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EVALUATION OF OPERATIVE MANAGEMENT OF LOWER THIRD TIBIAL FRACTURES WITH LOCKING COMPRESSION PLATE-A CLINICAL STUDY

Orthopaedics

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ABSTRACT

INTRODUCTION:-This study was conducted to assess the functional outcome ,duration of union***; clinical and radiological*** ,the advantages and complications of locking compression plate for lower third fractures of tibia.

METHOD:-In this prospective and retrospective study 40 cases with lower third tibial fracture treated with locking compression plate and followed up over a minimum period of six months for complication and functional outcomes. The assessment of anatomical and functional outcome was made according to Johner and Wruhs criteria system at 6 months.

RESULT:-In our study 40 cases were studied. The age of patient ranged from 18 to 65 years. The assessment of anatomical and functional outcome was made according to Johner and Wruhs criteria system at 6 month. 22 (55%) out of 40 patients showed excellent results, 12(30%) showed good, 4 (10%) showed fair, 2 (5%) had poor result respectively.

CONCLUSION:-We concluded that locking compression plate technique provides effective stabilization of the lower third tibia fracture, good fracture union and an early mobilization with adequate ankle mobility, allowing a rapid fracture healing and return to daily activity with great patient satisfaction.

KEYWORDS

Pilon fracture, Johner and Wruhs criteria, locking compression plate

INTRODUCTION

Today in this fast moving world and with rapid increase in traffic, the incidence of high velocity trauma has increased significantly. Tibia is the most common long bone to get involved in these types of injuries because of its peculiar position almost whole of which is subcutaneous and has very less cover of soft tissue and surrounding muscle mass[1].Distal tibia fractures are specifically more prone to undergo delayed union, nonunion and secondary osteoarthritis of ankle. Nonsurgical management is possible for stable fractures with minimal shortening but malunion, shortening of affected leg, limitation of range of motion and early osteoarthritis of the ankle have been reported after treatment of these fracture particularly pilon fractures[2].Several surgical methods have been described including external fixation, intramedullary `nailing and plate fixation. External fixation can be useful in open fractures with soft tissue injury, which preclude nail or plate fixation but may result in inaccurate reduction, non-union, malunion and pin tract infection[3]. Intramedullary nailing allows relatively atraumatic closed stabilization. It preserves the vascularity of the fracture site however it is difficult to achieve stabilization of the fracture site because the hourglass shape of the intramedullary canal prevents a tight endosteal fit and compromises torsional and angular stability[4]. Open reduction and internal fixation with plate require extensive soft tissue dissection and periosteal stripping with high rates of complication including infection, delayed union and non union[5].

Minimal invasive plate osteosynthesis techniques have been developed that aims to reduce surgical trauma and to maintain more biologically favourable environment for fracture healing. A new advance in this field is represented by the locked internal fixators which consist of plate and screw systems where screws are locked at a fixed angle thereby minimizing the compressive forces exerted by the plate on the bone. The plate does not need thus to be tightly pressed against the bone to stabilize the fracture thus minimizing disturbance of the bone blood supply[6].Despite all these advances distal tibial fractures remains a therapeutic challenge for orthopaedic surgeons and are associated with a high complication rate and complications affect 20-30 percent of patients[5-6].

AIMS AND OBJECTIVES

To evaluate the functional outcome, duration of union***; clinical and radiological, the*** advantages and complications of locking compression plate for lower third fractures of tibia.

MATERIAL AND METHODS

This study was conducted on patients who were treated with operative fixation of fractures of distal third tibial shaft by plating in the Department of Orthopaedics, DR. S.N. MEDICAL COLLEGE ASSOCIATED HOSPITALS JODHPUR. The study was both prospective and retrospective. Prospectively cases over a period from December 2016 to November 2017 were included and followed up over a minimum period of six months for complication and functional outcomes. Retrospectively cases done from December 2015 to November 2016 were included. We expected that the complication rate is about 25% in patients with Distal Tibia Fracture operated with plating. To achieve the precision within 5% i.e. (15% - 35%), we needed the total sample size of 75. The significance level of the test was targeted at alpha 0.05. Since it was a time bound study, the sample size was limited to at least 40 cases. So, forty cases were included. Out of the forty cases which formed the nucleus of our study 24 were prospective and 16 wereretrospective. Patients aged below18years, abnormal skin condition such as eczema and Compound fractures of Gustilo Anderson type II and type III fracture of tibia were excluded from study.

