

Diaphyseal Tibia and Fibula Malunion Treated with Open Osteotomy and Internal Fixation: A Case Report

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Abstract

Diaphyseal fractures of the tibia and fibula often occur due to traffic accidents. Bone fractures can heal well with proper treatment. However, many cases that are neglected lead to complications such as malunion, particularly in developing countries. Malunion occurs when a fractured bone heals with the fragments in improper positions. Malunion in bone fractures can lead to complications such as decreased bone or limb function, deformities, pain, non-union, avascular necrosis, and limb shortening. This case study reports on a 29-year-old woman with malunion in the tibia and fibula due to a neglected bone fracture for eight months. Symptoms include pain, deformities, and limb shortening. The management involved open osteotomy and ORIF (open reduction with internal fixation), demonstrating that ORIF and osteotomy are successful surgical techniques for correcting malunion in this case. The goals of surgical treatment for malunion are to restore function, reduce discomfort, and correct visually apparent abnormalities.

Keywords: Malunion, Open Osteotomy, ORIF

Abstrak

Fraktur diafisis tibia dan fibula merupakan hal yang umum, terutama akibat kecelakaan lalu lintas. Patah tulang akan sembuh dengan baik jika mendapat penanganan yang tepat. Namun, banyak kasus yang terabaikan berujung pada komplikasi seperti malunion, terutama di negara berkembang. Kondisi malunion terjadi ketika tulang yang patah sembuh dengan posisi potongan yang tidak semestinya. Malunion pada patah tulang dapat menyebabkan komplikasi seperti penurunan fungsi tulang atau anggota tubuh, deformitas, nyeri, tidak menyatu, nekrosis avaskular, dan pemendekan anggota tubuh. Studi kasus ini melaporkan seorang wanita berusia 29 tahun dengan malunion pada tibia dan fibula akibat patah tulang yang terabaikan selama 8 bulan lalu. Gejalanya termasuk nyeri, deformitas, dan pemendekan anggota tubuh. Tatalaksana yang dilakukan melibatkan osteotomi terbuka dan ORIF (fiksasi internal) yang membuktikan bahwa ORIF dan osteotomi merupakan teknik bedah yang berhasil untuk memperbaiki malunion pada kasus ini. Tujuan perawatan bedah untuk malunion adalah mengembalikan fungsi, mengurangi ketidaknyamanan, dan memperbaiki kelainan yang terlihat jelas.

Kata Kunci: Malunion, Osteotomi Terbuka, ORIF

Introduction

In Indonesia, alternative or traditional medicine is still a popular choice to treat illnesses or ailments caused by accidents or other reasons. For example, in treating fractures, some people still choose alternative fracture treatments as their first option to heal broken bones. People choose to seek treatment from traditional healers or bone-setters due to underlying beliefs, lower costs, and convenience without having to deal with administrative procedures. Traditional practices often lead to various complications such as infections resulting in gangrene and sepsis, compartment syndrome, non-union or failure of the bone to heal, and malunion or healing of the bone in a shortened or deformed position.

The high number of untreated bone fractures leads to deformities in the bones. Many patients are reluctant to visit doctors due to a prevalent belief in seeking alternative treatments or consulting traditional treatment, resulting in fracture fragments healing in abnormal positions, known as malunion.^{1,2} Malunion occurs due to inaccurate reduction or ineffective immobilization during the healing process, causing impaired bone or limb function and a visually apparent 'bent' appearance.^{3,4,5}

Treatment for malunion fractures depends on the severity of the condition and may include surgical intervention, such as corrective osteotomy.^{2,6} The complications that can occur due to malunion in fractures include impaired function of the bone or limb, deformity, and various symptoms, including pain, deformity, difficulty walking, non-union, avascular necrosis, and shortening of the limb.^{7,8}

Surgery is almost always necessary to realign the bone in cases of malunion. Osteotomy is a surgical technique commonly used to correct malunion, involving the cutting or breaking the affected bone at or close to the initial fracture location. The bone is then realigned to its proper position in the body. The stabilization of the bone during the healing process can be achieved through internal or external fixation, depending on the location and severity of the fracture.⁹ Successful internal fixations require mechanical sound constructs able to resist the contraction of muscular contraction generated during early functional activity. Internal fixation requires a plate with sufficient length to resist torsional forces.¹⁰

In this report, we present a case of tibia and fibula malunion successfully treated with open osteotomy, open reduction with internal fixation, and grafting from the callus. From this case report, we performed surgical correction for malunion fractures, aiming to restore function, alleviate pain, and correct visually apparent deformities.

