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Case report

PEDICLED MUSCLE FLAPS FOR THE MANAGEMENT OF IMPLANT COMPLICATIONS IN THE LOWER LIMBS: A REPORT

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Abstract: **Introduction**: Metallic implants are widely used for the reconstruction of bony defects caused by fractures, excision of cancer, and degenerative bone disorders. These implants are associated with complications, including exposure and infection, particularly when vascularized tissue is needed for reconstruction. A key tool in plastic surgery to address these complications is the pedicled muscle flap.

Case Report: This article presents two cases in which pedicled medial gastrocnemius and peroneus brevis muscle flaps were successfully used to salvage the hardware and achieve effective wound coverage.

Conclusion: Pedicled medial gastrocnemius and peroneus brevis muscle flaps are valuable options for covering complicated skin defects over exposed implants.

Keywords: hardware salvage, peroneus brevis, medial gastrocnemius, pedicled muscle flap, external fixators, free flap, graft take, total knee arthroplasty.

INTRODUCTION

Implants are commonly used in the lower limbs to manage degenerative, neoplastic, and traumatic conditions. However, they carry a significant risk of exposure, infection, and failure, particularly in trauma cases. The literature reports a hardware infection rate of up to 27% in Gustilo type III open tibia fractures (1). When complications arise, a multifaceted approach is used to salvage the implant, which includes debridement, antibiotics, and muscle flap coverage (2,3). We present two cases in which pedicled muscle flaps were successfully used to salvage the implants in the lower extremities.

CASE PRESENTATION

Medial Gastrocnemius Muscle Flap

A 62-year-old female presented with a non-healing wound (Figure 1) two months after undergoing right total knee replacement for chronic osteoarthritis. Her medical history included controlled hypertension (on ramipril 5 mg/day), hypothyroidism (on thyroxine 100 micrograms/day), and an uneventful cholecystectomy for symptomatic cholelithiasis 9 years prior. On examination, she was morbidly obese (weight 103 kg; BMI 34 kg/m²). A dehiscence measuring 3.5 x 3 cm with necrosis was observed at the distal end of a 15 cm long postoperative scar over the right knee (Figure 1 A-B).

Wound debridement and exploration revealed a 7 cm deep sinus that accommodated the entire shaft of a size 00 Spratt Brun bone curette (Figure 1 C-D), placing the hardware of the replaced knee at significant risk of exposure. There were no signs indicative of chronic arterial insufficiency. Blood work revealed leucocytosis and elevated C-reactive protein (CRP) levels. Microbiological analysis of the wound swab identified gram-positive bacteria (Staphylococcus aureus/epidermidis). Antibiotics were initiated according to the sensitivity reports, and the VAC-Instil system with Granudacyn (Molynlyke) antiseptic solution was

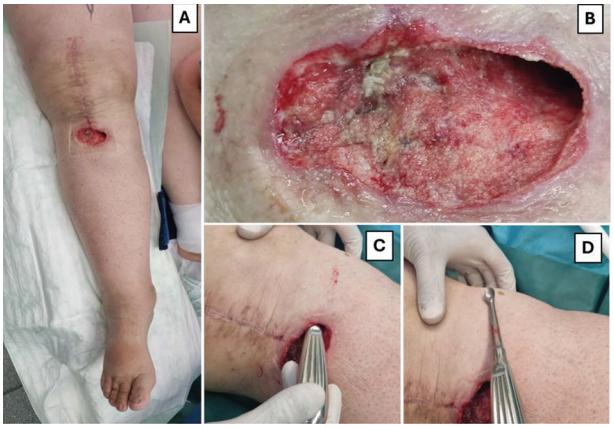

Figure 1*. **A-B)** Chronic wound post-total knee replacement. **C-D)** Wound leading to a 7 cm deep sinus. (Image credits: Saleh Alhotan - Author)*

applied to the wound, set at 125 mm Hg continuous pressure with added wash-suck cycles (15 minutes wash, 3 hours suck) twice daily.

