Plate over nail and bone graft for management of tibial non union after intramedullary fixation

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Received: 23 March 2023
Revised: 10 May 2023
Accepted: 18 May 2023
Published: 27 January 2024

The Egyptian Orthopaedic Journal 2023, 58:261–263

Non union after intramedullary nail fixation is difficult to treat. Many options are available for its management including nail exchange, bone graft while keeping the nail, nail removal and plating. Each method has its advantages and disadvantages. The aim of this study is to evaluate the results of management of tibial non union after intramedullary fixation using plate augmentation. Between January 2012 and December 2019, thirty four patients with nonunited fracture tibia previously treated with locked intramedullary nails were included in this study. The ages of patients ranged from 20 to 62 years (an average age: 43 years). All patients were diagnosed to have aseptic nonunion. All patients achived bony union except 2. Bone union was achieved in a time ranged from 3 to 9 months (an average time 5 months). The average limb length discrepancy was 1 cm (range 0 to 1.5 cm). The reported complications were superficial wound infection in 2 cases, joint stiffness in 3 patients and nonunion in 2 cases. There were no intraoperative complications. All patients reported no pain at the fracture site during weight bearing at the final follow-up. We concluded that augmentation plate fixation is a good option for treatment of tibial nonunion after intramedullary nail.

Keywords:
intramedullary nail, plate, tibial nonunion

Egypt Orthop J 2023, 58:261–263

1110-1148

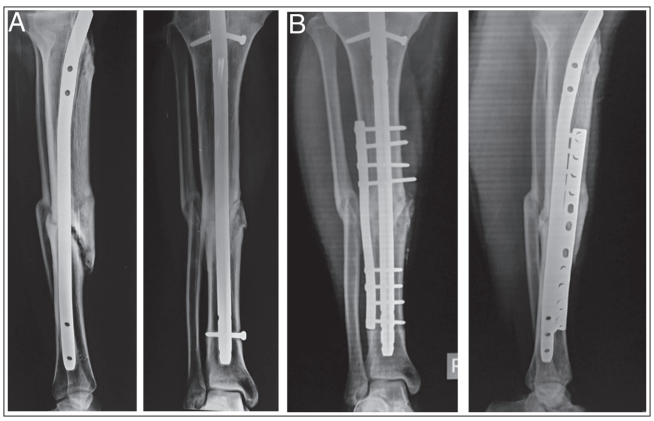
Introduction

Intramedullary fixation is considered to be the gold standard for diaphyseal long bone fractures. The union rate of this method approaches about 90% [1]. Non union after intramedullary nail fixation is difficult to treat. Many options are available for its management including nail exchange, bone graft while keeping the nail, nail removal and plating. Each method has its advantages and disadvantages. Plating over nail has been described by some authors with promising good results [2,3]. The plate achieves axial compression at the fracture site and provides sufficient stability that prevents rotation and allows for early weight bearing [4]. The aim of this study is to evaluate the results of the management of tibial non union after intramedullary fixation using plate augmentation.

Patients and methods

Between march 2012 and December 2019, thirty four patients with non united fracture tibia previously treated with locked intramedullary nails were enrolled in this study. The age of the patients ranged from 20 to 62 years (average age 43 years). All patients were diagnosed to have aseptic nonunion. Infection was excluded by clinical examination and laboratory investigations. Nonunion was diagnosed by pain and tenderness at site of the fracture and presence of fracture line on radiographic evaluation. The non union was hypertrophic in 19 patients and atrophic in 14 patients. The nonunion was located in the proximal tibia in 15 patients, middle third in 11 patients and lower third of the tibia in 8 patients. Dynamization was done in 9 patients to stimulate bone healing without improvement. All patients were treated by plate augmentation while leaving the nail in situ and bone graft. All patients gave their informed consent prior to surgery. Under spinal anesthesia and in supine position, through an anterolateral incision, the fibrous tissue was removed from the fracture site. The bone ends were debrided was done till a healthy bleeding surface. Shingling of the bone edges was done. Also decortications of the bone surface near the fracture was done aiming to increase the surface area for bone union. Dynamization was done in the static nails to allow compression at the fracture site. The bone ends were impacted against each other. In case of atrophic non union, cancellous iliac bone graft was harvested to graft the non union site. The plate was then applied to achieve compression. The screws were directed either anterior or posterior to the nail. The ordinary narrow DCP was selected for fixation as its holes allow for about 30 degrees redirection of the screws. The remaining graft was put around the fracture site.

