

Original research article

A Study on the Effect of Fibular Fixation on Malalignment of Fractures of Lower third of both Bones of the Leg Treated by Interlocking Nailing of the Tibia

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Abstract

Background: In the treatment of fractures of the distal third of the tibia and fibula treated by interlocking nailing of the tibia, the role of fixing the fibular fracture is not clearly defined. This study was undertaken to assess the benefits of fixation of the fibula clinically, radiographically and functionally in fractures of the lower third of the leg.

Methods: In this retrospective study thirty patients with fractures of the lower third of the leg were selected. The patients were divided into two groups based on whether fibula was fixed or not, the fracture tibia being treated with interlocking intramedullary nailing in all the cases. In the follow up data of the two groups were compared for radiological differences in the angulation at the fracture site, clinical and functional outcome at the end of six months, time of union and complications.

Results: The demographics of the two groups were similar with respect to age, sex, side of fracture, fracture classification and nature of the injury. The average valgus angulation was significantly less in the group where fibula was fixed. The outcome of the two groups for clinical outcome, measured at six months follow up, time of union and complications showed no significant differences.

Conclusions: Fixation of the fibula decreases the malalignment of the tibia in distal third fractures of the tibia and fibula treated with interlocking nailing of the tibia.

Keywords: Fracture ; Distal Tibia ; Fibula ; Interlocking nailing ; Plating

Introduction

Of all the long bones, the tibia has the highest incidence of diaphyseal fractures^{1,2,3,4}. Fractures of the tibial shaft are the most common of the long bone fractures. Fractures of the tibial shaft are important for two reasons – first is that they are common; the second that they are controversial and anything that is both common and controversial must be important^{2, 5}. Because the shaft of the tibia is subcutaneous throughout its length and may have a diminished blood supply, severe complications and major disability are common outcomes¹. Fractures of the tibia and fibula can range from completely undisplaced fractures with minimal soft tissue damage, to traumatic amputations. The treatment modalities described for tibia and fibula fractures range from simple cast immobilization to complex surgical procedures¹. Considerable concern exists that malalignment of a healed tibial shaft fracture may result in post traumatic arthritis of the ankle or knee^{3,4,6,7,8}. As the location of the deformity approaches the ankle or the knee, malalignment results in maldistribution of articular surface pressures that may predispose a patient to premature osteoarthritis^{1,8,9,10,11}. The location of the mal-union is important, with distal deformities more likely to be symptomatic^{6, 10, 11}. In the treatment of fractures of the distal third of tibia and fibula, the fibular fracture is often ignored and is not fixed because rarely is any specific treatment required for the fibula. The role of the fibula in maintaining stability after fixation of distal tibial fractures has not been clearly defined^{12, 13, 14}. To the best of my knowledge no study on the effect of fibular fixation in patients with fractures of the both bones of lower third leg treated with intramedullary nailing of tibia is available in literature. However cadaver study on the effect of fibular plate fixation on rotational stability of simulated distal tibial fractures treated with intramedullary nailing has been done. Cadaver study concluded that fibular plate fixation increased the initial rotational stability with distal tibial fractures compared with intramedullary nailing of tibia alone¹⁵. To study the clinical relevance of fibular fixation in lower one third fractures of both bones of leg and in an effort to outline the advantage and benefits of fixation of the fibula, in comparison with those without fixation, this study was undertaken.

METHODS

This retrospective study was conducted in the Department of Orthopaedics, Government medical college, Ernakulam after the institutional research committee and ethics committee approval. Patients who presented to the Department of Orthopaedics, Government medical college, Ernakulam with distal tibia and fibula fractures from January 2015 to December 2019.

Inclusion criteria:

- fresh cases of fractures of the lower one third of shaft of tibia and fibula.
- Patients who attained skeletal maturity.
- Closed and Gustilo type I and type II open lower one third diaphyseal fractures of the leg.

Exclusion criteria:

- Patients with upper one third and middle one third fractures.
- Patients who did not attain skeletal maturity.
- Segmental fractures and Gustillo type III open fractures.
- Fractures with intraarticular extension.
- head injury, chest injury, pathological fractures, ASA criteria >3

The study sample size was 30 selected by convenient sampling technique from records. In all cases tibial fracture was fixed with interlocking intramedullary nail. The cases were divided into two groups depending on whether the fibula was fixed or not. Follow-up data that was taken routinely for all patients at 2 weeks, 6 weeks, 12 weeks, and 6 months postoperative will

be collected from the patient's case sheets and documents. The follow up data which includes serial leg x-rays and clinical examination data will be used to assess the radiological and functional outcome respectively.

