

Fibular fixation as an adjuvant to tibial intramedullary nailing in the treatment of combined distal third tibia and fibula fractures : a prospective observational study

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Abstract

Distal 1/3rd extraarticular tibia fractures are common in trauma centers. It is often the result of high energy trauma, usually associated with distal fibular fractures. Tibia interlocking nail is an established way of treating these fractures. Fixation of fibular fractures in distal tibial metaphyseal fractures is controversial, although fixation of the fibular fracture by a plate partially stabilizes fractures of the distal tibial shaft and considered in distal tibial fractures treated with intramedullary fixation to prevent valgus deformity even there is increased potential for delaying the tibial fracture healing. Objectives: The purpose of this study was to compare the functional and radiological outcome of fractures of distal third tibia and fibula treated by interlocking nail of tibia with fibular plating and without fibular plating. Material and Methods: A total of 48 patients who had fractures of lower third tibia and fibula are included in this study. 48 patients were divided into two groups I and II (24 patients in each group) based on fibular fixation. Results: Functional results were evaluated based on radiological and biological union and absence or presence of complications. In Group A 3 out of 22 patients (13%) showed non union and in Group B 2 out of 21 patients (9%). In Group A 2 out of 22 patients (9%) showed malunion at end of 6 months and in Group B 3 out of 21 patients (8%). In Group A 15 out of 22 patients (68.8%) showed union at end of 6 months without complications and in Group B 14 out of 21 patients (66.66%). Conclusion: Based on the results of the study, it was concluded that union occurred in both groups where fibula was fixed and not fixed with same rates of complications in both groups except infection which was higher in fibula plating cases. In cases where fibula fixation wasn't planned and distal tibia reduction was achieved using percutaneous clamp. If intraoperatively, reduction wasn't possible it was seen that if fibula was fixed first then better reduction was achieved. A long term study is required for further exploration on indications of fibular plating in distal fractures of tibia.

Keywords: Distal tibia fractures, intramedullary nailing, fibula plating

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Introduction

Distal tibia fractures are known to be more challenging to treat than mid diaphyseal tibia shaft fractures. In particular, fractures at the distal end of the tibia have been shown to have higher rates of complications of nonunion, malunion, and malalignment. 1-3 For this reason, various studies have investigated the optimal treatment of distal tibia fractures with plating or intramedullary nailing with or without fibula fixation [1-5]. Fractures of the distal tibia have been described long back. However, despite the presence of large number of publications, several controversies still exist regarding the ideal method of managing these fractures. There is clinical evidence that distal third tibia fractures can also be successfully treated with IM fixation [2,4]. It has been shown that fibular fixation in addition to IM tibial nailing is unnecessary when a midshaft tibial fracture is accompanied by an ipsilateral fibular shaft fracture [5]. For a combined distal tibia and fibula fracture, there exists a debate among surgeons as to whether or not fibular fixation is required as an adjuvant to IM nailing. Some authors have demonstrated that spiral fractures of the distal tibia treated with IM nailing have a tendency toward malalignment, [6,7] and some biomechanical data support this

notion [8]. So there exists a debate whether or not fibular fixation in distal third tibia fractures is required as an adjuvant to intramedullary nailing of tibia. The aim of the current paper is to explain the role of stabilisation of the fibula in 43A1 AO fractures, correlating the rates of healing and non-union between patients with and without fibula fixation.

Materials and method

This was a prospective randomized study done from September 2017 to June 2021 at Gajra Raja Medical College, Gwalior. Patients with fractures of lower metaphysis of tibia and fibula were taken for this study after obtaining their informed valid written consent. Patients age above 19 years, closed fractures of distal third tibia and fibula (AO A1, A2, A3), Gustilo-Anderson type I and type II open fractures of distal third tibia and fibula are included in this study. Patients below 19 years, pathological fractures, Gustilo-Anderson type III open fractures of distal third tibia and fibula, associated neurovascular injury, patients with intra-articular fractures and segmental fractures of fibula were excluded. 48 patients with fractures of lower third tibia and fibula are included in this study to compare the functional and radiological outcome of fractures of distal metaphysis of tibia and fibula treated by interlocking nail of tibia with or without fibular plating. 48 patients are divided into groups A and B (24 patients in each group) based on fibular fixation. Group A: patients treated with intramedullary interlocking nailing tibia without fibular fixation. Group B: patients treated with intramedullary interlocking nailing tibia with plating of fibula with 3.5mm one third tubular plate and screws, study done by simple

