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Original Research Paper

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INTERLOCKING NAILING OF TIBIA WITH OR WITHOUT FIBULAR PLATING IN FRACTURES OF BOTH BONES OF LEG: A COMPARATIVE STUDY."

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ABSTRACT

Aim : to evaluate the influence of fibular plating on the stability of the construct and the reduction of valgus deformity resulting from fixation, when the tibia is stabilized by an intramedullary interlocking nail. **Materials And Methods:** 30 patients were divided into 2 groups. Group1(n=15): Patients underwent interlocking nailing of tibia. Group 2 (n=15): initially underwent an ORIF procedure for the fibula fracture, followed by a closed nailing procedure for the tibial fracture . post operative radio analysis was done. The correction percentage was recorded. The data was collected and analysed to determine the statistical relevance of using prior fibular plating to rectify the valgus of the distal fragment. **Results :** Males are majority with RTA being most common reason. Group I had an average union period of 15.8 weeks, but Group II had a somewhat lower average union time of 14.92 weeks. The correction rate attained in group I was 29.98% and group II was 53.9%. None of the cases in group II experienced fibular non-union or infection. **Conclusion :** Fibular fixation improves outcomes without increasing complications, recommending its use in conjunction with tibial nailing

KEYWORDS :

INTRODUCTION :

Tibial fractures are often associated with soft tissue injury, and if not treated effectively, they can cause significant disability to the patient. High intensity motor vehicle trauma is the most common cause, followed by falls, direct blows, and sports injuries. In most series, the incidence of distal tibia fractures is 0.6%, which accounts for around 10%-13% of all tibial fractures.[1]

Tibial diaphyseal fractures are the most common type of long bone fracture (26 per 100,000 people per year in an average population). Closed reduction with intramedullary interlocking nailing is now widely acknowledged by surgeons as the most common procedure for fixing tibial fractures in adults . Interlocking nailing has the following advantages: (a) it provides adequate mechanical stability with better fracture alignment, as in open reduction and internal fixation, and (b) it maintains a proper biological environment, including intact soft tissues with blood supply, as in closed reduction and plaster of Paris application.[2]

Locked intramedullary nailing is the preferred treatment for closed tibia shaft fractures. Proper nail alignment requires central placement in both proximal and distal pieces . However, improper placement in the distal fragment of the lower third of the tibia might lead to difficulties. This increases tension on the distal locking bolts, potentially leading to fracture and misalignment. Although more distal fractures can be nailed intramedullary, maintaining a mechanically stable reduction becomes challenging. Stability can be increased with usage of multiple locking options in the distal fragment of which fibular plating is one of them.[3]

The utility of fibular fixation in addition to tibial IM nailing in distal extraarticular tibia-fibular fractures is still debated. Furthermore, after fibula fixation, the biomechanical structure is thought to be more comparable to that before the injury, reducing the total load applied to the knee joint by one-sixth and 6% to 7% of the total load transmitted via both the tibia and fibula. The converse point of view is that fibular fixation may produce delayed union or nonunion because it limits cyclic loading on the tibial fracture site. [4]

However there are almost no studies demonstrating the comparison of Interlocking nailing of tibia with or without fibular Plating in fractures of both bones of leg. hence the present study is designed to to evaluate the influence of fibular plating on the stability of the construct and the reduction of valgus deformity resulting from fixation, when the tibia is stabilized by an intramedullary interlocking nail.

2. Aim Of The Study

The aim of our study is to evaluate the influence of fibular plating on the stability of the construct and the reduction of valgus deformity resulting from fixation, when the tibia is stabilized by an intramedullary interlocking nail.

Inclusion Criteria: Patients within 20 to 60 years of age, Closed fractures of tibia and fibula, Type I (Gustillo-Anderson classification) fractures tibia and fibula, Fracture pattern - Transverse, oblique, spiral, wedge, Comminuted fractures, Fractures with severe initial valgus deformity and unacceptable reduction after plaster application, Patients willing to participate in this study.

