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

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ABSTRACT

The most frequent fracture of a long bone is a tibial fracture. Anatomical reduction and rigid fixing may arise from open reduction and plating. To assess and contrast the outcomes of medial and lateral locking compression plates for fractures in the distal part of the tibia. 32 patients with distal tibial fractures were enrolled in the prospective clinical study from November 22, 2019, to November 12, 2020, at Nangarhar University and Public Health Hospital. With a mean age of 34.57 years, 26 closed fractures, and 6 open fractures. Based on the manner of therapy, 32 patients were split into two groups, with medial plating group (16) included (16 patients) and the lateral plating group. After being released, they were monitored for at least 5 months. The clinical assessment criteria developed by Tinny and Wiss were used to evaluate the functional outcomes. Malunion arose in two cases of medial plating group and two cases of lateral plating group as a result.4 cases of superficial and 2 cases of deep infections, 1 nonunion, and 2 wound dehiscence were found in the medial plating group. There were two cases of superficial and one case of deep infection as well as two nonunion in the group3 cases that were classified as excellent-1, good-7, fair-8, and poor. In the lateral plating group, the scores were excellent 2, good 6, fair 7, and poor 1 respectively. Ankle dorsiflexion and plantar flexion ultimate ranges of motion in the medial plating group were 18.2° and 29.5°, respectively. The end range of motion for the lateral plating group was 20° for ankle dorsiflexion and 33.2° for ankle plantar flexion. Finally, it is safe and practical to plat the distal tibia laterally, which can provide biological fixation and avoid soft tissue complications.

Keywords: Tibia fractures, Bone plates, Open fracture, Surgical surgery, Fibular fractures, and Fragments.

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 (Valier *et al.,* 2008). 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 (Clifford *et al.,* 1988). Recently, minimally invasive percutaneous medial plating has been devised (Helfet *et al.,* 1997). However, this method is technically

demanding, and it is often difficult to achieve anatomic reduction of the fracture site. Lateral third Due to unique soft tissue characteristics and a wide range of treatment choices, tibial fractures continue to be tough. The surgical surgery itself is controversial due to issues like the challenge of attaining and maintaining adequate reduction using nailing techniques, the risk of infection, and nonunion because the fracture site was dissected when the plate was inserted (Valier *et al.,* 2008). The anatomical reduction may be rigidly fixed and retained as a consequence of open reduction and plating. The medial plating technique, which is still widely used, provides good tibia exposure. However, there is a high risk of infection, hardware issues, and wound dehiscence (Clifford *et al.,* 1988). Percutaneous medial plating with minimally invasive surgery has recently been developed (Helfet *et al.,* 1997). Although technically challenging, this method frequently fails to a second incision should be made on the lateral side of the shin during medial plating if fixation of fibula is necessary (Karimi *et al*., 2023; Rana *et al*., 2021).

Although the majority of these studies were small series, single lateral plating for distal Tibial and fibular fractures was reported to produce the positive results (Manninen *et al.,* 2007). Surgical fixation of distal tibia fractures is frequently linked to the significant chances of developing problems, according to their biomechanical investigation (Clifford *et al.,* 1988). The majority of orthopedic surgery readmissions are caused by infection, discomfort, and mechanical instability, but they are also alerting re-operation risks based on surgical technique for frequently unavoidable and result in re-operation. In light of potential changes in the healthcare system that could punish repeat procedures, it is especially crucial to diagnose distal tibia fractures. Intramedullary nailing (IMN) is linked to a higher incidence of malalignment in the treatment of distal tibia fractures (Chen *et al.,* 2002) & minimally invasive plate osteosynthesis (MIPO) is a difficult procedure with debatable benefits over plating via open reduction and internal fixation (ORIF) (Cheng *et al.,* 2011). Due to the relatively low risk of complication development, ORIF has been shown to be useful in comparison to other approaches in a number of comparative studies on distal tibia fractures (Hasibuzzaman *et al*., 2022; Janssen *et al.,* 2007).

