Surgical Outcome of the Extra Articular Distal Tibia Fracture by Minimally Invasive Plate Osteosynthesis – Our Experience

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Abstract

Background:
Extra articular distal tibial fractures are one of the common injury managed by Orthopaedic Surgeon.

Methods:
Clinical and radiological outcome in extra-articular distal tibia fractures treated by minimally invasive plate osteosynthesis (MIPO) of 19 patients were evaluated. This study was done at the Department of Orthopaedics, Rangpur Medical College Hospital from 01/06/2019 to 31/05/2020. Clinical and radiological evaluation was done done immediate post operatively, at 6 weekly intervals till union and at 1 year follow up.

Results:
The mean age of the patients was 38.05 years ± 9.5 SD with 14 males and 5 females with 57.89 % having right tibia involvement. The average time for union in our study was 19.89±3.49 weeks. Also the average time required for partial and full weight bearing was 7.26 ± 2.5 weeks and 13.89 ± 3.49 weeks. Implant irritation was the main complication noted in our study. By Johner and Wruh's criteria, showed that majority of the patients in the study had satisfactory functional results i.e. 81%.

Conslusion:
MIPO is an acceptable modality for treatment in terms of union while exposing the patient to lesser soft tissue trauma. Implant irritation is the complication due to its superficial implant. Larger studies are required for further evaluation.

Key words: Extraarticular distal tibia, MIPO, Plate fixation

Introduction:

Extra articular distal tibia fractures are one of the difficult situation due to its associated soft tissue injury and if not treated properly may result in serious complications and disability[1]. The leading cause is high energy motor vehicle accidents usually in the adult male because of their more outdoor activity[2]. The incidence of distal tibia fractures in most series is 0.6 % and it constitutes to about 10-13% of all tibial fractures[3]. Open reduction and Plate fixation is effective but it is met with extensive soft tissue dissection and increased chances of infection[4]. MIPO techniques allows stabilization of distal tibia fractures while preserving vascularity of the soft tissue envelope.

Difficult learning curve, chances of infection are the possible complications noted with this technique[5,6]. This technique reduces surgical trauma and maintain a biologically favorable environment for fracture healing.

This study was undertaken to study the surgical management of closed extrarticular distal tibia fractures with MIPO, the functional outcome and the various complications associated with it.

Materials and methods:

This study was done in the department of Orthopaedics, Rangpur Medical College Hospital for a period of 1 year between 01/06/2019 to 31/05/2020. Total 19 patients with extra articular distal tibia fractures (AO type 43A1, 43A2, 43A3) were included. Inclusion criteria included age more than 18 years, those who gave valid consent, duration of injury <2 weeks, competent neurological and vascular status of the affected limb and patients who meet the medical standards for routine elective surgery. Patient with open fractures, intra articular extension, pathological fractures, poor medical health were excluded.

Surgical techniques:

This operation was done under spinal anesthesia in supine position on a standard radiolucent table under image intensifier guidance. The medial approach is used. The key concept of the approaches to the distal tibia is preserving the soft tissue envelope and the blood supply in the fractured metaphyseal area. Generally, the plate is inserted from distal to proximal through a tunnel between periosteum and intact overlying tissue.

A straight skin incision 3–5 cm is performed on the medial aspect of the distal tibia over the medial malleolus. The greater saphenous vein and saphenous nerve are protected. Separate stab incisions are usually sufficient for the insertion of the proximal screws in the diaphysis. It may be necessary to perform further stab incisions at the level of the fracture to percutaneously apply reduction forceps or insert a separate lag screw for better reduction.

Fracture reduction was achieved by manual traction and manipulation. Anatomically precontoured plate is inserted through the tunnel from distal to proximal on the anteromedial aspect of the tibia.

Temporarily fixation was done with K wires. After application of the screws the K wires are removed. The wounds are closed in layers and Sterile dressings were applied. Short leg posterior cast was applied for two weeks upto wound healing.

Postoperative protocol:

Radiological evaluation was done immediate post operatively, at 6 weekly intervals till union and at 1 year follow up. Active range of movements of knee along with quadriceps strengthening exercises were started on the next day of surgery. Ankle movement was started after removal of the cast during stitch removal. When there was signs of union as bridging callus in 3 out of 4 cortices and absence of tenderness at the fracture site[7] partial weight bearing was started which usually occurs by 6-8 weeks.

