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CASE REPORT

Reconstruction Surgery Using Free Vascular Fibular Graft for Treating Chronic Osteomyelitis of The Forearm with Critical Bone Defect- A Case report

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Abstract

Chronic osteomyelitis causes severe morbidity and disability. Radical debridement of all infected tissue is the only way to eradicate the infection, which usually results in large bone defects. Treatment of skeletal defects secondary to osteomyelitis is a challenging problem. Advances in microsurgery have made possible the reconstruction of soft tissue and bone defects using *Free Vascularized Fibular Graft* (FVFG). We present a ten years old girl with one year of neglected chronic osteomyelitis of right radius Cierny Mader type IIIA. The patient underwent two-staged surgery including debridement, sequestrectomy, external fixator application, and bone defect reconstruction using a *Free Vascularized Fibular Graft* (FVFG). The patient showed no significant complications after the surgery. The functional outcome has a good result, although there is some limitation in pronation and supination. The radiographic outcome also showed satisfaction with the bone union. Two-staged surgery is safer when the infection area is extensive. FVFG is more resistant to infection because it is vascularized. FVFG have highly bony union rates, resulting in limb preservation, pain relief, extremity stability, and satisfactory functional outcomes. The FVFG is a good reconstructive option for the management of infected long-bone defects in chronic osteomyelitis. FVFG fulfills most of the requirements from the aim of treatment in this kind of case.

Keywords: neglected chronic osteomyelitis, critical bone defect, FVFG

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Introduction

Chronic osteomyelitis has become health care problem especially in developing countries.[1] Chronic osteomyelitis is characterized by recurrent episodes of clinical infection because the presence of residual focal infection (avascular bone and soft tissue debris). The most common predilections are the long bones, both in upper and lower extremities, with the femur and tibia represent around half of the cases. In children, this disease usually arises from untreated acute hematogenous osteomyelitis.[2] Predisposing factors are often caused by lack of medical care, particularly in the suburb areas. Hematogenous osteomyelitis could became chronic due to inadequate antibiotic treatment.[1] Additional risk factor in developing country, especially in Indonesia, is masseuse as inappropriate initial treatment. Other risk factors include malnutrition, poor hygiene, anemia, coexisting infection, or any other disease that decrease immune function.[2] The affected limb usually decreased in function due to pain, joint stiffness, deformity, limb length discrepancy or lack of skeletal structural integrity. The wound often become a chronic discharging sinus.[3]

The principals of treatment are the eradication of infection, maintenance or restoration of the structural bone integrity, prevention or correction of deformity and return to adequate function.[3] Management of patients with chronic osteomyelitis includes both adequate surgical debridement and systemic antibiotic therapy.[4] Radical debridement of all infected tissue is the only way to eradicate the infection, because antibiotics cannot penetrate devascularized tissue.[2] However, the extent of radical debridement necessary to achieved uninfected bone usually results in large bone defects. The next step of treatment involves reconstruction of soft tissue and/or bone defect depending on the extent of debridement required.[5]

In many cases, conventional bone grafting may be helpful in bone reconstruction; however, there is limited amount of autogenous bone graft that can be harvested. The most common source of autogenous bone graft is

cancellous bone from the iliac crest and the proximal tibia. In general, this method is difficult to be done when segmental bone defects more than 2 cm in length.2 Advances in microsurgery have made possible the reconstruction of soft tissue and bone defects using vascularized bone grafts.

Case Illustration

A 10 years old girl with history of discharging wound on the left forearm for one year ago. Initially, patient fell with her left arm hit a chair and became fractured. It became swelling but there was no wound. Patient then brought to traditional bone healing. Two months after that, suddenly there was discharging wound on the left forearm. Patient then came into RSCM Orthopedics polyclinic seek for treatment. Clinical and imaging x ray showed extensive infection area almost along the radius bone with very large sequestrum. Normal bone appearance represents sequestrum and bone with periosteal reaction represent bones that are still alive. Patient then underwent debridement, sequestrectomy, external fixation application.

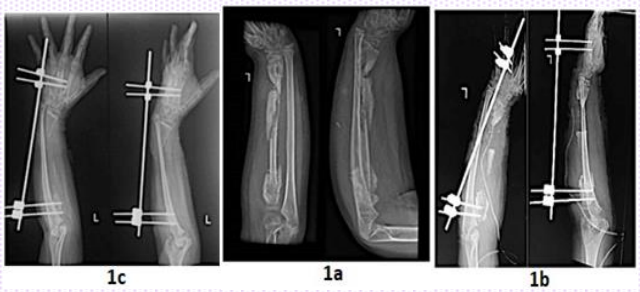

Figure 1. Serial X-Ray 1a. Initial. The normal bone appearance sequestrum and periosteal reaction represent healty bones; 1b. After 1st Operation; 1c. Six months after external fixation

Six months after the first surgery, the forearm has scars with no open wound or discharge and external fixation still in well position. There is no tenderness, skin temperature same with surrounding area, and normal distal sensory. Movement of the wrist joint is limited. The laboratory result showed an increased C-Reactive Protein and leukocyte. Others components were within normal limit. From radiological examination, there was major 9 cm of bone defect of the left radius bone. Then patient underwent second stage operation. The reconstruction consists of removal of external fixator, re-debridement and free vascularized fibular graft (FVFG) for the bone defect. Approximately, the length was 14 cm of fibular bone harvested including some soft tissue from patient's left leg. We put the fibular as bone graft until satisfaction alignment achieved and stitched donor to recipient vessels (artery and vein) and fixate the bone using K wire into adjacent bone donor.