Exclusion Criteria: Age less than 20 and more than 60 years, Type II and Type III (Gustillo-Anderson) fractures, Fracture pattern-severely multi fragmented fractures, Individuals not willing to participate in this study.

MATERIALS AND METHODS :

The present study is a hospital based comparative study conducted over a period of 24 months, from August 2022 to July 2024 which included 30 patients meeting the inclusion criteria. pre-operative assesmnet was done - Electrocardiogram (ECG), blood sugar, haemoglobin, urea, creatinine, chest X-ray, and X-rays of the affected area.

The tibia nails were measured for length and width prior to the operation. For the length and width measured at the narrowest point of the medullary canal in the lateral radiograph, use the following measurement: (tibial tuberosity to ankle joint line

minus 1 cm) as a guide.

Surgical Technique

Group 1

Following the acquisition of informed written consent from the patients, pre-operative prophylactic antibiotics were administered. Following the administration of spinal anaesthesia, a pneumatic tourniquet was placed at the upper middle thigh. The affected leg was prepared preoperatively using a 7.5% betadine solution. Before the surgery blood pressure was measured, the limb was elevated and exsanguinated, and the tourniquet was raised to a pressure 120mm Hg higher than the patient's systolic blood pressure.

The intraoperative control of knee flexion can be achieved manually on operating table. A surgical incised cut was performed, the patellar tendon was dissected by midline incision, allowing for visualization of the tibial plateau. The entry point was established at a location between the tibial articular surface and the tibial tuberosity using a bone awl, while the knee was flexed, in order to prevent the posterior cortex from being penetrated.

The proximal aspect was further enlarged by utilizing a 6mm diameter rigid intramedullary nail reamer to open its medullary canal. Subsequently, a guide wire was inserted through the fracture site into the distal fragment, following the reduction of the fracture with the assistance of fluoroscopy. Once the guide wire position was confirmed, the medullary canal was gradually widened using an intramedullary reamer, increasing the diameter by 1mm at a time. The reaming process continued until the sound of "chatter" was heard and no further widening of the canal was possible.

A nail size that was 1 mm less than the maximum reaming size was selected, and the length of the nail was once again confirmed using the preoperative measurement.

The nail was affixed onto the jig (an external guide) and inserted through the entry point. It then advanced across the fracture site until it reached a spot 1cm closer to the ankle joint line, as observed on the C-arm imaging in AP & lateral views . Precise measures were implemented to prevent any rotational abnormalities by matching the tip of the second toe with the upper pole of the patella on the same side.

Two 5mm size distal interlocking bolts were inserted through stab incision when outer sleeve touches the cortex with the use of imaging guidance after determining their depth. Subsequently, two 5mm size proximal interlocking bolts were inserted to securely lock the nail in place. Torniquet is removed. The patellar tendon was surgically repaired, including the paratenon layer, using 1'0 Vicryl® sutures. Subcutaneous sutures were also put using 1'0 Vicryl®. The skin was sutured, including the stab wounds caused for the implantation of the interlocking bolts. The tourniquet was released before to closing the wound to ensure complete haemostasis. Aseptic dressing was subsequently administered.

Group 2

This group initially underwent an ORIF procedure for the fibula fracture, followed by a closed nailing procedure for the tibial fracture. In order to facilitate repositioning during surgery after fibular plating, it is possible to make appropriate adjustments to the operating table.

A sandbag is positioned beneath the same-side buttock of the patient to improve visibility of the same-side fibula area while the knee is fully extended. The limb was prepared and covered with a sterile cloth from the middle of the thigh to the toes. A tourniquet was applied at the upper middle thigh level, and the leg was positioned straight on the table. The fibular fracture was revealed, reduced, and set with a 1/3rd tubular locking plate by making an incision between the soleus and peronei muscles.

The length of the plate was contingent upon the configuration of the fracture. The plate was utilized in one of three ways: as a basic compression plate, a bridge plate, or a neutralization plate. The wound was sutured.By manipulating manually , the knee was thereafter bent and the process of inserting a nail into the tibia was performed, following the same procedure as described for patients in Group 1. The wounds were sutured after releasing the tourniquet and attaining haemostasis.

