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Case Report

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Reconstruction of Traumatic, Open Distal Third Femoral Fracture by Non-vascularized Autologous Fibular Graft and Locked Plate

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Abstract

Introduction: Fractures of the distal third femur are rare and severe. Usually due to high energy trauma in a young patient and a domestic accident in an elderly person.

Surgical management can be technically challenging, with no clear advantage of any one particular surgical implant.

The femur is the second most common site of bone loss. It amounts to 22% of all traumatic skeletal losses.

A variety of options exist to reconstruct limbs following traumatic bone loss.

Fibular grafting is a popular method for bridging the gap in bone defects created by tumor excision, trauma or bone loss as sequelae to infection.

Case Presentation: 30 years old Sudanese man involved in RTA on 2017 and diagnosed with left hip fracture which treated by DHS, the patient improved.

Unfortunately in 2021 involved in other RTA and diagnosed with left distal third open femur fracture with large bone loss

Then patient underwent surgical wash and fixation with external fixator, after 6 weeks the patient underwent another operation ORIF with plate and fibular graft, after regular follow up the patient condition improved well with amazing outcomes.

Conclusion: The use of autologous, free, non vascularized fibular grafts is an effective method in the treatment of significant femur bone loss due to high energy trauma. It has an acceptable short-term and long-term outcomes.

Keywords: Bone loss, femur fracture, fibular graft, limb reconstruction

Introduction

Fractures of the distal femur are rare and severe. The estimated frequency is 0.4% of all fractures and 3% of femoral fractures. A classic bimodal distribution is found with a peak in frequency in young men and elderly women. The usual context is a high-energy trauma in a young patient and a domestic accident in an elderly person (1).

Surgical management can be technically challenging, with no clear advantage of any one particular surgical implant. Despite increased biomechanical and clinical research alongside the development of modern implants, persistent disability and poor clinical outcomes often result (2).

The femur is the second most common site of bone loss. It amounts to 22% of all traumatic skeletal losses (3).

A variety of options exist to reconstruct limbs following traumatic bone loss. The management of these injuries is challenging and often requires prolonged and potentially painful treatment. The Ilizarov technique of bone transport using circular external fixators is widely used for limb reconstruction of large bone defects. Other techniques include vascularized fibular grafting, the use of induced pseudosynovial

membranes combined with cancellous autologous bone grafts and the use of autologous, allogeneic or synthetic bone grafts on their own for smaller defects (4).

Bone grafting is involved in virtually every procedure in reconstructive orthopedic surgery. Although autologous bone grafts have excellent biologic and mechanical properties, considerable donor site morbidity and the limited volume available must be taken into consideration (5).

Fibular grafting is a popular method for bridging the gap in bone defects created by tumor excision, trauma, or bone loss as sequelae to infection (6).

Case Presentation

Our case is 30 years old man gentleman right handed with free medical background presented to our department after major RTA on 2017, we diagnosed the patient with left hip intertrochanteric fracture which treated later by DHS, the patient did well and improved completely.

Unfortunately in 2021 our case involved in other RTA and presented to us again, then he diagnosed with left open distal third comminuted femur fracture (gustalio IIIA) with large bone loss, on the day of trauma the patient underwent surgical toilet and debridement and received IV antibiotics, the fracture fixed with external fixator

After 6 weeks the external fixation was removed, the patient planned for internal fixation with locked plate and free non- vascularized fibular graft, operation was done at that time after medical and psychological optimization, after close and regular follow up the patient condition improved well with amazing outcomes.

Figure 1: Anteroposterior plain radiograph of the left hip shows DHS and good bone healing 2 years after firs operation in 2017.

Figure 2: Anteroposterior and lateral plain radiograph shows distal third femur fracture with large bone loss.

Figure 3: Anteroposterior plain radiograph of the left femur shows postoperative locked plate and screws placement and fibular graft.

Figure 4: Anteroposterior and lateral plain radiograph of left femur taken several months after second operation, shows LCP and good bone healing at fracture and graft site.

Discussion

Open high-energy distal third femur fractures with bone loss in polytrauma patients present unique therapeutic challenges when the pathway of limb salvage surgery is prescribed. Although amputation maybe the considered reconstructive strategy for the multiply injured patient in extremis, limb salvage using a staged approach to care should be considered. Management factors to consider include the scope of open fracture care, type of skeletal stabilization, soft tissue coverage, and bone grafting strategy (7).

Orthopedic surgeons have encounter challenges in managing open fractures for several years. In recent decades treatment has improved because of improved surgical techniques, antibiotic use and more recently because of improved soft tissue cover. However, these fractures remain difficult to treat and they frequently result in considerable morbidity for the patient and expense for the health system (8).

Several bone loss reconstruction procedures exist for the long bones that use bone auto- or allografts, vascularized bone lengthening, the induced membrane technique, or bone mobilization initially described by Ilizarov and Ledyaev and conceptualized by Cattaneo et al. Few(9).

The most important general factors are the psychological and social status of the patient. Reconstruction is a demanding form of treatment that requires active co-operation on the part of the patient. In some instances, personal or occupational problems may prompt the patient

to opt for amputation, which guarantees a more rapid return to work activity and to a satisfactory social life.

Reconstruction of the skeletal segment involved is a complex orthopedic problem, and a good functional result, will depend upon:

- restoration of adequate mechanical characteristics;
- restoration of the length of the injured bone segment;
- re-establishment of the correct axial alignment of the reconstructed segment (10).

The healing of fractures is a physiological process that results in bone union. Studies have estimated that 5–10% of all fractures are associated with impaired healing, resulting in delayed union or non-union. Bone defects are very challenging in orthopedic practice; they can result from a high-energy traumatic event, from large bone resection for different pathologies such as tumor or infection, or from the treatment of complex non-unions (11).

The gold standard for restoring bone defects is still considered to be autologous bone grafting. However, clinical benefits are not guaranteed and donor-site complications and morbidity is not infrequent. Research is on-going for the development of alternative bone substitutes of both biological and synthetic origin. (11)

The ilium and the fibula are the most common sites for bone-graft harvesting.

In spite of that is a good option for bone grafting fibular graft harvesting has many potential complications include neurovascular injury, compartment syndrome, extensor hallucis longus weakness, and ankle instability. The neurovascular structures at risk for injury during fibular bone-graft harvesting include the peroneal nerves and their muscular branches in the proximal third of the fibular shaft and the peroneal vessels in the middle third (12).

In our case we used a staged approach to treat the patient condition, firstly, we did an irrigation, debridement and fixation of the femur with an external fixator, and then after 6 weeks the patient operated with using of non vascularized fibular graft from ipsilateral limb and fracture fixed with distal femur locked plate.

After regular follow up the patient condition improved and bone healing was checked clinically and radiologically.

Conclusion

The use of autologous, free, non vascularized fibular grafts is an effective method in the treatment of significant femur bone loss due to high energy trauma. It has an acceptable short-term and long-term outcome.

Abbreviations

DHS: Dynamic hip screw

IV: Intravenous

LCP: Locked plate

ORIF: Open reduction and internal fixation

RTA: Road traffic accident

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