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Comparative Prospective Study; Treatment of Distal Third Tibial Fracture through Medial and Lateral Compression Plate Methods

Abstract

Tibial fracture is the most common long bone fracture. 1 open reduction and plating can result in anatomical reduction and rigid fixation. to evaluate and compare the results of medial and lateral locking compression plates for distal third Tibial fractures. The prospective clinical study involved 32 patients with distal Tibial fractures admitted in the orthopedic department of Nangarhar University and public health Hospital from 22th Nov 2019 to 12th Nov 2020.consisting 26 closed and 6 open fractures at the mean age of 34.57 years. 32 patients were divided into two groups based on treatment method, including medial plating group (16 patients) and lateral plating group (16 patients). They were followed up for at least 5 months after discharge. 10 The functional outcomes were evaluated using Tenny and Wiss clinical assessment criteria. As a result, Malunion was 2 1 cases of medial plating group and in 2 case of lateral plating group.in medial plating group,4 cases of superficial and 2 deep infections, 1 nonunion and 2 wound dehiscence. In lateral plating group, 2 case of superficial and 1 deep infection and 2 nonunion. In the lateral plating group, 3 patients reported feeling the plates and screws. In medial plating group, 8 patients reported symptomatic hardware problems and 5 asked to remove the hardware. The number of cases graded as excellent-1, good-7, fair-8 and poor was- 3 in the medial plating group. Excellent-2, good-6 fair-7 and poor was-1 in lateral plating group respectively. In medial plating group, final range of motion was 18.2° in ankle dorsiflexion and 29.5° in ankle plantar flexion. In lateral plating group, final range of motion was 20° in ankle dorsiflexion and 33.2° in ankle plantar flexion. Finally, Lateral plating of distal tibia is safe and feasible, which can provide biological fixation and prevent the soft tissue complications.

Keywords: Tibia fractures, Bone plates, Open fracture reduction

Introduction

Distal third Tibial fractures remain challenging due to peculiar soft tissue features and myriad treatment options. Surgical treatment itself has controversies such as difficulty in achieving and retaining good reduction by nailing methods, propensity to infection and nonunion due to dissecting the fracture site during the procedure of inserting the plate (13). Open reduction and plating can result in rigid fixation and retention of the anatomical reduction. Traditionally popular method of medial plating offers good exposure to the tibia. However, it is at high risk of wound dehiscence, infection and hardware problems (4). Recently, minimally invasive percutaneous medial plating has been devised (6). However, this method is technically demanding, and it is often difficult to achieve anatomic reduction of the fracture site. Also in medial plating, if fixation of the fibula is required, an additional incision should be made on the lateral side of the shin. Single lateral plating for distal Tibial and fibular fractures was reported to yield good results, but most of these studies were small series (11).in their biomechanical study, Surgical fixation of distal tibia fractures is often associated with high risks of developing complications (4). Although infection, pain, and mechanical instability are responsible for the majority of orthopedic surgical readmissions (5), they are notifying re-operation risks based on surgical approach for frequently unavoidable and result in re-operations. Ide distal tibia fractures is especially important considering future changes in the healthcare system that may penalize re-operations. In the treatment of distal tibia fractures, intramedullary nailing (IMN) is associated with an increased risk of malalignment (2), and minimally invasive plate osteosynthesis (MIPO) is a challenging technique with contested advantages over plating via open reduction and internal fixation (ORIF) (3).Several comparative studies on distal tibia fractures have demonstrated the utility of ORIF compared with alternative approaches due to the relatively low risk of complication development (7)A comparative study by Cheng et al. demonstrated no significant differences in outcomes among distal tibia fracture patients treated with MIPO compared

with ORIF (3).increased infections

(9). Several comparative studies on distal tibia fractures have demonstrated the utility of ORIF compared with alternative approaches due to the relatively low risk of complication development (8). A comparative study by Cheng et al. 6 demonstrated no significant differences in outcomes among distal tibia fracture patients treated with MIPO compared with ORIF (3). joint. Sometimes the fibula also is fractured. The extent of the injury is usually not obvious in the plain x-rays; accurate definition of the fragments demands a computed tomography (CT) scan (12).

Materials and methods

the course of this research, the 1 patients with distal Tibial fractures admitted in Department of orthopedics at the university Hospital of Medical faculty of Nangarhar university from 22th Nov 2019 to 12th Nov 2020 were included with the following criteria. Inclusion criteria were adult 3 patients with distal third Tibial fractures with or without coincide fibular fractures, closed and open fractures in which soft tissue injury was healed and skin condition was good enough for definitive treatment.

