Case Report

The proximally and distally pedicled hemisoleus muscle flap as option for coverage of soft tissue defects in the middle third of lower leg

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Abbreviations: VAC: Vacuum Assisted Closure; NFCSAF: neurofasciocutaneous sural artery flap; HSMF: hemisoleus muscle flap; ORIF: open reduction and internal fixation

Case presentation

Soft tissue defects of the ventral aspect of lower leg with exposure of bone, tendon, and/or osteosynthesis plates represent a challenging therapeutic problem. The use of local pedicled flaps for coverage is one option for treatment in patients who are not willing or healthy enough to undergo free microvascular tissue transplantation. Additionally, it does not require microsurgical expertise. Negative-pressure Vacuum Assisted Closure (VAC) therapy before soft tissue coverage provides a sterile and controlled environment that can lessen the duration of wound healing, promotes better capillary circulation, and decreases the bacterial load [1].

In the first case, a 47-year-old male with a history of social desintegration, severe alcohol and tobacco abuse, chronic liver disease, and diabetes mellitus presented with a 9 cm in diameter necrotizing pre-tibial ulcer in the middle third of the right lower leg (Figure 1A, first photograph). Microbiological examination revealed massive bacterial load with Staphylococcus aureus and Enterococcus faecalis. The patient could not remember any trauma in the history. First, multiple radical debridements combined with negative-pressure VAC therapy and concomitant intravenous application of antibiotics were performed over a period of 3 weeks. Second, after consolidation of soft tissue infection (Figure 1A, second photograph), confirmed by microbiology, the defect was covered with the use of distally pedicled neurofasciocutaneous sural artery flap (NFCSAF) (Figure 1B). Eight days after coverage, the distally pedicled NFCSAF has failed due to septic venous thrombosis. Third, the necrotic distally pedicled NFCSAF was excised, followed by once more necessary multiple debridements and VAC therapies (Figure 1C). Fourth, the resulting second defect was reconstructed with the use of proximally pedicled medial hemisoleus muscle flap (HSMF) (Figure 1D). The further course was uncomplicated (Figure 1E).

In the second case, a 56-year-old male sustained a closed fracture of the proximal and middle third of the right tibia that was treated primarily with open reduction and internal fixation (ORIF), and resulting in a non-infected postoperative pre-tibial soft tissue defect associated with exposure of the osteosynthesis plate with size of 5 x 2 cm (Figure 2A). The defect was covered with the use of a distally pedicled medial HSMF, the healing was uncomplicated (Figure 2B–C). Ten weeks after injury, the patient could be mobilized with full weight-bearing on the affected leg, and there was no ankle instability nor loss of plantar flexion of his right foot (Figure 2D).

If a primary non-infected posttraumatic or postoperative 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 the published results in 1984 with a secondary wound sepsis and required amputation rate of 42% for open fractures type IIIC, the required amputation rate of leg after infected total knee arthroplasty could be significantly decreased recently to 15% when using an adequate soft tissue management [2,3].

The distally pedicled NFCSAF, introduced in 1992 by Masquelet et al. [4], is one option for coverage of the middle and distal third of lower leg, ankle, and heel [5,6]. It is a skin island flap which is retrograde supplied by at least three perforator vessels from the peroneal artery within approximately 6 cm from the tip of lateral malleolus. However, this flap is not free of complications, mostly based on venous congestion. In a meta-analysis of 50 articles including 720 procedures, the necrosis rate or any other flap-related complications of distally pedicled NFCSAF is reported to be 18% [7]. The weakness can be the pivot point. The flap’s arterial inflow is robust and constant, but the venous congestion is susceptible occurring in up to 21.4% of cases, and it is mostly detected if the flap was used in a 180° turned manner [8,9]. To prevent early venous stasis, the pivot point of vascular pedicle including the short saphenous vein can be covered temporary with a skin substitute and covered secondary with a skin graft (Figure 3A–C). Another options to prevent venous congestion is the use of NFCSAF in a two-stage, supercharged or superdrained manner, and intermittent short saphenous vein phlebectomy [9-12]. Schmidt et al. [13] reported on a survival rate when using the NFCSAF in an adipofascial manner with additional skin grafting in 87.5% of 104 cases. In cases in which the short saphenous vein cannot be found, the flap should not be utilized; and in older, high-risk, and critically multimorbid patients including peripheral arterial disease, a considerable necrosis rate of 36% of a total of 70 procedures was found by Baumeister et al. [14]. An unacceptable failure leading to loss of flap is when the vascular pedicle was selected too short and no sufficient arterial supply exists [15].

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Local muscle flaps, first reported by Stark in 1946, became an established procedure for coverage of soft tissue defects of the lower leg with exposure of bone with or without osteosynthesis plates, joints with or without total knee or total ankle arthroplasties in the absence of deep infect, tendons, and can provide as well as prevent shortening of the tibial bone [6,15-20]. Muscle flaps promote better capillary circulation leading to a decrease of bacterial load, hence, muscle flaps are not contraindicated when superficial bacterial wound contamination is present. When using muscle flaps for coverage, all surgeons need a learning curve. In 1983, Neale et al. [21] reported on...
The proximally and distally pedicled hemisoleus muscle flap as option for coverage of soft tissue defects in the middle third of lower leg

Schmidt I (2017) The proximally and distally pedicled hemisoleus muscle flap as option for coverage of soft tissue defects in the middle third of lower leg

Figure 3. (Example for temporary coverage of the pivot point of a distally pedicled NFCSAF in 74-year-old male, clinical photographs): (A) Chronic ulcer of the right heel after consolidation of infection with VAC therapy. (B) Harvesting the distally pedicled NFCSAF. (C) Coverage of defect, the flap showing sufficient arterial blood supply without venous congestion, and the pivot point of flap’s pedicle was temporary covered with a skin substitute (Epigard, arrow) for 5 days (after that the definitive coverage was performed by split-thickness skin grafts).

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