |
| <25 (Normal) | 18(26.9) |
| 25–29.9 (Overweight) | 28(41.8) |
| ≥30 (Obese) | 21(31.3) |
| **Residence** | |
| Urban | 39 (58.2) |
| Rural | 28(41.8) |
| **Comorbidities** | |
| Hypertension | 19(28.4) |
| Diabetes Mellitus | 15(22.4) |
| Both HTN + DM | 9(13.4) |
| None | 24(35.8) |

**Table-II: Type of surgery and operative classification (N=67)**

| Variable | no. (%) |
|---|---|
| **Type of Procedure** | |
| Conventional Laparoscopic Cholecystectomy | 51(76.1) |
| Difficult Laparoscopic Cholecystectomy | 10(14.9) |
| **Associated Metabolic Syndrome Indicator** | |
| HTN + DM | 9(13.4) |

**Table-III: Intraoperative gallbladder findings (N=67)**

| Gallbladder Appearance | no. (%) |
|---|---|
| Normal | 13(19.4) |
| Distended, congested, edematous | 22(32.8) |
| Contracted fibrosed | 4(6.0) |
| Compacted with stones | 2(3.0) |
| Intrahepatic gallbladder | 6(9.0) |
| Wrapped with omentum | 14(20.9) |
| Adhesion between GB and duodenum | 6(9.0) |

Table-II indicated that conventional laparoscopic cholecystectomy accounted for the majority of procedures (76.1%), while 14.9% were classified as complex operations.

Table-III highlighted several pathological gallbladder states, including distension or edema in 32.8%, omental wrapping in 20.9%, and intrahepatic gallbladder in 9.0%, all of which contribute to operative complexity.

Adhesions were common, as demonstrated in Table-IV, where liver–omentum adhesions were observed in 20.9%, GB-duodenum adhesions in 9.0%, and dense multi-organ adhesions in 4.5%, while 62.7% of procedures proceeded without significant difficulty. Operative challenges included difficult Calot's triangle dissection in 23.9%, difficult GB bed dissection in 25.4%, and difficulty holding the gallbladder in 17.9%, alongside GB perforation and bleeding in 9.0% each.

**Table-IV: Intraoperative adhesions and surgical difficulties (N=67)**

| Variable | no. (%) |
|---|---|
| **Adhesion Sites** | |
| Liver–omentum adhesions | 14(20.9) |
| GB–duodenum adhesions | 6(9.0) |
| Dense multi-organ adhesions | 3(4.5) |
| No significant adhesions | 44(65.7) |
| **Intraoperative Difficulty Events** | |
| Omental wrapping | 14(20.9) |
| Difficulty in holding GB | 12(17.9) |
| Calot's triangle difficult dissection | 16(23.9) |
| GB bed difficult dissection | 17(25.4) |
| Adhesions around GB | 14(20.9) |
| GB perforation | 6(9.0) |
| Bleeding during surgery | 6(9.0) |
| No difficulty / Smooth procedure | 42(62.7) |

Multivariate analysis in Table-V showed that thick gallbladder wall (OR 6.97, p=0.006) was the strongest independent predictor of complex surgery, followed by dense adhesions (OR 4.85, p=0.012), difficult Calot's dissection (OR 3.56, p=0.021), and moderate–severe bleeding (OR 2.56, p=0.049). Age above 50 years (p=0.186) and female sex (p=0.382) did not significantly influence operative difficulty.

**Table-V: Multivariate predictors of difficult laparoscopic cholecystectomy (N=67)**

| Predictor | β | p-value | OR (Expβ) | 95% CI |
|---|---|---|---|---|
| Thick GB Wall (≥3 mm) | 1.94 | 0.006 | 6.97 | 1.73–28.1 |
| Dense Adhesions | 1.58 | 0.012 | 4.85 | 1.42–16.6 |
| Difficult Calot's Dissection | 1.27 | 0.021 | 3.56 | 1.21–10.4 |
| Moderate–Severe Bleeding | 0.94 | 0.049 | 2.56 | 1.00–6.54 |
| Age >50 years | 0.42 | 0.186 | 1.52 | 0.81–2.84 |
| Female Sex | 0.18 | 0.382 | 1.2 | 0.79–1.81 |

**Discussion:**

This prospective observational study analyzed intraoperative difficulties encountered during laparoscopic cholecystectomy in 67 patients with symptomatic gallstone disease. Our results indicate that 76.1% of the cases were completed as standard laparoscopic procedures, with significant intraoperative difficulties necessitating prolonged dissection or extensive adhesiolysis in 14.9%. These rates compare favorably with the reported conversion rates of 2-15% with Pal et al,[11] indicating appropriate patient selection and surgical expertise at our institution. In multivariate analysis, three independent predictors of difficult laparoscopic cholecystectomy were found to be gallbladder wall thickness ≥3 mm (OR=6.97, p=0.006), dense adhesions (OR=4.85, p=0.012), and difficult dissection of the Calot's triangle (OR=3.56, p=0.021). Gallbladder wall thickening is the highest-order predictor; Khan et al[8] showed that a wall thickness greater than 3 mm significantly prolongs operative time and increases complications, while Alotaibi et al[12] stated that increased wall thickness negatively affects surgical outcomes through impaired tissue handling and obscured anatomical planes. Our correlation analysis demonstrated an influential association between wall thickness and dissection of Calot's triangle (r=0.82), gallbladder bed dissection (r=0.75), and adhesions (r=0.78); this cascading effect of chronic inflammation on multiple parameters signifies an exponential increase in difficulty as these parameters rise. The second most significant predictor in our cohort was dense pericholecystic adhesions, observed in 34.3% of cases, with variable severity. Kapoor et al[9] stressed that adhesions, especially those involving the duodenum and omentum, are strongly associated with visceral injury and prolonged operative time. Adhesions between the gallbladder and duodenum were recorded in 9.0% of our series, reflecting a high-risk scenario requiring an exceptionally delicate dissection technique. Omental wrapping to the gallbladder (20.9%) and dense adhesions of multiple organs (4.5%) further complicated surgical access and increased the risk of conversion. The difficult Calot's triangle dissection, which occurred in 7.5% of our procedures, is a critical technical challenge associated with a risk of bile duct injury. Gupta et al[6] pointed out that failure to obtain a critical view of safety during the dissection of Calot's triangle is the common cause of bile duct injuries that complicate 0.3-0.7% of laparoscopic cholecystectomies. Strasberg et al[13] determined that obscured anatomy in that area requires conversion to avoid disastrous complications. We have identified this parameter as an independent predictor (OR=3.56), underscoring the importance of systematic intraoperative assessment and the surgeon's judgment regarding when conversion is required. The demographic profile from our cohort showed a female preponderance (65.7%) and a significant number of overweight or obese patients (73.1%), in line with established risk factors for gallstone disease.[7] The metabolic comorbidities, such as hypertension (28.4%) and diabetes mellitus (22.4%), reflect a systemic inflammatory milieu that may also contribute to gallbladder pathology and increase surgical complexity.[2] Although age >50 years was included in our multivariate model, it did not reach statistical significance (OR=1.52, p=0.186), suggesting that anatomical and pathological factors outweigh demographic variables in determining operative difficulty. These findings have significant implications for clinical practice, particularly for preoperative counselling and surgical planning. Ramнrez-Giraldo et al[4] developed preoperative scoring systems using ultrasound measurements of

wall thickness and the presence of adhesions to stratify operative risk. Integration of our intraoperative predictors with these preoperative assessments could further improve risk stratification, support appropriate scheduling of operating time, ensure the availability of experienced personnel, and enhance the patient consent process regarding conversion likelihood. Early identification of high-risk cases may prompt referral to tertiary hepatobiliary centres with advanced laparoscopic expertise and immediate access to interventional radiology for the management of complex biliary injuries.

**Limitations:**

This single-centre study with a limited sample size may limit the generalizability of the findings to broader populations. Exclusion of malignant disease and patients who have undergone previous upper abdominal surgery avoids extension of findings to those at high risk, who typically present with the most challenging surgery.

**Conclusion:**

Gallbladder wall thickening ≥3 mm, dense pericholecystic adhesions, and difficult dissection of Calot's triangle are the most relevant independent predictors of operative difficulty in laparoscopic cholecystectomy. These intraoperative parameters are strongly interrelated and have a combined effect on surgical outcome, operating time, and the risk of conversion. The well-executed preoperative ultrasonographic evaluation of gallbladder wall thickness and the routine intraoperative reporting of anatomical difficulty provided a platform for appropriate surgical planning, resource utilization, and patient counselling.

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# Clinicopathological Presentation of Lupus Nephritis

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Submission Date : 02 Feb 2026
Accepted Date : 03 March 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90060

**Abstract**

**Background:**
Despite great improvement in the management of lupus nephritis, it remains the most frequent cause of SLE-related mortality. It has diversities of clinical and histological presentations.

**Objective:**
The aim of this study was to observe the most common clinicopathological presentations of lupus nephritis (LN).

