Medical Science

pISSN 2321–7359; eISSN 2321–7367

Revision surgery in comminuted distal one-third femur fracture using retrograde intramedullary nail: A case report

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To Cite:
Shukla R, Choudhari SG. Revision surgery in comminuted distal one-third femur fracture using retrograde intramedullary nail: A case report. *Medical Science* 2023; 27: e78ms2697.
doi: https://doi.org/10.54905/disssi/v27i132/e78ms2697

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Peer-Review History
Received: 17 December 2022
Reviewed & Revised: 21/December/2022 to 31/January/2023
Accepted: 06 February 2023
Published: 09 February 2023

Peer-review Method
External peer-review was done through double-blind method.

URL: https://www.discoveryjournals.org/medicalscience

ABSTRACT

Fractures of the distal one-third of the Femur bone are quite common nowadays due to the increase in the incidence of road traffic accidents, falls, sports and outdoor activity, etc. Retrograde intramedullary nailing has been considered a good surgical intervention for the management of such cases. Cement augmentation and shape memory alloy is also preferred to provide mechanical stability at the site of fracture. However, in the case of comminuted fracture, this modality of surgery cannot be used as the first option of choice. The present case report of 18 years old male who sustained a comminuted fracture of the distal one-third of the femur reviews the progression of the case after the first surgery using open reduction and internal fixation and plating and postoperative complication of nonunion after dynamization. It also describes the outcome of revision surgery using the retrograde intramedullary nail.

Keywords: Comminuted fracture, retrograde intramedullary nail, Surgery, Distal femur fracture

1. INTRODUCTION

Comminuted distal 1/3rd femur fractures are common in road traffic accident cases and often accompany damage to the knee joint, ultimately restricting knee mobility and complete knee range. In such cases, the surgeons usually support the bone with a fixed-angle plate fixation implant. After a distal femur fracture, nonunion is the most common reason for a second operation and is linked to significant morbidity (Yoon et al., 2021). Notorious infections like Streptococcus Aureus and epidermidis may be seen forming biofilms around the bone, near the implant. Non-union usually leads to the breaking of such fixation implants often requiring revision surgery in a few cases. Revision surgery is usually done with the same procedure using the same fixation implants but some surgeons prefer retrograde intramedullary nailing, a rod/long nail placed along the center of the bone and supporting screws are

fixed at required locations (Griffin et al., 2019; Sasun et al., 2022).

2. CASE PRESENTATION

An eighteen-year-old male was met with a road traffic accident and rushed immediately to the hospital with complaints of pain, swelling and deformity over the left thigh and inability to bear weight over the left lower limb 30 minutes before the admission. No history of any chronic illness or previous hospitalization. The patient was examined by a neurosurgeon and was admitted to the Intensive Care Unit as found to have a tentorial subdural hemorrhage. On radiological investigations, a comminuted distal one-third femur fracture was noted over the left femur.

Under general anesthesia and taking all aseptic precautions, open reduction and internal fixation with plating for comminuted supracondylar fracture femur was done. Fracture reduced and fixed with distal femur locking plate 9 holes. No bone grafting was done. The range of motion (ROM) achieved postoperatively was 40 degrees. For the next 3 months, nonunion was seen. Around four months after the surgery, while taking physiotherapy for ROM, the patient heard a crackling sound from the injured leg and was unable to walk. Later X-ray and 3D CT scan was done which revealed a broken implant. Linear implant break along mid position was seen.

Under epidural anesthesia, the patient underwent revision surgery with the removal of the previous implant and insertion of Retrograde Intramedullary nailing and bone graft. The surgeon noticed some pus cells near the implant and sent it for microbiological examination. The patient too complained of evening rise fever previously. Staphylococcus epidermidis infection was suspected and treated with Linezolid 600mg BD for 3 months. The graft was taken from the iliac crest. Analgesics and muscle relaxants were given for pain management. The patient is currently having a ROM of 100 degrees and no fever.

Radiological Evidence

Figure 1 X-ray showing comminuted fracture of distal Femur (Left)