In the post operative radiographs tibial malalignment was measured. The degree of the tibial angulation [varus or valgus] was measured on the anteroposterior radiographs by determining the angle formed by the intersection between the perpendicular lines drawn from the tibial plateau and tibial plafond^{6, 4, 7}.

RESULTS

In this study, thirty cases with fractures of lower one-third fractures of tibia and fibula treated from January 2015 to December 2019 at ernakulam medical college were included and data was collected from xrays and medical records. The longest duration of follow up was two years six months and shortest duration was six months. The mean duration of follow up was fourteen months.

Age incidence: ranged from 18 to 70 years with average age for males [who were 26 in number] being 36.16 years and average age for females [who were 4 in number] being 44.5 years. The combined average age was 37.08 years.

Side of the fracture: The right side was more commonly involved [20 in number] than the left side [10 in number]. When comparing cases in which fibula was fixed to those without fixation, the right side of fracture was equally distributed but left ratio was 7:3

Nature of the injury: Most cases were due to road traffic accidents (93%). Other mechanisms which included were fall from height, assault which accounted for 7% of cases.

Pattern of the fracture: 60% were simple transverse type of fracture and 30% were simple oblique type. Wedge fragmented type accounted for 5 %. Complex spiral type was present in 5 % of patients.

Type of fracture [Open or closed]: In the study 90.3% of cases were closed fractures and 9.7% were open fractures of the tibia. Among the patients with fibula fixed 14 (82.3 %) out of 17 were closed fractures. In the second group with no fibula fixation 10 (76.9%) were closed fractures. In the group with fibula fixation, two patients had type I and two had type II open fracture. In the group without fibular fixation two were type I and one patient had type II open fracture.

Assessment of radiological valgus/varus angulation: Of the thirty cases twenty four cases went to valgus angulation . The average valgus deformity of the tibia in patients in whom fibula was fixed was 6.69° and those in whom fibula was not fixed was 9.05° . To assess the effect of angulation, the patients were divided into 4

Groups¹⁶ :

1. Excellent : 0 -1° valgus / varus
2. Good : 2 – 5° valgus / varus
3. Fair : 6 – 10° valgus / varus
4. Poor : >10° valgus / varus

37.5% of patients with fibular fixation had good results, 50% of patients had fair and 12.5% had poor results. Among the patients in whom fibula was not fixed 10% had good results, 65% had fair and 25% had poor results.

Association of range of movements at the ankle [expressed as a percentage] with

fixation of fibula: The mean range of movements in patients with fibula fixation was 66.98% and that in whom fibula is not fixed was 68.20%

To assess the range of movements at the ankle, the patients were divided into 4 groups³²:

1. Excellent : 100% motion of ankle
2. Good : >75% motion of ankle
3. Fair : 50 – 75% motion of ankle
4. Poor : <50% motion of ankle

In patients with fibula fixed, 4 had good results, 12 had fair and 1 had poor results. In patients without fibula fixation 4 had good results and 9 had fair results.

Time of union: Mean time of union in patients with fibula was fixed were 5.47 months and those in which fibula was not fixed was 5.28 months.

Complications: Three out of the 17 patients in whom fibula was fixed developed superficial wound infections at the fibular wound site.

According to Johner and Wruh's criteria¹⁶ patients were divided into four groups – those with excellent, good, fair and poor results. Among the cases with fibula fixed, 4 (23.5%) had good results, 12 (70.5%) had fair and 1 (6%) poor result. Among the 13 patients in whom fibula fixation was not done, 2 (15%) had good results and 11 (85%) had fair results