Case Presentation

A 29-year-old woman presented to the Orthopedic Clinic at Haji General Hospital Makassar on July 27, 2023, with the chief complaint of a crooked left lower limb and discomfort that has been experienced for the past two months. The patient reported that her left leg is shorter than the right leg and mentioned experiencing pain and a limp while walking. The patient has already undergone informed consent and approved their case to be published without revealing their name.

The patient experienced a traffic accident eight months ago, resulting in a fracture of the lower limb. However, she did not receive medical treatment due to fear and instead opted for

alternative therapy from a traditional healer since the incident. Several months later, the patient noticed her leg had become crooked and experienced shortening of the left lower limb.

On the physical examination, the patient appeared to be well-conscious. Vital signs examination revealed a blood pressure of 120/80 mmHg, a heart rate of 78 beats per minute, a respiratory rate of 18 breaths per minute, a body temperature of 36.5°C, and oxygen saturation of 99% in room air. General physical examination findings were all within normal limits. In the local examination of the lower extremities, from the appearance, it is evident that the left leg is shorter than the right leg, with a deformity of the left lower limb (Figure 1). There is no swelling, redness, or other signs of inflammation, and no exposed bones. Furthermore, there is no warmth on palpation, and arterial-venous blood circulation appears to be better than in the right leg. The active range of motion is still positive. The patient does not have a history of chronic conditions such as obesity, diabetes mellitus, hypertension, asthma, allergies, HIV/AIDS, tuberculosis, cancer, or heart disease.



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

Following this, the patient had an AP/Lateral view X-ray of their left lower leg (Figure 2), which revealed a malunion of the fracture in the middle third of the left tibia and fibula. Following that, the patient has an appointment for open osteotomy therapy and open reduction with internal fixation surgery (ORIF).



Figure 2. X-Ray Left leg ap/ lateral: malunion fracture of diaphyseal tibia et fibula

During the surgery, the patient was placed in a supine position and under regional anaesthesia, then sterilized and draped with sterile surgical drapes. Subsequently, an incision was made layer by layer, and malunion was identified in the tibia and fibula bones (Figure 3). Osteotomy (bone cutting) was performed at the fracture site, followed by recanalization (reopening the bone canal), reduction (realigning the bone), and fixation with a 9-hole broad plate and eight screws on the tibia, and a 5-hole broad plate and four screws on the fibula, with a plate and screws on the tibia and fibula bones (Figure 4). A bone graft was performed using a callus, and a drainage system was inserted. During the evaluation, a defect at the fracture site was filled with a bone graft from the callus.



Figure 3. The incision was deepened layer by layer, which then found the malunion of the (a), (b) Tibia, and (c) Fibula bones and an osteotomy was performed

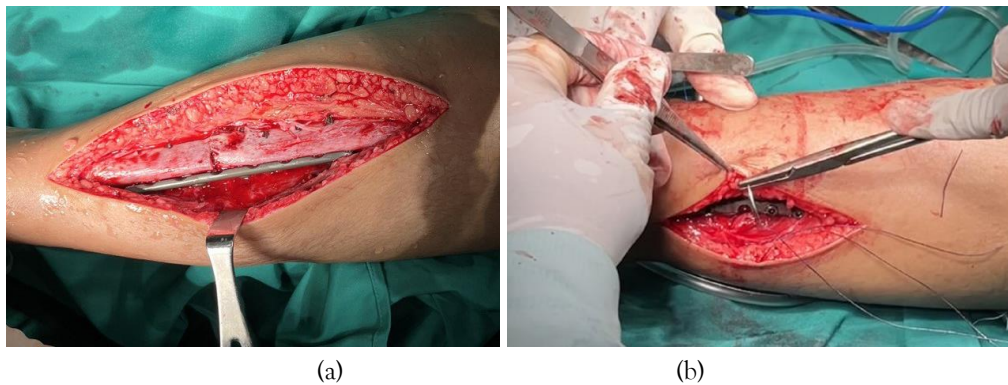


Figure 4. Reduction and fixation with a plate in the Tibia (a) and Fibula (b) Bones

Following the osteotomy + ORIF procedure, an X-ray examination was performed, with the interpretation that the fixation was correctly in place (Figure 5).