No appreciable differences in outcomes were seen between patients with distal tibia fractures treated with MIPO versus ORIF, according to a comparison study by (Cheng *et al.,* 2011) elevated infection rates (Joveniaux *et al.,* 2010). Due to the very low risk of complication development, several comparative studies on distal tibia fractures have shown the efficacy of ORIF compared to alternative methods (Jensen *et al.,* 1977). No appreciable differences in outcomes were seen between patients with distal tibia fractures treated with MIPO versus ORIF, according to a comparison study by Cheng *et al.* (*Cheng et al.,* 2011). In some cases, the fibula is also broken. A computed tomography (CT) scan is necessary to accurately define the fragments because the extent of the injury is typically not visible in ordinary x-rays (Solomon *et al.,* 2014).

MATERIALS AND METHODS:

The following criteria were used to include the patients with distal tibial fractures who were admitted to the orthopedic department at the university Hospital of Nangarhar University from November 22, 2019, to November 12, 2020. Adult patients with distal third Tibial fractures together with or without concurrent fibular fractures as well as closed and open fractures in which soft tissue damage had healed and skin condition was sufficient for effective treatment met the inclusion criteria.

Patients with open fractures in which the soft tissue injury had not healed or in whom the skin condition was poor, as well as patients with concurrent vascular injury, were excluded. 32 patients in total, with a mean age of 34.57years, including 26 closed and 6 open fractures, were included in the research study and were followed up for at least 5 months following discharge. All open fractures received adequate IV antibiotics, irrigation, and debridement as primary treatments. In one example, calcaneal pin traction was used, and in two other cases, an external fixator was used to provide a temporary fix. All patients had definitive care once their skin and soft tissues had recovered. Based on the chosen treatment strategy, 32 patients were evenly split into two groups. The group that had medial plating had 16 patients (mean age, 32.17 years) in it. 13 patients (81.25%) experienced car accidents. 14 patients had Tibial fractures concomitant with

ipsilateral fibular fractures, while 3 patients had open fractures. A 5.9-month follow-up was the average.

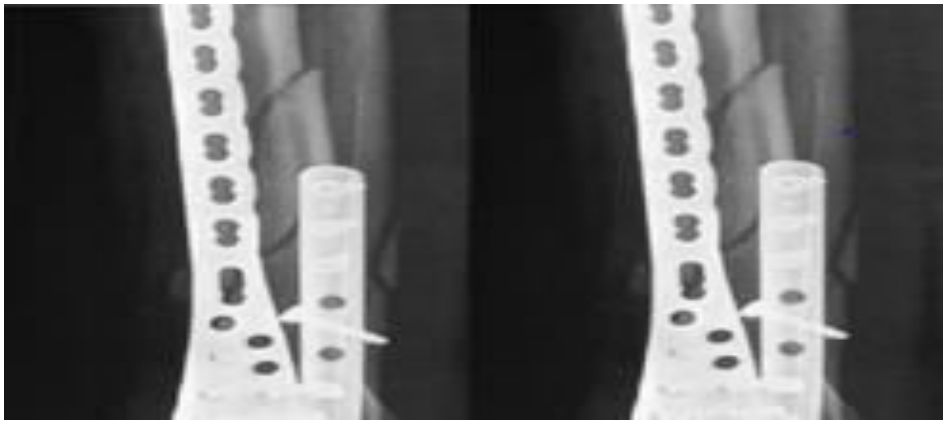

Fig. 1: Median Plating Group and X-Ray.

The lateral plating group included 16 patients (mean age 36.97 years) and employed a lateral technique.12 individuals (75.00%) experienced trauma from a vehicle. 12 patients had Tibial fractures concomitant with ipsilateral fibular fractures, while 4 patients had open fractures. A 5.5-month follow-up was average. Clifford *et al.* described the medial plating. 3 If the distal fibula was shattered, different incisions were used to repair it. According to Manninen *et al.* instructions, a lateral approach was used in the lateral plating group.

Fig. 2: Lateral Plating and X-Ray.

