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Case Report

Management of aseptic non-union of shaft femur using intramedullary nailing combined with bone grafting: a case report

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ABSTRACT

Despite the advances in trauma care, improved surgical techniques, latest implants and therefore the evolution of new adjuvants to healing, biologic agents, non-union still persists thanks to high energy trauma as initial event. Non-union of femur shaft represents a significant socioeconomic problem to the patient, related to prolonged patient morbidity, inability to return to figure, gait abnormality, re-operations and psycho-emotional impairment. Here we discuss the case of such non-union of fracture shaft femur presented to us with shortening of 3.5 cm managed with bone graft and intramedullary nailing. 22-year-old male patient had a history of trauma due to fall from bike due to dash from behind by tractor (high velocity road traffic accident) sustaining injury over right thigh leading to closed fracture mid-shaft femur of the same side treated immediately by femur nailing. After 6 months post-surgery, he noticed swelling over operated thigh which was increasing and causing difficulty in walking. X-rays revealed broken nail, re-operated at the same centre with dynamic compression plating (DCP) probably after freshening the fracture edges using 12-hole DCP, implant failure with whole plate and screw construct extrusion and re-fracture at the same site. This time patient presented to our institute. We planned of implant removal and intramedullary nailing with bone grafting. Management of aseptic femoral non-union with fracture gap of 2.5-4 cm range with intramedullary nailing combined with autologous fibular cortical and cancellous grafts showed good functional results at the end of 1 year post operative interval after prior repetitive failure of implants due to non-union.

Keywords: Aseptic non-union, Bone grafting, Intramedullary nailing

INTRODUCTION

Despite the advances in trauma care, improved surgical techniques, latest implants and therefore the evolution of new adjuvants to healing, biologic agents, non-union still persists thanks to high energy trauma as initial event. Non-union of femur shaft represents a significant socioeconomic problem to the patient, related to prolonged patient morbidity, inability to return to figure, gait abnormality, re-operations and psycho-emotional impairment. It moreover stands for a treatment challenge for the orthopaedic surgeon, having to require factors into consideration such as different treatment modalities, deformity correction, treatment of infection and rapid rehabilitation of the patient.[1] There are various surgical options for treating non-union of femur shaft fracture like nail exchange, bone grafting, and plate osteosynthesis. Here we discuss the case of such non-union of fracture shaft femur presented to us with shortening of 3.5 cm managed with bone graft and intramedullary nailing.

CASE REPORT

22-year-old male patient had a history of trauma due to fall from bike due to dash from behind by tractor (high velocity road traffic accident) sustaining injury over right thigh

leading to closed fracture mid-shaft femur of the same side.

Figure 1 (A-B): Initial fracture.

He was treated immediately by femur nailing at the other centre which was uneventful and started weight-bearing after 6 weeks. He was followed up regularly at that centre.

Figure 2: Postoperative X-ray after intramedullary nailing.

After 6 months post-surgery, he noticed swelling over operated thigh which was increasing and causing difficulty in walking. X-rays revealed broken nail which resulted in non-union.

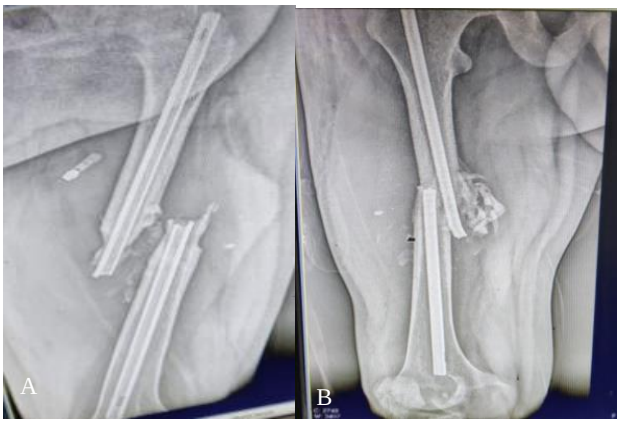

Figure 3 (A-B): Post op failed nail.

He was re-operated at the same centre with dynamic compression plating probably after freshening the fracture edges using 12-hole DCP with 4 cortical screws proximally and 4 cortical screws distally.

Figure 4: Post operative X-ray following DCP.

On postoperative day 7, patient noticed pain over thigh which on X-ray revealed implant failure with whole plate and screw construct extrusion and re-fracture at the same site.

Figure 5: Failed plate.

This time patient presented to our institute. We planned of implant removal and intramedullary nailing with bone grafting.

Cancellous graft harvested from ipsilateral iliac crest and cortical graft harvested by fibular strut of same side. Implant removal of 10 holed plate and 8 cortical screws done and checked under C arm and intramedullary reamed nailing of titanium nail measuring 11×38 mm with 2 distal interlocking screws and 1 proximal interlocking screws done after bone ends freshened till punctate bleeding and

the nail size was calculated using the X-ray of the contralateral normal femur. Since it had a shortening of 3.5-4 cm, fibular strut grafts from the same limb introduced and fixed with titanium cortical screws in the inter-fragmentary fashion over lateral aspect and medially cancellous graft filled and impacted. Wound was closed in layers under negative suction. 2 units of whole blood transfused intraoperatively and 2 units of whole blood postoperatively.

