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Right femur malunion treated with open osteotomy and open reduction with internal fixation percutaneous surgery (ORIF PS): A case report



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ABSTRACT

Introduction: Fracture femur distal third is a common orthopedic problem in patients of all ages. Malunion is common due to neglected conditions; an osteotomy plus ORIF PS procedure is required in the management. Surgery is currently the treatment of choice for distal femoral malunion fractures. Malunion requires deep fixation of compression using lag screws, cortical screws or cancellous screws depending on the type of fracture. Patients with distal femoral malunion are also treated with grafting using bone graft, allograft, autograft, synthetic graft and blade plate with screws in combination with a safe quadriceps approach.

Case description: A 16-year-old female patient complained of unbalanced walking and cramps in the right leg for the last 3 months. The patient had a

history of traffic accidents and then suffered femur fracture 9 months ago, debridement and a plaster cast. The physical examination found that the right leg was shorter than the left, and the AVN and active ROM distal right leg were still good. Then X-Ray examination obtained the results of his Malunion fracture of the middle 1/3 right femur and then decided to do an osteotomy + ORIF PS. The patient returned home in good condition and then controlled through the outpatient polyclinic.

Conclusion: In most malunion patients, osteotomy and PS ORIF are surgical methods. Corrective osteotomy with ORIF PS should be regarded as a salvage procedure for treating distal third malunion.

Keywords: Malunion, open osteotomy, ORIF PS.

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INTRODUCTION

Femur is the longest and heaviest bones in the human body. Fracture femur distal third is a common orthopedic problem in patients of all ages, with an annual incidence of approximately 37 per 100,000 people.¹ Fractures of the distal third of the femur are injuries that often occur; if the management is appropriate, it does not produce complications. In developing countries, the neglected form is frequent and presents as a non-union or malunion. The main cause of distal femoral malunion is inadequate fracture fixation so as to provide stability to the fracture area, excessive fracture gap, avascularization around the fracture area due to excessive separation of soft tissue, infection, and endogenous causes associated with the patient. In the early 1960, most fractures of femur distal third

were treated conservatively with traction and fracture braces and achieved good outcomes in 67% until 90% of patients. However, with new surgical technique and implants, management has shifted from conservative management to surgical stabilization of distal femoral fractures.²

Malunion is a condition of broken bones that have undergone union with the fracture fragments in an abnormal position (including shortening, rotational deformity and angular deformity).³ Malunion occurs due to inaccurate reduction or ineffective immobilization during healing. The three conditions of the femoral shaft malunion that require surgery are 1) there is an overlap of more than 5 cm, 2) there is an angulation between the fracture fragments of more than 15 degrees, 3) there is a rotation between the two fracture fragments of

more than 45 degrees with or without angulation. Generally, a shaft femoral malunion includes either angular deformity of more than 10 degrees, a rotational mal-alignment greater than 10 degrees, or a shorter by more than two cm. Malunion is usually caused by inadequate initial management. However, most patients tolerate this disorder very well and usually have no signs and symptoms. Since the initiation of surgical treatment of femoral shaft fracture with locked or unlocked intramedullary nails, the incidence of malunion due to femoral shaft fractures has decreased dramatically. Most femoral shafts malunion are due to shortening only and cause by treating a non-union while neglecting leg length.⁴

In fractures with complications of malunion, an osteotomy is necessary and is performed in an open procedure.

One surgical procedure carries out the difficulty of treating the femoral diaphysis malunion to correct the shortening of the limb.⁵ Malunion requires deep fixation of compression using lag screws, cortical screws or cancellous screws depending on the type of fracture.⁶ Considering the necessary balance between stability and movement of the fractured part, techniques such as cortical screwing are introduced which combine locking technology with elastic materials which are expected to produce a symmetrical callus.² According to a study by Bottlang et al., femur surgery with cortical screw resulted in more callus and stronger healing with 54% resistance.⁷ Cancellous screws are often used for fracture stabilization or surgery for malunions that occur in the metaphyseal bone, including the distal femur area, proximal and distal tibia, distal fibula.⁸ Internal fixation in the case of malunion has several definitive advantages including biomechanical predictability, and cosmetic benefits.⁹ The disadvantage of open reduction and internal fixation (ORIF) is that inappropriate corrective measures will require revision surgery if not recognized intraoperatively. Successful internal fixations require mechanical sound constructs able to resist the contraction of cyclist muscular contraction generated during early functional activity. Internal fixation require a plate with sufficient length to resist torsional forces.² In this report, we aim to present a case of right femur malunion treated with open osteotomy and open reduction with internal fixation percutaneous surgery