Figure 2 Surgery is done via the fixed-angle plate fixation

Figure 3 X-ray showing healing progression

Figure 4 3D CT scans showing the broken implant

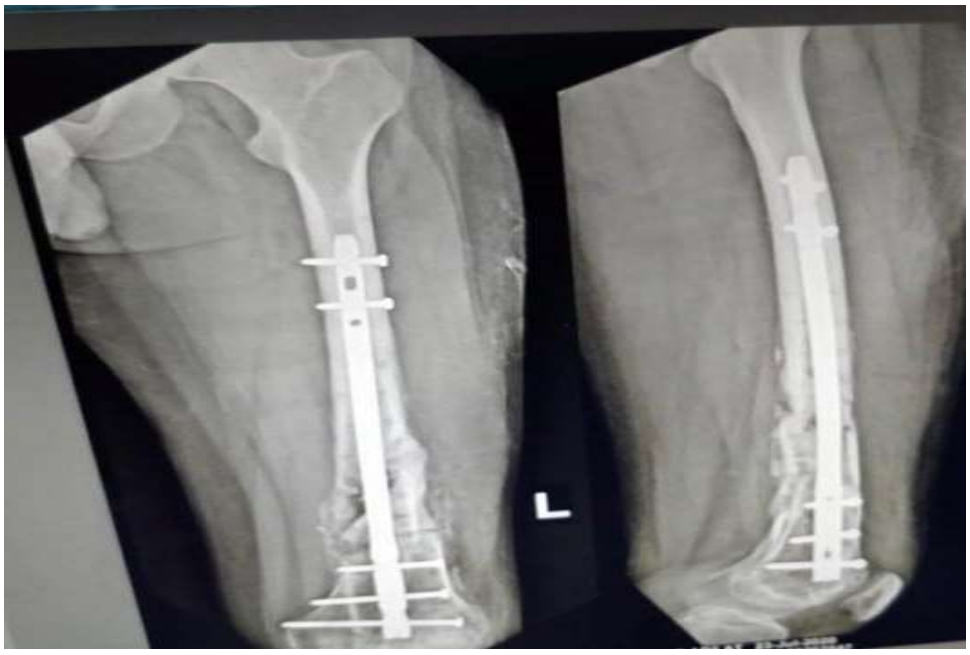

Figure 5 Retrograde Intramedullary nail with Screw fixation and bone grafting

3. DISCUSSION

The said patient was operated on after the accident only when the neurosurgery and the team had cleared the tentorial subdural hemorrhage. An immense amount of bleeding from the head injury was the primary area of concern. A severely comminuted

fracture was seen which was reconstructed with, a distal femur locking plate with 9 holes on the left side along with 5mm cancellous locking and supporting screws. Supracondylar and intercondylar fractures can be effectively treated with a retrograde IM nail (intramedullary nail) and bolt (Li et al., 2004).

The stitches were removed after 7 days. The patient achieved a ROM of 40 degrees in the next 12 days, which was a welcome sign. The patient continued the physiotherapy for the next 3 months and achieved a ROM of 95. However, extensive physiotherapy could have been a reason for the non-union of the bone. Biofilm activity and the primary methods for biomaterial surface modification to prevent the formation of bacterial plaque and ensuing infection Catheters, orthopedic and breast implants are frequently infected by Staphylococcus aureus and Staphylococcus epidermidis (Oliveira et al., 2017). The patient while performing squats heard the rod breaking, suggesting overuse of the injured site and leading to the breaking of the implant thereafter. The fixed-angle plate fixation implant is a weight-sharing device while intramedullary nailing is considered as a weight-bearing device. The 3D CT done after the breaking of the plate seen in the X-ray revealed that the bone fragments were in place and intact with no displacement. The breaking of the plate was supposedly from the site of nonunion. The revision surgery was done under Epidural anesthesia with Retrograde Intramedullary nailing. At a median of 182 days after surgery, post-operative fractures occurred in 7 (1.1%) patients (either peri-implant or distal to implant) (40–450). The other failure categories (screw cut-out, implant fracture and non-union) occurred at 111 days in 9 (1.5%) of the patients (80–413) (Tarrant et al., 2021). The supporting screws were also placed near the knee to stabilize the condyle of the femur. IM nailing required fewer screws for support. The IM couldn't have been done in the first surgery due to many bone fragments as it was a comminuted fracture. The femoral anatomy and nail design specifications (radius of curvature), the need for distal interlocking screws, the requirement for close radiographic follow-up after nail placement with X-rays of the entire nail and awareness of potential nail infiltration into the knee joint after dynamization are fundamental for the counteraction of intraoperative and postoperative confusions connected with intramedullary nailing (Fantry et al., 2015).

The operation/ implant of choice at the first surgery were a fixed-angle plate fixation implant. The revision surgery using the IM also had bone grafting done with it from the iliac crest of the patient itself, to fill the void of the nonunion. The patients needed the intramedullary nail to be removed, their comminuted femoral condyles to be rebuilt and they needed to be stabilized with an angled or buttress plate (Sen et al., 2005). In a recent study, the locations with the greatest resistance to breakaway torque were represented by the most distal holes, but in this case, the breakaway was in the middle part. The same study also showed a significant relationship between local bone strength and cycles to failure. Less bone strength could have been a cause in this case (Gehweiler et al., 2021). The graft is not taken from an animal or any other person because it could lead to rejection. The Staphylococcus Epidermidis infection near the implant accompanying the night fevers could have been damaged if not treated. The most common etiologic agents of orthopaedic implant infections are Staphylococcus aureus and Staphylococcus epidermidis, which are also often present in infections of catheters and orthopedic/breast implants (Oliveira et al., 2018). Adhesins mediate the precise contact between microbial cells and the extracellular matrix proteins filming biomaterial surfaces in the early stages of infection. Bacteria can then adhere to the surface of the biomaterial by adhesion-mediated anchoring; creating a biofilm that favors their capacity to resist antibiotics (Montanaro et al., 2011). Linezolid is the Drug of choice for these infections.

According to research by Virk et al., (2016) all patients attain union after adhering to the principles of fracture reduction, with the meantime to the radiological union being 19 weeks. With 20 patients having a close score rated as outstanding to satisfactory, the average ROM is typically 109 degrees. Nine cases in the study required further procedures. All nine of these instances required bone grafting and three of them also originally required the insertion of antibiotic cement beads. During the trial, three patients experienced problems in the form of infection (two cases) and malunion (one case), but all were successfully treated by the time it was over.

4. CONCLUSION

What we derive from the given case is that both surgeries did well on the patient. This can be made out from the callus formation seen over time. The first surgery was done via fixed-angle plate fixation implants as it was a case of comminuted fracture. The linear implant broke along the mid position possibly because of the extreme pressure or exertion of the injured site due to physiotherapy. The bone graft with the retrograde intramedullary nailing with a screw was the surgery of choice during revision surgery. The bacterial gram-positive cocci infection could have been due to sterilization issues. Ultimately, healing was seen properly, but the ROM was hampered and the only issue.

Acknowledgement

We thank the participant who contributed the case to the study. We also thank our guide for contributing in the case report.

Author Contributions

Both the authors contributed equally to the case report.

Informed consent

Written and Oral informed consent was obtained from the participant included in the study.

Funding

This study has not received any external funding.

Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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