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randomization method, on admission first patient was grouped into group A and second patient into group B, alternatively all are divided into two groups (24 patients in each group. Antero-posterior and lateral radiographs of the affected leg along with knee and ankle were taken and confirmed. The limb was then immobilized in an above knee POP slab till swelling subside and necessary

investigations and pre anaesthetic check up was done and consent was taken and definitive fixation was done for fracture tibia by closed reduction and internal fixation with interlocking nail and fracture fibula by open reduction and internal fixation with one third tubular plate and 3.5mm cortical screws.



Fig 1 : Distal 1/3rd tibia/fibula fracture (AO43A1)

Results

There were 22 patients in Group A(2 patients lost in follow up) and 21 patients in Group B(3 patients lost in follow up). Details about demographics, AO classification of tibial and fibular fracture, and type of tibial osteosynthesis for both groups are shown in Table 1.

Table 1 Clinical characteristics of patients with “distal 43A1 fractures”.

	Group A: fixed fibula	Group B: no fixed fibula	Total
No. of fractures	22 (51)	21 (49)	43
Gender			
Male	10(47)	11(53)	21
Female	12(54)	10(46)	22
Open/closed fractures			
Open fractures	9(52)	8(48)	17
Closed fractures	13(50)	13(50)	26
Location of fibular fracture			
Same as level as tibia	20(74)	7(26)	27
Different level	2(12)	14(88)	16
Healing or non-union after 6 months			
Union	15(52)	14(47)	29
Non-union	3(60)	2(40)	5
Mal union	2(40)	3(60)	5
Infection with non-union	3(75)	1(25)	4

(Number in brackets show percentages)

A total of 38 patients healed within 6 months. There were five non-unions: three in Group A and two in Group B. In Group A, the two non-unions were in open injuries. One non-union had fracture with fibular fracture at a different level. The other non-union was with fibular fracture at the same level. In Group B, two non unions were in open fractures. In two cases fibular and tibial fractures were at the same level. There were 2 cases of malunion in Group A and 3 cases of malunion in Group B. There were 3 cases of infection with non-union in Group A and 1 case in Group B. Demographic data and specific features of the tibial and fibular fractures were analysed to identify factors that could be significantly correlated to the development of a non-union. None of the parameters considered (open injury, AO classification, and level of the fibular fracture relative to the tibial). Some factors seemed to have an influence on the healing process, although the results were far from statistical significance.



Fig 2 : Union at 6 months in case where fibula was fixed

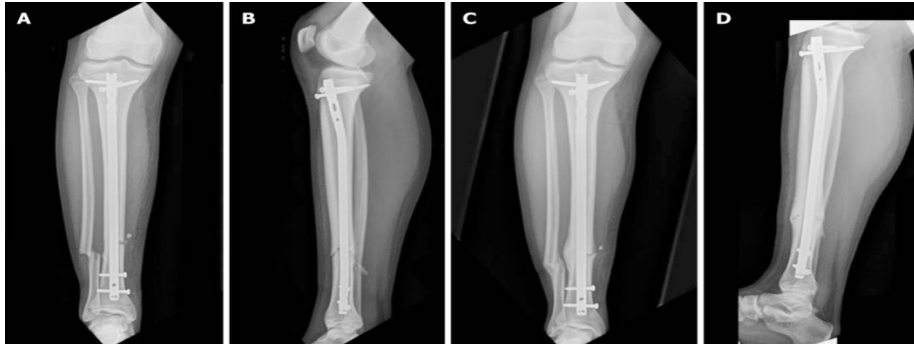


Fig 3 : Union at 6 months in case where fibula was not fixed.



