

Exchange Nailing, Augmentation Plating with open Bone Grafting in the Treatment of Aseptic Nonunion Femur Initially Treated with Intra Medullary Nailing

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Abstract

Union rates of femur fractures deteriorate when the fracture is further distal than the isthmus or is complicated with other risk factors like proximal third shaft fracture, HTN, DM, overweight and obese, NSAIDs, smoking & alcohol consumption. All the treatment strategies, whether exchange nailing or augmentative plating or open bone grafting which are presently employed, have their own advantages as well as disadvantages. In order to overcome their individual lacunae a combination modality approach may be helpful.

Keywords: Augmentation Plating; Bone Grafting; Intra Medullary Nailing.

Introduction

Intramedullary (IM) interlocking nailing is considered as the first line treatment and gold standard for the treatment of femoral shaft fractures.^{1,2} Despite this, the rate of non union progresses from 2.8% in closed simple fractures³ to 5% with intramedullary nailing (Dencker 1963). Union rates further deteriorate when the fracture is further distal than the isthmus or is complicated with other risk factors like proximal third shaft fracture, HTN, DM, overweight and obese, NSAIDs, smoking & alcohol consumption. Johnson et al. suggested that remaining rotational instability after IM nailing may reach up to 10°-15° rotational movement, resulting in fracture non union.⁴

Treatment Strategy: Why to prefer a combination

approach.

Evaluating the cause of the nonunion can help guide an appropriate treatment strategy. But with our present level of understanding and available evidence it can be said that the optimal treatment strategy of femoral shaft nonunion or delayed union after nailing remains controversial.

Prior to the introduction of reamed exchange nailing, the use of compression plating for femoral shaft nonunions was the gold standard. Several studies have clearly indicated that the cause of nonunion is instability.^{5,6} Exchange nailing with a thicker nail therefore emerged as an obvious contender to being branded as the gold standard. A thicker nail improves stability while at the same time reaming products contain osteoblasts and multipotent cells as well as growth factors that play

a role in bone union. Reaming also increases the length of the isthmus providing a better endosteal purchase of the new thicker exchanged nail. In case the fracture gap is larger, the scope of further open bone grafting is always available.

Failure of exchange nailing on the other hand has prompted Augmentative plate fixation as failure of exchange reamed nailing has been noted in many nonunions with extensive comminution, large segmental defects, and (distal/proximal) metaphyseal diaphyseal nonunions.^{7,8} This approach possibly combines the load sharing capacity of the nail and utilizes the plate's ability to further prevent any rotational instability. But an obvious shortcoming of this technique is that it does not allow for correction of any deformity with the presence of an intact nail which had been left in situ. Further the advantages of the products of re-reaming are also lost.

Augmentation nailing would therefore suffice in a scenario with hypertrophic nonunion where the initial nail and most of the callus was kept untouched with adding a plate leading to a stable construct in order to allow the patients to undergo mobilization and weight bearing for early functional recovery as well as full recovery.^{9,10}

But in a scenario where the cause is biological as well as mechanical with an atrophic/hypertrophic type of nonunion with large gaps, leaving the nail untouched would not be sufficient. Supplementation with open bone grafting would take care of the requirement of addressing the bone gaps while an exchange nailing would definitely improve stability and add greater bending rigidity and strength than the original nail and the reaming debris will augment bone union.⁹

This procedure has the similar drawbacks as a

augmentative plating such as the additional incision and the patients' complains that often necessitate the removal of the plate.¹¹ Besides additional costs due to dual implants as well as inherent risks of longer duration surgery, infection due to excessive hardware presence/longer duration, risk of contralateral limb compartment (in case of using a well leg holder for prolonged duration) are some further drawbacks.

Surgical Technique

Removal of the primary femur nail can be done either in a traction table or a radiolucent fracture table. Exchange nailing is done with a reaming of 2 mm greater than the previous size, and re insertion of statically locked exchange intra-medullary nail of 1 mm greater size, than the previous time. A direct lateral approach is taken by splitting the tensor fascia lata and vastus lateralis muscles to reach the non-union site. Depending upon the bone gap assessed at this point, Iliac crest bone grafts are taken. The periosteum was not stripped from the bone to preserve the periosteal blood supply. The fixation of fracture is done with 8-12 holes, 4.5 mm stainless steel/titanium combi-hole limited contact dynamic compression plate (LC-DCP), using unicortical locking head screws and wherever possible bicortical screws (with locking or non locking heads). Where required 3.5 mm cortical screws with washers may also be employed to circumvent the nail especially when the screw region is nearer to the isthmus. Cortico-cancellous bone grafts is used around the fracture site at this juncture of time. The knee was mobilised immediately in post operative period and the patient is made to do full weight bearing using a standard walking frame.

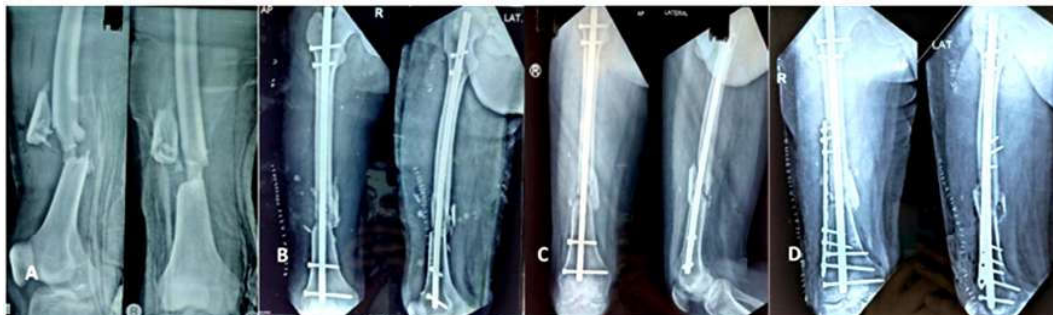


Fig. 1: A. An open grade 3A fracture of the distal femur shaft B.

Immediate post operative image after debridement and IM nailing C. 7 month Non union fracture femur after IMN; D. Post operative x-ray after treatment with exchange nailing, augmentation plating and open bone grafting.

Conclusion

Treating femoral nonunions with a combination approach of exchange nailing (provides more stability and reaming products), augmentative

plating (addresses any concern regarding rotational stability) and open bone grafting (ensures that large gaps are dealt with) will possibly cater to all the surgically addressable mechanical and biological factors contributing to a nonunion. This may ideally result in fracture union with better functional outcomes and faster patients' recovery times giving a fillup to our treatment armamentarium.

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