TABLE 1: GENDER DISTRIBUTION OF STUDY

GENDER	No. OF PATIENTS	PERCENTAGE
FEMALE	26	86%
MALE	14	14%
TOTAL	30	100%

TABLE 2: AGE DISTRIBUTION OF STUDY

AGE	No. OF PATIENTS	PERCENTAGE
< 30	3	10%
40-50	10	33%
50 -60	11	37%
>60	6	20%
TOTAL	30	100%

TABLE 3 : Association of Fibula fixation with side of fracture

SIDE OF FRACTURE	FIBULA FIXATION	
	YES	NO
LEFT	7	3
RIGHT	10	10
TOTAL	17	13

TABLE 4: Association of fibula fixation with nature of Injury

NATURE OF INJURY	FIBULA FIXATION	
	YES	NO
RTA	14	12
OTHERS	3	1
TOTAL	17	13

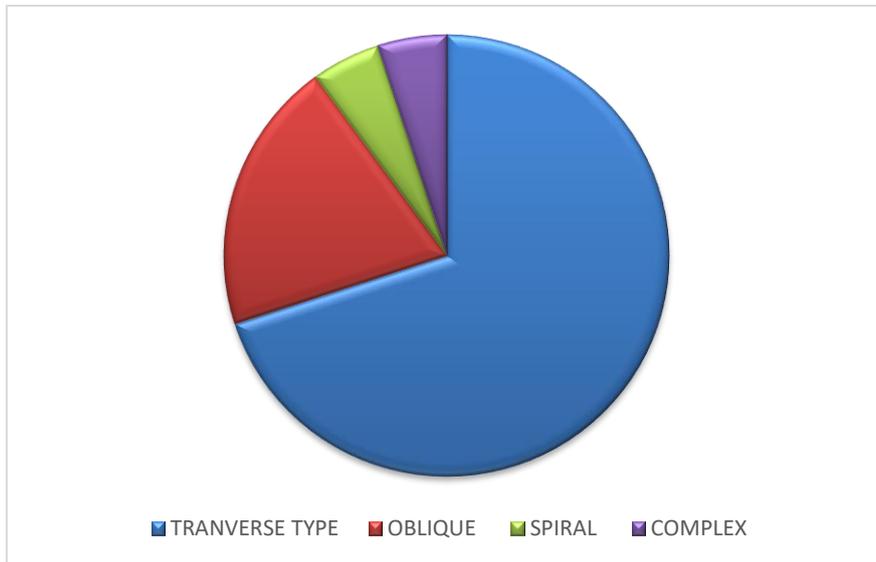


FIGURE 1: TYPE OF FRACTURE

TABLE 5:

TYPE OF FRACTURE	FIBULA FIXATION	
	YES	NO
OPEN	3	3
CLOSED	14	10
TOTAL	17	13

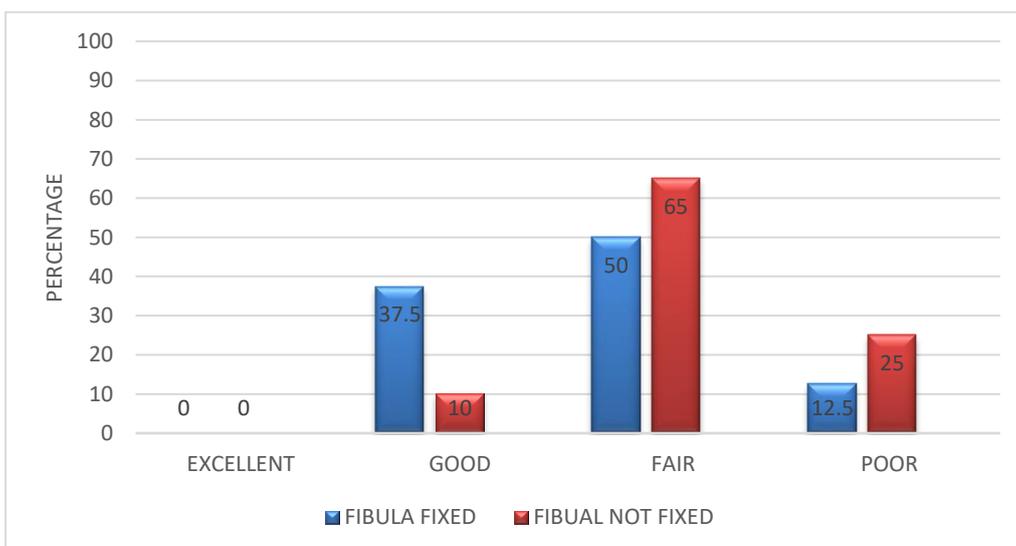


FIGURE 2 : Association of radiological valgus score with fibula fixation

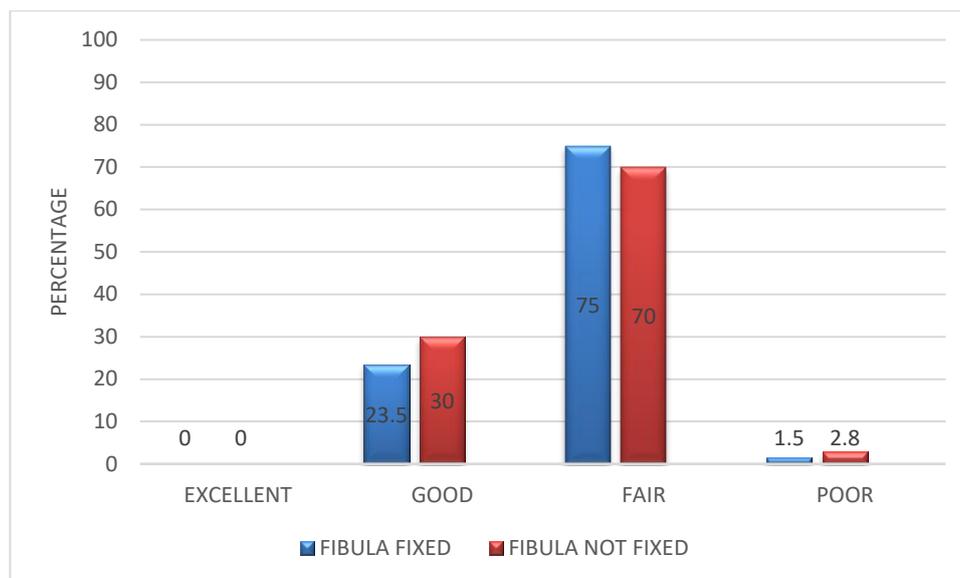


Figure 3: Association of range of movement at the ankle with fibula fixation

DISCUSSION

The role of fibula fixation in distal third fractures of the shaft of tibia and fibula has not been clearly defined^{12, 13, 14}. This study was conducted in 30 patients to analyse the results of fixing the fibula fracture in fractures of the lower third of shaft of tibia and fibula when compared with cases in which fibula is not fixed. In all of the cases, the fracture tibia was treated with interlocking intramedullary nailing.

The demographics of the two groups, with and without fibular fixation were similar with respect to age, sex, side of the fracture, fracture classification, nature of the injury and open fractures. Of the thirty cases twenty four cases went to valgus angulation. The probable reasons could be: (1) the relatively wider diameter of the medullary canal of the distal fragment decreases the amount of fixation with less contact surface between the nail and the bone³. This in turn can result in the distal fragment going for valgus/varus angulation. (2) the short distal tibial segment (3) the most important factor in avoiding malreduction of distal fragment is ensuring that the guidewire is placed in the exact middle of the medullary canal and that it is perpendicular to the tibial plafond. Any variation from this can result in the distal segment going for valgus/varus angulation^{2, 6, 17}. (4) comminution at the fracture site.

The average valgus angulation was significantly less when fibula was fixed when compared to those where fibula was not fixed. Additionally, patients in whom fibula was fixed are more likely to have good valgus score. The fixation of the fibula establishes the length of the lateral column. When the fixation of the fibula is done prior to nailing of the tibia, it helps to restore the alignment of proximal and distal tibial fragments¹⁷. This may be the reason for less valgus angulation in cases where fibula was fixed.

Patients treated with fixation of fibula had comparatively higher complications than those without fibula fixation. Three out of 16 patients treated with fixation of fibula developed superficial wound infections over the fibular wound site. All the three infections were controlled by appropriate dressing and antibiotics, Assessment of results according to Johner & Wruh's criteria showed that the distribution of results were statistically similar between patients with and without fibula fixation.

CONCLUSION

Based on the results of the study, the following conclusions were reached:

1. The tibia malalignment [valgus angulation] was significantly less in patients in whom fibula was fixed in lower third tibia and fibula fractures compared to those in whom fibula was not fixed.
2. The functional outcome after 6 months follow up between patients with and without fibula fixation were statistically similar.
3. There is no significant difference in the time of union of the tibial fracture between the two groups of patients.
4. There was no significant difference in the rate of complications between the two groups.

DECLARATIONS

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Ethical approval: IRB approval was obtained for the submitted work at our institution.

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