On admission a detailed and careful history regarding mechanism of injury whether high velocity or low velocity trauma, time since injury, the likelihood of associated injuries, presence of underlying medical condition that can affect treatment or healing and environment in which injury occurred weretaken.All the patients were explained about the aims of the study, the methods involved and an informed written consent was obtained before being included in the study.

PHYSICAL EXAMINATION-:A detailed physical examination was performed. Deformity of the foot and ankle is often apparent on initial inspection. The neurological and vascular status of the foot evaluated. When the circulation was doubtful, the ankle was realigned, and then the vascularity was reassessed. The condition of the skin was carefully examined, including the amount of swelling and the presence of fracture blisters. The presence or absence of skin wrinkles were noted to assess the degree of soft tissue swelling[17]. The true extent of the soft tissue injury may not declareditself initially, so the ankle was frequently reassessed for compartment syndrome which was more common in plafond fractures with diaphyseal extension[18]. Open wounds were inspected to determine their extent and the amount of contamination.

IMAGING:-Radiographs of leg with ankle and knee anteroposterior and lateral views were taken and the fracture was classified according to AO/OTA classification system[19]. Repeat radiographs were taken after provisional reduction of the fracture. Above knee slab was given to give rest to soft tissue and to prevent further soft tissue injury

OPERATIVE PROCEDURE IN BRIEF:-Patients were operated under general or spinal anesthesia according to associated medical condition. The patient was placed in a supine position and tourniquet was applied as high as possible on thigh. Taking all aseptic precautions cleaning and draping of the part was done.

First of all if lateral column was fractured then this was stabilized.A longitudinal incision on the anteriomedial surface of leg parallel to anterior border of tibia and about one centimetermedial to it was given, with the dissection essentially being sub-periosteal. The fracture was reduced and held in position with a reduction clamp. Once the fracture was adequately reduced, selection of appropriate length distal tibia plate was done and it was placed across the fracture and held with bone clamps and screws were inserted. Wound was closed in layers over drain, and aseptic dressing was done and above knee slab was applied to take care of postoperative edema and to provide soft tissue rest.

Anteroposterior and lateral radiographs were obtained next day. Isometric quadriceps exercises were then started from the very next day. Dressing was done on the second postoperative day and drain was then taken out. Suture line assessed for any gaping wound discharge or infection. Crutch or walker aided non weight bearing ambulation started.

POSTOPERATIVE FOLLOW UP: Patient was called on fourteenth postoperative day for suture removal, and below knee slab was applied and continued upto three weeks and advised for active toe movements. Slab was removed at post operative fourth week and non weight bearing ankle mobilization exercises were started for upto six weeks. Radiographs were obtained at regular intervals and assessment was done for the progress of union and tibial mal-alignment weremeasured.The acceptable mal-alignment in tibia will be less than 5° of angulation and shortening of less than 1cm. Partial weight bearing was started when radiograph showed callus was observed at fracture site in one plane radiographic image or after post operative six weeks and full weight bearing was started on observation of callus in two planes of radiographic images.

GRADING OF REULTS:-At each follow up progress of the patient was noted and the range of movement of ankle (Dorsiflexion/ Plantiflexion), pain on movement or rest, any deformity, limitation of activity and disturbance in gait was noted. Radiological progress of fracture and any sign of infection or other plate related problems like impingement or plate breakage were also assessed. Finally, we have taken the patients' clinical assessment at final follow up for the grading of result according to Johner and Wruhs criteria[16] which was very comprehensive criteria as it takes into account activity level, gait, mobility and deformity into account.

OBSERVATION AND RESULTS

In our study 40 patients were studied. The age of patient ranged from 18 to 65 years. Maximum patients were injured in their Fifth decade (30%) followed by fourth (25%) and third (20%).Out of these 40 patients, 30(75) % were men and 10(25%) were women. The right side was injured in 18(45 %) cases, the left side was injured in 22 (55 %) cases.The mode of injury was a fall (low impact) in 18 (45%) patients and a road traffic accident (high impact) in22 (55 %). Out of these 40 Patients, 36(90 %) patients had closed fracture and 4(10%)had Type I Open fracture according to Gustilo& Anderson classification.Out of 40 patients, 16(40%) were A1, 8(20%) were A2, 2(5%) was A3 when classified according to OTA classification. There were 8 (20%) B1 fractures and 2 (5%) fracture each of B2, C2 and C3 type. There was no fracture of B3 or C1 type. In our study, average time of surgical intervention since injury was 3 days, excluding the 4 extreme cases, 2 being 15 and 20 days and other 2 being 6 and 9 months post injury.

