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The Gastrocnemius Muscle Flap for Reconstruction of the Proximal Third of Lower Leg

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Abstract

Soft tissue defect of the lower leg with exposure of bone, tendon, and osteosynthesis plates or total knee artthroplasty is a challenging therapeutic problem. The gastrocnemius muscle flap is one option for coverage. This flap is probably one of the safest flaps, and relatively easy to dissect. However, about functional loss for higher loads especially in sports activities is reported in the literature.

Keywords: Proximal third lower leg; Soft tissue defect; Gastrocnemius muscle flap

Introduction

A 57-year-old male presented with a highly comminuted open fracture type IIIb of the proximal tibia right (Figure 1A). First, the fracture was stabilized with knee joint-bridging external fixation. After four debridements and negative-pressure Vacuum Assisted Closure (VAC) therapies including incorporation of polymethyl methacrylate (PMMA) beads containing gentamycin (Figure 1B), the pre-tibial soft tissue defect was covered with the use of a medial gastrocnemius muscle flap and additional split-thickness skin grafts (Figure 1C). Then, the fracture was definitively treated with open reduction and internal fixation (ORIF). Eight weeks after injury there was uncomplicated fracture and wound healing with completely restoration of knee joint function (Figure 1D and 1E), and 12 weeks after injury the patient could be mobilized with full weight-bearing on the affected leg.

Local muscle flaps since first reported by Stark in 1946 [1] became an established procedure for coverage of soft tissue defects of the lower leg with exposure of bone, tendons, osteosynthesis plates or total knee arthroplasty (TKA) with or without infection. If a primary non-infected post-traumatic or post-operative soft tissue defect is present that is usually associated with bacterial contamination, a surgical intervention should follow as soon as possible to avoid infection. As compared to published results in 1984 with a secondary wound sepsis and required amputation rate of 42% for open fractures type IIIC [2], the required amputation rate of leg after infected TKA could be significantly decreased recently to 15% when using an adequate soft tissue management [3]. Local muscle flaps are an option for treatment in patients who are not willing or healthy enough to undergo free microvascular tissue transplantation, and do not require microsurgical expertise.

Figure 1: (A) Postero-anterior (PA) radiograph demonstrating highly comminuted fracture of proximal tibia. (B) Clinical photograph showing soft tissue defect at the ventral aspect of proximal tibia with incorporated PMMA beads. (C) Clinical photographs showing harvesting and transposition of the medial gastrocnemius head and its additional coverage with spli-thickness skin grafts. (D) PA and lateral radiographs demonstrating fracture healing after ORIF. (E) Clinical photographs showing uncomplicated wound healing and completely restoration of knee joint function.

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However, muscle flaps for reconstruction of leg are generally not free of any complications. Neale et al. [4] reported on major and minor complications in 32% of a total of 95 muscle flaps and they agreed that the causes were mainly technical errors, inadequate debridement, use of diseased and traumatized muscle, and unrealistic objectives.

The use of the gastrocnemius muscle flap is one method of choice for reconstruction of the anterior and medium side of the knee as well as the proximal third part of lower leg [5]. Ger and Efron [6] first published this procedure in 1970. There is only one vasculonervous pedicle for each of both muscle heads composed of a sural artery and one or two veins, and is classified as type I according to the classification of Mathes and Nahai [7]. It is possible to divide the muscle in two sections longitudinally according to the needs; however, the lateral head has to be rotated around the proximal fibula, therefore, it has a lower rotation angle than the medial head. There is an option to safely harvest a skin paddle overlying the muscle [8]. The gastrocnemius muscle flap is probably one of the safest flap, however, functional loss can occur. Daigeler et al. [9] reported on complete flap loss in only one case of 218 patients (0,46%) and 87% of patients were not significantly limited walking on even ground, but only 42% of patients could run and 40% of patients complained about pain when walking more than 200 meters. If a gastrocnemius muscle flap is not indicated nor possible, the use of random pattern skin transposition flaps can be one salvage option, the advantage of this procedure is that no functional loss occurs [10,11].

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