(fig 1; median plating group & x- ray)

1 Exclusion criteria were patients with open fractures in which soft tissue injury was not healed or skin condition was poor and patients with coincide vascular injury. Totally 32

patients at the mean age of 34.57 years were included in this study and were followed up for at least 5 months after discharge, including 26 closed and 6 open fractures. All open fractures were primarily treated by irrigation, via debridement and appropriate IV antibiotics. Calcaneal pin traction was applied in 1 cases and spanning external fixator in 2 case as temporary fixation. [1] With healed soft tissues and good skin condition, definitive management was undertaken in all patients. 32 patients were divided equally into two groups based on treatment method. The medial plating group used medial approach including 16 patients (mean 32.17 years). 13 patients (81.25%) suffered from vehicular trauma. 3 patients had open fractures and 14 had Tibial fractures concurrent with ipsilateral fibular fracture. The mean follow-up was 5.9 months. The lateral plating group used a lateral approach including 16 patients (mean 36.97 years).12 patients (75.00%) suffered from vehicle-related trauma. 4 had open fractures and 12 had Tibial fractures concurrent with ipsilateral fibular fracture. The mean follow-up was 5.5 months. The medial plating was described by Clifford et al.3 If the distal fibula was fractured, it was fixed using separate incisions. [7] In the lateral plating group and lateral approach was performed as described by Manninen et al.

Fig 2: Lateral Plating & X-Ray

A vertical skin incision was performed from distal fibula to the anterior margin of the fibula. The dorsal cutaneous branches of the superficial peroneal nerve were retracted and

protected. The fibula was exposed, if fractured, it was fixed firstly to obtain the reference length of the tibia. The anterior muscles and neurovascular tissue were bluntly dissected from the interosseous membrane and retracted anteriorly [1] After the reduction of Tibial fracture, precontoured metaphysical plate was applied in medial plating group and precontoured anterolateral distal Tibial plate was applied in lateral plating group. The distal end of the plate could nearly reach the joint line. At least 6 cortex fixations proximal and distal to the fracture site were done. Operating time was recorded. Below-knee slab in a neutral position was applied for 3 postoperative weeks for soft tissue healing. Radiographs taken immediately and postoperatively were reviewed for adequacy of fracture reduction in all patients.

Anteroposterior alignment was determined by measuring the angle between a line paralleled to the proximal fragment and a line paralleled to the distal fragment on lateral radiographs. Varus– valgus alignment was determined by measuring the angle between the line perpendicular to and bisecting the Tibial plateau and proximal medullary canal and the line bisecting the distal medullary canal and Tibial plafond on anteroposterior radiographs. If both the fracture gap <2 mm and angular deformity ≤5° in any plane (valgus/Varus, or anterior/posterior) were present, it was considered as excellent reduction. The fracture gap of 2–5 mm and angular deformity of ≤5° in any plane were regarded as good reduction. Adequate reduction included excellent and good reductions. Bony [5] union was defined as evidence of bridging callus across the fracture sites or the obliteration of the fracture lines based on radiographic findings. Malunion was defined as angular deformity >5° in any plane, or internal rotation ≥10°, external rotation >15°, or shortening ≥2 cm. Nonunion was defined as no evidence of healing after 6 months. [1] Final evaluation was done for distal Tibial fractures using Tenny and Wiss clinical assessment criteria based on 100 points system.12 The Student's t test was used to compare the outcomes of the two groups. p values less than 0.04 were considered significantly different. Overall wound complications (mainly infection) in our series [5] in both groups were 15 %, distributed as five cases in the ORIF group against one only in the

MIPO group, although there was no statistically significant difference in the incidence between both groups, but we consider this a clinical significant finding, apart from soft tissue dissection needed for exposure and fixation in ORIF group, four of the five cases had an open fracture, both factors may contribute to increase incidence of infection in ORIF group. Our results in the ORIF which was 12.5 % of overall infection incidence were comparable to what was reported by Yih-Shiunn Lee et al. who had a superficial infection rate of 8% in distal tibia fracture treated by ORIF technique [13] also Jensen et al. Wound problems considered to be one of the most annoying complication to the trauma surgeon while treating this type of fracture, mainly infection and skin necrosis (1).

Results

There were 2 cases of malunion in the medial plating group and 2 in the lateral plating group. In the medial plating group, there were 4 cases of superficial infections, 2 deep infections, 1 nonunion and 2 wound dehiscence. In the lateral plating group, there was 2 case of superficial infection, 1 deep infection and 2 nonunion ssuperficial infections In the first follow-up, 7-10 days after surgery, wounds were clinically diagnosed and treated with oral antibiotics for 7 to 14 days. Both cases of deep infection were presented at the first follow-up 7-10 days after surgery as a discharge around the suture. According to the results of the drug sensitivity test, they were hospitalized and given intravenous antibiotics. No signs of chronic osteomyelitis were seen at the last follow-up. In the lateral plating group, 3 out of 16 patients felt plaque and screws. In the internal plating group, 8 out of 16 patients reported symptomatic hardware problems, and 5 asked them to remove the hardware. Therefore, the lateral plating group experienced fewer hardware problems and hardware removal. In the final follow-up, functional results were evaluated using somatic and Weiss clinical evaluation criteria. The number of cases that are rated as excellent= 1, good=7, fair=8 & poor =2 also excellent= 2, good=8, fair=7 and poor =1sin the internal plating group, In the lateral plating group, the final range of motion behind the ankle was 20° and at the flexion of the sole of the ankle was 33.2°. According to Table 1, it was observed that there is a significant difference in gender distribution between the two

groups while there is no significant difference in the mechanism of injury and fracture characteristics. Table 2 had significantly less operating time in the lateral plating group than in the internal plating group, while no significant differences were observed in union rate, recovery time, symptomatic hardware, superficial infection, performance score, and 12 range of motion of the ankle (p>0.04).

