CASE REPORT

The Titanium Mesh Cage for Bone Defect in Femur: *Report of Two Cases*

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Abstract

This report describes a new technique for treatment of a segmental defect in the femur using cylindrical titanium mesh cage in combination with cancellous bone autograft and buttress condylar plate. Two cases of femoral defect treated with this technique are presented. At one year follow up, both cases demonstrated excellent limb alignment, stability and bone healing radiographically with good limb functional recovery. Preliminary data suggest that this technique may be a reasonable alternative to currently used methods for management of long bone segmental defects.

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Introduction

The treatment of a large segmental defect in a long bone remains a formidable challenge in orthopedic surgery. Currently the treatment options include bone grafting (autograft or allograft), vascularized bone transfer, distraction osteogenesis and the option of addition of various biologic stimulators like bone morphogenic proteins (BMP-2 and BMP-7). However these techniques often involve multiple surgical procedures, inhibits early limb function and requires serial revision procedures to maintain acceptable alignment and achieve healing.

We describe a new simple technique for the treatment of segmental bone defects in femur using a one stage surgical procedure that provides anatomical alignment of the extremity, structural support of the defect and permits early weight bearing and functional limb recovery.

Cobos *et al.*[1] reported treatment of two tibial fractures associated with segmental bone loss using titanium mesh cage packed with cancellous bone allograft and stabilized with IM nail. Attias *et al.*[2] reported one humerus fracture treated with cage packed with allograft and stabilized with LC-DCP. At the time of writing this paper, an extensive search in the literature didn't show any case report of using this technique for femoral bone defects.