Between the distal fibula and the anterior border of the fibula, a vertical skin incision was made. The superficial peroneal nerve's dorsal cutaneous branches were retracted and shielded. The fibula was exposed, and if it was fractured, it was repaired first to determine the tibia's reference length. The interosseous membrane was cut bluntly, and the anterior muscles and neurovascular tissue were retracted anteriorly. Recontoured metaphysical plate was used in the medial plating group and recontoured anterolateral distal after the reduction of the tibial fracture. In the group of lateral plating, the tibial plate was used. The plate's distal end might almost touch the joint line. At least six cortical fixations were performed both proximally and distally of the fracture site. The operating period was noted. For three weeks following surgery, a below-knee slab in a neutral position was used to promote soft tissue healing. Radiographs were collected immediately after surgery and again afterward to assess each patient's fracture reduction. On lateral radiographs, the angle between a line parallel to the proximal fragment and a line parallel to the distal fragment was measured to determine the anterior-posterior alignment. On anteroposterior radiographs, the angle between the lines perpendicular to and bisecting the proximal medullary canal and Tibial plateau and the line bisecting the

distal medullary canal and Tibial plafond was used to calculate the varus-valgus alignment. Excellent reduction was defined as the presence of both a fracture gap 2 mm and an angular deformity 5° in any plane (valgus/varus, or the anterior/posterior). A satisfactory reduction was considered to have a fracture gap of 2 to 5 mm and an angular deformity of less than 5° in any plane. Bony union was defined as the presence of bridging callus across the fracture sites or the obliteration of the fracture lines based on radiographic findings. Malunion was defined as an angular deformity greater than 5° in any plane, or an internal rotation greater than 10°, external rotation greater than 15°, or a shortening greater than 2 cm. Nonunion was defined as the absence of healing after six months. Adequate reduction included excellent and good reductions. Teeny and Wiss clinical assessment criteria based on a 100-point system were used to conduct the final evaluation for distal tibial fractures.12 the results of the two groups were compared using the Student's t test. P values of less than 0.04 were regarded as statistically significant. In our study, the overall rate of wound complications (mostly infection) was 15%, distributed as five cases in the ORIF group against one in the MIPO group. Despite the fact that there was no statistically significant difference in the incidence between two groups, we still view this as a clinically important finding. In addition to the soft tissue dissection required for exposure and fixation in the ORIF group, four of the five cases had an open fracture; both of these factors may have contributed to the higher incidence of infection in the ORIF group. Our findings in the ORIF, which represented 12.5% of the incidence of all infections, were comparable to those of Yih-Shiunn Lee *et al.* who, while treating a distal tibia fracture with the ORIF approach, experienced an 8% risk of superficial infection (Valier *et al.,* 2008).

RESULTS:

In the medial plating group there were two occurrences of malunion, while in the lateral plating group there were two cases. There were 4 cases of the superficial infections, 2 cases of deep infections, 1 case of nonunion, and 2 cases of wound dehiscence in the medial plating group. There were two cases of superficial infection, one case of deep infection, and two cases of nonunion superficial infection in the lateral plating group. During the initial checkup, which took place 7–10 days after surgery, wounds were clinically identified and given oral antibiotic treatment for 7-14 days. At the first follow-up appointment seven to ten days after surgery, both cases of deep infection were diagnosed as a discharge around the suture. They were admitted to the hospital and given intravenous antibiotics in accordance with the results of the drug sensitivity test. At the most recent check-up, no indications of chronic osteomyelitis were present. 3 out of 16 patients in the lateral plating group reported feeling plaque and screws. When it comes to interior plating, out of the 16 patients, 8 reported symptoms of hardware issues, and 5 requested that the hardware be taken off. As a result, there were fewer hardware issues and hardware removals in the lateral plating group. Functional outcomes were assessed using somatic and Weiss clinical evaluation criteria in the final follow-up. The number of instances in the internal plating group that are assessed as excellent= 2, good=8, fair=7, and poor=1 is also excellent= 2, good=8, fair=8, and poor=2. The final range of motion behind the ankle and at the ankle's sole's flexion were both 20° and 33.2° in the group with lateral plating. **Table 1** shows that while there is no significant difference in the parameters of the fracture and the cause of injury, there is a significant variation in the gender distribution between the two groups. **Table 2** lateral plating group had significantly less operating time than the internal plating group, although there were no appreciable changes in the ankle's range of motion, performance score, symptomatic hardware, superficial infection, recovery duration, or union rate (p>0.04).