The results at the end of 1 year follow up were evaluated using the "Johner & Wruhs' Criteria" as excellent, good, fair and poor[8].

Results:

In our study, 19 patients of extra articular distal tibia fractures, the mean age of the patients was 38.05 years ± 9.5 SD with range from 19 to 58 years. There were 14 males and 5 females in the study (Figure-1) with 57.89% having right tibia involvement (Figure-2).

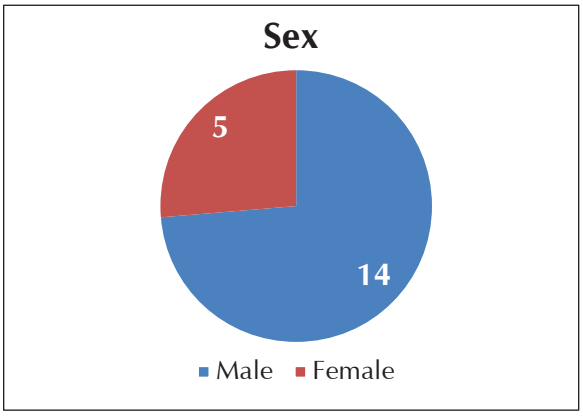


Figure-1: Sex distribution of the patients

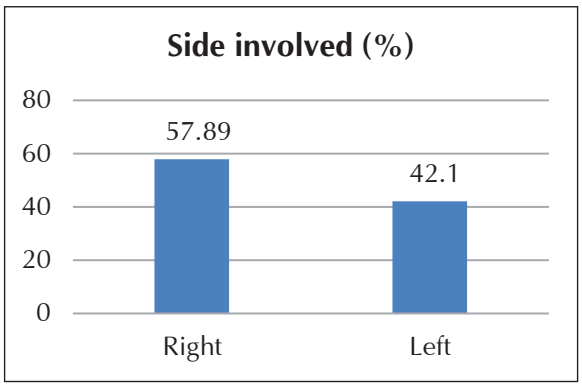


Figure 2: Side involved

Extra articular distal tibial fractures were classified according to AO classification, the most common type 43A1 which accounts 9 patients i.e. (47.61%) followed by 8 (42.85%) type 43A2 and 2 (9.52%) type 43A3 (Table-I).

Table-I: Number of patients according AO classification (n=19)

AO types	Number of patient	%
43A1	9	47.61
43A2	8	42.85
43A3	2	9.52

The commonest mode of injury was RTA (Road Traffic Accident) seen in 68.42% patients followed by falls, sports injury (e.g. football) and assault. More than half (61.90%) were operated within 4 to 7 days of injury (Figure 3).

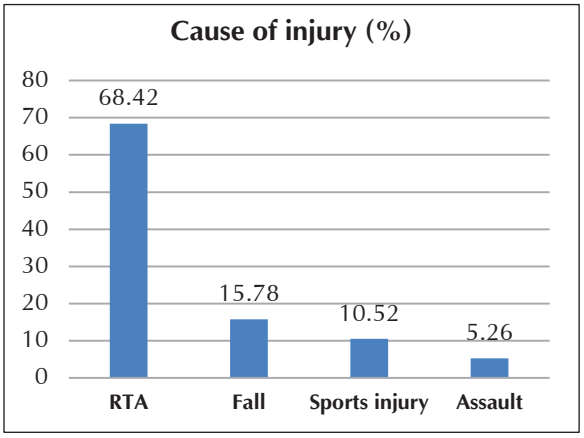


Figure-3: Causes of injury in different patients

Case operated after 7 days as due to limb was swollen and blisters formation over the fracture so we waits for once blisters and swelling settled down.

The operating duration mean was 71.36±5.04 min with ranged from 55 – 90 minutes. No single case of injury to great saphenous vein and saphenous nerve was detected. The mean time for starting partial weight bearing is 7.26 ± 2.5 weeks. The average time for full weight bearing was 13.89 ± 3.49 weeks. The union occurred in an average of 19.89±3.49 weeks.

The functional results, as assessed by Johner and Wruh's criteria, showed that majority 53.56% of the patients in the study had excellent functional results and 27.44% had good results.

Implant irritation (21.05%), ankle stiffness (5.26%) and infection (5.26%) were the main complications noted amongst patients.