CASE DESCRIPTION

A 16-year-old female patient came to the Orthopedic Clinic at Wangaya General Hospital Denpasar on August 15, 2022, complaining of cramping and discomfort in her right leg when walking 3 months ago, but she denied the complaint of pain. The patient said that his right leg was shorter than his left, so he felt uncomfortable when walking. The patient said it was more comfortable when sleeping on his back and less comfortable when he was brought up and walking. Currently, the patient is in the second grade of high school, and during this complaint, the patient is helped to go to school by his parents and cannot



Figure 1. The difference in length between the right and left lower extremities.

do other activities at school.

The patient had a traffic accident 9 months ago, where the patient was riding a motorcycle and was grazed by a truck from the opposite direction. Then the patient was taken to Umbu Rara Meha Hospital (East Sumba) and received treatment in the form of debridement and installation of a cast, but no surgery was performed because there were no adequate tools or plates. After debridement and plastering, the patient did not complain of swelling or other signs of inflammation. Before going to Wangaya Hospital, the patient did not visit a doctor or chiropractor since the complaint appeared.

On physical examination, the patient appeared to be well conscious. From the examination of vital signs, blood pressure was found to be 110/70 mmHg, pulse 86x/minute, RR 18x/minute, temperature 36.5°C, and oxygen saturation 98% of room air. On generalist status examination, all were within normal limits. On examination of the local status of the lower extremities, from the look, the right leg is shortened compared to the left (**Figure 1**), there is no swelling, redness or other signs of inflammation, and no bone is exposed. Furthermore, from the examination of the feel, it was not warm, the AVN was still good compared to the left leg, and from the examination, the active move ROM was positive.

Then the patient was examined for AP/Lateral Dextra Femur Photo (**Figure 2**) with the interpretation of malunion fracture of the middle 1/3 right femur. Then the patient was also examined for a PA chest X-ray with the results of the cast



Figure 2. X-Ray Femur dextra AP/Lateral: Malunion fracture of the middle third right femur.

impression and Pulmo. No abnormalities were seen.

In a durante operation, the patient was placed in a supine position and under regional anesthesia, then disinfected and drained with a sterile drape. After that, the lateral approach incision was deepened layer by layer, which then found the distal malunion of the femur (**Figure 3**). Subsequently, an osteotomy was performed on the fracture site. Recanalization, reduction, and fixation were performed with a 10 broad plate and 9 screws (**Figure 4**). In the evaluation process, it was found that the gap at the fracture site was filled with a bone graft from callus and synthetic. Then after the



Figure 3. The lateral approach incision was deepened layer by layer, which then found the distal malunion of the femur.

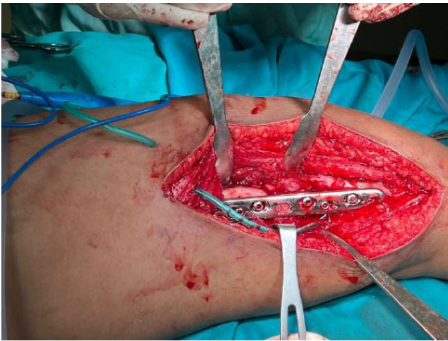


Figure 4. Reduction and fixation with a broad plate 10 + 9 screw.



Figure 5. X-Ray Femur Dextra AP/ Lateral with interpretation fixation was good.

action is complete, a stability check is carried out, the wound is sutured, and a drain is installed.

After the osteotomy + ORIF PS was performed, the patient had a re-X-Ray examination (Figure 5) with the interpretation that the fixation was good.

Then the patient was transferred to the room in a well-conscious condition with postoperative pain controlled by the analgesic ketorolac 3x30mg IV (VAS score 3), a drain was installed with the production of 50cc/3 hours of blood, and the patient complained of nausea. Examination of the lower extremities revealed good distal AVN and active ROM. From laboratory examination, Hb was 8.6. The patient was treated with ceftriaxone 2x1 gram IV, analgesics as requested, ondansetron 3x4mg IV transfusion of PRC target Hb >10, then release of dower catheter and bladder training.