**Methods:**
This cross-sectional observational study was conducted among thirty patients with lupus nephritis, admitted into department of Medicine, Rangpur Medical College and Hospital during June, 2023 to May, 2024 through convenient sampling. After written consent, all patients were undergone renal biopsy and tissue was analyzed for histopathological examination. After compilation data was analyzed by SPSS version 25.0.

**Results:**
Out of thirty patients female were 27(90%) and male 3(10%), most of them 21(70.00%) were at childbearing age between 18 and 35 years, the mean age was 24.16±4.23 years. The most frequent clinical features were edema (100%), joint pain/arthralgia 18(60.00%), fever 16(53.33%) and oral ulceration 11(36.66%). On examination 21(70%) patients were anaemic, 18(60%) patients had microscopic hematuria and proteinuria >0.5 gm/24 hours was noticed in all patients. Among the respondents 18(60.00%) patients had nephrotic range of proteinuria. 10(33.33%) patients had serum creatinine >1.40 mg/dl. On serological test 28(93.3%) patients had a positive ANA, 27(90%) patients had a positive anti-ds DNA. The most common histological feature was class IV in 17(56.70%) patients, followed by 6(20.00%) patients had Class II, 4(13%) patients had Class V and 2(6.7%) patients had Class III lupus nephritis.

**Conclusion:**
Generalized swelling/ edema was the commonest clinical presentation with class IV lupus nephritis on histology .

**Keywords:** Lupus nephritis, Clinical presentation, Histological feature

**Citation:** Bakas MA,Rahman M,Kabir MJ,Ali ML,Anwar MMU,Rahman MM.Clinicopathological Presentation of Lupus Nephritis.J Rang Med Col.2026 Mar;11(1):202-207.doi: https://doi.org/10.3329/jrpmc.v11i1.90060

## Introduction:

Systemic lupus erythematosus is the paradigm of systemic autoimmune disease. Lupus nephritis develops in most of the SLE patients with their disease process.[1] Near about 50% of patients with SLE develop lupus nephritis; Male SLE patient are at increased risk of aggressive disease having higher rates of kidney involvement and increase risk of developing renal failure than female.[2]Lupus nephritis mainly develops early in the disease course, within the first six to thirty six months, and can present at initial diagnosis. Risk factors for the developing lupus nephritis are male sex, early age; and non-European ancestry. In the USA, the incidence of lupus nephritis is higher in Asian people (33%-55%) black people (34%-51%), Hispanic people (31%-43%), and then white (14%-23%) patients. Hispanic and Black people have adverse outcomes and are most likely to develop renal failure than white people.[2]

The overall incidence ranges from 1.8 to 7.6 cases per 100,000 people.[3] Clinically identification of LN can be challenging because patients often presented without overt signs of kidney disease, especially in early stage.[2]

The clinical presentations of lupus nephritis are variable, ranging from proteinuria to overt proteinuria, nephrotic syndrome or nephritic syndrome, and renal failure may be asymptomatic. Sometimes patients can present with "silent" LN, where patients do not have any findings of clinical renal disease but have histopathological changes on kidney biopsy consistent with lupus nephritis.[4,5] Renal involvement in lupus nephritis is assumed by an abnormal urinary finding and raised serum creatinine and confirmed by histological findings on kidney biopsy.[6] The histopathological class of LN; the degree of disease activity, chronicity and the presence of other complications like as interstitial nephritis and thrombotic microangiopathy have been suggested as the main histological features indicating further management.[7] Proteinuria is found in 100% of people with lupus nephritis and nephrotic range proteinuria is found in 50% of total patients with lupus nephritis.[8-10]

Despite progress in the discovery of diagnostic and prognostic biomarkers, renal biopsy remains essential in clinical practice to diagnose lupus nephritis. Renal biopsy gives evidence of disease prognosis, chronicity activity, and treatment planning. Management of lupus nephritis includes potentially toxic medications; it can be; not beneficial into the treatment without definitive diagnosis. The common indications for doing first renal biopsy are proteinuria >500 mg/day, active urinary sediments (≥5 RBC cast or WBC cast /HPF, mainly dysmorphic without evidence of infection) or elevated serum creatinine.[11,12]

The recent approach for managing lupus nephritis and researching new treatment modalities is mainly guided by ISN/RPS, classification. Lupus nephritis is a disabling disease in patients with systemic lupus erythematosus. Despite difference biochemical and laboratory tools are used for diagnosing lupus nephritis, renal biopsy is still gold standard. Management of lupus nephritis depends upon - its histological classification, as we used mainly toxic medications; it can be not beneficial into the treatment without definitive diagnosis. So, it is important to specify histological pattern of lupus nephritis for specific treatment and better outcome. Several studies are done in different parts of our country, especially Dhaka based. But in our northern area we have limited data related to clinicopathological presentations of lupus nephritis. That's why this study aimed to determine clinicopathological presentations of lupus nephritis.

**Methods:**

A cross-sectional study was carried out in the Department of Medicine at Rangpur Medical College Hospital from June, 2023 to May, 2024 for a period of 12 months. Ethical clearance was obtained from ethical approval committee (ERC) of Rangpur Medical College. Informed written consent was taken from each eligible person. Then total 30 lupus nephritis patients aged ≥ 18 years were enrolled in study according to inclusion & exclusion criteria who were admitted in the department of Medicine and department of Nephrology of Rangpur medical college hospital. After enrolment, comprehensive history, physical findings and laboratory reports collected through direct interview. All patients were undergone renal biopsy and tissue was analyzed for histopathological examination. Lupus nephritis is staged according to the classification revised by the International Society of Nephrology (ISN) and the Renal Pathology Society (RPS) in 2004.[13] After compilation data was analyzed by SPSS version 25.0 and presented in tabulated form.

**Results:**

Among 30 patients with lupus nephritis, the mean age of the study patient was 24.16±4.23 (SD) years, 18-25 years was the most prevalent group. Total female was 27(90%) and male were 3(10%). Mean age of female and male was 23.11±3.22 and 30.83±4.12years respectively (Table-I).

**Table-I: Age and sex distribution of the respondents (N=30)**

| Age (years) | Male no. (%) | Female no. (%) | Total |
|---|---|---|---|
| 18 – 25 | 2(6.66) | 11(36.66) | 13(43.33) |
| 26 - 35 | 1(3.33) | 10(33.33) | 11(36.66) |
| 36 - 45 | 0(0.0) | 5(16.66) | 5(16.66) |
| >45 | 0(0.00) | 1(3.3) | 1(3.3) |
| Total | 3(10.00) | 27(90.0) | 30(30) |
| Mean±SD | 30.83±4.12 | 23.11±3.22 | 24.16±4.23 |

Most of the study subjects resided in rural area 26(86.66%). Maximum of the study subject occupation was housewife 20(66.66%). Most of the study subject religion was Islam 22(73.33 %). Most of the respondents belongs from 16(53.33%) low socioeconomic status are shown in Table- II.

**Table-II: Demographic profile of the study subjects (N=30)**

| Demographic profile | no. (%) |
|---|---|
| **Residence** | |
| Urban | 4(13.33) |
| Rural | 26(86.66) |
| **Occupation** | |
| Service | 3(10.0) |
| Housewife | 20(66.66) |
| Others | 7(23.33) |
| **Religion** | |
| Islam | 22(73.33) |
| Hindu | 8(26.66) |
| **Socioeconomic status (monthly income in taka)** | |
| Low(≤10000) | 16(53.33) |
| Average(11000-20000) | 11(36.66) |
| High(>20000) | 3(10) |

The most frequent clinical features were edema 30(100%), Joint pain /arthralgia 18(60.00%), serositis 17(56.7%), fever 16(53.33%) and skin rash 14(46.7%). The other clinical manifestations were oral ulceration 11(36.66%), gross haematuria 9(30%), headache 9(30%) and most common symptoms was edema, shown in Figure-1.

At the time of renal biopsy 21(70%) patients were anaemic, 18(60%) patients had microscopic hematuria and Proteinuria >0.5 gm/ 24 hours was notices in all patients. Among them 18(60.00%) patients had nephrotic range of proteinuria. ANA was positive in 28(93.3%) patients, 27(90%) patients had a positive anti-dsDNA. These are shown in Table- IV.

Most common histological class of lupus nephritis in this study was class IV found in 17(56.7%) respondents followed by Class II, 6(20%) patients; Class V, 4(13.3%) patients; Class III, 2(6.7%) patients; Class VI, 1(3.3%) patient are described in Table-V.