Following nine days of diligent wound care, swabs showed no signs of bacterial growth. A pedicled, proximal-based medial gastrocnemius muscle flap with a meshed split-thickness skin graft was used to close the wound. The skin graft was harvested from the right medial thigh. Postoperatively, the VAC (vacuum-assisted closure) system was reapplied with continuous pressure of 75 mmHg, and the knee joint was immobilized in a macron cast to prevent flexion (figure 2 A-B). The VAC system was discontinued on the fifth postoperative day when 100% graft take was achieved, and the muscle flap showed no signs of infection and was viable (Figure 2 C-D). On the seventh postoperative day, the patient was discharged to home care. The graft donor site and flap harvest surgical incision healed without complications. At the 6-month telephonic follow-up, the patient reported no complaints and was highly satisfied with the outcome.

***Figure 2**. **A)** Gastrocnemius muscle flap with meshed split-thickness skin graft. **B)** Wound attached to the VAC system, and knee immobilized with a macron cast. **C-D)** Healed wound, surgical incision, and skin graft donor site, 2 weeks post-surgery. (Image credits: Saleh Alhotan - Author)*

Peroneus Brevis Muscle Flap

A 58-year-old female presented with an exposed plate and screws four weeks after open reduction and internal fixation (ORIF) of a fracture in the lower third of the fibula. She had controlled diabetes (managed with oral hypoglycemics) and hypertension (treated with ramipril). Her medical history included a laparoscopic appendectomy performed 15 years ago. On examination, she was of average build (weight: 82 kg; BMI: 27.7 kg/m²) and showed no clinical signs of chronic arterial insufficiency. The wound, measuring 5 cm x 2.5 cm, showed exposed plate and screws along the lower lateral surface of the left leg (Figure 3 A-B). The wound edges appeared healthy, with no significant discharge. Blood work was normal, and a CT scan of the left leg revealed incomplete healing of the fracture, but no signs of active osteomyelitis. Wound swabs did not grow any bacteria.

***Figure 3. A-B)** Exposed hardware over the lateral surface of the left leg. **C)** Blood soakage of dressing on the first postoperative day. **D)** Hematoma at the flap inset site. (Image credits: Saleh Alhotan - Author)*

The wound was debrided under general anesthesia, the hardware was removed, and external fixators were applied by the orthopedic team. A VAC system with 125 mm Hg pressure was applied for 5 days. Wound biopsy revealed no bacterial growth, and wound closure over the exposed bone was achieved under general anesthesia using a distally based pedicle peroneus brevis muscle flap with a meshed skin graft. Postoperatively, the VAC system (continuous pressure 75 mmHg) was reapplied.

However, on the first postoperative day, profuse soaking of the dressings was observed (Figure 3C), and upon removal, bleeding and hematoma formation (Figure 3D) were detected. This required limited re-exploration to evacuate clots and achieve hemostasis. After this, the course was uneventful, and by the fifth day, about 80% of the skin graft had taken (Figure 4A). The patient was discharged home on the seventh postoperative day and was advised to follow up with the orthopedic team, who later removed the external fixators after 8 weeks. The flap was fully viable, and complete skin coverage was gradually achieved as the patient was followed up for 10 weeks (Figures 4B-C).

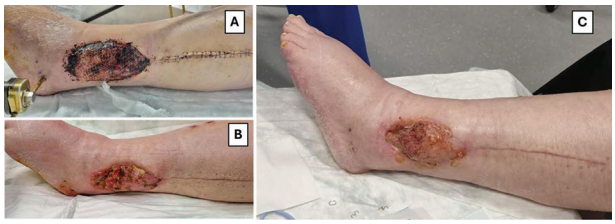

***Figure 4**. **A)** Viable flap with 80% graft take at 5 days. **B)** Viable flap with 90% skin coverage at 3 weeks. **C)** Viable flap with complete skin coverage at 10 weeks. (Image credits: Saleh Alhotan - Author)*

DISCUSSION

The pedicled gastrocnemius muscle flap is considered a reliable option for soft tissue reconstruction around the knee and upper leg, particularly when ex-

posure of bone, tendon, hardware, or joint capsule threatens the limb (4). Each head of the gastrocnemius muscle can be independently harvested due to its distinct vascularization, with a vascular pedicle supplying each head. This flap is particularly well-suited for restoring soft tissue and the extensor mechanism around the knee and popliteal fossa. The large muscle belly fills the dead space, and its transfer does not significantly impair the function of the donor limb, resulting in minimal donor-site morbidity (5).

