

CASE REPORT

Chronic Osteomyelitis of the Femur with Segmental Bone Defect: Concepts and Treatment

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Abstract:

Chronic osteomyelitis of the femur has always been a challenging scenario for the treating surgeon. It leads to morbidity to the patient as it interferes with the patient's rehabilitation and mobilisation. This is further complicated with the presence of a segmental bone loss following debridement due to the infection. We present a case of a young man who had a femur fracture which was initially treated with intramedullary nailing and subsequently was complicated with deep surgical site infection leading to chronic osteomyelitis.

Keywords: Bone Loss, Infection, Intramedullary Nailing

Introduction:

Intramedullary nailing is the gold standard in managing femoral shaft fractures for its biological and biomechanical advantages over plate fixation [1]. It is unusual to see chronic osteomyelitis of the femur following intramedullary nailing for close fractures and its incidence is 1-2% [2]. In cases of open fractures, the incidence may be as high as 4-7% [3].

Following multiple debridement, patients may end up with segmental bone defect. To manage this subsequent complication, treatment consists of principal surgical technique (nailing, plating, external fixator, ring fixator) and the adjunctive treatment (mainly the use of autogenous or synthetic bone grafts). This in turn is dictated by the location of the bone defect and the amount of bone defect [4].

Case Report

A 27-year-old man sustained close right intertrochanteric and mid shaft of right femur fracture and close comminuted fracture of the right patella (Fig. 1) following a motor vehicle accident. He was otherwise haemodynamically stable and no other injuries noted.

On the second day of admission, he underwent elective surgery which included a recon nail, cerclage wiring for the femur and cerclage wiring for the patella (Fig. 2). Post-operatively was uneventful and he was discharged well on the third day post-op.

At 15 months' post operation, he started to develop pain and redness of the lateral thigh wound associated with intermittent fever. This problem resolved with short courses of antibiotics and recurred after antibiotic cessation.

At 17 months' post-operative, patient had pus discharge from a sinus on the lateral thigh. Radiographs showed chronic osteomyelitis of the mid shaft of femur. He was admitted for emergency debridement and removal of the femur cerclage wire. The discharge did not subside and a second debridement was performed in which the recon nail was removed and 10 cm of bone resected. Biofilm was noted on the nail and pus tracking within the previous cerclage site. A K-nail with antibiotic cement spacer was used to stabilise the proximal and distal segments and to fill up the defect (Fig. 3).

Tissue culture from the debridement showed infection by *Pseudomonas aeruginosa* and *Enterococcus* species. He was treated with IV ceftazidime and ampicillin for six weeks. Repeated culture from the wound also showed no growth. Patient had no metabolic diseases. Patient is an ex-smoker.

Following this, the patient underwent definitive surgery which involved the use of the Limb Reconstruction System (LRS) monorail. During the removal of the antibiotic cement spacer, a pseudomembrane was noted around the area of

bone defect. The LRS monorail was applied at an anterolateral position for easier wound care. Osteotomy was done on the distal segment for the purpose of distraction osteogenesis after the application of the LRS monorail (Fig.4). Demineralised Bone Matrix (DBX) was also used. Intraoperative cultures were negative and patient was given one week of post-operation IV Cefuroxime and was instructed to start distracting 1mm/day upon discharge on day 10 post-operation.

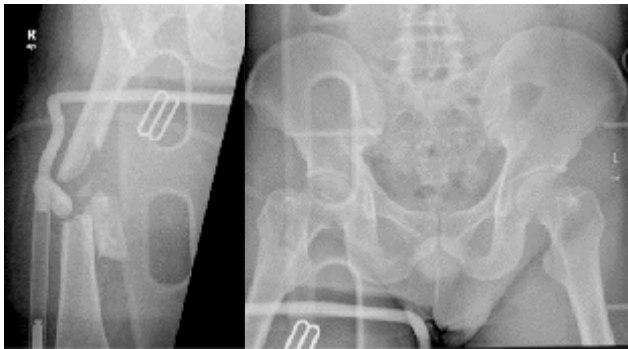


Fig. 1: Initial Radiographs upon Arrival to ED

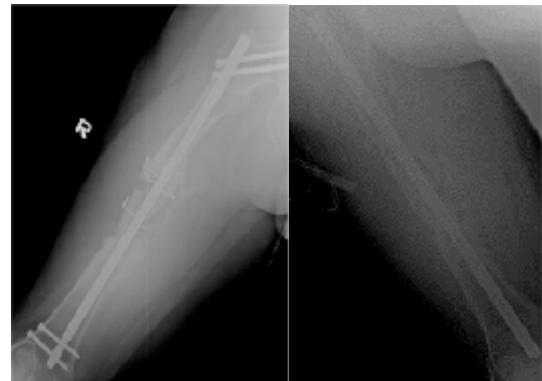


Fig. 3: Radiographs showing Chronic Osteomyelitis Changes before Debridement and after Debridement and Insertion of K-Nail with Antibiotic Cement Spacer