**Table-IV: Frequency of main laboratory variables (N=30)**

| Name of test | no. (%) |
|---|---|
| **Hematological** | |
| Anemia (Hb-<10gm/dl) | 21(70.0) |
| Leucopenia (<4×109/L) | 2(6.66) |
| Thrombocytopenia (p<100×109/L) | 3(10.00) |
| Raised ESR (>60) | 24(80.0) |
| **Renal** | |
| Microscopic hematuria | 18(60) |
| Nephrotic syndrome >3.50gm/24 hours | 18(60.00) |
| Serum creatinine - ≤ 1.40 mg/dl | 20(66.66) |
| Serum creatinine - >1.40 mg /dl | 10(33.33) |
| **Immunological** | |
| ANA (positive) | 28(93.3) |
| Anti-ds DNA (Positive) | 27(90.0) |

**Table-V: Histological classifications of lupus nephritis (N=30)**

| Class of LN | no. (%) |
|---|---|
| Class I | 0(0.00) |
| Class II | 6(20.0) |
| Class III | 2(6.7) |
| Class IV | 17(56.7) |
| Class V | 4(13.3) |
| Class VI | 1(3.3) |
| Total | 30(100.0) |

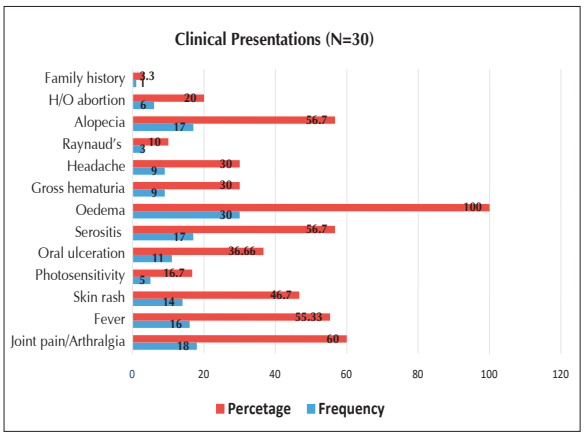



**Figure-1: Frequency of main clinical presentations (N=30)**

## Discussion:

In this study the mean age was 24.16±4.23 years and male: female sex ratio is 1:9. Similar studies were carried out in Singapore and China showed that the mean age of the patient was 35.4 years and 33±14 years, respectively.[14,15] A study in Iran showed that the mean age was 25.6±10.3 years and in other studies the mean age varied from 33.5±14 years to 36.8±13.8 years.[16,17] Another study conducted in Bangladesh showed mean age of the patients was 26±11.97 years and the age range was 10 to 60 years.[18]

This study was conducted among 3(10%) male and 27(90%) female. It was observed that female patients were more than the male. A hospital-based study done in Bangladesh showed that 31(91.18%) patients were females and only 3(8.82%) patients were male.[18] This study showed that male: female ratio of 1:9 which is similar with a previous study from Iran with a male: female ratio 1:13.[19] In this study, most of the respondents resided in rural area 26(86.66%) and most common occupation was housewife 20(66.66%).Another study showed that 61.3% patient's occupation was housewife.[20] The most common clinical symptom was generalized swelling/ edema reported in 30(100%) cases in this study followed by joint pain /arthralgia 18(60.00%), serositis 17(56.7%) fever16(53.33%) oral ulcer11(36.66%) and gross hematuria 9(30%) which is similar with a previous study that showed edema in 52.46% cases, fever in 47.54% , joint pain in 42.62%, photosensitivity/rash in 40.98%, oral ulcer in 22.95%, and central nervous system involvement in 11.48% cases.[20] Another study conducted in Bangladesh showed that edema in 76.3% cases, joint pain 51.6%, skin rash 41.95% and fever, 33.4% cases.[20] This study showed that 21(70%) patient was anemic, 3(10%) patient had thrombocytopenia and 2(6.66%) patient had leucopenia. In another study it was found mean Hb 9.87±1.78 gm/dl.[20] In this study, 9(30.0%) patients had gross haematuria and 18(60%) had microscopic haematuria, which was similar to those reported by some authors.[22] Most common histological class of lupus nephritis in this study was class IV found in 17(56.7%) respondents followed by Class II, 6(20%) patients; Class V, 4(13.3%) patients; Class III, 2(6.7%) patients; Class VI, 1(3.3%) patient. In other study most common histological class of lupus nephritis was Class IV 52.7%, Class III 21.5%, class II- 14%, class V- 7.5% and class VI- 1.1% which was consistent to this study.[20]

## Limitation:

Small sample size was a major limitation of this study. Conducted in a single center.Moreover, patients were not selected randomly.

## Conclusion:

Most respondents were female and aged 18-25, primarily from rural areas, housewives, and Muslim. Lupus nephritis has varied clinical features with different histological type.Common symptoms included edema, joint pain, and fever. Nephrotic range proteinuria occurred in 18(60%) and elevated serum creatinine was noted in 10(33.33%) patients. The majority had Class IV histology. Renal biopsy aids in evaluating renal status and lupus nephritis classification.

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Open access Original article

# Role of Fine Needle Aspiration Cytology (FNAC) in the Differential Diagnosis of Neck Swelling: A Hospital Based Study

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Submission Date : 02 Feb 2026
Accepted Date : 03 March 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90061

**Abstract**

**Background:**
Both neck swellings are usually due to lymph nodes, thyroid, paralymphatic, or soft tissue swellings that can vary from inflammatory to malignancies, which are manifestations of head and neck malignancies in adults. FNAC, USG-guided FNAC, and ultrasonography are the major diagnostic modalities in hematologic swellings of lymph nodes that are accurate to the extent of 82–96% sensitivity and in nonthyroid swellings of the neck that are accurate for their sensitivity of 93% and specificity of 72%. This study aims to investigate the cytological distribution of FNAC in 61 cases.

**Objective:**
To assess the diagnostic efficacy, accuracy, and cytological findings of Fine Needle Aspiration Cytology (FNAC) in case of neck swellings and correlation of cytological results with demographic details and site-wise distribution for appropriate patient care.

**Methods:**
This retrospective study included 61 patients with head and neck swellings from the Department of ENT, Ad-Din Sakina Hospital, between December 2024 and March 2025; FNAC was performed in all cases under strict aseptic conditions using a 23-gauge needle and 10-ml syringe, with aspirated material stained by MGG, H&E, and Papanicolaou methods, Z-N staining applied for suspected tuberculous or purulent cases, and repeat FNAC conducted when initial samples were inadequate.

**Results:**
Among 61 FNAC-evaluated neck swellings, thyroid lesions were most common (42.6%), followed by neck and parotid swellings (13.1% each), with female predominance (~66%) and peak incidence in middle age (45–59 years; 26.2%); cytology showed mainly benign and inflammatory lesions predominantly nodular goiter and lymphadenitis (14.8% each) with fewer malignant cases, highlighting FNAC's effectiveness in characterizing the anatomical and cytological spectrum.

**Conclusion:**
Neck swellings predominantly involve the thyroid gland with female and mid-life predominance, are largely benign with inflammatory and benign neoplastic lesions forming the majority despite a notable malignant proportion, and FNAC proves to be a precise, minimally invasive, and indispensable primary diagnostic tool enabling reliable benign–malignant differentiation and optimal clinical management.

**Keywords:** FNAC, Neck swellings, Cytological diagnosis

**Citation:** Rahman MHH,Ahmed S,Razzak MA,Stella JT,Nahar S,Adhikary L.Role of Fine Needle Aspiration Cytology (FNAC) in the Differential Diagnosis of Neck Swelling: A Hospital Based Study.J Rang Med Col.2026 Mar;11(1):208-212.doi:https://doi.org/10.3329/jrpmc.v11i1.90061

## Introduction:

A swelling in the neck is a very common presentation in a patient's case and can pose a challenge to the physician in terms of differential diagnoses attributed to the complex anatomy in the neck with its high concentration of lymph nodes, thyroid, salivary glands, blood vessels, nerves, and developmental abnormalities that can develop into swellings.[1] The differential diagnoses in this swelling can range from infectious to

inflammatory diseases to tumors. These swellings can also develop from "lymph nodes, thyroid, salivary glands, or soft tissues.[2] In an adult case, this swelling has been described as a leading symptom to an important underlying disease. It can often present as a cancer of the head and neck when this swelling occurs in an adult's case, especially when the tumor's origin is unknown.[3] Fine Needle Aspiration Cytology (FNAC) has developed as the mainstay and initial investigative modality for the assessment of neck swellings.[4] It is a short procedure, performed on an outpatient basis, where cell material is aspirated through a fine-caliber needle, analyzed cytologically, and has gained widespread acceptance because of its ease, rapid turnover time, cost effectiveness, as well as excellent diagnostic yield.[5] The main use of FNAC lies in discriminating between infectious and/or inflammatory swellings and malignancy, as well as benign versus malignant lesions, which impacts significantly onpatient management.[6]

FNAC is an essential component in the diagnostic work-up for neck swellings. Ultrasonography has become the preferred imaging tool for guiding FNAC because it can assist in localization and evaluation of lesions, hence increasing the yield of FNAC.[7] FNAC can be used to evaluate a vast range of pathologies in neck swellings, the most common being thyroid swellings, pathologies in the lymph nodes, and salivary gland pathologies.[8] FNAC has played a crucial role in diagnosing certain pathologies such as inflammatory thyroid diseases, congenital swellings in the neck, salivary gland tumors, and metastatic diseases in the lymph nodes.[9]