Fig 4 : Complication in case where fibula was fixed. Plate got exposed and fracture went into non union.



Fig 5 : Complication in Group B : Fibula not fixed. Fracture was at non union at 6 months.

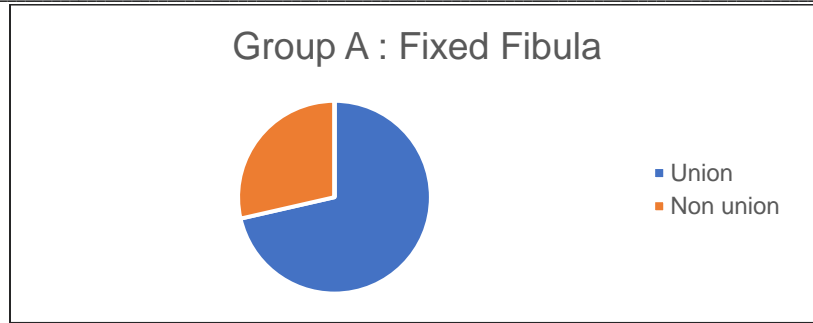


Fig 6 :Diagram showing results of Group A : Fixed Fibula

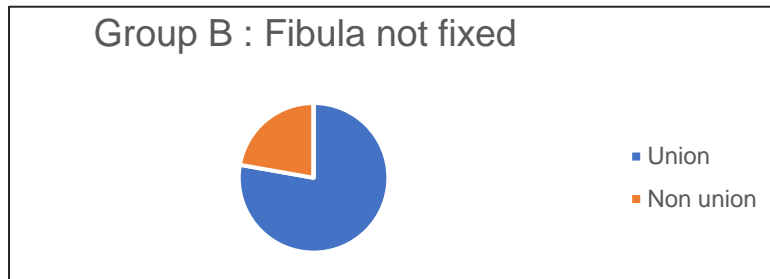


Fig 7 :Diagram showing results of Group B : Fibula not fixed.

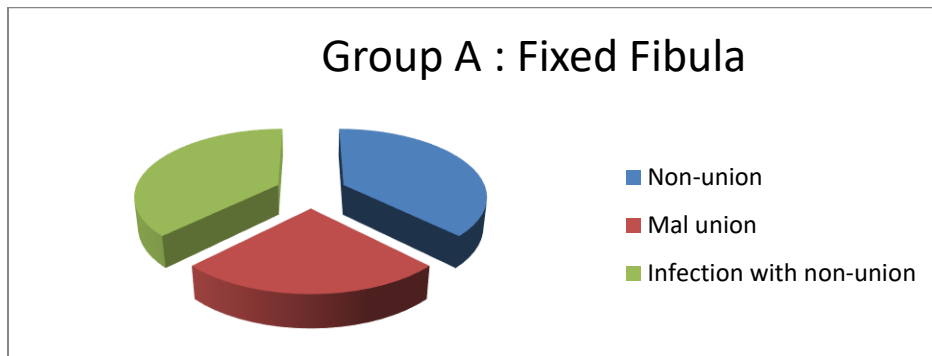


Fig. 8 : Diagram showing complication of Group A: Fibula fixed.

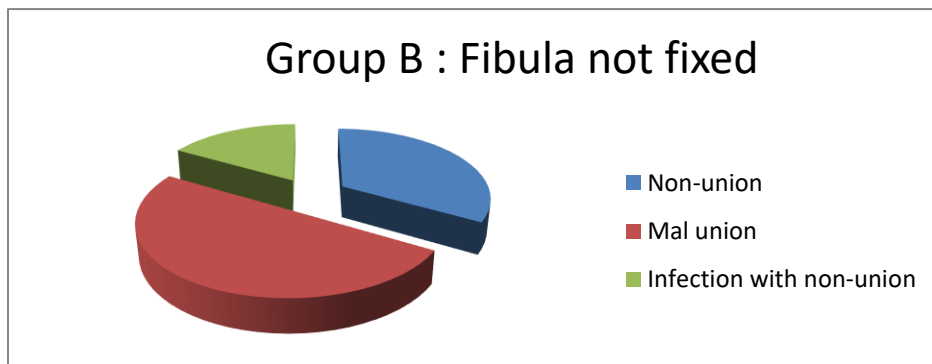


Fig. 9 : Diagram showing complication of Group B:Fibula not fixed.