Fig. 2: Radiograph Post Fixation

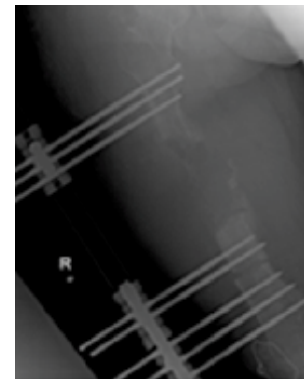


Fig. 4: Radiograph after Definitive Surgery using LRS Monorail

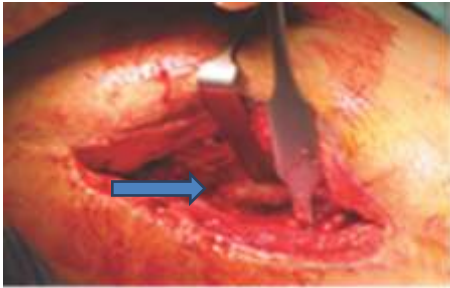


Fig. 5: Presence of Induced Membrane after Removal of the Antibiotic Cement Spacer (Shown By Blue Arrow)

Discussion:

Limb reconstruction in a diaphyseal bone with significant bone loss is technically demanding and time-consuming. In a review article by Keating *et al.* (2005), a general guideline was outlined as well as an algorithm on how to approach fractures with bone loss [4]. Segmental defects larger than 2 cm or involving more than 50% of its diameter will not heal spontaneously with just skeletal stabilisation. Location of the segmental defect, the degree of soft tissue damage, patient's age, presence of metabolic diseases and tobacco use contributes to the success of the osteogenic response in bone area of concern.

The LRS monorail is versatile and rigid which is required in maintaining the alignment until the fracture heals. It can also be used to restore limb length later if there is presence of shortening [5]. There are other options such as ring fixator and allograft usage, or the use of distraction osteogenesis over an intramedullary nail. However, this depends on the available resources, surgeon's preference, and presence of active or previous infections and familiarity of the implant used.

Another aspect pertaining to this case is the presence of chronic osteomyelitis. After debridement and bone resection, many surgeons would opt for an antibiotic cement spacer to ensure high dose of local antibiotic delivery to the

surrounding tissues and bone and prevent the formation of dead space. This technique was popularized by Masquelet *et al.* in 2000 [6]. The aim was to induce membrane surrounding the spacer. After the spacer has been removed, a pseudomembrane is noted which contains growth factors such as BMP, TGF- β , VEGF and IL-6. Placement of bone graft within this membrane will ensure the success of osteogenic response within the defect.

In cases with defect of more than 6 cm, another option would be to primarily shorten the bone (acute docking) followed by a corticotomy away from the zone of injury. By doing so, the limb may be lengthened and fracture may be healed. Shortening of the limb will lead in the reduction of any sizeable soft-tissue defect which may avoid the need of a free flap procedure [5]. It is also noted that by performing bone shortening and staged reconstruction (lengthening), complications are lower in comparison to bone transport technique [7-8].

In a metaphyseal defect of up to 6 cm, the available options are plating or intramedullary nailing with bone grafting [4]. If there are significant articular defects, they will require allograft or arthroplasty. Allografts are considered in articular defects measuring 3cm in diameter and 1cm deep. However, the success rate is low in patients older than 50 years old thus, its use limited to the younger age group [9-10]. For the older age group, arthroplasty should be considered.

In summary, the management of chronic osteomyelitis with segmental bone defect begins with eradication of infection by debridement and use of antibiotic cement spacer to fill up the defect. Definitive surgery can proceed when the soft tissue condition and the infective parameters have normalised. Patient's biology such as nutrition and any underlying metabolic diseases needs to also be optimised.

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