Then H+1 postoperative drain evaluation obtained 200cc/18 hours of blood and tranexamic acid therapy 3x500mg IV. On the second day, postoperative drain evaluation was found to be 55cc/24 hours sero-hemorrhagic and had entered the 2nd PRC kolf transfusion, which was then planned to check for DL. After the DL examination, the patient's Hb dropped to 7.5, which continued with the 3rd PCR transfusion. On the third postoperative day, evaluate a 5cc/24-hour serohemorrhagic drain. On the fourth day, the drain was no longer producing. Then the plan was to check the DL again. After doing the DL check again, the result was 10.2. Then on the fifth postoperative day, August 27, 2022, the patient was able to sit and mobilize, post-op pain (VAS 1-2) distal AVN and active distal ROM, both planning to go home.

DISCUSSION

A distal femur fracture is a common orthopedic problem in patients of all ages. The surgeon's ultimate goal in managing these injuries is to achieve good fracture

correction and bone fusion results without complication. In addition, the surgeon needs to correct malalignment and avoid infections.⁶ One of the surgical techniques can be ORIF to prevent complications. However, this patient did not receive adequate treatment at the time of fracture, resulting in complications in the form of malunion. Surgery is currently the treatment of choice for distal femoral malunion fractures. Patient with distal femoral malunion are also treated with grafting using bone graft, allograft, autograft, synthetic graft and blade plate with screws in combination with a safe quadriceps approach.¹ From this case, patient treated with a bone graft from callus and synthetic

The surgical technique in malunion was performed with the patient in the supine position using a direct anterolateral approach to the distal femur injury. The approach and exposure are identical to the surgical procedure described above for the case of malunion. After evaluating the location of the malunion, if a metallic implant was previously attached, it is removed, and a corrective osteotomy is performed according to the specific needs to correct the deformity found.¹⁰ One of the problems of close-wedge osteotomy is the accuracy of corrections. Surgeons rely heavily on preoperative planning to estimate the accuracy of bone resection. Even though it is prepared in such a way, most surgeons still find it difficult to perform technically precise incision resections during surgery.¹¹ Besides, the shortening of the limbs will increase with the enlargement of the corrections angle.¹² The tools for the osteosynthesis use in all case was a condylar blade steel plate. It was applied with a dedicated surgical kit to the fracture site and a compression cortical screw to stabilize the bone strut, placed to reinforce the medial wall of the distal metaphysis and diaphysis. According to this case, an osteotomy was performed on the fracture site, and recanalization, reduction, and fixation were performed with a 10 broad plate and 9 screws. The placement of the fixation metal was evaluated during the surgical procedure and again at the end of the osteosynthetic stage with fluoroscopy imaging. Finally, fascia, subcutaneous tissue and skin are

sutured in layers after adequate rinsing and accurate hemostasis.¹

The surgical approach used in the corrective intervention in the case of malunion is not aimed at re-establishing the previous surgical approach but at maintaining a blood supply and vast lateral integrity¹³ for early functional recovery and optimization of recovery time.¹⁴ The uses of bones graft and bone graft substitute to improve stability and achieve optimal bone fusion is an important part of managing malunion. Although autologous bone grafting is the gold standard compared to other grafts, there are circumstances in which the use of allografts and proper replacement of bone grafts can prevent patients from potential risks and complications.¹⁵ Closed wedge osteotomy has a high success rate and contributes to early weight-bearing. Lobenhofer reported that the osteotomy of the distal femur healed only in 4 until 6 weeks, facilitating full weight bearing at 4 weeks after surgeries. In a report of lateral closing wedge osteotomy treating 16 cases of distal femoral malunion due to different causes, the mean bone healing time was 3 month.¹⁶ According to this case, in the evaluation process, it was found that the gap at the fracture site was filled with a bone graft from callus and synthetic

CONCLUSION

Fractures of the distal femur are common practically everywhere globally and mostly caused by traffic accidents. If they receive the proper care, they will recover nicely. In underdeveloped nations, however, many neglect cases result in problems, including malunion. When it affects the lower extremities, the condition of malunion will hinder the patient's ability to walk. Several investigations that have been conducted and published have demonstrated that osteotomy and ORIF PS are effective surgical procedures. In some conditions it will be able to use bone graft and bone graft substitute to improve stability and achieve optimal bone fusion.

ETHICS APPROVAL

The author has secured informed consent from patients to publish clinical photographs and medical data in medical and scientific publications while protecting patient anonymity.

CONFLICT OF INTEREST

We declare that there were no conflicts of interest in this study.

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AUTHOR CONTRIBUTION

All of the authors equally contributed to the study.

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