FNAC is quite helpful in assessing swellings in the neck region. Regarding lymph node swellings, the accuracy of FNAC is between 82% and 96%, and that makes it the test of choice in this context.[10] Regarding non-thyroid swellings in the neck region, the sensitivity of FNAC is 93%, with a specificity of 72%, and that makes it an excellent test in a variety of situations.[6] It is quite helpful in separating cases with inflammation and those with malignancies, and that is quite useful in giving the right treatment to the right patient at the right time. FNAC is not restricted to swellings in the lymph nodes. It can be quite helpful in cases related to the thyroid gland or the salivary glands.[11] It can be quite helpful in cases of pleomorphic adenomas in the parotid gland.[12] It can be quite helpful in children also with swellings in the neck.[13] It is better than surgery in cases where it may not be necessary. Of course, in some cases, there can be a problem of "false negatives" or "false positives," mostly when the sample obtained isn't of good quality.[14] Although this is why one still needs to check the results of the FNAC along with personal observations. In some cases, if one can't determine, then again, one can either do the "FNAC again" or an "excision biopsy." Although in most ways, "FNAC helps in making most of the plans of treatment based on patients." If something appears benign, then most patients don't need surgery. And if something appears malignant, then it helps doctors in planning treatment.[15] Within this scenario, the current study also retrospectively examined the cytological findings of 61 Successive cases of neck swellings diagnosed through FNAC. Theobjective ofthe studyis toexamine the diagnostic scope and distribution of neck swellings, correlate the findings of cytological diagnosis with the demographics and location of patients, and highlight their replaceable role of FNAC in the diagnosis and management of neck swellings. By doing so, the efficacy of FNAC as a rapid, accurate, and successful approach to decrease morbidity related to excisional biopsies is also demonstrated.[4]

**Methods:**

This retrospective study carried out in the Department of ENT in Ad-Din Sakina Hospital on 61 patients who presented with swellings in the head and neck region during December 2024 and March 2025. Fine needle aspiration cytology was carried out on each of the patients after maintaining complete asepsis using a 23-gauge needle fixed to a 10 ml syringe. Informed consent was obtained in all cases before performing FNAC. Aspirated samples were spread on glass slides and stained for cytopathological examinations using May Grunwald Giemsa (MGG), Hematoxylin and Eosin (H&E), and Papanicolaou (Pap). Ziehl Neelsen stain for acid-fastbacilli (AFB) was further performed on samples in cases preliminarily suspected to be due to tuberculosis and in samples which yielded an aspirate consistent with purulent and/or caseous material.

**Results:**

The swelling distribution in 61 cases shows that 42.6% were in the thyroid, 13.1% in neck and

parotid areas, and 9.8% and 8.2% in submandibular and cervical lymph nodes, respectively. Other locations were rare (Table-I).

**Table-I: Distribution of swellings among the participants (N=61)**

| Diagnosis | no. (%) | Cumulative % |
|---|---|---|
| Thyroid | 26(42.6) | 42.6 |
| Neck | 8(13.1) | 55.7 |
| Parotid | 8(13.1) | 68.9 |
| NeckLN | 1(1.6) | 70.5 |
| SubmandibularLN | 6(9.8) | 80.3 |
| Cervical LN | 5(8.2) | 88.5 |
| Inguinal LN | 1(1.6) | 90.2 |
| TMJ | 1(1.6) | 91.8 |
| Post-Ear | 1(1.6) | 93.4 |
| Submental LN | 1(1.6) | 95.1 |
| Submandibular LN | 1(1.6) | 96.7 |
| Post-auric LN | 1(1.6) | 98.4 |
| Neck+ Thyroid | 1(1.6) | 100.0 |
| Total | 61(100) | |

Figure-1 showed that neck swellings are over twice as common in females. This suggests that females are more likely to seek hospital treatment than males.

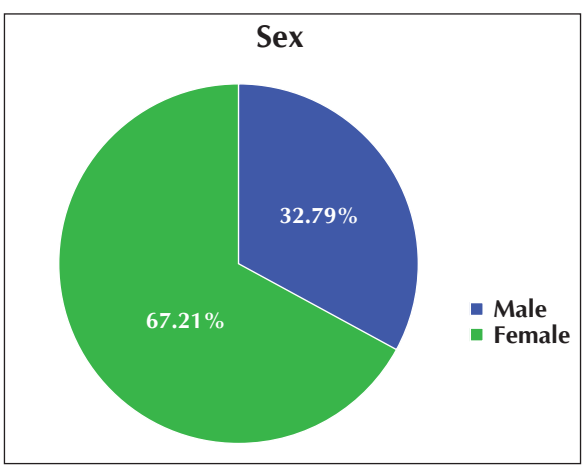



**Figure-1: Sex distribution of patients with neck swellings (N=61)**

Table-II showed the distribution of cytological diagnoses among study subjects. Nodular goiter or lymphadenitis was the most common diagnosis (9,14.8%), followed by thyroiditis (6, 9.8%). Colloid goiter, TB lymphadenitis, Pleomorphic adenoma, and Lipoma each had 3 cases (4.9%). Malignant lesions like metastatic carcinoma and Squamous cell carcinoma had 2 cases each (3.3%). Other conditions accounted for single cases. The study indicates that benign, inflammatory conditions are more common than malignant ones.

**Table-II: Distribution of cytological diagnosis among the participants (N=61)**

| Diagnosis | no. (%) | Cumulative % |
|---|---|---|
| Nodular goiter | 9(14.8) | 14.8 |
| Colloid goiter | 3(4.9) | 19.7 |
| Thyroiditis | 6(9.8) | 29.5 |
| Lymphadenitis | 9(14.8) | 44.3 |
| Metastatic CA | 2(3.3) | 47.5 |
| SCC | 2(3.3) | 50.8 |
| TB Lymphadenitis | 3(4.9) | 55.7 |
| Follicular Lesion | 2(3.3) | 59.0 |
| Follicular Neoplasm | 1(1.6) | 60.7 |
| PleomorphicAdenoma | 3(4.9) | 65.6 |
| Sialadenitis | 2(3.3) | 68.9 |
| Lipoma | 3(4.9) | 73.8 |
| Hodgkin Lymphoma | 2(3.3) | 77.0 |
| NHL | 1(1.6) | 78.7 |
| Warthin Tumor | 1(1.6) | 80.3 |
| Adenoid Cystic CA | 1(1.6) | 82.0 |
| Adenomatousgoiter | 1(1.6) | 83.6 |
| Colloid Cyst | 1(1.6) | 85.2 |
| Infected cyst | 1(1.6) | 86.9 |
| Thyroglossal cyst | 1(1.6) | 88.5 |
| Branchial cyst | 1(1.6) | 90.2 |
| Dermoid Cyst | 1(1.6) | 91.8 |
| Abscess | 1(1.6) | 93.4 |
| Hematoma | 1(1.6) | 95.1 |
| TB abscess | 1(1.6) | 96.7 |
| Suspicious Thyroid | 1(1.6) | 98.4 |
| Sialadenitis +Lymphadenitis | 1(1.6) | 100 |
| Total | 100 | |

**Discussion:**

This study involving 61 patients has resulted in important findings in relation to neck swellings that underwent FNAC investigation. Most frequent

localization was associated with thyroid gland, representing 42.6%. Other locations were non-specific neck swellings and parotid gland swellings, both representing 13.1%. Similar findings are also reflected in literature reporting on FNAC as an important tool for evaluation of head and neck lesions.[8] Frequent identification of involvement of lymph nodes in the submandibular and cervical areas, their classification as reactive, inflammatory, and neoplastic types, is also similar to what has been stated in previous studies. In general, FNAC test has proved to provide diagnostic yield ranging from 82 to 96% in the case of lymph nodes swellings, and therefore considered a gold standard in this respect.[10] It should also be highlighted that in relation to non-thyroidal masses, FNAC is highly valuable from a diagnostic perspective.[6] In addition, high frequency of females in this study who represented approximately two-thirds of total population was similar to observations reported in other studies where increased prevalence of thyroid diseases and benign goiter or thyroiditis has been shown among women.[14,15] It can also be highlighted in relation to greater tendency of health seeking behavior observed among females in relation to neck swellings. Most frequently affected age group in this study was adults between 45 and 59 years old, whereas second most frequent age group was adults aged 30 to 44. Pediatric age group represented 19.7% of study population, which is consistent with other studies reporting on efficacy of FNAC in all age groups, even in pediatric patients.[11,13] It can also be mentioned here that neck swellings are not limited only to adult patients only. From a cytological point of view, most frequent swellings were benign swellings such as nodular goiter, colloid goiter, thyroiditis, and lymphadenitis. This finding was in line with other studies indicating usefulness of FNAC as a technique for distinguishing malignant swellings from benign ones. Thus, FNAC could prevent unnecessary surgery in patients with benign conditions.[9,15]

Malignant swellings including metastatic carcinoma and squamous cell carcinoma were found in approximately 15 to 20 percent of cases in this study, which is in line with previous studies confirming importance of preoperative diagnosis of malignancies through FNAC test.[2,4]

It has been shown here that a number of swellings, which included both common swellings such as colloid goiter and rare swellings such as Warthin tumors and branchial cysts, were encountered in the current study. It proves usefulness of FNAC test for diagnosing thyroid swellings, lymph node swellings, and salivary gland lesions.[8,12] It has been reported that FNAC has high efficacy in diagnosing pleomorphic adenomas of salivary glands.[12]

Despite limitations of small sample size in this study without appropriate histopathological confirmation, findings of the current study are in line with those reported in other studies, proving usefulness of FNAC in relation to neck swellings.[5,9]

**Conclusion:**

The paper characterizes the presentation of neck swellings in a clinical community, reaffirming the thyroid gland as the commonest location, with a definitive female predilection and a strong tendency for these presentations in mid-life. The cytological spectrum is overwhelmingly benign; inflammatory conditions and benign neoplasms account for the predominant number of cases, although the fact that a significant proportion has been identified to be malignant serves to emphasize just how important it is to evaluate them. FNAC turns out to be a crucial, precise, and minimally invasive primary diagnostic agent in the management algorithm of neck masses. Its capacity to distinguish reliably between benign and malignant lesions makes it greatly helpful in the effective management of the situation and, in effect, the optimization of outcomes. It is imperative to encourage the utilization of FNAC in the management of the clinical situation in question.