In our study 12 patients (30%) started partial weight bearing at 6-7 weeks, 14 (35%) at 8-9 weeks, 10 (25%) at 10-111 weeks, and 4 (10%) at ≥12 weeks respectively. Average time for partial weight bearing was 8.8±2.16 weeks, minimum time was 6 weeks and maximum was 14 weeks.

Table 1: Time to Partial weight bearing

Partial weight bearing (weeks)	Number of patients	Percentage
6-7	12	30
8-9	14	35
10-11	10	25
≥12	4	10

In our study 10 patients (25%) started full weight bearing at 14-15 weeks, 12 (30%) at 16-17 weeks, 6 (15%) at 18-19 weeks, 8 (20%) at 20-21 weeks and 2 (5%) at ≥22 weeks respectively. 2 patients (5%) couldn't bear full weight due to nonunion. Average time for full weight bearing was 17.23±2.53 weeks excluding nonunion, minimum time was 14 weeks and maximum was 22 weeks.

Table 2: Time to Full weight bearing

Full weight bearing (weeks)	Number of patients	Percentage
14-15	10	25
16-17	12	30
18-19	6	15
20-21	8	20
≥22	2	5
Not Done	2	5

In our study 10 patients (25%) showed radiological union at 14-15 weeks, 12 (30%) at 16-17 weeks, 6 (15%) at 18-19 weeks, 8 (20%) at 20-21 weeks, 2 (5%) at ≥22 weeks respectively. 2 patients (5%) showed deficient callus and hence nonunion. The average time to attain radiological union excluding the 2 cases who went into nonunion was 17.23±2.53 weeks ranging from a minimum of 14 weeks to a maximum of 22 weeks.

Table 3: Radiological Union

Time taken (weeks)	Number of patients	Percentage
14-15	10	25
16-17	12	30
18-19	6	15
20-21	8	20
≥22	2	5
Not Seen	2	5

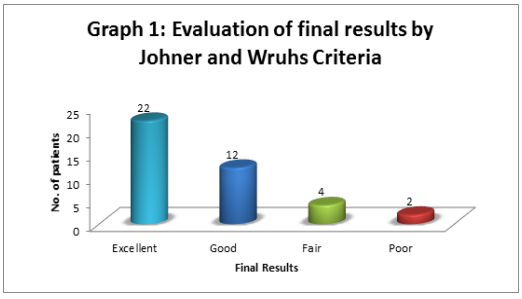
In our study 24 (60%) patients had no pain, 10 (25%) had occasional pain, 6 (15%) had moderate pain respectively. None of the patients had severe pain.

Complications;-6 (15%) patients had ankle movement restriction, 2(5%) had non-union and 2(5%) had superficial skin infection.

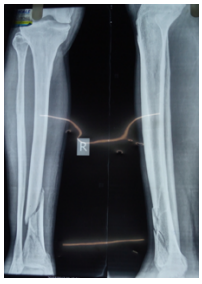
Table 4: Incidence of Complications

Complications	Number	Percentage
None	30	75
Ankle restriction	6	15
Non Union	2	5
Skin Infection	2	5

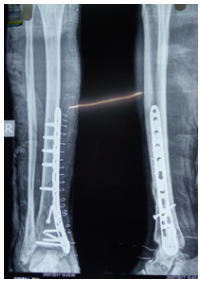
In our study results were finally evaluated using **Johner and Wruhs Criteria**. 22 (55%) out of 40 patients showed excellent results, 12(30%) showed good, 4 (10%) showed fair, 2 (5%) had poor result respectively.



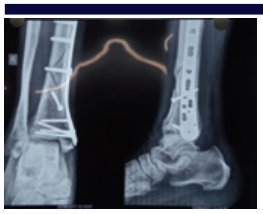
CLINICAL PHOTOGRAPH;-



Prepoerative XRAY



Immidiate Postoperative XRAY



12 Weeks Postoperative XRAY 6 Months Postoperative XRAY

PLANTER FLEXION

DORSAL FLEXION

SQUAT POSITION

DISCUSSION

Distal tibial fractures are one of the most difficult fractures to treat and obtaining a good functional recovery has been a therapeutic challenge for orthopedicians. The status of soft tissue injury, degree of comminution and other fractures sustained at the time of injury affect the long term clinical results. The main objective behind surgery and plating is to provide anatomic realignment of the bone and joint and to allow early mobilisation and recovery to normal daily activity. Keeping in view the outcomes and target of treatment approach is required to cause minimal osseous and soft tissue devascularisation in lieu of reduced complications.

