

Case Report

Surgical management of critical femoral bone loss by bone transport over intramedullary nail by monorail system: a case report

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ABSTRACT

Present case report is about a male patient who met with a road traffic accident sustained an open crush, contaminated, injury of lower end femur of right side with significant loss of lower thigh bone (8 cm). He had fracture of inter condylar femur with fracture upper end tibia and lower third tibia with impending vascular insufficiency of leg and foot. Operated after correction of anaemia by debridement, fixation of femur with plate and inter condylar screw. Upper end tibia and Lower half tibia were fixed with separate plates and fasciotomy of leg. After 2 months femoral plate was replaced with intramedullary locking nail and superadded with monorail fixator. Corticotomy at proximal femur for bone transportation. Bone gap was corrected within 4 months and bone grafting was done at distal docking site. Union achieved and fixator removed after 4 months of this. Patient showed good results till last follow up 28 months, having good range of motion of knee. so critical bone loss at femur was treated by distraction osteogenesis over intramedullary nail with monorail external fixator system.

Keywords: Femoral bone loss, Primary plating, Bone transport over I M nail, Monorail system

INTRODUCTION

Managing a high velocity polytrauma patient with significant bone loss in major long bones involving the diaphysis and metaphyseal bones and specially open injuries pose a greater challenge to the treatment and limb salvation.¹⁻³ it's also a psychological, physical, social and economic challenge to the patient. in spite of all, stiffness of joints, scarring of skin residual deficiencies of muscular or Neurovascular nature may bring dissatisfaction to the patient. Many time amputations may take place in later course of time. So careful selection of treatment modality or primary amputation is of utmost importance in such conditions. Infection or non-union may eventually end up in secondary amputation. Management of such cases can't be applied to a single definitive procedure as each individual case needs customised approach.

Vascularised fibular graft demands a high degree of technicality and vigilance towards its failure. Chances of graft fracture and even infection can take place in near future. Autologous bone grafts need more volumes posing difficulty to get it. Allografts have higher chances to get resorbed. Ilizarov ring fixator has different problems regarding its application in thigh, Multiple rings and wires poses bulkier construct and needs more care.^{4,5} Monorail on intramedullary nail gives better stability but chances of hidden infection may take place. Bone grafts at docking site is an additional procedure that becomes mandatory. Many times, scanty regenerate at corticotomy site can pose a risk of failure. so in such conditions thawing (accordion) mechanism has to be applied to enhance regenerate. Distraction osteogenesis involves mechanical induction of new bone formation between bony surfaces that are gradually pulled apart. The trailing end regenerates bone by intramembranous ossification and the leading end fuses

with the target bone surfaces. Bone transport has been found to be better suited over conventional bone grafts in terms fewer graft fractures, lesser hospital stays, less operating time, better restoration of leg lengths and lesser chances of infection.^{6,7} Bone Transport has been compared to conventional techniques for the treatment of segmental defects and infection and found to provide better restoration of leg length, to need less cancellous grafting, to have fewer graft fractures and to require less operating time and hospital stay and to have a lower disability.

CASE REPORT

Male patient aged 33 years met with a road traffic accident referred to us in an emergency department after ten hours of trauma with significant blood loss and vascular insufficiency in the right lower limb toes. He had open fracture lower end femur with bone loss of 8 cm and intra articular fracture of femoral condyles. As per classification the fracture was (AO 32-C2, Anderson-Gustilo IIIa).



Figure 1: (A) Pre-op clinical picture and (B) X-ray.

Patient had an ipsilateral intra articular fracture upper end tibia and fracture lower end tibia and fibula with tight leg compartments. Patient was operated with debridement. Femur was stabilised with distal locking plate and screws along with proximal and distal tibial locking plates, fasciotomy done while doing fasciotomy incident tear of anterior tibial artery was repaired. Primary closure of thigh wound done.



Figure 2: Post op X-ray of right femur. (A): 3.5 inches of bone gap. (B) and (C): Fixation of fractures of tibia.

After 3-½ months of this surgery femur plate was removed and interlocking nail was done, superadded with rail road fixator. Corticotomy was done in proximal femur.



Figure 3: Corticotomy and rail road fixator and bone loss.

Bone transport was done for distraction of regenerate at 1 mm per day till the bone gap of 3-½ inches was completed. In between the accordion technique was applied for poor regenerate formation. Autologous iliac bone graft was done at distal femur after 4-1/2 months of last surgery.



Figure 4: Union at the fracture site but weak regenerate at corticotomy site.

After 3 months of this again bone graft was done at corticotomy site and sufficient bone was formed after 3 months or can say treatment completed in 20 months post injury.



Figure 5: Complete healing on X-ray after 20 months post trauma.



Figure 6: Limb length equality and knee flexion after 23 months of trauma.

DISCUSSION

Critical sized defects when they are 2-3 times diameter of the involved bones which is not going to heal or even 10% regeneration will be not possible. Defects less than 4 cm can be treated with autologous bone graft. 4-7 cm bone defects can be treated with primary shortening and later on limb lengthening. vascularized fibular graft can be used for defects larger than 10 cm. Masquelet technique involves a two-stage procedure in which fracture is stabilized mechanically and bone defect is filled with local antibiotic delivery material and biological membrane formation around it, is utilized for bone graft incorporation. Bone morphogenic proteins have role alongside the allografts. Reamer irrigation aspiration can be used for bone graft healing. Distraction osteogenesis is very useful technique for significant bone loss defects. it can be accomplished with ring fixator or monoplane rail road fixator system.² Bone transport over an intramedullary nail provides better stability to fixation configuration, maintenance of length of limb, alignment of fixator, allowing early removal of fixator and mobilization of joints and muscles.⁷⁻⁹

CONCLUSION

Functional outcome of this case was good as per Karlstrom and Olerud system of -flail knee injuries criteria includes pain, difficulty in walking, difficulty in stairs, shortening, loss of motion at knee, loss of motion at subtalar joint, muscle atrophy, deformity, limitation at work, loss of previous sports, status of skin which includes maximum 33 points for excellent results. This case falls in good category with 30 points.¹⁰

Severe injury like Gustilo type 3 A can be treated with good primary debridement and plating of femoral fracture and associated fractures of tibial bone. critical bone loss can be overcome by a monorail distraction system over intramedullary nail over other methods like Ilizarov ring fixator or vascularised free fibula grafts procedures.

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