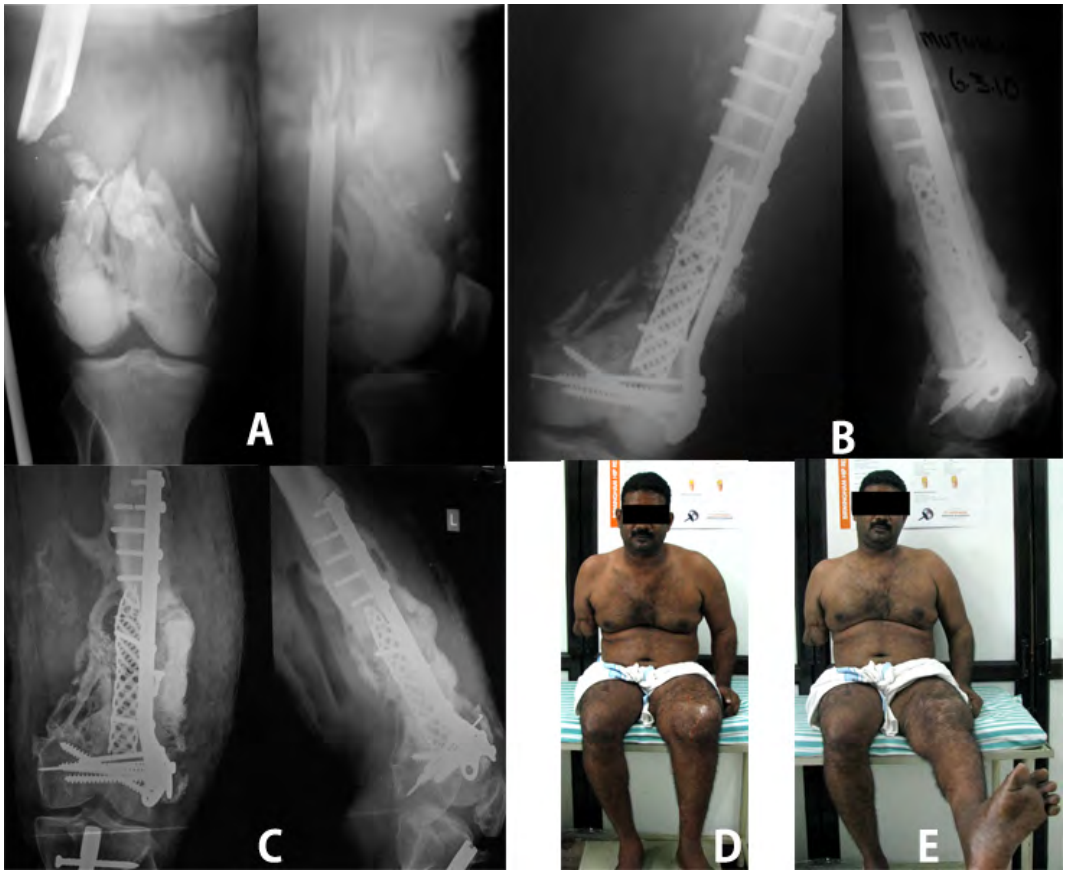
Case History

Case I

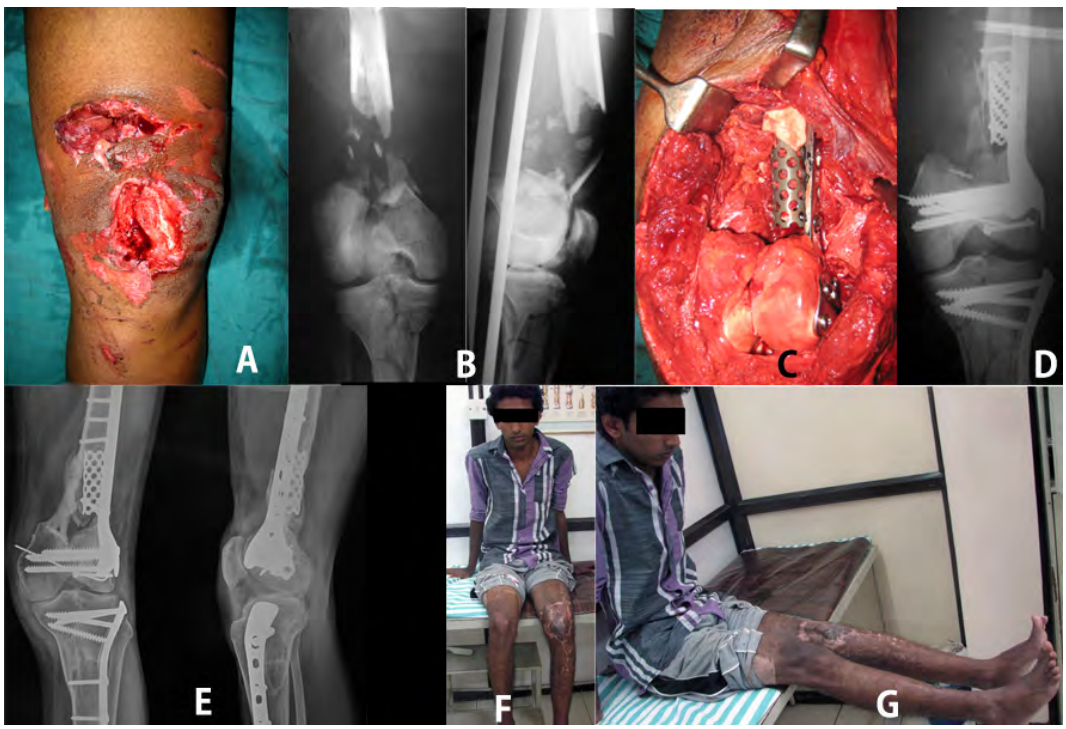
A 38 year old male, right arm amputee, presented to the emergency department following a road traffic accident with Gustillo grade IIIA open comminuted fracture of left lower end femur (OTA 33C2) with 8 cm bone loss, and Gustillo grade II (Fig 1) fracture both bones lower 1/3 left leg with a Ganga Score[3] of 10.

Case II

A 21 year old male involved in a motor vehicle accident sustained Gustillo grade III B open fracture of left lower end femur (OTA 33C2) with 5 cm bone loss and ipsilateral fracture both bones upper 1/3rd leg (Fig 2) with a Ganga Score[3] of 10.



Case 1. (A) Pre operative radiograph. (B) Immediate postoperative radiograph. (C) 2 year follow up radiograph. (D) & (E) Range of movements at 2 years follow up.



Case 2. (A) Pre operative clinical picture. (B) Pre operative radiograph. (C) Intra operative picture. (D) Immediate postoperative radiograph. (E) 1 year 10 months follow up radiograph. (F) Clinical picture at 1 year 10 months.

The patients were initially treated with surgical irrigation, broad spectrum antibiotics, tetanus prophylaxis and other supportive measures in the emergency minor OT and posted for debridement, primary fixation and bone grafting.

The patients were stabilized and taken to operating room within 12 hours after the injury with all necessary investigations. In both cases the tibia was fixed first to get better control and alignment in the femur. In the first case, the tibia was fixed with an intramedullary nail and in the second, with lateral tibial DC plate.

The femur was exposed with modified incision through open wound, thoroughly debrided, irrigated and cleaned, preserving the soft tissue and viable bone fragments. The defect was measured to be about 8 cm in the first and 5 cm in the second case. The distal femoral fragments were reduced and fixed with dynamic compression buttress condylar plate with lag screws through the plate in the condylar region, and the plate was aligned to the proximal femur. Iliac crest bone graft was harvested and packed in titanium mesh cage (5 cm × 2 cm size) and impacted into the bone gap with reasonable stability and reinforced with proximal screws through the plate and one screw through the cage. Two cages were locked together and used in the 1st case for getting sufficient length. The extra bone graft was put around the fracture site. The wound was closed with loose sutures and suction drain. The suction was removed after 48hrs and IV antibiotics continued for one week. In the second case there was skin sloughing over the patella and required gastrocnemius flap cover. Patients were discharged non-weight bearing with knee brace allowing intermittent knee bending and quadriceps exercises. Partial weight bearing was started after six weeks and full weight bearing after Three months. X-rays were taken at six weeks, three months, six months and one year. A two year follow up of both cases showed excellent union and good functional recovery with a knee ROM of 0° to 100° in both cases.