The present study was undertaken to evaluate the results of operative fixation of fracture of distal tibia by plating in relation to union and functional outcome.We evaluated our results and compared them with various other studies on management of distal tibial fractures using different modalities of treatment. The analysis obtained is as follows:

In our study the age of people sustaining distal tibial injury was ranging from 18-65 years with a mean of 42.02±13.24 years. It was comparable with other studies as range of patients' age was 23-59 and 16-77 years in studies done byYong Li et al[15] and Heather AVallier et al[8] respectively and the average age of patients in their studies was 39 and 39.1 years respectively.

The average time to attain radiological union excluding the 2 cases who went into nonunion was 17.23±2.53 weeks. We found our results to be similar to other studies on distal tibial plating. T. W. Lau et al[13] observed union time to be 18.7 weeks, Abdulla S. Abu Senna[14] found 17.5 weeks, Hazarika et al[11] found 19.3 weeks and Im GI et al[7] found 20 weeks respectively.

Table 5; Average Union Time

Study	Union Time (in weeks)
. T. W. Lau et al[13]	18.7
Abdulla S. Abu Senna[14]	17.5
Hazarika et al[11]	19.3
Im GI et al[7]	20
Our Study	17.23

All fractures showed good radiological union except 2 cases who went into non union and hence showed Poor result. 2 patientshad developed superficial skin infection which was treated well with antibiotics and wound care without affecting fracture union and the patient had good result.2 cases showed Excellent result despite of late presentation at 9 and 6 months after failed conservative treatment, plating with bone graft placement provided optimally functional limb.

None of the patients had deep wound infection or shortening of limb more than one cm. All patients had full range of movement at the knee and strenuous activity although was limited, daily routine light work was easily accomplished by all the patients excluding the 2 who went into nonunion. Excluding the same 2 patients none of the patient required another surgery or implant removal. The patient with nonunion was advised for another surgery but it could not be performed due to loss of follow up. There were no cases of delayed union, plate breaking or implant impingement.

In our study we used Johner and Wruhs Criteria to evaluate the bony and functional outcomes of distal tibial plating. We found that 22 (55%) out of 40 patients showed excellent results, 12 (30%) showed good, 4 (10%) showed fair and 2 (5%) had poor result.

When compared with other studies we found similar results as tabulated below:

Table6; Functional Outcomes of distal tibial plating

Study	Acceptable	Not Acceptable
sHazarika et al[11]	85	15
Im GI et al[7]	88	12
Abdulla S. Abu Senna[14]	90	10
Mahajan N[12]	90	10
Maffulli N. et al[9]	65	35
Ahmad MA et al[10]	73	27
Our Study	85	15

Note: Excellent and Good results have been grouped as acceptable and Fair and Poor results have been termed as Not acceptable for easier and better understandable analysis

In our present study results for the bony and functional outcomes of distal tibial plating using Johner and Wruhs Criteria were**Acceptable in 85% cases & Not Acceptablein 15% cases** which is in accordance withMaffulli N. et al[9]in which 65% were acceptable and Ahmad MA et al[10] in which 73% were acceptable ,While our results are equivalent withHazarika et al[11], however, in comparison with the studies ofIm GI et al[7]in which 88% were acceptable, Abdulla S. Abu Senna[14]And Mahajan N[12]in which 90% were acceptable, our results showed inferior results.

CONCLUSION

In our study on 40 patients with distal tibial fractures fixed with plating we found that this technique provides effective stabilization of the fracture, good fracture union and an early mobilization with adequate ankle mobility. The open reduction allows fracture approximation

even in difficult situations with comminution without disturbing much the fracture hematoma and mostly preserves the blood supply to fragment. Intramedullary nail often fail to provide adequate stability and range of ankle movement especially in intra-articular fractures and external fixators mostly provide a primary stabilization followed by fixation and delay the return to daily activity. On the other side plating is a simple straightforward and single step approach to the fracture, with lesser surgical time and soft tissue handling in newer techniques, allowing a rapid fracture healing and return to daily activity with great patient satisfaction.

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