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Open access Review article

# Sexually Transmitted Infections in Bangladesh: A Narrative Synthesis of Multidimensional Impact

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Submission Date : 04 Feb 2026
Accepted Date : 07 March 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90074

**Abstract**

**Background:**
Sexually transmitted infections (STIs) remain a global public health challenge, especially in low- and middle-income countries where social, economic, and structural factors increase vulnerability.

**Objective:**
The objective of this narrative review was to synthesize evidence on the epidemiology, determinants, multidimensional impacts, and prevention strategies of sexually transmitted infections (STIs) in Bangladesh.

**Methods:**
A narrative literature review of studies published from 2000 to 2024 was conducted using PubMed, ScienceDirect, and Google Scholar. Ten studies met inclusion criteria. Data were analyzed using qualitative content analysis, categorizing themes into epidemiology, determinants, impacts, and control strategies.

**Results:**
HIV appeared in 20% of studies, mostly among people who inject drugs, while 60% reported high prevalence of other STIs among female sex workers. Structural determinants such as poverty and inequality were identified in 30% of studies, and behavioural factors such as low condom use in 20%. Health complications (60%), social stigma (20%), and gender-related vulnerability (20%) were documented. Prevention strategies were discussed in 70% of studies, but were mostly population-specific rather than integrated.

**Conclusion:**
STIs in Bangladesh are influenced by behavioural, social, and structural determinants. Integrated, inclusive, and evidence-based interventions addressing both individual and societal risk factors are necessary to prevent future escalation.

**Keywords:** STI, Epidemiology, Determinants, Vulnerability, Public health, Prevention strategies.

**Citation:** Islam T,Mahmud MS.Sexually Transmitted Infections in Bangladesh: A Narrative Synthesis of Multidimensional Impact.J Rang Med Col.2026 Mar;11(1):213-220.doi:https://doi.org/10.3329/jrpmc.v11i1.90074

## Introduction:

Sexually transmitted infections (STIs) remain a major global public health challenge, affecting more than one million individuals daily and contributing substantially to morbidity, mortality, and long-term health consequences worldwide.[1] Common bacterial and viral STIs such as chlamydia, gonorrhea, syphilis, human papillomavirus (HPV), herpes simplex virus (HSV), and human immunodeficiency virus (HIV) are associated with adverse reproductive health outcomes, infertility, increased susceptibility to HIV acquisition, and considerable psychological distress. Persistent transmission is closely linked to structural and social determinants, including inequality, limited access to quality healthcare, stigma, discrimination, and weak surveillance systems. In Bangladesh, STIs represent an ongoing but under-recognized public health concern. Although national HIV prevalence remains relatively low, STI-related symptoms and risk behaviors are prevalent among vulnerable groups, including adolescents, ever-married women, urban slum residents, female sex workers, and displaced populations such as Rohingya refugees.[2] National survey data indicate that approximately

10% of ever-married women report abnormal genital discharge and 6% report genital sores or ulcers, suggesting a considerable hidden burden.[3] Urban–rural disparities, poverty, limited sexual and reproductive health education, and sociocultural stigma significantly influence care-seeking behavior and reporting, resulting in likely underestimation of true prevalence.[4] Broader structural determinants such as gender inequality, labour migration, informal employment, and inadequate surveillance infrastructure—continue to impede effective prevention and control efforts.[5] Across South and Southeast Asia, STI transmission is facilitated by rapid urbanization, mobility, evolving sexual norms, and persistent gender disparities.[6] Regional evidence from India, Pakistan, Nepal, Bhutan, Malaysia, and Vietnam highlights substantial variation in STI prevalence among key populations, including men who have sex with men (MSM), female sex workers, adolescents, married women, and people living with HIV. STIs are also strongly associated with intimate partner violence, poor mental health, and socioeconomic disadvantage, underscoring their multidimensional impact.[7] Beyond physical morbidity, STIs carry significant psychosocial and economic consequences. Affected individuals frequently experience shame, anxiety, depression, strained interpersonal relationships, and barriers to timely healthcare, which may perpetuate transmission cycles.[8] Evidence suggests that inadequate knowledge, negative attitudes toward condom use, and low self-efficacy remain critical drivers of vulnerability, particularly among youth and marginalized communities.[9] Therefore, integrated, context-specific strategies addressing biomedical, behavioral, and structural determinants are essential. This narrative review aims to synthesize evidence on the epidemiology, determinants, impacts, and prevention strategies of STIs in Bangladesh.

**Methods:**

This narrative literature review, conducted over a three-month period from November 2025 to January 2026, synthesizes evidence on the epidemiology, determinants, impacts, and intervention strategies of sexually transmitted infections (STIs) in Bangladesh. A structured search was conducted in PubMed, ScienceDirect, and Google Scholar for studies published between 2000 and 2024, using keywords such as "HIV," "gonorrhea," "syphilis," "chlamydia," "female sex workers," and "Bangladesh." Inclusion criteria were primary research studies conducted in Bangladesh that examined HIV or other STIs, reported on prevalence, determinants, impacts, or interventions, and were published in English.

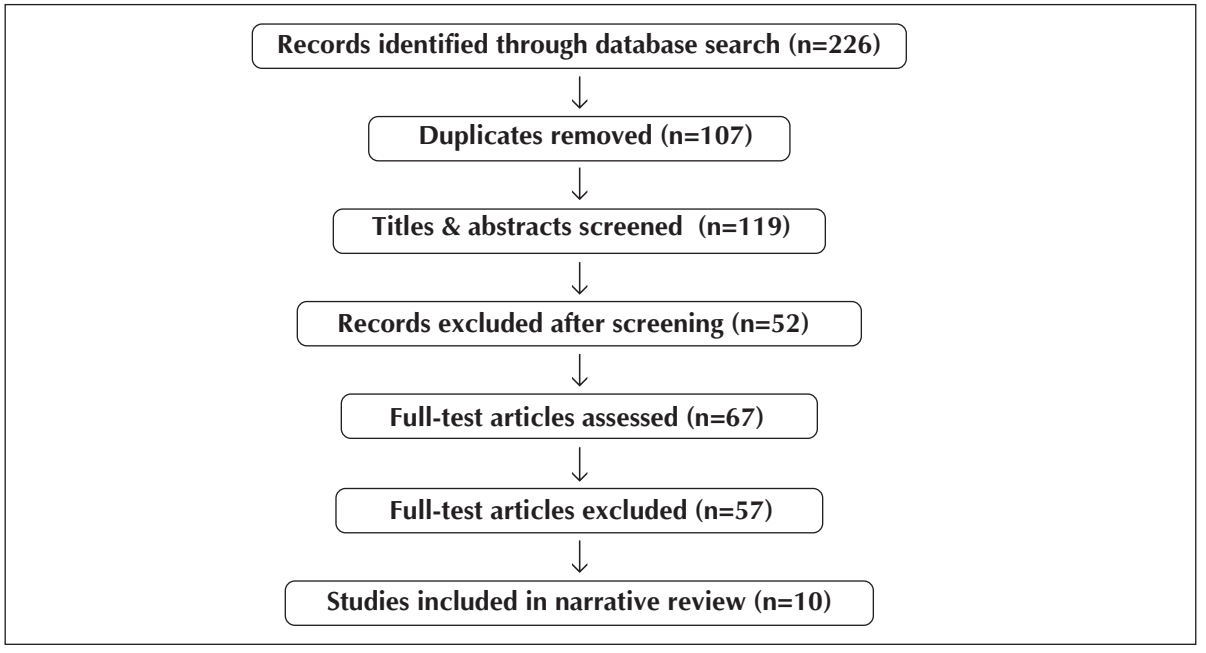



**Figure 1: PRISMA flow diagram of study selection process for the narrative review**

Review articles, commentaries, conference abstracts, and studies conducted outside Bangladesh were excluded. Ten studies were selected, and data on study design, population, STI type, findings, determinants, and interventions were extracted and organized into summary tables.

