Case Report

Combined Use of the Hemi-Gastrocnemius Muscle and Split Tibialis Anterior Muscle Flap for Reconstruction in a Necrotizing Fasciitis Patient

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ABSTRACT:

Background: *Soft tissue reconstruction of the lower limb following trauma or necrotizing fasciitis presents significant challenges in preserving both function and appearance. This case report demonstrates the clinical feasibility and functional success of using a combination of hemi-gastrocnemius and split tibialis anterior muscle flaps for coverage of extensive anterior tibial defects caused by necrotizing fasciitis.*

Case presentation: *A 30-year-old male with uncontrolled diabetes presented with severe tissue loss and tibial bone exposure after multiple debridement. To salvage the limb, a medial hemi-gastrocnemius muscle flap was used for the proximal defect, and a longitudinally split tibialis anterior flap was applied distally. Both flaps remained viable, and complete wound closure was achieved with split-thickness skin grafting in same operation. The ankle dorsiflexion function and independent ambulation were intact following physiotherapy. This method allowed effective soft tissue coverage without microsurgical intervention and minimized donor site morbidity.*

Conclusion: *Though rarely used worldwide, the combined use of hemi-gastrocnemius and split tibialis anterior muscle flaps offer reconstructive surgeons a reliable, function-preserving solution especially in resource-limited settings where conventional or free flaps are not feasible due to anatomical or systemic limitations.*

Key Words: Hemi-Gastrocnemius Muscle, Split Tibialis Anterior Muscle Flap, Reconstruction

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Introduction

The injured person's treatment, psychological well-being, and appearance all depend on the reconstruction of defects brought on by trauma and open fractures. If untreated, these defects which can be brought on by tumors, infections, or trauma cause discomfort, restricted movement, and a general sense of unhappiness in people.1 Lower leg reconstruction is classified into three anatomical regions proximal, middle and distal third.2 In clinical practice, middle-third tibial wounds are frequently seen. Though defects are small in size but must have a definite vascular cover for example local fasciocutaneous flaps, gastrocnemius and soleus flaps can be an option in some of these patients. And also, in contusion injury fasciocutaneous flaps or posterior group muscle flaps may not be an option.3 Tibial bone exposed due to

trauma usually warrants a vascularized muscle flap for coverage. The soleus muscle flap is commonly used in the exposed middle third of the tibia.2 For very long and linear wounds, there may be a combination of gastrocnemius and soleus of flaps.4 Because of its excellent blood supply, the gastrocnemius muscle flap (GMF) has been used as a dependable and secure technique for the restoration of soft tissue abnormalities in the knee.5 A case report is presented here wherein a combined hemi-gastrocnemius and split tibialis anterior muscle flap were used to reconstruct a patient with necrotizing fasciitis.

Case Report

A 30-year-old male, with uncontrolled DM, had necrotizing fasciitis extend up to thigh leading to tibial bone exposure. The patient developed sepsis from the infected left leg with the sign of fever, swelling in left leg which resolved after intravenous antibiotic therapy and debridement several times under spinal anesthesia. With patients stabilized the main concern was to salvage his left lower extremity. Following the first wound debridement tibial bone was exposed (Fig 1). He had required daily dressing for several weeks and Negative Pressure Wound Therapy (NPWT) was given. A hemi gastrocnemius muscle (medial head) flap was given anteriorly to cover the proximal part of exposed tibia. Subsequently, a split tibialis anterior muscle flap, created by longitudinally dividing the tibialis anterior muscle, was used to cover the distal part of the exposed tibia (Fig 2) (Fig 3). This flap was able to cover narrow and linear defects on the distal part of the tibia comfortably. The muscle's size and pliability were also evaluated. There was no sign of venous engorgement of the flap. Both muscle flap was viable and become adherent to the adjacent bone. Then split skin graft applied over the muscle. There was good graft taken without any skin loss. The flap coverage remained stabled. There was complete survival of both the muscle flap and skin graft and no functional deformity in the lower extremity. The wound healed in two weeks, post operative recovery was uneventful (Fig 4a,b). Patient was on regular follow up. Injectable antibiotics and analgesics were continued postoperatively according to the culture sensitivity report.

