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CASE REPORT
Reconstructive

Borderline Case in Reconstructive Plastic Surgery of the Lower Limb Treated with Bone Drilling and Use of Dermal Regeneration Template

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Summary: The traumatic pathology of the lower limb represents a very complex branch of medicine, which, despite the wide presence of guidelines, aimed at regulating the various therapeutic procedures, and is still greatly influenced by random variables and by the multiple responses to treatments. In this report, we present our experience with a borderline case, where the timing of the trauma and the patient's characteristics made it difficult to use the most recommended procedures in trauma management. *(Plast Reconstr Surg Glob Open 2024; 12:e5694; doi: 10.1097/GOX.0000000000005694; Published online 26 March 2024.)*

Lower limb traumas have posed a complex challenge throughout the history of surgery, witnessing significant advancements in therapeutic strategies from the simple debridement applied during the Great War to the increasingly sophisticated protocols and guidelines implemented today.[1] The management of such traumas remains intricate, often subject to variables, especially those related to patient access timing and characteristics. Notably, patients do not always seek immediate medical attention after sustaining trauma, a factor that significantly influences the treatment course.[2] Additionally, patients may exhibit voluntary habits or preexisting pathologies that worsen over time, further complicating the response to treatment.

In this case report, we delve into a scenario where these variables played a crucial role in shaping our approach to lower limb trauma.

CASE REPORT

A 32-year-old male patient presented to our facility with sequelae from a road injury sustained eight days before admission. Initially, he sought care at his local emergency room, where the wound was treated, antibiotic therapy was initiated, and subluxation of the left hip was reduced. However, upon the 8-day follow-up at the same facility, there was a noted deterioration in the clinical condition, marked by extensive necrosis of the tissues in the left lower limb.

During the history-taking, the patient appeared to be in relatively good health, with a quiet medical history but a regular use of intravenous narcotic substances (heroin) and cigarettes (30 cigarettes per day). Physical examination revealed significant areas of soft necrosis on the lateral aspect of the left thigh and leg (Fig. 1). A culture swab was taken, along with multiple biopsies. The initial step involved a surgical debridement, followed by another culture swab and multiple biopsies, and initiation of empiric antibiotic therapy.

The patient underwent hospitalization and staging with a computed tomography scan of the lower limb, revealing extensive suffusion of subcutaneous tissue, a large continuous solution of the skin plane in the perimalleolar area, and supra/subfascial parafluid collection with multiple air bubbles extending up to the deep planes at the proximal diaphyseal third of the tibia. This resulted in extensive subversion of the muscle bundles of the peroneus longus and extensor digitorum longus. Another culture swab was taken (with no evidence of pathogenic bacterial flora), and angiography showed halving of the caliber of the peroneal artery.

As the soft tissue necrosis progressed, further surgical debridement was performed to eliminate the necrotic tissue, which had extended to almost all the anterior compartment of the leg, compromising the extensors common, tibialis anterior, and flexor hallucis longus muscles. The tibialis anterior's perforators were observed to be impaired during these procedures.

A negative pressure wound therapy (NPWT) dressing (−125 mm Hg) and a leg cast were applied on the 18th

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Fig. 1. Clinical presentation of the injured limb, with extensive areas of soft tissue necrosis at the level of the tibial crest and anterior thigh (not clearly visible in the photographs).

day posttrauma. After an initial rapid centripetal granulation, a regenerative stall was noted after 2 weeks of treatment around the middle third of the tibia and the lower third of the fibula (which appeared without periosteum; Fig. 2). The patient then underwent bone drilling of the tibia, implantation of a dermal regeneration template on the bone, and another round of NPWT dressing.

After 16 days, another healing stall was observed, which was treated with advanced dressings and NPWT. A healthy granulation tissue developed in the whole lesion, excluding the area above the tibial crest. The option of using a pedicled flap (eg, cross leg) was offered, but the patient declined. Tangential osteotomies were then performed to reduce the bony prominence (Fig. 3). After achieving optimal coverage with granulation tissue, split-thickness skin grafting was performed, resulting in the final stage of healing (Fig. 4).

DISCUSSION AND CONCLUSIONS

This case highlights several clinical decision challenges arising from suboptimal treatment conditions, especially in managing a noncompliant patient with proposed reconstructive perspectives. The primary challenge was the patient's refusal to undergo reconstruction procedures involving free or pedicled flaps.

Fig. 2. The lesion after the application of the first round of NPWT.

Fig. 3. The area after tangential osteotomies, with optimal coverage of the defect with healthy granulation tissue.

Another factor that played a role in the management of the case was the timing of access: the patient arrived at our facility 8 days after the trauma. According to the literature, the first surgical debridement and starting of antibiotic therapy must be performed within 24 hours of injury,[1] and loss of substances coverage (both of soft

Fig. 4. Final stage of healing after partial thickness skin graft (to note the flexing attitude of the foot, partially recovered using braces and physiotherapy sessions).

tissues and of open fractures) must be carried out within 7 days of the trauma.[1,3,4] Some authors suggest that a first surgical approach beyond 12 hours after trauma increases the number of debridement procedures, elevates the risk of acute renal failure and septic shock, and correlates with higher mortality rates.[3,4]

The use of free flaps,[5] aside from facing resistance from the patient, was further complicated by the patient's voluntary habits, such as smoking and heroin use (with greater risk of necrosis, wound dehiscence, and reoperation,[6] as well as a greater risk of surgical site infections[7]).

Additionally, the impairment of blood vessels in the lower limb posed challenges, although attempting a terminolateral anastomosis on the posterior tibial artery could have been considered (even if with a low chances of survival).

Even the use of pedicled flaps (for example the cross leg or sural flap) was not possible, as the patient refused these surgical options.

But despite these asperities, we managed to obtain coverage of the loss of substance, with a return of the patient to almost all daily activities (41 points out of 44 with the Berg Balance Scale,[8] and 82 out of 100 with the modified Gait Efficacy Scale[9] at 18 months after the trauma), even if impaired by the loss of the extension capacity of the left foot, damaged by the complete destruction of the leg extensor muscle compartment, but helped by various physiotherapy sessions and using the Codivilla spring.

Critical in achieving defect coverage and addressing bone exposure was the application of a dermal regeneration template directly onto the bone surface.[10] This approach facilitated the optimal formation of granulation tissue, paving the way for subsequent skin grafting.

Obviously, some questions remain as to how using different techniques could have changed the management of the case, such as ankle arthrodesis, and nonsurgical adjuvant treatments such as hyperbaric therapy.

The reported case is not intended to serve as a model for managing lower limb trauma but is useful in understanding the complexity of traumatic pathology in the lower limbs, given the complicated presentation of the case and the patient's refusal to accept reconstructive proposals. It illustrates how reconstruction can be achieved even in the absence of optimal therapeutic options.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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