Post Op Care:

Prophylactic antibiotics were administered to patients in both groups. Patients received Inj.Cefoperazone and sulbactam combination at a dosage of 1.5g, administered 6 hours and 12 hours following the initial dose. Each patient received a soft padded elastocrepe bandage for the leg and foot segment to facilitate movement.

Patients were treated with analgesics to facilitate their ability to move. None of our patients received a blood transfusion. Every patient received Continuous Passive Mobilisation (CPM) from the second day after surgery to the twelfth day after surgery. Subsequently, the patients were discharged from the medical facility following the removal of sutures.

Post-operative Radiodiagnosis - involved the capture of full leg radiographs to assess the extent of valgus in the distal 1/3rd of the tibia. These radiographs are being compared to the pre-operative radiographs of the same patient. The correction percentage was recorded. The data was collected and analysed to determine the statistical relevance of using prior fibular plating to rectify the valgus of the distal fragment.

5. RESULTS

This study is a prospective case-control study that examined a total of 30 cases. The cases were operated with intramedullary interlocking nailing for the tibia, with or without fibular plating. The aforementioned cases were examined over the timeframe spanning from August 2022 to July 2024.

A total of 15 cases (12 males and 3 females) underwent tibia nailing in the first group, whereas the second group consisted of 15 patients (11 males and 4 females).

The mean age of patients in Group I was 39.53 years, while in Group II it was 42.73 years. The trial lasted for a total of 24 months. Patients were monitored until the fracture achieved both radiographic and clinical union.

Our analysis revealed a higher proportion of men, with 80% males in Group I and 73.3% males in Group II. The most common mode of injury was a road traffic accident.

Table 1 : Pre-op And Post Op Valgus Angles Group1 & Group 2

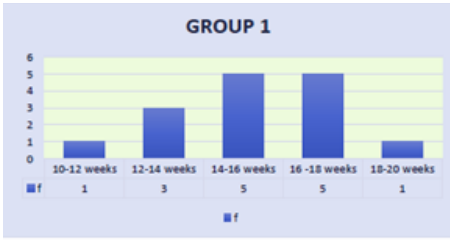
PREOP VALGUS	POSTOP VALGUS	DIFFERENCE
10.7	4.18	6.52
5.25	3.55	1.7
6.5	3.9	2.6
9.5	2.8	6.7
7.3	3.22	4.08
12.4	8.48	3.92
1.8	4.34	-2.54
6.7	5.71	0.99
3.74	6.15	-2.41
5.15	4.14	1.01
9.7	3.1	6.6
6.3	3.5	2.8
2.1	3.87	-1.77
3.3	5.9	-2.6
2.2	2.1	0.1

GROUP 1

PREOP VALGUS	POSTOP VALGUS	DIFFERENCE
11.96	2.13	9.83
12.67	5.46	7.21
26.1	2.71	23.39
10	5.76	4.24
13.21	4.31	8.9
-6.93	-3.39	-3.54
11.75	1.73	10.02
9.8	5.44	4.36
8.4	5.24	3.16
0.66	6.24	-5.58
8.86	7.94	0.92
11.1	7.67	3.43
12.33	5.1	7.23
11	5.9	5.1
11.1	7.8	3.3

GROUP 2

Table 2 : Time Of Reunion



Immediate post-operative x-rays films were taken for all patients, and the resulting valgus/varus angles were assessed and reported. Patients were instructed to have regular follow-up appointments at 4, 6,12 ,16-week intervals. Out of the patients in group I, 4 individuals had inconsistent follow-up visits, whereas 3 patients from the other group also had irregular visits. Group I had an average union period of 15.8 weeks, but Group II had a somewhat lower average union time of 14.92 weeks. The average pre-operative valgus angle in the two groups was 6.176 and 10.134, respectively. The average valgus angle after the operation was 4.32° and 4.66°, respectively . The p value of Group 1 was about 0.024(0.024<0.05) & p value of Group 2 is 0.003(0.003<0.05) which are significant. The mean disparity in valgus angle before and after surgery was 1.847 and 5.465 in the respective groups. The correction rate attained in group I was 29.98% and group II was 53.9%.