In our case, the flap was harvested as muscle only, and skin coverage was achieved with a split-thickness skin graft. Alternatively, the gastrocnemius flap may be raised as a chimeric musculocutaneous flap, avoiding the need for a skin graft and the associated prolonged immobilization (6).

Tetreault et al. (7) analyzed the risk factors for medial gastrocnemius flap failure in total knee arthroplasty (TKA) patients and found that 52% of patients experienced persistent or recurrent infection. At four years, the survivorship of the TKA prosthesis was 48%. Importantly, no flap-related complications were reported. The authors concluded that the high failure rates were not related to the flaps themselves but to the complexity of the clinical issues at hand.

The peroneus brevis is a versatile and reliable flap that can be harvested with minimal donor-site morbidity (8). Its unique vascular supply runs down its deep aspect, connecting perforators from the anterior tibial artery and peroneal artery. This feature allows the flap to be raised on a single perforator, either proximally or distally, depending on the requirements. The peroneus brevis flap is easy to harvest and suitable for coverage of small- to moderately large distal leg, ankle, and foot defects. Donor-site closure is typically possible by primary intention, resulting in a linear and aesthetic scar (8, 9).

Well-vascularized pedicled flaps provide blood flow to the recipient area, facilitating the delivery of systemic antibiotics, immune cells, and antibodies. This enhances infection control and promotes wound healing. In advanced healthcare facilities with robust microvascular surgery capabilities, free flaps are often preferred over pedicled flaps for covering wounds with exposed hardware. However, Fallico et al. (3) reviewed the outcomes and complications of both free and pedicled flaps for exposed hardware in the lower extremities and concluded that pedicled flap reconstruction should be reconsidered as a valid alternative option when possible.

CONCLUSION

Pedicled muscle flaps, including the gastrocnemius and peroneus brevis, are viable options for managing soft tissue defects, particularly in complex clinical situations involving exposed metal implants. Mastery of these flaps by plastic and reconstructive surgeons is crucial for limb salvage, especially when resources for free flap procedures are limited.

Acknowledgments / Patient Consent: The patients have given consent for their case history and images to be used for research and publication, provided their identities are not disclosed. The author acknowledges the patients' participation and commitment to this research.

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Conflicts of Interest:There are no conflicts of interest.

Note: Artificial intelligence was not utilized as a tool in this study.

Sažetak

VEZANI MIŠIĆNI REŽNJEVI ZA LEČENJE KOMPLIKACIJA IZAZVANIH IMPLANTATIMA U DONJIM EKSTREMITETIMA

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Uvod: Metalni implantati se široko koriste u rekonstrukciji koštanih defekata izazvanih prelomima, ekscizijom tumora i degenerativnim bolestima kostiju. Međutim, ovi implantati su povezani sa komplikacijama, uključujući izlaganje i infekciju, posebno u slučajevima kada je potrebna upotreba vaskularizovanog

tkiva za rekonstrukciju. Vezani mišićni režnjevi predstavljaju ključni alat u plastičnoj hirurgiji za rešavanje ovih komplikacija.

Prikaz slučaju: Ovaj članak prikazuje dva slučaja u kojima su vezani mišićni režnjevi medijalnog gastroknemijusa i peroneusa brevisa uspešno primenjeni za spašavanje implantata i postizanje efikasnog pokrivanja rana.

Zaključak: Vezani mišićni režnjevi medialnog gastroknemijusa i peroneusa brevisa predstavljaju vredne opcije za pokrivanje komplikovanih kožnih defekata na izloženim implantatima.

Ključne reči: spašavanje implantata, peroneus brevis, medialni gastroknemijus, vezani mišićni režnjevi, spoljašnji fiksatori, slobodan režanj, uzimanje grafta, totalna artroplastika kolena.

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