Case Report

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

Kuldeep Nahar1*, Nikita Nahar2

1Department of Orthopedics, GRMI, Shahibagh, Ahmedabad, Gujrat, India
2NHL Medical College, Ahmedabad, Gujrat, India

Received: 18 July 2020
Accepted: 10 September 2020

*Correspondence:
Dr. Kuldeep Nahar,
E-mail: naharkuldeep@yahoo.com

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 intercondylar 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 IM nail, Monorail system

INTRODUCTION

Managing a high velocity polytrauma patient with significant bone loss in major long bones involving the dia- and metaphyseal bones and specially open injuries pose a greater challenge to the treatment and limb salvation. 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 bulky construct and needs more care. Monorail on intramedullary nail gives better stability but chances of endosteal blood supply reduction or reactivation 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 osteo-genesis 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 of fewer graft fractures, lesser hospital stays, less operating time, better restoration of leg length 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 intraarticular 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.](image1)

Patient had an ipsilateral intraarticular 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.](image2)

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.](image3)

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.](image4)

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.](image5)
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.

Funding: No funding sources  
Conflict of interest: None declared  
Ethical approval: Not required

REFERENCES

1. Keating JF, Simpson A.H.R.W, Robinson CM. The management of fractures with bone loss. J Bone Joint Surg. 2005;87:142-50.  
2. Pauls pipitone DO, Rehman S. Management of traumatic bone loss in lower limbs. Orthop Clin N Am. 2014;45:469-82.  
3. Kumar R, Mohapatra SS, Joshi N, Goyal SK, Kumar K, Gora R. Primary Ilizarov external fixation in open grade III type C distal femur fractures: Our experience. J Clin Orthop Trauma. 2019;10:928-33.  
4. Baruah RK, Kumar S. Ilizarov strategies in the management of non-unions and difficult fractures of the femur. J Limblengthrecon. 2019;5(2):79-87.  
5. Krishnan A, Pamecha C, Patwa JJ. Modified Ilizarov technique for infected nonunion of the femur: The principle of distraction-compression osteogenesis. J Orthop Surg (Hong Kong). 2006;14:265-72.  
6. Arazi M, Memik R, Ogün TC, Yel M. Ilizarov external fixation for severely comminuted supracondylar and intercondylar fractures of the distal femur. J Bone Joint Surg Br. 2001;83:663-7.  
7. Li G, Berven S, Athansou NA, Simpson AH. Bone transport over an intramedullary nail: a report with histologic examination of the regenerated segment. Injury.1999;30:525-34.  
8. Paley D, Herzenberg JE, Paremain G, Bhave A. Femoral lengthening over an intramedullary nail: a matched-case comparison with Ilizarov femoral lengthening. J Bone Joint Surg. 1997;79-A:1464-80.  
9. Zhang Q, Zhang W, Zhang Z, Zhang L, Chen H, Hao M et al. Femoral nonunion with segmental bone defect treated by distraction osteogenesis with monolateral external fixation. J Orthop Surg Res. 2017;12:183.  
10. Shukla R, Jain A, Jain RK. Long-term study of functional outcomes of floating knee injuries. J Orthop Traumatol Rehabil 2020;12:23-30.

Cite this article as: Nahar K, Nahar N. Surgical management of critical femoral bone loss by bone transport over intramedullary nail by monorail system: a case report. Int J Res Orthop 2020;6:1309-11.