None of the cases in group II experienced fibular non-union or infection.

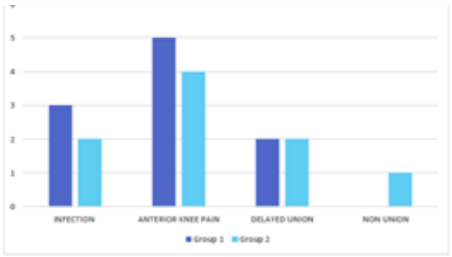
One patient in each group had varus angulation at the conclusion of the healing process, which fell within the permissible range. The often reported consequences included anterior knee discomfort, infection, delayed union, and non-union. Anterior knee pain was observed in 5 individuals (33.3%) in group I and in 4 patients (26.67%) in group II. Out of the patients in group I, 3 individuals (20%) experienced seropurulent discharge and fever after their surgery.

One patient experienced an illness at the location of the proximal dynamic bolt, while another patient had an infection at the site of the distal bolt. Additionally,1 patient had an infection at the fracture site. Other 2 cases given IV antibiotics and had their wounds dressed. The initial patient required an implant removal following the healing of the fracture, which occurred 19 weeks after the surgical procedure.

The patient was immobilised with a protective patellar tendon cast to support weight bearing. Out of the group II, two patients (13.3%) experienced infection at both the site of tibial fracture and the proximal interlocking bolt sites. The patient received intravenous antibiotics and underwent regular wound treatment for the wounds at both locations. The patient underwent union and nail removal was performed after 19 months.

2 patients from their respective groups experienced delayed union, with a prevalence of 13.3% in Group I and 13.3% in Group II. One patient (6.6%) in group II experienced complete non-union, as evidenced by the absence of radiological union in the 4- and 8-week follow-up x-rays. There were no recorded cases of complete failure to heal in group I. One patient in group II experienced non-union.

Table 3 : Distribution Of Patients Based On Type Of Complications



DISCUSSION :

This study examined the impact of fibular fixation on treatment outcomes for distal 1/3 leg fractures, specifically when combined with tibial intramedullary interlocking nailing. Despite controversy and conflicting findings in previous research, our study aimed to clarify the benefits of fibular plating in correcting valgus deformities.

Demographically similar groups underwent either fibular plating or not, with results showing minimal malalignment in the plating group. Notably, valgus angulation remained consistent between pre-operative and follow-up radiographs.

Our findings support previous research, such as Egol et al.'s [5] study, which demonstrated reduced malalignment and improved bone alignment beyond 12 weeks post-operatively with fibular fixation. This suggests fibular plating may be a viable alternative to intramedullary nailing for distal third fractures.

Our investigation revealed that performing fibular plating before tibia nailing offers several benefits, including: Maintaining limb length, Facilitating indirect reduction of the tibia, Reducing complexity of manipulation during fracture reduction and fixation, Minimizing soft tissue injury and promoting healing

Studies by R Buzzi et al[6] , Ajay Krishnan et al [7], and others support these findings. Fibular fixation provides rotational stability, ensuring the construct remains stable during tibial nailing.

However, some studies contradict these findings. Rouhani et al[8] , Varsalona et al[9] , and Mustafa et al suggest that fibular plating may not provide significant advantages or may even have negative effects.

Other studies, such as those by Vallier et al[10], Chengxin Li et al[11], and Deepak Kumar Devatheya et al[12], provide mixed results, highlighting the need for further research to determine the optimal treatment approach for distal tibia-fibula fractures.

Ultimately, the decision to perform fibular plating should be based on individual case scenarios and careful consideration of the potential benefits and drawbacks.

CONCLUSION :

Although the initial valgus angle measurements were smaller in the group without fibular plating, the percentage correction of valgus angulation was significantly greater in the group with fibular plating. This study suggests that fibular fixation improves outcomes without increasing complications, recommending its use in conjunction with tibial nailing

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