Table 1 shows the sex and follow up of patients in internal & 1 lateral plating group:

No

Parameter Sex

Median plating

Lateral plating group (16)

T– value

P–value

group (16)

1

Male

1

3

8.74

0.008

2

Female

15

13

3

Usual age

32.2

36.9

4

Follow up (months)

5.9

5.5

Table 2-A: Characteristics of patients in internal & lateral plating group

No

parameter

(Injury

Median

plating

Lateral

plating

t- value

p- value

mechanism)

group (16)

group (16)

1

RTA

12

10

0.12

0.49

2

Fall from height

3

2

3

Others

1

4

Table 2 – B: Characteristics of patients in internal & lateral plating group

No

Parameter Fracture

Median Plating

Lateral

Plating

T - value

P – value

type

Group

Group

1

0pen

2

3

0.15

0.59

2

Closed

14

13

3

concomitant

14

12

Table 3 ; Results of the medial 4 and lateral plating in distal Tibial fractures.

No

Factors

Median plating

Lateral plating

t- value

p- value

group (n = 16)

group (n = 16)

1

Operative time (min)

97.5 ± 14.2

85.3 ±11.7

1.88

0.03

2

Union rate

14/16

15/16

0.32

0.49

3

Healing

time

16.8 ± 2.8

16.5 ± 4.5

0.33

0.62

(weeks)

Table 4 shows postoperative complications

No

Parameter

Median plating

Lateral plating

t-value

p-value

group

group

1

Symptomatic

8

3

2.67

0.07

hardware

2

Hardware removal

5

0

–

–

3

Superficial infection

4

2

2.84

0.02

4

Wound dehiscence

2

0

–

–

5

Result grading

6

Excellent

1

2

7

Good

7

6

8

Fair

8

7

9

Poor

3

1

10

Ankle dorsiflexion

18.2 ± 6.9

16.4 ± 7.0

−0.68

0.40

(°)

11

1 Ankle plantar flexion

29.5 ± 7.8

30.1 ± 8.2

−1.05

0.01

(°)

Discussion

Nonsurgical treatment of Tibial fractures can increase the incidence of malalignment with 9 unacceptable shortening as Hooper et al. concluded that Nonoperative treatment resulted in more malunion and shortening. The most surgical methods for 2 distal Tibial fractures are intramedullary nailing or medial plating.1, 2 although, malalignment of the distal tibia may occur after nailing.1 Valier et al 2 reported 113 cases of extra-articular distal Tibial fractures treated with an 11 intramedullary nail (n = 76) or a medial plate (n = 37) and found that the plating led to fewer malunion compared with the nailing (5.4% vs 38%). In our 36 patients, 4 (11.1%) reported malunion. In our research, 1 symptomatic hardware was a common problem in the medial but unusual in the lateral plating group. Totally 39% of the patients treated with medial plating requested a secondary operation to remove the implants because of the comfort produced by the medial plate placed under the skin over anteromedial tibia. In contrast, in the lateral plating group, a lateral plate was

placed beneath the anterior compartment muscles with thick soft tissue coverage 6 cases had superficial infections in our study, including 5 in the medial and 1 in the lateral plating group. Wound necrosis and symptomatic hardware were more common in the medial plating group than the lateral plating group. Theoretically, medial plating increases skin tension of the anteromedial tibia. In addition, medial plating often requires a separate incision for the accompanied distal fibular fracture, leading to double skin incisions around the ankle which may disturb the skin circulation between incisions. This may develop poor blood supply to the region and cause wound necrosis. in our study, operative time in the lateral approach was not significantly longer than anterior approach. We experienced no difficulties using the lateral approach. Therefore, we concluded that the lateral plating is a safe and feasible technique. Our result was consistent with that of a retrospective study conducted by Lee et al15 in Lin Shin Hospital, Taichung City. They retrospectively reviewed 88 3 patients with distal Tibial fractures treated with medial or lateral plating and concluded that both methods achieved good functional outcomes with a low malunion rate; however, the lateral plating group had a lower complication rate and fewer hardware problems ($p < 0.001$). Our study was a prospective one, but with small sample size.

1 Conclusion:

Lateral plating of distal tibia can provide biological fixation and prevent the soft tissue complications associated with medial plating.

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