After 1 year follow up, the FVFG showed well healed and. The hand function is good, patient can do fine pinch, key grip and power grip. Normal range of motion of wrist joint was reached but limited supination forearm movement. No limited daily activities such as

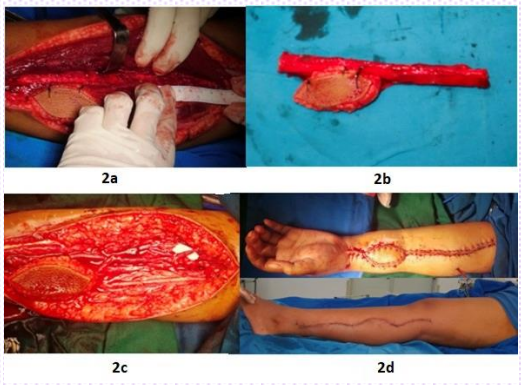

Figure 2. Surgical Technique. 2a. Donor site preparation; 2b. Fibular Graft (14 cm in length); 2c. Donor and recipient vessels approximation; 2d. Wound Closure.

eating, bathing, and lifting weights. We measured the functional outcome with DASH Score and it was 11.4% (range 0-100), it means good outcome with slightly limited hand function.

Patient can walk normally, x-ray examination showed fibular graft alignment and intramedullary wire within good position and union appeared well. Deep specimen culture result showed a staphylococcus aureus bacterial.

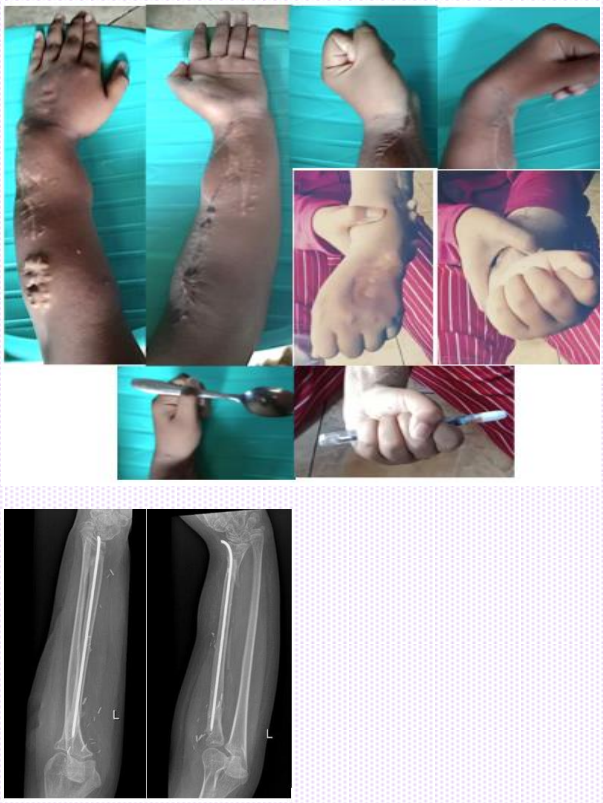

Figure 3. Six months follow up, (A) Clinical picture and hand function, (B) Forearm x-ray examination

Discussion

Chronic osteomyelitis management includes both adequate surgical debridement and systemic antibiotic therapy.[3] The goal of infection elimination was achieved via radical debridement until life and bleeding bone was reached. Eradication of infection is dependent on the removal of the dead bone.[4,5]

We chose 2 stage surgery due to extensive infection area while the other study showed did 1 stage surgery because of narrow infection area. Our patient underwent radical debridement and sequestrectomy at the first stage of operation. Approximately 9 cm of the radius bone were removed. External fixation application was done from the third metacarpal bone to the remaining distal radius bone. Stabilization of the bone during the first stage of the protocol aids in eradication of the infection and diminishing pain. To avoid implants at the site of infection, we generally prefer external fixation.3 In this study, in nondraining and inactive infections, locking plate fixation could also be done when radical debridement had been performed.[5]

In our patient, bone defects that follow a radical debridement of infected tissues was poorly vascularized. This condition needs special consideration so we chose free vascularized bone graft as the reconstruction method. *A free vascularized bone* graft can be defined as a segment of bone which is detached from its donor site and is transferred to a distant, recipient site with preservation and restoration of its intrinsic, nutrient blood supply by microvascular anastomoses to recipient vessels.[3]

Free vascularize fibular grafts (FVFG) have become the most commonly used free vascularized bone grafts. It has very high bony union rates and can improve regional circulation. Bone unions occurred within 4.5 months, determined by evidence of three of the four cortices bridging on plain radiographs. Full weight bearing following the reconstructions has 10 months of mean time (range, 7–17 months) overall.[5] Successful bony healing following free fibular grafting, resulting in limb preservation, pain relief, extremity stability, and satisfactory functional outcomes. Bone fixation no need to be rigid so fast union could be followed by early mobilization. With 6 months of follow up showed a good hand function, although there is still limitation in supination.

FVFG is a good reconstructive option for the management of infected long-bone defects in chronic osteomyelitis. This treatment protocol provides good structural support and rapid recovery. Vascular anastomoses to recipient vessels maintain osteoinductive, osteoconductive, and osteogenic properties of the bone. For optimizing clinical outcomes, anatomical alignment, rigid internal fixation, and accurate microvascular surgical technique also need to be considered. Study conducted by Ren et al comparison effectiveness of Illizarov bone transport and FVFG, showed result FVFG have same effectivity with Illizarov bone transport with specific each advantage and disadvantages.[6]

Acknowledgement
No conflict of interest regarding for the publication of this paper.

Ethical Approval
This is a case report; written informed consent has been obtained from the patient. Ethical approval for this case report has been exempted by our ethical committee.

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

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