**Data Analysis**

A qualitative content analysis approach was applied to categories epidemiological patterns, determinants, multidimensional impacts, and intervention strategies. The proportion of studies addressing each theme was calculated to provide a structured synthesis of the literature.

**Results:**

Table-I to V summarized the studies regarding on Sexually Transmitted Infections,prevalence and determinants of STIs,multidimensional impacts of STIs,interventionstrategies for STI prevention and controlin Bangladesh.

**Epidemiological Landscape and Determinants of STIs in Bangladesh**

The literature indicates that STIs in Bangladesh are largely concentrated among high-risk populations. HIV was reported in 20% of studies, mainly among PWID, while 60% reported other STIs, including gonorrhea and syphilis, particularly among FSWs. Key determinants include poverty and social

**Table-I: Summary of selected studies on sexually transmitted infections in Bangladesh**

| Article | Purpose | Design & Sample | Population/ Area | Key Findings | Conclusion |
|---|---|---|---|---|---|
| Azim et al (2008)[10]– HIV and AIDS in Bangladesh | Estimate HIV prevalence among youth | Cross-sectional; 1,860 youth | National | No HIV detected; high behavioral vulnerability | Targeted prevention needed among youth |
| Azim et al (2008)[11] –PWID in Dhaka | Investigate HIV outbreakCross-sectional; 1,200 PWID | Dhaka HIV prevalence 7% | in PWID cluster | Harm reduction programs essential | |
| Kawser et al (2024)[12] – Gonorrhea | prevalence Gonorrhea burden | Cross-sectional; 731 FSWs | Dhaka | 7–15% prevalence Routine STI | screening required |
| Huda et al (2022)[13] – Chlamydia infection | Chlamydia prevalence | Cross-sectional; 731 FSWs | Dhaka | 10–20% prevalence | Untreated infections risk infertility |
| Alim et al (2023)[14] – STI prevalence | Observational; STI burden | urban high-risk groups Urban | High HSV-2 & | syphilis rates Syndromic | management insufficient |
| Hasan (2020)[15]– Women's vulnerability | Gender dimensions of STI risk | Qualitative; married women | Rural Bangladesh | Limited condom negotiation power Gender empower- | ment necessary |
| Kundu et al (2023)[16] – MSM healthcare access | Barriers to STI care Qualitative; MSM | & Hijra Urban | Discrimination | delays treatment Reduce stigma in | healthcare system |
| Hussain & Ferdous (2020)[17] – Bangladesh | Country Report National overview | Surveillance data; national | National | <0.1% HIV in general population Concentrated | epidemic persists |
| Khanam et al (2017)[18]– Syphilis among street-based FSWs | Syphilis prevalence Cross-sectional; | 395 FSWs Dhaka | 8–11% prevalence; | low condom use Strengthened outreach needed | |
| Haseen (2012)[19] – STI risk among male clients | Risk among male clients | Cross-sectional behavioral survey Urban | Low condom use | with regular partners Male clients critical | in prevention |

**Table-II: Prevalence and determinants of STIs in Bangladesh**

| Infection | Prevalence (Bangladesh) | Key Population | Determinants | Source |
|---|---|---|---|---|
| HIV | <0.1% general; 7% PWID Dhaka | PWID | Needle sharing, unsafe injecting | Azim et al, 2008 |
| Syphilis | 8–11% | Street-based FSWs | Low condom use, multiple partners | Khanam et al, 2017 |
| Gonorrhea | High prevalence | FSWs Dhaka | Structural vulnerability, poverty | Kawser et al, 2024 |
| Chlamydia / STI symptoms | Nationally reported | Ever-married women | Socioeconomic and behavioural factors | Huda et al, 2022 |
| Overall STI burden | Increasing trends | Urban high-risk groups | Age, education, income, behavioural risks | Alim et al, 2023 |

**Table-III: Multidimensional impacts of STIs in Bangladesh**

| Impact Domain | Manifestations | Evidence |
|---|---|---|
| Health Impact | Infertility, reproductive complications, HIV risk | Kawser et al, 2024; Khanam et al, 2017 |
| Psychological Impact | Fear, stigma, distress | Hossain & Ferdous, 2020 |
| Social Impact | Exclusion, discrimination | Hossain & Ferdous, 2020 |
| Economic Impact | Higher healthcare costs, poverty | Kawser et al, 2024 |
| Gender Impact | Limited condom negotiation, adolescent vulnerability | Hasan, 2012; Huda et al, 2022 |

**Table-IV: Intervention strategies for STIs prevention and control in Bangladesh**

| Intervention Domain | Description | Evidence |
|---|---|---|
| Harm Reduction | Needle/syringe exchange for PWID | Azim et al, 2008 |
| Condom Promotion & Safe Sex | Condom distribution and behavioral interventions for FSWs & clients | Haseen et al, 2012 |
| Structural & Social Interventions | Address poverty, vulnerability, and structural risks | Kawser et al, 2024 |
| Behavioural Surveillance | Monitor high-risk behaviors and STI prevalence | Azim et al, 2008; Haseen et al, 2012 |
| Reproductive Health & Women Empowerment | Targeted services for adolescents and women | Hasan, 2012; Huda et al, 2022 |
| Social Inclusion & Stigma Reduction | Reduce discrimination among marginalized groups | Hossain & Ferdous, 2020 |
| National Surveillance | Monitor HIV/STI trends nationally | Hussain & Ferdous, 2020 |

instability (30%), low condom use (20%), needle sharing among PWID (10%), and gender inequality (10%), highlighting structural, behavioral, and gender-related vulnerabilities.

**Multidimensional Impacts of STIs**

STIs in Bangladesh have wide-ranging impacts:

- Health: Reproductive complications and increased HIV susceptibility were discussed in 6 studies (60%).
- Social: Exclusion and stigma were noted in 2 studies (20%).
- Gender: Limited condom negotiation power among women was identified in 2 studies (20%).
- Structural determinants, including poverty and inequality, were reported in 3 studies (30%).

**Prevention and Control Strategies**

Interventions were discussed in 7 out of 10 studies (70%). Key strategies included:

- Condom promotion and behavioral interventions: 3 studies (30%) targeted FSWs and male clients.
- Harm reduction (needle exchange): 1 study (10%).
- Women empowerment and reproductive health: 2 studies (20%).
- Stigma reduction and social inclusion: 1 study (10%).

**Table-V: Preventive and control strategies identified in STI studies in Bangladesh**

| Authors | Intervention Discussed | Type of Intervention |
|---|---|---|
| Azim et al (2008 – PWID) | Yes | Needle & syringe exchange |
| Kawser et al (2024) | Yes | Structural & social determinant intervention |
| Huda et al (2022) | Yes | Reproductive health awareness |
| Alim et al (2023) | No | - |
| Hasan (2020) | Yes | Women's empowerment & reproductive health |
| Kundu et al (2023) | No | - |
| Hossain & Ferdous (2020) | Yes | Social inclusion & stigma reduction |
| Khanam et al (2017) | Yes | Condom promotion & outreach |
| Haseen et al (2012) | Yes | Behavioural intervention & condom promotion |
| Azim et al (2008–youth study) | No | - |