Patient was followed up regularly, bridging callus seen around 6 weeks radiologically and union around 8 months with remodelling of bone.

Figure 6: Our postoperative X-ray following intramedullary nailing with bone graft.

Figure 7 (A-B): Follow up at 6 months.

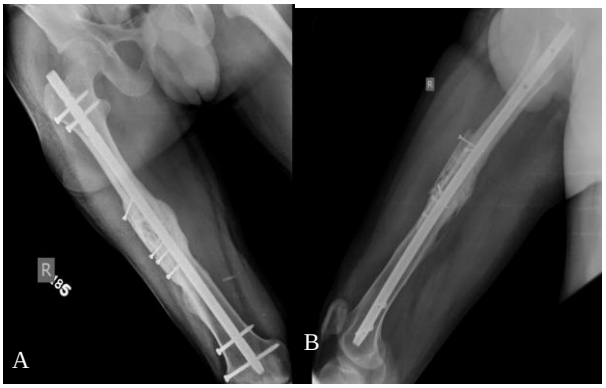

Figure 8 (A-B): Final union at 1 year.

Figure 9 (A-D): Clinical photographs at 15 months of final surgery.

Patient achieved complete range of motion and complete union with slight shortening of 1 cm at the end of 15 months of surgery.

DISCUSSION

The intramedullary nail acts as a load-sharing device, which allows physiologic compression of the non-union site. The fixation is especially based on elastic three-point contact in a longitudinal direction and offers excellent stability promoting early weight-bearing.[2] Motion of the non-union site is reduced but not eliminated. Interlocking nailing has extended the indications for intramedullary nailing to the entire diaphyseal and metaphyseal shaft providing excellent stabilization and early functional rehabilitation.[3] The late effects of stress shielding from plate fixation and refractures through screw hole stress risers aren't seen using intramedullary nailing.[4,5]

Reaming causes considerable vascular damage to the blood circulation of the endosteum supported the vascular anatomy of the endosteum, the essential damage is especially caused by the first reaming.[6,7] On the opposite hand, reaming particles represent a robust osteoinductive substance and are considered of great importance in fracture healing when vital tissue is presented at the non-union site. At devitalized zones of the endosteum the reaming particles can become necrotic particles and must be considered in sight of possible bacterial contamination, when an open technique is performed. In our case we've done reamed nailing. El Moumni et al investigated the incidence of non- union in 129 femoral shaft fractures treated with unreamed intramedullary stabilization where

non-union occurred in two patients (1.9%). The authors concluded that the incidence of non-union following un-reamed intramedullary nailing is low and comparable the best results of reamed nailing in the literature.[8] Management of femoral non-unions with intramedullary nail fixation is reported highly successful.[2,9,10]

Muller and Rosen first described the utilization of the plate compression principle in the treatment of femoral nonunions.[11,12] Despite the disadvantages of upper blood loss, higher rates of infection and better non-union rates than with exchange nailing, plate osteo- synthesis has been proven effective. Since there's high risk of infection and non-union with plating, we have avoided doing it and preferred doing intramedullary nailing with bone graft for the treatment of femoral non-union.[13,14] In our case, since non-union with implant failure already occurred so we decided to do intramedullary nailing with bone grafting. Bone grafting techniques are used as adjuncts combined with surgical techniques usually with nailing or plating.[15-18] Autologous bone graft are often obtained either from the iliac crest or from the reaming products in cases of intramedullary nailing.[19-21] Autogenous bone has repeatedly been shown to be superior to all or any other types of bone grafts or bone substitutes.[22] Cancellous bone features a large surface area and more cells survive per unit volume of graft than in cortical bone grafts. Therefore, autogenous cancellous bone features a greater potential to form new bone than autogenous cortical bone. Osteoinduction is that the process of recruitment of mesenchymal precursor cells to differentiate into preosteoblasts or chondroblasts, leading to cartilage and bone production.[23,24] Osteoconduction occurs through provision of a matrix for the ingrowth of recipient site capillaries, perivascular tissue, and osteo-progenitor cells necessary for bone formation.[22,24] The cortical graft functions as a scaffold and mechanically structure during bone replacement. Cortical bone grafts heal far more slowly than cancellous bone grafts, but follow the identical sequential processes.[22,25] This delay is said to slowed revascularization in cortical grafts secondary to the limited porosity of cortical bone. After failure of fixation due to non-union twice attempted, autologous cortical and cancellous bone graft with intramedullary nailing yielded good functional results.

CONCLUSION

Management of aseptic femoral non-union with fracture gap of 2.5-4 cm range with intramedullary nailing combined with autologous fibular cortical and cancellous grafts showed good functional results at the end of 1 year post operative interval after prior repetitive failure of implants due to non-union.

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