

Plate Fixation for Management of Non United Tibial Fractures Previously Fixed with Locked Intramedullary Nail

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Abstract: Introduction: Tibial nonunion after locked intramedullary fixation is uncommon but if occurred there is much controversy about its management. Patients and methods: Twenty-one cases were managed by augmentation plating. Additional procedures as bone grafting and fibular osteotomy were done in some cases. Results: Union was achieved in 100% of cases with no serious complications reported Conclusion: This method is more reliable than other methods in treatment of tibial non union after locked intramedullary nail fixation in certain situations.

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1. Introduction

The use of interlocking nails for fixation of diaphyseal tibial fractures remains the gold standard for management of these cases. This method shows high success rate, union rates reaches about 90% (1). Non union of tibial fractures fixed with interlocking nail is considered if there is no radiological evidence of healing after 6 months of treatment (2) of at least 3 cortices after 6 months of treatment (3). There are several methods used for treatment of this problem as exchange nailing with or without bone grafting, plate augmentation with leaving the nail *in situ*, external fixation and bone grafting alone with the nail *in situ*. Plate augmentation without removal of the intramedullary nail can give superior results over the other methods in certain situations.

2. Patients and Methods

We treated 21 cases of diaphyseal tibial fractures previously fixed with intramedullary locked nail in the period from January 2009 till October 2010, the mean age was 29.3 years (Range from 21 to 43), 18 cases were males while 3 cases were females. The mean follow up period was 12 months (range 8 –18 months). All cases were due to RTA. All cases were presented with clinical and radiological findings of non union 6 months and more after the initial treatment. The causes of non union in our series were different, seven cases were due to the use of unreamed smaller sized nail used for cases of open fractures (Figure 1), four cases were due to ill fitted nail in proximal tibial fractures leaving non union with angular deformity, while ten cases were due to presence of defect at the fracture site due to fracture comminution. (Figures 2,3) Five of our cases had iatrogenic preoperative rotational deformity. Three of

the comminuted cases had over distraction at the fracture site as compared with the contralateral limb.



Figure 1: pre and post for a case with small nail diameter



Figure 2: pre and post for one case having bone defect



Figure 3: pre and post for one case having bone defect

Before decision was made to do augmentation plating sepsis was excluded both clinically and laboratory. In all cases pain was related to patient trial of full weight bearing, there were no throbbing pain, no night pain nor pain at rest. There were no hotness or swelling at the fracture site. Tenderness was elicited only on stressing the fracture site. Laboratory evaluation included CBC, ESR and CRP and all were within normal ranges.

Surgical technique

Under spinal anaesthesia and the patient in supine position the limb was prepared from mid thigh down to the toes, also the ipsilateral iliac crest was prepared. Small anterolateral incision centered over the fracture site was done. The fracture site was exposed through minimal subperiosteal dissection, fibrous tissue was removed from the fracture site and bone ends were refreshed. Bone graft was inserted in the fracture site to fill all defects in ten cases where a defect at the fracture site was present, narrow DCP with at least two bicortical screws in each segment was applied to the tibia with applying compression at the fracture site after dynamization of the locked nail. Dynamization was not done in cases with defect at the fracture site. Exposure and dissection at the anterolateral surface of tibia was done if the bone defect requiring grafting is present on that side otherwise the soft tissue envelope was retained undisrupted and the plate is applied to the anteromedial surface. Fibular osteotomy was done for eight cases where there was a rotational deformity and overdistraction at the fracture site.

Skin and subcutaneous tissue were closed and no splint was applied. Range of motion exercises for knee, ankle and foot were started on the second postoperative day and weight bearing was not allowed

till there was evidence of progressive union, at that time gradual weight bearing was allowed. Follow up x-ray was done every month till healing was achieved. The plate was removed from cases, which complained on pain due to the implant about one and half year after operation

3. Results

Union was achieved in all cases(100%) within a mean time of 16 weeks (range 12 – 17 weeks). Only 3 cases had superficial early postoperative infection, which was controlled with intravenous antibiotics for three days and repeated dressing. Early range of motion exercise improves joint mobility, muscle power. There were no disuse muscle atrophy or osteoporosis. The plate produced pain in 11 cases (52.3%) and removed later after fracture consolidation one and half year from the operation

4. Discussion

For the intramedullary locked nail to give the optimum results it should provide axial, rotational and side to side stability so it should be of appropriate length and diameter to perform its function well, also a considerable bony contact should be present at the fracture site to avoid delayed union and non union. Cases with gap at the fracture site due to marked comminution or distraction commonly have healing problems. The use of unreamed technique for treatment of open tibial fractures usually involves the use of nails of smaller diameter than those in the reamed technique, which can result in stability problems that is reflected on the process of fracture healing (4).

Treatment of tibial non union by augmentation plate and retaining of the intramedullary nail provides a strong fixation device with the intramedullary nail acting as internal splint (8) and the plate controls rotation and provide compression and axial stability

The need to bone graft in this technique is determined by the type of non union and the presence of bone defect. Bone grafting was done for all cases of non union with bony defect at the fracture site. We agree with Birjandinejad *et al.* (5) in their indications for bone grafting. They used iliac bone graft for this condition if there were less than 50% bone contact due to comminution or if there was bone loss more than 1 cm between the two segments whatever the type of non union (atrophic, oligotrophic or hypertrophic). The use of exchange reamed nailing in presence of bone defect has proved to be non effective without iliac crest graft because the internal cancellous bone graft achieved from pure reaming under an inserted intramedullary nail is not hypothetically copious. Therefore, supplementation of cancellous bone graft from other sites should be more reasonable (7).

Fibular osteotomy was not routinely done for all cases. It was done for cases in which the fracture needed correction as the presence of rotational deformity or in presence of fracture distraction and the fracture ends needed to come in contact. We agree with Zelle *et al.* (2) and Wu *et al.* (7) in their indications for fibulectomy in management of cases of tibial non union. If there are no indications it is better to leave the fibula intact because this will reinforce local stability of the tibia (2)

Ateschrang *et al.* (6) found that treatment of tibial non union with plate augmentation achieved bony consolidation in a shorter time than treatment with exchange reamed intramedullary nailing. They attributed that to less endosteal perfusion disturbance and more stability offered by plate fixation

Compression effect of the plate and the blocking effect of the screws offer more stability than intramedullary locked nail alone. This fact is well evident in fractures in the metaphyseal diaphyseal junction in the proximal tibia while this part is wide and cone shape and the intramedullary nail will not be well fitted (8).

The rate of union in our series is 100%. It is comparable to others Wu *et al.* (96%) (7) and Ueng *et al.* (100%) (8)

Augmentation plate technique has many advantages, one of the main advantages of this technique is that it allows to attack the non union site by debridement of the fracture site, insertion of bone graft and increase stability of fixation by fracture compression. Other advantages of that technique is being simple, low cost and allows early patient rehabilitation. (9)

On the other hand this technique also has many disadvantages being more invasive than exchange nailing, leaving additional postoperative scar, which may increase postoperative pain. The soft-tissue sleeve around the nonunion site is disrupted disturbing local periosteal blood supply that is important for fracture healing. Finally in many case the plate causes irritation to many patients and needs to be removed later (8)

Conclusion

We found this technique more reliable than the other techniques in certain situations as fractures in the proximal metaphyseal diaphyseal junction in which the intramedullary nail cannot control angular deformities in the coronal plane and in presence of bone defect due to fracture comminution with the need

to place bone graft and add stability to the fracture site otherwise exchange nailing with larger diameter nail with or without bone graft can get nearly the same results and avoids future operation of plate removal later

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