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

No	Parameter Sex	Median plating group (16)	Lateral plating group (16)	T– value	P–value
1	Male	1	3		
2	Female	15	13		
3	Usual age	32.2	36.9		
4	Follow up (months)	5.9	5.5	8.74	0.008

Table 2 (A): Characteristics of patients in internal and lateral plating group.

No	Parameter (Injury mechanism)	Median plating group (16)	Lateral plating group (16)	T- value	P- value
1	RTA	12	10		
2	Fall from height	3	2		
3	Others	1	4	0.12	0.49

Table 2 (B): Characteristics of patients in internal and lateral plating group.

No	Parameter Fracture type	Median Plating Group	Lateral Plating Group	T - value	P – value
1	0pen	2	3		
2	Closed	14	13		
3	concomitant	14	12	0.15	0.59

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

No	Factors	Median plating group (n = 16)	Lateral plating group (n = 16)	t- value	p- value
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 (weeks)	16.8 ± 2.8	16.5 ± 4.5	0.33	0.62

Table 4: Shows postoperative complications.

No	Parameter	Median plating Group	Lateral plating group	t-value	p-value
1	Symptomatic hardware	8	3	2.67	0.07
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	Ankle plantar flexion	29.5 ± 7.8	30.1 ± 8.2	−1.05	0.01

DISCUSSION:

As Hooper *et al.* found that nonoperative treatment led to more malunion and shortening, nonsurgical treatment of tibial fractures can increase the incidence of malalignment with unacceptable shortening. For distal Tibial fractures, intramedullary nailing or medial plating is the two most common surgical techniques. Nevertheless, after nailing, the distal tibia may become misaligned 1, 2.1 In 113 cases of extra-articular distal tibial fractures, either an intramedullary nail (n = 76) or a medial plate (n = 37) were used for treatment. Valier *et al.* 2 showed that the plating resulted in fewer malunions than the nailing (5.4% vs. 38%). 4 (11.1%) of the 36 patients in our group had malunions. In our study, symptomatic hardware was a typical issue for medial plating but uncommon for lateral plating. Due to the comfort the medial plate, which was positioned beneath the skin over the anteromedial tibia, provided, 39% of the patients who underwent medial plating wanted a second surgery to have the implants removed. In contrast, a lateral plate with thick soft tissue coverage was positioned beneath the anterior compartment muscles in the group that underwent lateral plating. In our study, 6 cases - 5 in the medial plating group and 1 in the lateral plating group-had superficial infections. The medial plating group experienced higher wound necrosis and symptomatic hardware than the lateral plating group. The anteromedial tibia's skin tension is supposedly increased by medial plating. Furthermore, medial plating frequently necessitates a second incision to treat the comorbid distal fibular fracture, resulting in double skin incisions around the ankle that may impair skin circulation in the area in between. As a result, the area may experience insuffi-

cient blood flow, leading to wound necrosis. In our investigation, the lateral approach's operating time was not noticeably longer than the anterior method. We had no issues employing the lateral strategy. As a result, we came to the conclusion that the lateral plating method is both practical and safe.

Our findings were in line with a retrospective research done by Lee *et al.* 15 at Lin Shin Hospital in Taichung City. Retrospective analysis of 88 patients with distal tibial fractures treated with medial or lateral plating revealed good functional outcomes with low rates of malunion in both groups, but the lateral plating group experienced fewer complications and the hardware problems (p 0.001) than the medial plating group. Our study had a limited sample size and was prospective.

CONCLUSION:

The anterolateral locking compression plate appears to be a reliable choice for treating distal tibia fractures. The lateral malleolus and distal tibia can be properly exposed using the anterolateral approach, which makes it easier to understand the fracture anatomy on the operating table. For the fixation of distal tibia fractures, this method allows the placement of an anterolateral locking compression plate that is recontoured. Treatment of the distal tibia fractures, particularly comminuted intra articular fractures, is aided by this method. In this area, a well-positioned plate has sufficient soft tissue coverage, which lowers the risk of wound collapse. The study's findings, which demonstrated a 75% well to outstanding functional outcome with a few problems, can be used to evaluate the efficacy of the anterolateral locking compression plate.

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CONFLICTS OF INTEREST:

The author(s) declare that there are no potential conflicts in publishing the present review study.

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