Figure 5. X-ray of Left Leg AP/ Lateral with Interpretation Fixation was Good

The patient was then transferred to a room while conscious, with post-operative pain controlled using ketorolac analgesics at a dosage of 3x30mg IV (VAS score 3). A drainage system was installed with a blood output of 50cc every 3 hours, and the patient complained of nausea. Examination of the lower extremities indicated good distal arterial-venous circulation and active range of motion. The patient was treated with ceftriaxone at a dosage of 2x1 gram IV, ketorolac 3x30 mg IV, and onoiwa 3x2 tablets.

When drainage evaluation was performed on the first post-operative day, the patient reported pain at the surgical site (VAS 4-5), and 100 cc/18 hours of blood output was found. The patient was prescribed three doses of 30 mg IV ketorolac, two doses of 1 gram IV Ceftriaxone, and three doses of tablets of ondansetron. The drainage assessment on day two revealed a drop to 50 cc/24 hours. On the third day, the patient was able to sit and move, the distal arterial-venous circulation was good, the post-operative pain was reduced (VAS 1-2), and the patient's drainage production had decreased to less than 20 cc/24 hours. Additionally, the patient had an excellent active range of motion and was allowed to go home.

The lack of follow-up data and true leg length (TLL) after surgery measurements in this case presents significant limitations. Without these data points, it is difficult to draw definitive conclusions about the long-term success of the surgical procedure.

Discussion

Malunion fracture treatment in the diaphyseal tibia and fibula depends on various factors, including symptoms, the bone involved, the severity of the malunion, and whether the condition impacts mobility and daily functioning.² When treating these injuries, the surgeon's ultimate objective is to achieve successful fracture correction and non-complicationous bone fusion outcomes. The surgeon must also prevent infections and realign abnormalities. To avoid complications, one surgical method that can be used is ORIF.^{4,10}

A delay in receiving treatment means the body starts the healing process before the bones can be aligned. This patient did not receive adequate treatment at the time of fracture, resulting in complications in the form of malunion. The malunion causes pain and movement disabilities,

and surgery is recommended to fix it. Surgery is currently the treatment of choice for malunion fractures. Patients with malunion are also treated with grafting using bone graft, allograft, autograft, synthetic graft, and blade plate with screws, and a corrective osteotomy is performed as needed to correct the deformity.^{3,11}

In the case of malunion, the surgical technique is performed with the patient in a supine position using a direct anterolateral approach to the lower limb injury. The approach and exposure are the same as the surgical procedure described above in the case of malunion. After evaluating the location of the malunion, it was found to involve the tibia and fibula, and a corrective osteotomy was performed as needed to correct the deformity. The malunion is fixed by shortening the tibia and fibula bone.^{2,12} It is also still important to correct the patient's deformity either using the implant or a corrective osteotomy.¹⁰

An osteotomy is a surgical technique used to straighten or reshape the bones. It involves cutting bone and occasionally inserting bone tissue. It will correct a malunion the most frequently. An osteotomy involves cutting or breaking the affected bone at or close to the initial fracture location and then realigning it to its proper position in the body. The bone may be stabilized while it heals using either internal or external fixation, depending on the location and degree of the fracture.¹³

According to this case, an osteotomy was performed on the fracture site, and recanalization, reduction, and fixation were performed with a plate and screws; the osteotomy was filled with a bone graft from the callus. The placement of the fixation metal was evaluated during the surgical procedure. Using bone grafts and substitutes to improve stability and achieve optimal bone fusion is essential to managing malunion.⁴ From this case, the patient was treated with osteotomy, bone graft from callus, and use plate and screws.

Malunion occurs due to inaccurate reduction or ineffective immobilization during the healing process.^{1,2} Four phases are involved in healing a broken or fractured bone: hematoma formation, bone generation, formation of a bony callus, and bone remodelling. Malunion may arise from the bone becoming crooked during these stages if it does not maintain its anatomical position.^{13,14}

Conclusion

Through this case, it can be concluded that osteotomy is a commonly used surgical technique to correct malunion. The use of bone grafts and internal fixation with plates and screws also contributes to achieving successful treatment outcomes. It is essential to understand that malunion can occur due to inaccurate reduction or ineffective immobilization during the fracture healing process, and proper management involves stages such as corrective surgery, selecting bone grafts, and stable fixation.

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