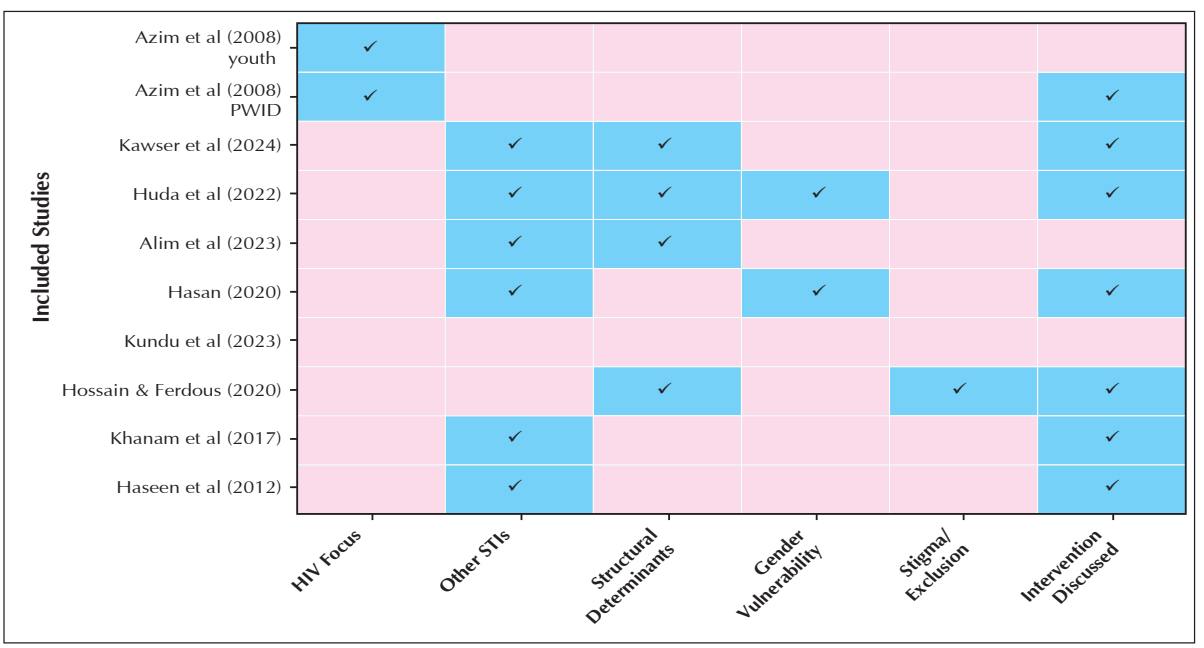



**Figure 2: Thematic frequency heatmap of STI research coverage in Bangladesh**

**Discussion:**

The literature indicates that sexually transmitted infections (STIs) in Bangladesh predominantly affect specific high-risk groups rather than the general population. This pattern aligns with global trends. According to the World Health Organization (WHO, 2022), more than 374 million new curable STI infections occur worldwide each year, disproportionately affecting marginalized and vulnerable populations. Similarly, Viswasam et al (2021) reported that approximately 10.4% of female sex workers globally are HIV positive, highlighting how occupational and structural vulnerabilities increase the risk of infection.[20] Consistently, this review found that 60% of the included studies reported a high prevalence of STIs among female sex workers, which reflects international patterns. In contrast, Bangladesh exhibits a very low HIV prevalence in the general population, whereas some African countries have rates exceeding 5% (UNAIDS, 2023).

Determinant analyses also show both similarities and differences compared to previous research. Baral et al (2007) found that 18% of men who have sex with men worldwide are HIV positive, emphasizing the role of stigma, discrimination, and limited healthcare access in increasing vulnerability.[21] Gupta et al (2019) also highlighted that poverty and gender inequality make women in South Asia more susceptible to STIs. This study identified structural factors in 30% of the included studies, yet only 20% examined gender inequality, suggesting a notable research gap in Bangladesh.[22] The effects of STIs on multiple domains mirror global findings. Untreated STIs are strongly linked to infertility and reproductive complications (Satterwhite et al, 2013) and also increase susceptibility to HIV. Psychological impacts, including fear, stigma, and distress, are consistent with Newman et al (2015), who demonstrated that stigma reduces treatment-seeking behaviour.[23] Social and structural inequalities including limited healthcare access, poverty, and restricted condom negotiation power further exacerbate STI risks and negative outcomes.

International evidence underscores the effectiveness of integrated prevention strategies. Fonner et al (2014) found that combining behavioural interventions with condom promotion can reduce STI risk by up to 25%. Similarly, 70% of studies included in this review suggested preventive measures.[24] However, interventions in Bangladesh remain largely fragmented and population-specific, unlike the nationwide integrated approaches implemented in other countries. This suggests that program structure, rather than the type of intervention, influences effectiveness.

**Limitations:**

The study's short duration and limited sample of ten studies may not capture Bangladesh's full STI diversity. Focus on urban/high-risk populations, cross-sectional designs, underreporting, and unexamined practical challenges such as resource, sociocultural, and healthcare system barriers limit comprehensive analysis.

**Conclusion:**

This review indicates that STIs in Bangladesh remain concentrated among high-risk and marginalized populations, driven by behavioural, structural, and gender-related determinants. Although HIV prevalence is low in the general population, persistent vulnerabilities and fragmented interventions highlight the need for integrated, inclusive, and evidence-based public health strategies to prevent future escalation.

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Open access Case report

# Giant Hepatic Hemangioma: A Case Report

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Submission Date : 05 Feb 2026
Accepted Date : 07 March 2026
Published Date : 30 March 2026
DOI: https://doi.org/10.3329/jrpmc.v11i1.90075

**Abstract**

Hepatic hemangiomas are the most common benign liver tumors, typically asymptomatic and discovered incidentally. Giant hepatic hemangiomas (>10 cm) are rare and may present with symptoms due to mass effect. This report describes a 45-year-old woman presenting with abdominal fullness due to a massive hepatic hemangioma measuring approximately 20.5×17.5×23 cm in the left lobe, with a smaller lesion in the right lobe. Diagnosis was confirmed via ultrasonography, contrast-enhanced computed tomography (CECT), and fine-needle aspiration cytology (FNAC). Laboratory findings included mild normocytic normochromic anemia and leucopenia, with normal liver function tests and tumor markers. Management was conservative, with recommendations for open biopsy. This case underscores the diagnostic utility of multiphasic imaging and the benign nature of these lesions, supported by a review of similar cases in the literature.

**Keywords:** Giant hepatic hemangioma, Liver tumor, Contrast-enhanced CT, Fine-needle aspiration cytology

**Citation:** Alam KM,Ali MN,Anwar MMU,Hossain MS,Zaman F,Islam MA.Giant Hepatic Hemangioma: A Case Report.J Rang Med Col.2026 Mar;11(1):221-225.doi:https://doi.org/10.3329/jrpmc.v11i1.90075

## Introduction:

Hepatic hemangiomas are the most common benign liver tumors,[1,2] representing benign vascular malformations composed of dilated blood-filled spaces lined by endothelium and supported by fibrous stroma. Prevalence in the general population varies widely, with estimates ranging from 0.4% to 20% in autopsy series[3-5] (some imaging-based studies report 2–7% in clinical populations, reflecting improved detection with modern modalities). Giant hepatic hemangiomas (GHH) represent a rarer and more clinically significant subtype. The definition of a GHH varies in the literature: it is commonly defined as a lesion greater than 4cm, 5cm, or 10cm in diameter, with >10 cm often used for very large or symptomatic cases in surgical and complication-focused reports.[6-9] These lesions are predominantly found in women between 20 and 60 years of age and are often located in the right hepatic lobe.[6,10]

Hepatic hemangiomas are typically asymptomatic and discovered incidentally during imaging studies performed for unrelated conditions.[2,3] However, GHHs can become symptomatic due to mass effect on adjacent organs or structures, leading to abdominal distension, pain (including epigastric pain[11]), loss of appetite, early satiety, or compressive symptoms.[10,11] In rare cases, GHHs are associated with severe complications, including spontaneous rupture, intratumoral hemorrhage, torsion (especially in pedunculated variants), Kasabach-Merritt syndrome (consumptive coagulopathy and thrombocytopenia), sclerosing variants presenting as Bornman-Terblanche-Blumgart syndrome,[12] and high-output cardiac

failure.[4,5,10,13] For example, one reported case involved a GHH complicated by bilateral pulmonary embolism and portal hypertension,[14] while another described a 23 cm GHH with severe malnutrition and blood coagulopathy.[15] Giant abdominal extension originating from the liver has also been documented.[16] Unusual presentations, such as fetal hepatic masses, have been noted in other contexts.[17] A rapidly enlarging 25-cm GHH in a Bangladeshi patient required surgical resection due to Kasabach-Merritt syndrome,[18] while an earlier Bangladeshi report described conservative management of multiple lesions (largest ~11.5 cm) in a 28-year-old woman diagnosed via characteristic MRI findings.[19] The risk of complications generally correlates with tumor size, with higher risks observed for lesions exceeding 5cm, consistent with Laplace's law (where wall tension increases with radius).[6]

Diagnosis of GHH relies on characteristic imaging features observed in ultrasonography, computed tomography (CT), and magnetic resonance imaging (MRI).[2,20] The most common type, cavernous hemangioma, shows discontinuous peripheral nodular enhancement in the arterial phase, with progressive centripetal fill-in in the portal venous and delayed phases on dynamic contrast-enhanced studies.[21] This pattern reflects the low-flow hemodynamic state ("slow river" flow). On T2-weighted MRI, lesions often appear markedly hyperintense ("light-bulb bright") due to the long T2 relaxation time of stagnant blood.

Management of GHH depends on symptoms, size, growth rate, and presence of complications. Asymptomatic or minimally symptomatic GHHs are usually managed conservatively with observation.[2,3] Symptomatic or complicated cases may require intervention, including surgical resection or enucleation, transarterial embolization (TAE), radiofrequency ablation, or in rare, unresectable cases with severe symptoms liver transplantation.[10,20,22,23] Transarterial embolization using agents such as bleomycin-lipiodol emulsion has shown efficacy in reducing tumor size and alleviating symptoms.[24,25] Surgical resection guided by three-dimensional visualization is effective for GHHs with hemorrhagic necrosis.[21] The overall prognosis for GHH is excellent with appropriate individualized management.[20]

**Case Presentation**

A 45-year-old woman presented on January 25, 2026, with progressive abdominal fullness over several months. She had no history of jaundice, fever, weight loss, gastrointestinal bleeding, or oral contraceptive use. Physical examination revealed a large, soft, non-tender abdominal mass without signs of anemia, jaundice, edema, or organomegaly. Vital signs were normal.Initial ultrasonography (USG) of the whole abdomen revealed a large heterogeneous soft tissue mass measuring more than 34×22cm, displacing abdominal organs, with a suspected retroperitoneal origin. The liver's right lobe was partially visualized without focal lesions in the visible portions; gallbladder, biliary tree, pancreas, spleen, kidneys, urinary bladder, uterus, and adnexa appeared normal where visualized.