Discussion:

Extra articular distal tibial fracture which are presented to the orthopaedician, often poses a challenge to the surgeon as status of soft tissue and degree of comminution itself complicates the plan of management. The goal of operative treatment is to obtain anatomical alignment of the joint surface while providing enough stability to allow early motion. This should be accomplished using techniques that minimize osseous and soft tissue devascularization in the hopes of decreasing the complications resulting from treatment.

With the development of minimally invasive surgery, percutaneous plating has challenged interlocking nailing as locked plate designs act as fixed-angle devices whose stability is provided by the axial and angular stability at the screw-plate interface instead of relying on the frictional force between the plate and bone, which is thought to preserve the periosteal blood supply around the fracture site[6,7].

Understanding of the mechanical background for choosing the proper implant length and the type and number of screws is essential to obtain a sound fixation with a high plate span ratio and a low plate screw density. A high plate span ratio decreases the load onto the plate. A high working length of the plate reduces the screw loading, thus fewer screws need to be inserted and the plate screw density can be kept low[9].

In our study, the patients were in the range from 19 to 58 years, with mean age being 38.05 years ± 9.5. Out of the 19 patients, the gender distribution was as 14 males; 5 females. Predominant male involvement in our study was probably due to more outdoor activities and heavier labor undertaken by males as compared to females in our society. The result were comparable to that of Redfern etal10, Sitnik etal[11].

In our study most common cause for these fractures was road traffic accident (R.T.A) followed by fall and sports injury especially football. Our results were comparable to other studies Deebak etal[12], Eknath etal[13] which also showed that RTA is the most common mode of injury as modernization and industrialization has intruded our lives.

In our study, the operating time in the lock plate it ranged from 55 – 90 minutes (mean 71.36±5.04 min). This was comparable to studies done by Guo etal14 and Hasenbohler et al.[15].

The mean time for starting partial weight bearing in 7.26 ± 2.5 weeks. In our study, we allowed partial weight bearing only after signs of union in form of bridging callus on at least 3 cortices out of 4 cortices on radiograph and clinically as absence of tenderness and movement at the fracture site11 which was usually by 6-12 weeks. Majority of the cases, having fulfilling above criteria around 6-12 weeks and were allowed partial weight bearing on the affected limb.

The average time for full weight bearing was 13.89 ± 3.49 weeks. The mean time of union in our study was 19.89±3.49 weeks. These observations are similar to study done by Guo J J et al.[14]

In our study, we had acceptable alignment in 17 cases i.e. 89.47%. Malalignment was found in 10.52% patients.

This was comparable to studies by Sitnik etal[11]. In our study of 2 cases which had malalignment

evident on immediate postoperative period healed in same position at follow up of 1 year and no significant change was noted. This finding suggests intraoperative error could be the prime cause for malunion and it also throws light on difficulty in reducing the distal fragment accurately. 1case had valgus and 1 case had varus malunion were noted. In our study implant irritation (21.05%) was the most common complication. Superficial infection was seen in 1 patient (5.26%) which was healed with extended period of intravenous antibiotics. As RTA was the commonest cause in our study, alongwith causing the fracture, it might also affect the soft tissue. This may leads to soft tissue disintegrity and infections.

The functional results, as assessed by Johner and Wruh's criteria, showed that majority 53.56% of the patients in the study had excellent functional results and 27.44% had good results.

Our study was comparable for complications with other studies which were conducted by Redfern et al.[10].

Conclusion:

Minimally invasive plate osteosynthesis by locking plate have shown a reliable method of fixation for distal tibia fractures. This procedures preserving most of the osseous vascularity, fracture hematoma which provide biological repair so there is lesser incidence of delayed union and non-union. This technique can be used in fractures where locked nailing cannot be done like distal tibial fractures with small distal metaphyseal fragments and comminuted fractures. The decision to fix the fibula was based on intraoperative reduction of tibia fracture. If significant malalignment was still persisting after fixation of tibia, only then the decision to fix fibula fracture was made. Thus we do not recommend fibular fixation routinely because the essential benefit of closed MIPO in the avoidance of soft tissue dissection might be compromised in this way and also reduces strain over the tibial fracture, which heightens the potential for delayed healing or nonunion but to support this, larger trial are needed. Implant prominence and its related complications because of mismatching of the implant contouring and supra malleolar anatomy especially in thin built patients. Meticulous soft tissue handling is imperative. Further study with large number of patients and long term follow up is required for better understanding of this procedure.

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