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Case Report

Good Functional Outcome After Fibular Graft Application for Tibial Large Bone Defect: A Case Report

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Abstract: Introduction: Fibular grafts have been well reported for treating various conditions with bony defects because there is cortical bone, and it has excellent strength and potential for remodeling. Here, we reported using a fibular graft for a patient with an open fracture middle shaft tibia fibula grade IIIB with a bone defect. **Presentation of Case:** Our patient was male, 25 years old, and complained of deformity with no pain in his right lower leg. Historically, he had a motorcycle accident and was diagnosed with an open fracture of the middle shaft tibia and fibula grade IIIB with peroneal nerve injury. Physical examination revealed a right lower leg deformity with a drop foot sign. The plain radiographic evaluation of the right lower leg showed an intramedullary nail in the tibia, plate, and screw on the fibula, with a large bone defect on the tibia. The application of a fibular graft to cover the bone defect was performed with the goal was to improving the lower leg's function. On one month follow-up, we observed improvement in the right lower leg's function with full right knee's range of motion. The patient had good overall condition and was satisfied with the outcome of the surgery. **Conclusion:** Fibular graft application provided satisfactory results in our patient with a large tibial bone defect.
Keywords: Fibular graft, non-union, bone defect, FTSG.

Introduction

The most common long bone fractures are tibial fractures, which cause high-energy trauma associated with a significant soft tissue injury. The purpose of managing these fractures is to provide stable fixation with minimal additional soft-tissue injury.[1] The use of fibular grafts has been well reported for the treatment of various conditions such as bony defects and non-unions, osteomyelitis, bone loss after resection of tumors, spinal surgery fusions, and congenital pseudoarthrosis of the tibia, among many others.[2] Because there is cortical bone, the fibular graft has excellent strength and potential for remodeling with loading. The structural characteristics of the fibula, such as its square shape, sufficient length, mechanical strength, and limited donor-site morbidity, make it more suitable for reconstructing long bone defects in the limbs.[3,4]

Several reports have found significant functional changes following partial fistulectomy, including decreased range of motion and strength at the knee and ankle, gait alteration and contracture, stiffness, and weakness of the great toe. Other complications are osteomyelitis, wound infection, transient peroneal nerve palsy, donor-site pain, edema, hematoma, ankle valgus deformity, and distal fibular osteoporosis.[2]

In this case report, we reported a case in which the patient with open fracture middle shaft tibia fibula grade IIIB had a bone defect and was treated with a fibular graft.

Presentation of Case

A 25-year-old male presented to our outpatient clinic complaining of a deformity in his right lower leg. Functionally, his right ankle was impaired, and he used crutches during his daily activity. He experienced no pain. Historically, he had a motorcycle accident and was brought to the emergency unit one year ago. He was diagnosed with an open fracture of the middle shaft tibia and fibula grade IIIB with peroneal nerve injury. For this condition, he underwent debridement and the application of external fixation in the emergency operating room. One month later, he underwent surgery to apply full thickness skin graft (FTSG) to cover his wound. Eight months later, he underwent another FTSG application surgery for his injury, but a bone defect was discovered. Subsequently, he underwent another surgery for intramedullary nail insertion to his tibia and the application of a plate and screwed for his fibula. From history taking, no chronic diseases were found in the patient. Physical examination revealed a right lower leg deformity with no ankle dorsal and plantar flexion (Figure 1). There were no swelling, tenderness, or signs of infection and inflammation. The right anterior tibial artery and posterior tibial artery were strong and regular. Oxygen saturation of all toes indicated 96% to 99% in oximetry. The ROM examination of the right ankle revealed a drop foot sign. Meanwhile, the examination of his left lower extremity revealed no abnormality. No congenital anomalies were observed.

Figure 1. Clinical picture showing the deformity of the right lower leg

A plain radiographic evaluation of the right lower leg showed an intramedullary nail in the tibia, plate, and screw on the fibula. A large bone defect on the tibia (Figure 2). The diagnosis of non-union middle shaft R tibia fibula with bone defect post intramedullary nailing of the tibia and plate and screw application on the fibula was established.

Figure 2. Plain radiographic of the right lower leg showed an intramedullary nail in the tibia, plate, and screw on the fibula and a large bone defect on the tibia

After establishing the diagnosis, the application of a fibular graft to cover the bone defect was performed (Figure 3 & 4). The goal was to improve the lower leg's function. At one month follow-up, clinical evaluation was conducted. We observed improvement in the right lower leg's function with a full right knee's range of motion. The postoperative wound was healing, and no pus was observed (Figure 5). No adverse and unanticipated events were discovered. There was no complaint from the patient regarding his lower leg's condition, and the patient was satisfied with the outcome of the surgery.