Discussion

The distal part of fibula plays vital role in the biomechanics of the ankle. Tibia interlocking nail concerns include the insufficient stability of fracture fixation, risk of malunion, and delayed / nonunion with break of nail and locking screws. The present study examined the necessity of fibular fracture fixation to help in prevention of malunion after intramedullary interlocking nail of distal tibia fractures. In this study the average age of patients with such injuries was found to be 46.3 years (20-69). Present study showed male preponderance. In the present study road traffic accidents was most common mode of injury and intra-articular fractures are excluded, only extra articular fractures are included (type A). Guilherme Boni (2015) [13] stated that in distal third tibial shaft fractures undergoing intramedullary nail fixation, adjunct fibula fixation may allow for achieving and maintaining fracture reduction of the tibia and improvement seen in clinical outcomes a retrospective review on open tibial fractures with ipsilateral fibular injuries, Whorton and Henley [9] stated that fibular fixation in the absence of syndesmotom and mortise-related injuries did not affect outcomes of open tibial fractures. Varsalona and Liu [10] underlined the great morbidity that the additional trauma of internal fixation of the fibula may induce and concluded that in distal metaphyseal tibial fractures without involvement of syndesmosis or ankle mortise, stabilisation with intramedullary nail or with an external fixator alone is sufficiently stable and carries little risk of soft tissue morbidity and late stage malalignment. Conversely, Strauss et al. [5] and Bonneville et al. [11], in two separate biomechanical studies, emphasised the value of surgical fixation of the fibula as a complement to the overall implant stability and as an aid to the reduction when external fixation or nailing was indicated.

Vallier et al [4] in a retrospective, radiographic, and clinical comparison of distal tibial fractures treated with plating or intramedullary nailing showed that both treatment methods provided successful treatment. In comparison between both treatment techniques, the malunion rate was found to be significantly more common in intramedullary nailing with a malunion rate of 29% in contrast to 5.4% malunion rate with plating. Given the higher rates of malalignment associated with nailing, fibula fixation was used as a technique of providing additional stabilization to prevent malalignment and malunion.

Egol et al [8] reported that fibula stabilization with intramedullary nailing of distal tibia fractures, in comparison to intramedullary nailing without fibula stabilization, had no significant difference in malalignment but rather showed significant difference in a reduced amount of late malalignment development.

In Group A 15 out of 22 patients (68.8%) showed union at end of 6 months without complications and in Group B 14 out of 21 patients (66.66%).

Fibula fixation establishes the length of the lateral column. If fibula fixation is done prior to nailing of tibia, it helps to restore the alignment of proximal and distal tibial fragments. If fibula fixation wasn't planned then prior to nail insertion fracture was reduced using percutaneous clamp.

In Group A 3 out of 22 patients (13%) showed non union and in Group B 2 out of 21 patients (9%). In Group A 2 out of 22

patients (9%) showed malunion at end of 6 months and in Group B 3 out of 21 patients (8%). In Group A 15 out of 22 patients (68.8%) showed union at end of 6 months without complications and in Group B 14 out of 21 patients (66.66%).

Shan Wei Yang et al. (2005) [12] had done plating for all associated fibular fractures and noted no rotational deformity postoperatively. Therefore, they support performing fibular plating first before the treatment of distal tibial fractures.

Conclusion

Based on the results of the study, it was concluded that union occurred in both groups where fibula was fixed and not fixed with comparable rates of complications in both groups except infection which was higher in fibula plating cases. In cases where fibula fixation wasn't planned and distal tibia reduction was tried using percutaneous clamp. If intraoperatively, reduction wasn't possible it was seen that if fibula was fixed first then better reduction was achieved.

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