



## Re-Innovation of Split Lateral Gastrocnemius Muscle Flap for Complicated Proximal Tibia Open Fracture: Case Report

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### Abstract

**Introduction and Importance:** Maintaining mobility and hence the productivity of individuals depends on the preservation of lower limb integrity. Increasing violence, mainly triggered by weapons, inversely impacts limb functionality, and the resulting wounds require proper care.

**Case Report:** A 47-year-old African man without any previous medical conditions experienced an injury to his right leg from a high-speed accident, resulting in an open fracture in the upper third of the tibia with missing tissue. At first, he received care from orthopedic surgeons and had debridement done along with the use of an external fixation device to stabilize his limb. Two weeks later, he was referred to the plastic surgery unit and was preparing for urgent surgery. A split lateral gastrocnemius muscle flap was used to reconstruct him after a surgical debridement.

**Clinical Discussion:** Proximal leg trauma can be managed successfully by rearrangement of local tissue, resulting in a perfect outcome with less donor site morbidity and a long, complex surgery compared to free tissue transfer. Gastrocnemius muscle or myocutaneous flap, is a gold standard for proximal leg trauma, mainly when a cavity exists, and it is able to create wonderful reconstruction.

**Conclusion:** The split lateral gastrocnemius muscle flap is an effective modification of the flap, resulting in greater surface area coverage, less bulk and shape distortion, and reliable blood supply. Furthermore, it is easy to harvest and apply, deferring the need for step-curve microsurgical procedures.

**Keywords:** Leg injury; Lower limb reconstruction; Lateral gastrocnemius muscle flap; Split lateral gastrocnemius muscle flap

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### Introduction

Traumatic lower limb injuries induced by high-speed weaponry result in difficult wounds that carry a high morbidity and necessitate the collaboration of orthopedic and plastic surgery departments for immediate reconstruction. An injury in the upper portion of the tibia requires urgent attention in order to preserve joint integrity and function. Deep infection is the main opponent, which can distract locally and spread to cause a catastrophic wound. This condition existed in the vast majority of open fracture victims with delayed presentation [1,2].

The objective of therapy for a lower limb open fracture is debridement and obliteration of the lesion with viable tissue. Local tissue is usually sufficient to cover minor to moderate defects, eliminating the requirement for distant and free tissue transfer. For upper leg defects, the gastrocnemius muscle flap is the workhorse method of reconstruction, especially when the defect requires a considerable quantity of tissue to conceal dead space [3-5].

The lateral head of the gastrocnemius muscle is less commonly utilized than the medial head, although it can cover lateral proximal leg and knee wounds with less complications and functional limitations. Modifications to this flap increase its value, and the split lateral gastrocnemius muscle flap is not a popular variety of flap, despite its ability to cover a larger area than the standard approach.

This article describes using a split lateral head of gastrocnemius muscle flap for the reconstruction of complicated defects at proximal leg.

## Case Presentation

A 47-year-old man-African with no known significant medical background. He presented to plastic surgery unit with right upper leg wound resulted from the explosion. Firstly, he was admitted to orthopedic department where he was undergoing initial assessment and management. He also underwent surgical debridement and subsequent stabilization of the proximal third tibia fracture. After two weeks, he was directed to a plastic surgery department. His arrival was delayed because the medical facilities related to the war were inaccessible. On arrival at the plastic surgery department, the patient was systematically examined and found to have only injured his right leg.

On examination, the right leg was supported by an external fixator and had a wound of approximately 5 cm × 6 cm × 4 cm on the anterior LEG with a skin defect distal to the edge of the hole. Unfortunately, the wound was complicated by infection and pus discharge, but examination of the remaining part of the limb revealed no abnormalities. In addition to routine dressing changes, the microbiologist analyzed wound secretions for microbiological testing and antibiotic treatment.

He was scheduled for urgent surgical debridement and wound cover. At operating room, after application of spinal anesthesia and a tourniquet, all necrotic tissue was being excised result in expanded wound about 8 cm × 10 cm × 6 cm. Lateral head of gastrocnemius muscle became exposed after debridement and was chosen to reconstruct defects. Incision was extended distal to 10 cm above lateral malleolus, then lateral head of gastrocnemius muscle was isolated from overlying skin and underlying soleus muscle. Distal insertion of muscle was divided from Achilles tendon, then dissection continued proximal towards origin, lateral sural artery was exposed and this the end point of proximal dissection. Deep peroneal nerve was identified and secured to prevent iatrogenic injury and compression by flap transposition. Pedicle was dissected distally to trace the branches of lateral sural artery, and muscle was divided into two parts, each has dependent vascular branch; superficial segment was used to obliterate wound while deeper part was utilities to resurface rest of wound. Flap was not covered with a skin graft to facilitate flap monitoring. Wound was closed with semi-occlusive wound dressing.

Partial necrosis at edge of deeper portion was observed about 1 cm to 2 cm, but the rest of flap healed nicely and infection was not encountered. Split thickness skin graft was used to resurface flap in separate operation.

This work is under SCARE guideline [6].

## Discussion

The lower extremities are human ambulatory tools, with the orthopedic team's efforts focused on maintaining skeletal stability and favorable coverage. Most lower extremity injuries cause significant morbidity and negative effects on the individual, while also exhausting the health care system. It is recommended to have a team of vascular, orthopedic, and plastic surgeons provide definitive coverage for lower extremity injuries within days of injury. Unfortunately, this case does not apply to worldwide or conflict areas like Sudan.

Traumatic injury by war weapons usually contaminated and a delayed in presentation of patient double risks of infection which convert wound into challenging one. Temporal management with negative pressure wound therapy accompanied by implanted

antibiotics was reported to treat open leg fracture, but long hospitalization and multiple sessions for dressing changes promoted toward flap coverage. The use of fasciocutaneous, muscle or mucocutaneous flap for complicated wound is still debatable and many researches revealed no superiority of one over another. In our case, muscle was needed to provide bulky tissue with generous blood supply to obliterate cavity. Also, local flap is easy, reliable with less donor site morbidity comparing with free tissue reconstruction.

Gastrocnemius muscle flap proves effectiveness for reconstruction of defects around knee joint and proximal leg, and consider the most salvageable tool for complicated knee replacement procedures. Lateral head of gastrocnemius muscle is not commonly used flap because it has less bulk and limited arc of rotation, and some report mentioned postoperative personal neuropathy. Deposit these withdrawal effects, the lateral head able to manage complex wound at lateral aspect of knee and the leg [7,8].

Splitting of lateral head of gastrocnemius muscle flap is not a new modification but also is not commonly used although it is a fabulous method to increase the total surface area of flap while providing durable bulk for small cavity. Lateral sural artery divided into superficial and deep branches makes splitting of flap into two parts achievable, and both segments can be used either simultaneously or separately. In our case, using of this method facilitated obliteration of proximal cavity while another segment was recruited to resurface the upper anterior side of the tibia [9,10]. Within two-week flap healed beautifully with adorable shape without excessive bulk or disfiguring leg shape. Marginal necrosis did not affect outcome significantly, and other complication such as hematoma, the infection and neuropathy did not develop.

## Conclusion

The lateral gastrocnemius flap is a powerful tool for knee and proximal leg reconstruction if wisely used in the management of selected patients, although it is associated with many complications. Splitting of the gastrocnemius head robust utility of flap and increase total surface area covering with reliable predictable outcome.

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