Discussion

The management of a large long bone defect is extremely challenging in open fractures. Initial treatment consists of irrigation and debridement, immediate stabilization and early soft tissue coverage and wound closure. Once the wound is amenable, definite bone reconstruction is done with free autogenic or allogeneic bone grafting.

Vascularized bone grafting can significantly shorten the time for bony healing. But this complex procedure is technically demanding. Graft hypertrophy, graft fracture and donor site morbidity are the complications.

Distraction osteogenesis, according to the principles of Ilizarov, is extremely popular and considered by many to be the modern standard of care for these injuries[4]. This method requires considerable surgical skill and exceptional patient compliance. Bone transportation and lengthening has numerous complications which can include pin tract infections, wire loosening or failure, delayed union or non-union and soft tissue contracture.[5–8]

Titanium mesh cage implants were approved by the FDA in 1990 for reinforcement of deficient bone and for cement restriction in selected surgical procedures. Titanium mesh cage filled with bone graft have become quite popular in spine surgery. Preliminary studies have shown the cage to be safe, mechanically stable and effective in spine.[9] Due to this success, we have modified the technique for use in long bone segmental defects. The strength of the titanium cage increased the limb stability. The graft packed in the cage can be cancellous bone and the cage can be cyclically loaded axially. This appears to be a superior biomechanical medium for the bone graft to incorporate.

In the cases presented here, the mean bony defects were approximately 8 cm and 5 cm respectively, yet the limbs were anatomically reconstructed in one single procedure and union was achieved without the need for additional bony procedures. Previous case reports were secondary procedures after primary debridement and external fixation. We used autografts instead of allografts in the cases reported.

References

1. Cobos JA, Lindsey RW, Gugala Z. The cylindrical titanium mesh cage for treatment of a long bone segmental defect: description of a new technique and report of two cases. Journal of orthopaedic trauma 2000;14:54-59.
2. Attias N, Lehman RE, Bodell LS, Lindsey RW. Surgical management of a long segmental defect of the humerus using a cylindrical titanium mesh cage and plates: a case report. Journal of orthopaedic trauma 2005;19:211–216.
3. Rajasekaran S, Naresh Babu J, Dheenadhayalan J, et al. A score for predicting salvage and outcome in Gustilo type-IIIA and type-IIIB open tibial fractures. The Journal of bone and joint surgery British volume 2006;88:1351–1360.
4. Green SA. Skeletal defects. A comparison of bone grafting and bone transport for segmental skeletal defects. Clinical orthopaedics and related research 1994:111–117.
5. Cierny G, 3rd, Zorn KE. Segmental tibial defects. Comparing conventional and Ilizarov methodologies. Clinical orthopaedics and related research 1994:118–123.
6. Georgiadis GM, DeSilva SP. Reconstruction of skeletal defects in the forearm after trauma: treatment with cement spacer and delayed cancellous bone grafting. The Journal of trauma 1995;38:910–914.
7. Naggar L, Chevalley F, Blanc CH, Livio JJ. Treatment of large bone defects with the Ilizarov technique. The Journal of trauma 1993;34:390–393.
8. Prokuski LJ, Marsh JL. Segmental bone deficiency after acute trauma. The role of bone transport. The Orthopedic clinics of North America 1994;25:753–763.
9. Hertlein H, Mittlmeier T, Piltz S, Schurmann M, Kauschke T, Lob G. Spinal stabilization for patients with metastatic lesions of the spine using a titanium spacer. European spine journal : official publication of the European Spine Society,

the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society 1992;1:131–136.
10. Rajasekaran S, Sabapathy SR. A philosophy of care of open injuries based on the Ganga hospital score. Injury 2007;38:137–146.
11. Rajasekaran S. Early versus delayed closure of open fractures. Injury 2007;38:890–895.
12. Rajasekaran S, Dheenadhayalan J, Babu JN, Sundararajan SR, Venkatramani H, Sabapathy SR. Immediate primary skin closure in type-III A and B open fractures: results after a minimum of five years. The Journal of bone and joint surgery British volume 2009;91:217–224.
13. Crowley DJ, Kanakaris NK, Giannoudis PV. Debridement and wound closure of open fractures: the impact of the time factor on infection rates. Injury 2007;38:879–889.