Subsequent spiral contrast-enhanced CT (CECT) of the whole abdomen demonstrated an enlarged liver spanning 28cm. A large hypodense lesion measuring approximately 20.5×17.5×23cm was identified in segments II, III, and IV of the left lobe. Triphasic imaging showed peripheral discontinuous nodular enhancement in the arterial phase, gradual centripetal filling in the portal venous phase, and prolonged enhancement in the delayed phase, characteristic of hemangioma. A smaller similar lesion was noted in the right lobe. The right kidney and pancreas were compressed and displaced inferiorly, with normal contrast excretion and no dilatation of the pelvicalyceal system. No lymphadenopathy, ascites, or other abnormalities were seen. Impression: Classical findings consistent with giant hepatic hemangioma involving both lobes.

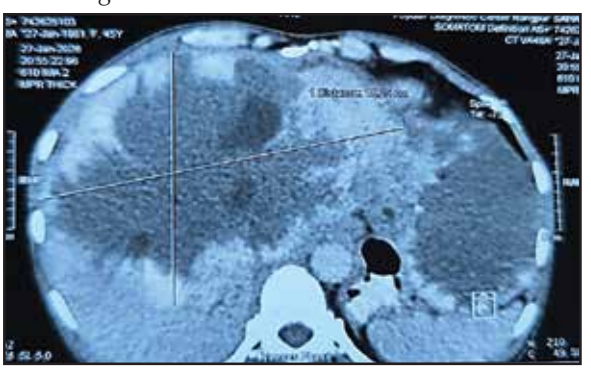


**Figure-1: Representative axial slices from plain, arterial, portal venous, and delayed phases of CECT showing the giant hemangioma with characteristic enhancement patterns**

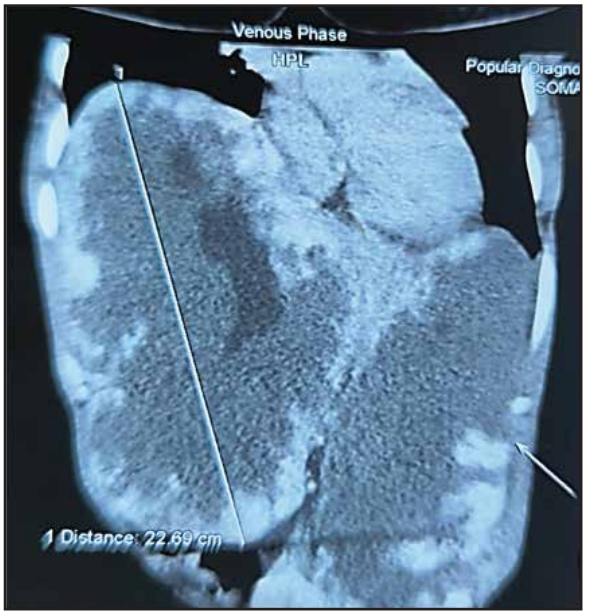



**Figure-2: Coronal and sagittal reformatted images demonstrating mass effect on adjacent structures**

Hematology showed hemoglobin 9.3 g/dL, erythrocyte sedimentation rate 37mm/1st hour, red blood cell counts $3.0\times10^{12}$/L, white blood cell count $3.8\times10^{9}$/L (with normal differential), and platelet count $190\times10^{9}$/L. Peripheral blood film indicated normocytic normochromic anemia with leucopenia. Biochemistry revealed random blood sugar 6.8mmol/L, serum creatinine 1.03mg/dL, and ALT 38 U/L, all within normal limits. Immunology: HBsAg negative, CA-125 17.96 U/mL (normal). Blood group: A positive.

USG-guided fine-needle aspiration cytology (FNAC) from the abdominal mass yielded fresh blood spontaneously. Microscopic examination revealed formed elements of blood without malignant cells. Diagnosis: Compatible with giant hemangioma. Remark: Open biopsy recommended for further evaluation.

The patient was admitted to the gastroenterology ward and managed conservatively with soft liquid diet, blood transfusion (2 units), intravenous fluids, iron supplementation (Ferisen 500mg IV daily for 5 days), and analgesia (Disopan 1mg IV as needed). Follow-up was advised in 2 weeks, with CECT and FNAC already performed.

**Discussion:**

Giant hepatic hemangiomas (GHHs) are benign vascular tumors and the most common benign liver neoplasms, with prevalence ranging from 1.4% to 20% in autopsy series.[1-5] In this report, a 45-year-old woman presented with progressive abdominal fullness attributable to a giant hepatic hemangioma measuring approximately 20.5× 17.5×23cm in the left lobe (segments II, III, and IV), fulfilling the criteria for GHH commonly defined as >10 cm.[5-8] This size places it among the largest reported lesions, comparable to the 23cm case complicated by severe malnutrition and coagulopathy and the 25cm GHH from Bangladesh that required surgical resection.[9]

Although GHHs are predominantly located in the right hepatic lobe,[9] this lesion originated primarily from the left lobe with an additional smaller lesion in the right lobe. The patient experienced symptoms secondary to mass effect, including displacement of adjacent structures (right kidney and pancreas), which aligns with the typical presentation of symptomatic GHH causing abdominal distension, fullness, and early satiety.[9,10] There was no history of oral contraceptive use (a factor noted in some pedunculated variants)[7] and, importantly, no severe complications such as spontaneous rupture, intratumoral hemorrhage, Kasabach-Merritt syndrome, pulmonary embolism, or high-output cardiac failure.

Diagnosis was established through a stepwise imaging approach. Initial ultrasonography suggested a large heterogeneous mass (>34×22cm) possibly of retroperitoneal origin, illustrating the limitations of ultrasound when lesions reach massive proportions. Subsequent multiphasic contrast-enhanced computed tomography (CECT) provided the definitive diagnosis, demonstrating the classic pattern of discontinuous peripheral nodular enhancement in the arterial phase, gradual centripetal filling in the portal venous phase, and prolonged enhancement in the delayed phase.[12,15] These features reflect the low-flow hemodynamic state ("slow river" flow) characteristic of cavernous hemangiomas.[15] USG-guided fine-needle aspiration cytology (FNAC) yielded fresh blood without malignant cells, supporting the benign vascular nature; however, open biopsy was prudently recommended for further histological confirmation, reflecting the cautious diagnostic approach advocated for giant lesions.

Laboratory investigations revealed mild normocytic normochromic anemia and leucopenia (hemoglobin 9.3g/dL, WBC $3.8\times10^{9}$/L)

with normal platelet count, liver function tests, and tumor markers. These mild hematological changes did not evolve into consumptive coagulopathy or thrombocytopenia, distinguishing this case from complicated GHHs associated with Kasabach-Merritt syndrome.[19]

In the absence of life-threatening complications or rapid enlargement, management remained conservative with supportive care (blood transfusion, intravenous iron supplementation, and symptomatic relief), consistent with recommendations for uncomplicated or mildly symptomatic GHH. This approach contrasts with the interventions required in more aggressive cases surgical resection or enucleation,[19] transarterial embolization,[21] or liver transplantation[22] typically reserved for symptomatic, rapidly growing, or hematologically complicated lesions. The present case adds to the limited Bangladeshi experience with GHH, demonstrating that even very large lesions can be safely observed when multiphasic imaging confirms the classic benign pattern.

This case reinforces the diagnostic utility of multiphasic CECT and the generally favorable prognosis of GHH with individualized management. Early recognition through characteristic imaging features avoids unnecessary aggressive interventions, while regular follow-up is essential to monitor for potential growth or rare complications, whose risk increases with tumor size according to Laplace's law.

**Conclusion:**

This case highlights a symptomatic giant hepatic hemangioma diagnosed through characteristic imaging and cytology, managed conservatively. Early recognition avoids unnecessary interventions, with biopsy recommended for confirmation. Further studies on regression factors could inform non-surgical approaches.

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Erratum

DOI: https://doi.org/10.3329/jrpmc.v11i1.90080

**Article** : "Radiologic-Pathologic Correlation in Middle Ear Malignancies: Insights for Early Detection and Surgical Planning"

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**Journal** : Journal of Rangpur Medical College

**Volume** : 10; **Issue:** 2; **Year:** 2025.

In the originally published article, the first author's name was incorrectly printed as **Muhammad Mahudul Haque**. The correct spelling is **Muhammad Mahmudul Haque**.

The error appeared in the article byline and in the Cover page. The authors regret this mistake and confirm that the correct name is as shown above. The online version of the article has been corrected accordingly.

The publisher apologizes for any inconvenience caused.

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