Figure 1



(a): Plain X ray anteroposterior and lateral views showing non united middle third tibia (b): final follow-up with complete union.

The wound was then closed over drain. Active range of movement was allowed from the second postoperative day. Partial weight bearing was encouraged from the second postoperative week.

Results

The hospital stay ranged from 2 to 7 days (average time 5 days). The follow-up time ranged from 18 months to 38 months (average time 27 months). The average blood loss was 300 (range: 200–500) ml. All patients achieved bony union except 2. The average time of union was 5 months with a range from 3 to 9 months. The average limb length discrepancy was 1 cm (range 0 to 1.5 cm). The reported complications were superficial wound infection in 2 cases, joint stiffness in 3 patients and nonunion in 2 cases. There were no intraoperative complications. All patients reported no pain at the fracture site during weight bearing at the final follow-up (Fig. 1).

Discussion

The non union rate after intramedullary fixation of tibial fractures may reach up to 10%. This may be related to many factors, some are patient related and others are technically related factors. Many options have been described for management of tibial non union after intramedullary fixation with varying degrees of success and failure [5].

Several methods have been used for treatment of aseptic non union after intramedullary fixation of tibial fractures, the most popular method is exchange nailing with larger diameter nails to provide a rotational stability. Some authors replaced the nail with plate and bone grafting, however, this method has many drawbacks: more operative time, more surgical procedures, more wounds and more blood loss. Dynamisation while retaining the nail have been used in femoral non-unions. Dynamisation is a simple procedure. However, its results are unreliable. Also, it may lead to further instability at the fracture site [6–8].

Theoretically this technique should reduce bone healing as the endosteal blood supply is already destroyed by the IMN and plating will destroy the periosteal blood supply. But this was proven untrue on clinical bases as most of the cases in this study united. Plate augmentation first described by ueng [9] in 1997 for treatment of non united femoral fractures after intramedullary nail fixation. Augmentation plating has the following advantages of: easy surgical technique, more mechanical stability at the fracture site; minimal soft tissue injury during operation; enhance biological factors by bone grafting; and early weight bearing and movement.

Soft tissue stripping, possible donor site complications and more blood loss are disadvantages of using augmentation plate and autograft. Cole [10] Wolnisky *et al.* [11] in their study reported that the blood supply recovered within 5 to 12 weeks in the endosteal and periosteal cortical areas after a reamed or an unreamed nail. Thus, if sufficient time is allowed to pass between two procedures: nail and plate augmentation, the problems related to the endosteal and periosteal cortical blood supply will not arise.

In the current study, the incidence of superficial infection was 2%. This is comparable to other reports, the average blood loss was 300 ml, which is also comparable to other reports and no donor site complication occurred [7,8].

In a comparison to nails alone, Park *et al.*, [12] in their study concluded that plate augmentation has shown to increase both torsional stiffness and bending force several folds. The nail acts as a load sharing device also, it maintains the stability and alignment of the fracture, and. Further, compression at the nonunion site can be achieved with the usage of the dynamic compression feature of an LCDC plate.

Few reports exist in the literature of this technique used with tibial nonunion. Birjandinejad *et al.*, [3] reportd 84.6% in tibial union after augmentation plate leaving intramedullary nailing in situ in addition to autogenous bone graft.

In the current study, we did bone grafting combined with plate augmentation of the nail in all cases and we obtained union in all patients except two. The time of bone healing ranged from 3 to 9 months (average

time: 5 months). It is similar to the studies conducted by other authors [13,14].

Conclusion

This technique is not a new method for management of nonunion, however, our series is larger than the previous studies. Few reports exist in the literature for treatment of tibial nonunion using this technique. We suggest augmentation plate fixation as a good option for treatment of tibial nonunion after intramedullary nail.

Acknowledgements

Nil.

Financial support and sponsorship

Nil.

Conflicts of interest

No conflict of interest.

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