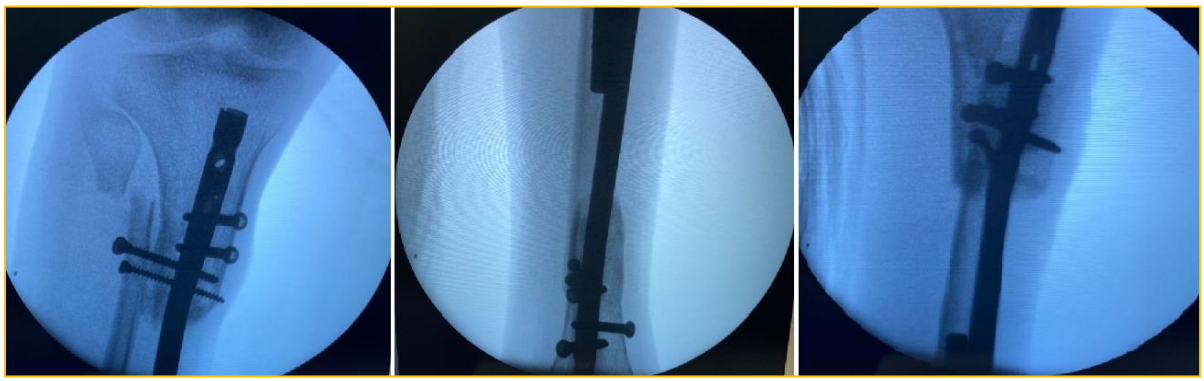

Figure 3. A C-arm image showing the fixation of the fibular graft on the bone defect

Figure 4. Intraoperative image showing the fibular graft

Figure 5. Follow-up care clinical picture postoperative

Discussion

The treatment for tibial shaft fractures is re-establishing pre-injury anatomy and function with lower complication rates. Treatment for these fractures has been used, including external fixation and intramedullary nailing. Each of these methods has indications and advantages for particular

fractures.[1] External fixations are preferred for obtaining bone stability and can be used for virtually all grade III open-tibial fracture patterns without the added risk of infection. Modern uniaxial-frame designs have the benefit of simplicity and are less cumbersome than multiplanar frames. The disadvantages of external fixation are pin-tract sepsis and pin loosening, the cumbersome nature of the device, and a less physiological environment for the later stages of fracture healing.[5] The current method of choice for treating tibial shaft fractures is an intramedullary nail.[6] There is some debate in the literature regarding the best way to manage severe tibial fractures with extensive bone loss, especially in open fracture type III tibial fractures with severe soft tissue injuries. Some reports have recommended early dynamization or bone graft because of the high proportion of cases requiring secondary procedures to obtain bone union.[1]

Grade III open-tibial fractures are usually characterized by wide initial bone-fragment displacement and comminution, disrupted local blood supply, and soft-tissue loss. Even though fixation techniques and wound management have been proposed, there are problems with wound coverage, bone delayed healing, deep infection, and prolonged disability. The best method for treating these fractures remains debated. However, the management of early wound coverage, radical debridement of avascular bone and soft tissue, correct skeletal stabilization, and bone graft are preferred management of these fractures.[7]

Recent advances in microsurgical techniques have made it possible to transfer various kinds of autogenous composite tissues and to apply the free osteocutaneous flap to patients with massive bone and soft tissue defects due to open fractures.[1] Fibular grafts have been widely accepted for reconstructing long bone defects, especially when the bone defect is more than 6 cm.[8] The fibula's structure characteristics, such as square shape, sufficient length, mechanical strength, and limited donor-sited morbidity, make it more suitable for reconstructing long bone defects in the limbs. Some literature has reported that the use of fibular graft in salvaging massive bony defects and that hypertrophy of the fibular graft can also increase the limbs' weight-bearing capacity.[9] The development of the free vascularized osteocutaneous fibular flap seems to lie in the feasibility of one-stage reconstruction for bone and soft tissue defects in grade III open-tibial fractures. Meanwhile, the availability of a well-vascularized composite flap encourages generous debridement of all tissue with questionable viability, and the filled dead space can minimize the deep infection and prevent the development of osteomyelitis in the exposed bone.[1] The union rates of fibular grafts after a bone gap was reported to vary between 80-100%. These rates were not influenced by the method of fixation, but some report was found that the reduced union rates were reported in infected cases. The time for union is variable, ranging from three to eight months.[10]

Conclusion

Fibular graft application provided satisfactory results in our patient with a large tibial bone defect. We found this method beneficial in improving the patient's leg function. Therefore, this method can be a treatment alternative for patients with a large tibial bone defect.

Declarations

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Informed Consent: Written informed consent was obtained from the patient to publish this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal at the request.

Author Contributions: Panji Sananta: conceptualization, writing original draft preparation, supervision. Respati S. Dradjat: writing the paper and editing, data interpretation, supervision. Moh Arie Arifin: writing the paper and editing, data interpretation, data collection.

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