



## Treatment of Non-Union with Bone Loss in Femur Fracture Using Non-vascularized Fibular Graft: A Case Report

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**Abstract:** Fibula is a very versatile source of autogenous graft and has been used for decades in the field of limb reconstruction. Bony defects of the lower extremity are usually the result of high-energy trauma, tumor resection, or severe sepsis. Non-vascularized fibular graft (NVFG) is useful in the reconstruction of skeletal defects, especially in cases of scarred and avascular recipient sites, or in patients with combined bone and soft tissue defects. This study aimed to assess the effectiveness of NVFG in the management of non-union bone fracture. We reported a 16-years-old male with non-union femur fracture. Debridements were applied at the first time of admission to the hospital. Open reduction of fracture with internal femur fixation. Fibula bone was extracted as the donor of vascularized graft for the bone loss. After two years of follow-up, the patient acquired his motor functions back well, and was able to carry out daily activities as expected. In conclusion, taking together the repair and reconstruction of non-union bone in the lower extremity with NVFG and internal fixation is an effective and important option for treating non-union femoral fracture. NVFG osteosynthesis has encouraging results in such instances. It is technically less demanding, simple, and can be performed in almost all centers where image intensifier is available.

**Keywords:** bone fracture; non-vascularized fibular graft; reconstructive microsurgery; femoral non-union

## INTRODUCTION

A recurrent topic discussed in the medical literature with several methods describes the prevention or treatment of bone nonunion in challenging situations.<sup>1</sup> Some studies have shown that nonvascularized fibular graft (NVFG) could induce membrane technique, reduce the time healing of fracture, and improve the final outcome.<sup>2</sup> The simple procedure does not require specialized training or equipment and has a low complication rate, therefore, it become the consideration of using this technique.<sup>3</sup> This study aimed to assess the effectiveness of NVFG to manage the non-union bone fracture.

## CASE REPORT

We reported a 16-year-old male who came to the clinic with non-union of femur fracture. Previously, the patient had a history of open fracture, and with missing distal of femoral was referred as bone loss. Debridements were applied when the patient first time entered the hospital. The surgeon chose to perform an open reduction of fracture with femur's internal fixation (open reduction internal fixation/ORIF). Fibula bone was extracted as the donor of non-vascularized graft for the bone loss. During the immediate post operative period, the patency of the anastomoses was monitored by observing the color of the skin of an island pedicle (so-called bouy) skin graft whose blood supply was in continuity with that of the fibular graft. During periodical follow-up, the patient was given albumin, calcium supplement, and analgesics. After two years of follow-up, the patient acquired his motor functions back well, and was able to carry out daily activities as expected.

## DISCUSSION

Fibula is a very versatile source of autogenous graft and has been used for decades in the field of limb reconstruction. Its use has been well described in the reconstruction of the distal radius post-giant cell tumor resection.<sup>4</sup> As a cortical bone, fibula provides mechanical strength to the fixation besides stimulating union. The incorporation of fibular graft with the surrounding bone gives biological fixation. Once the graft is revascularized, the osteoblasts stimulated by bone morphogenic protein replace the resorbed bone of the femoral neck and subchondral region. If this bone is appropriately stressed, the graft acquires sufficient strength to handle the observed forces.<sup>5-10</sup>

Bony defects of the lower extremity are usually the result of high-energy trauma, tumor resection, or severe sepsis. NVFG are useful in the reconstruction of skeletal defects, especially in cases of scarred and avascular recipient sites, or in patient with combined bone and soft tissue defects like our patient.<sup>11</sup> NVFG are often a subset of autogenous graft where the graft solely depends on the recipient's vascularity and is indicated in defect sizes of less than 6cm.<sup>12</sup>

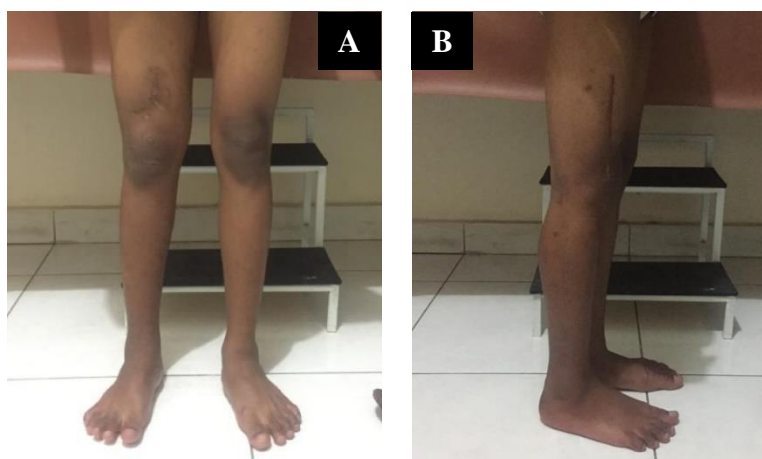
The repair and reconstruction of nonunion bone in the lower extremities, with NVFG and internal fixation is an effective and important option for treating non-union of the femoral fracture.



**Figure 1.** Three days post-operative evaluation after ORIF and NVFG. A, Anteroposterior view; B, lateral view



**Figure 2.** A, Evaluation of three days post operation (ORIF and NVFG); B, Radiological result of three months post operation



**Figure 3.** Two years post operation; A, anterior view; B, lateral view

NVFG osteosynthesis has encouraging results in such instances. It is technically less demanding, simple, and can be performed in almost all centers where image intensifier is available.<sup>13</sup> Based on a study that has been held by Lenze et al,<sup>14</sup> it is shown that in the setting of small segmental defects, it can be considered by using NVGF. In this case, the patient was performed an open reduction of fracture with femur's internal fixation. The surgeons extracted fibula bone as the donor of NVFG for the bone loss. After two years follow-up the patient acquired his motor functions back well, and was able to carry out daily activities as expected. Regarding the vascularity of the graft, vascularised or non-vascularised grafts may be utilised depending on whether a blood supply is transferred with the bone graft or not. There is no clear consensus in the literature to indicate which type of graft is more successful in the reconstructive setting.<sup>15</sup>

## CONCLUSION

Taken together the repair and reconstruction of nonunion bone in the lower extremities, with NVFG and internal fixation is an effective and important option for treating non-union of the femoral fracture. NVFG osteosynthesis has encouraging results in such instances. It is technically less demanding, simple, and can be performed in almost all centers where image intensifier is available.

## Conflict of Interest

The authors affirm there is no conflict of interest in this study.

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