Initially knee joint stiffness was present, but it was reduced by regular physiotherapy sessions. Dorsiflexion of ankle joint was preserved. At the end of the first postoperative month, the patient reported pain during standing and walking, with restricted knee joint movements. He had progressive improvement in mobility. By three months, he was able to walk and move comfortably. He was kept on regular follow-up at 1 month, 3 months, 6 months, and 1 year, with progressive improvement in function and mobility noted throughout.

Discussion

This case report presented a standard approach to lower leg coverage for necrotizing fasciitis patients with reliable local muscle tissue available. With exposed bone cleared of periosteum, skin grafts have little chance of adherence and survival as local fasciocutaneous flaps are seldom available. Granulation tissue growth over bone typically require weeks to months of waiting, which raises the risk of infection. In our case study, we used the combination of the hemi-gastrocnemius flap and split tibialis anterior muscle flaps to increase and achieve the substantial length. In another case study we have seen that the tibialis anterior turnover flap is a useful alternative to the gastrocnemius and soleus flaps in muscle coverage of the upper two-thirds of the tibia. This procedure causes minimal donor site dysfunction. it is simple to perform and reliable. They used a combination of the gastrocnemius flap and fasciocutaneous flaps in a burn patient.2

In our case, the gastrocnemius muscle flap was selected for reconstruction based on defect location and size. Along with the gastrocnemius, a split tibialis anterior muscle was used to cover the anterior proximal third of the lower leg. When covering the proximal third of the leg and the area surrounding the knee requires both muscle and skin coverage, the gastrocnemius flap provides the ability to adapt.6 Reconstructive surgeons may technically dissect and harvest it quickly, and it produces good functional results without requiring microsurgical vascular anastomosis.7 In another study, they used the tibialis anterior muscle and soleus muscles to cover the lower leg in a patient with leiomyosarcoma in the proximal third of the leg.8 Other journal showed, they used the tibialis anterior muscle flap for longitudinal middle third tibial defects.4

Another case, a single muscle flap was insufficient to cover the wound and the defect was large, so they needed a combination of muscle flaps. They covered the defect by using a hemi-split tibialis anterior muscle for the

proximal portion and a hemi-split soleus muscle for the distal portion.9 but during our case, we did not face this kind of trouble.

Superiorly based muscle and fasciocutaneous flaps are only suitable for small defects of the lower third of the lower leg but there is significant risk when inferiorly based muscle flap is used to treat lower leg defects. The anterior tibial artery flap provides a longer pedicle and a bigger skin surface and it might extend inferiorly from the tip of the toe to the superior knee. It can be utilized as a free flap. Split skin grafts are easily accepted by the secondary defect with little alteration to the shape. The proximal half of the anterior tibial artery must be divided and stripped to do the flap which is contraindicated if the anterior or posterior tibial arteries are not palpable at the ankle. If one of these vessels is frequently damaged after a traumatic loss the flap cannot be employed. If there has been a history of trauma to the upper third of the lower leg, without angiography, there is uncertainty in the continuation of the anterior tibial artery in the area where the perforating vessel originated. A patent anterior tibial system is typically indicated by forward flow palpable in the anterior tibial artery at the anterior ankle and closure of the posterior tibial artery.10

Conclusion

The combined use of a hemi-gastrocnemius and split tibialis anterior muscle flap provided a safe, reliable, and function-preserving solution for extensive anterior tibial defects in a patient with necrotizing fasciitis. Before contemplating the flap as a reconstructive option, it is crucial to take into account the size of the defect as well as the condition and pliability of the muscle. This combination is regarded as useful repair techniques that maintain function in the lower extremities. In complex lower limb reconstructions particularly when free flaps are not feasible regional muscle flap combinations can serve as valuable alternatives. Surgeons should consider this underutilized approach as a practical, limb-saving option, especially in resource-constrained environments.

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Figure 1: Feature of after several debridement wound with exposed tibia

Figure 2: Insert of gastrocnemius and tibialis anterior flap after NPWT

Figure 3: Insert of gastrocnemius and tibialis anterior flap

Figure 4: Appearances of left leg after coverage, on late follow-up