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Case Report

Limb salvage in a lower extremity with no venous circulation: free muscle sparring latissimus dorsi cross-leg flap - a case report

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ABSTRACT

Lower extremity trauma is prevalent in Mexico, with tibial fractures in about 15% of cases and wounds in 37%. Reconstruction, particularly with severe crush injuries, is challenging due to the risk of complete devascularization. The Gustilo-Anderson classification is essential for evaluating injury severity and vascular risks, and advanced planning is critical for severe cases. A 49-year-old male with systemic hypertension sustained blunt and crush trauma to the left leg. Initially managed with external fixation without fracture reduction, the patient was later referred to our centre. Angio tomography revealed a severe Gustilo-Anderson IIIB tibial fracture with diminished vascular flow and no detectable veins. We performed two interventions, ultimately utilizing a free latissimus dorsi flap to achieve successful coverage. In complex cases with limited recipient vessels, comprehensive diagnostic methods such as angiography and ultrasound are crucial. These tools provide vital information for precise surgical planning and improve patient outcomes.

Keywords: Latissimus dorsi flap, Lower extremity reconstruction

INTRODUCTION

In Mexico, lower extremity trauma is common, with approximately 15% of fractures involving the tibia accompanied by wounds in 37% of the cases.[1,2] The reconstruction of this limb poses one of the most significant challenges in reconstructive surgery, particularly in cases of crush injuries that result in severe fractures and may even lead to complete devascularization of the extremity.[2]

The Gustillo-Anderson classification is a highly valuable tool for categorizing vascular risks and the severity of lower extremity injuries.[3] For low-grade fractures according to this classification, the reconstruction process is well established. However, in severe cases with a high risk of distal devascularization, the availability of reconstructive tools becomes essential.[4] We have previously outlined how incorporating clinical variables and ultrasound findings can help define risks and enhance decision-making, ultimately aiming to improve surgical outcomes.[5]

When performing lower extremity reconstruction, it is crucial to assess the patient's vascular status. In most cases, viable recipient vessels can be identified.[3-5] However, in very rare situations, we may not have secure recipient vessels that allow for coverage with a free flap without risking distal devascularization. For these cases, options such as flow-through free flaps have been proposed.[6] But what if the recipient vessel does not have a safe flow velocity to warrant the use of such a flap? Or

if there is significant incompatibility in diameter between the flap and the recipient vessel? While many authors have reported success with these reconstructions, those of us in the field of microsurgery understand that the success of a technique in one specialized center does not guarantee the same outcomes in another.[5]

To standardize and optimize the microvascular reconstruction plan, we have sought to integrate clinical variables and ultrasound findings to establish objective foundations for planning complex surgical cases. We perform ultrasound studies to assess the flow in recipient vessels, with particular attention to flow velocity. As Dr. JP Hong described, it is ideal for this velocity to exceed 16 cm/s.[7] The objective of this article is to present a complex case of lower extremity reconstruction using limb salvage measures.

CASE REPORT

A 49-year-old male with a history of systemic arterial hypertension presented with blunt and crush trauma to the left leg. He initially received external fixation from orthopedic surgeons at another facility, but the fractures were not reduced. The plan was to proceed with open reduction and fixation with plates once soft tissue coverage and limb salvage were achieved. Multiple debridements were performed, resulting in a wound involving skin, muscle and bone. The patient was referred to our center for coverage. An angiotomography revealed a severe Gustilo-Anderson IIIB fracture of the tibia and fibula. The vascular structures appeared to have diminished flow and no veins were detected in the venous phase.

First surgery

The initial plan, once cultures reported negative, was to perform a flow-through anterolateral thigh flap. However, upon exploring the posterior tibial artery, no suitable veins were found. Consequently, a gastrocnemius flap was raised and placed in situ, with no initial complications.

Orthopaedic definitive treatment ORIF

Four months later, the patient returned to the initial facility, where orthopedic surgeons performed cadaveric bone grafting and fixation with plates and screws. Within four weeks, some of the gastrocnemius flap was lost, leading to exposure of the bone graft. The patient was subsequently referred back to our center for further management.

Second intervention for limb salvage

During this intervention, we conducted exhaustive ultrasound mapping and found no nearby veins. Additionally, potential recipient arteries for anastomosis had very slow blood flow velocities (<16 cm/s). Consequently, we performed a latissimus dorsi muscle-sparing flap with recipient vessels from the posterior tibial artery of the contralateral extremity. After three months, flap release was performed, revealing excessive congestion and loss of the skin grafts over the flap. However, the muscle flap itself survived. Subsequently, new skin grafts were successfully applied.

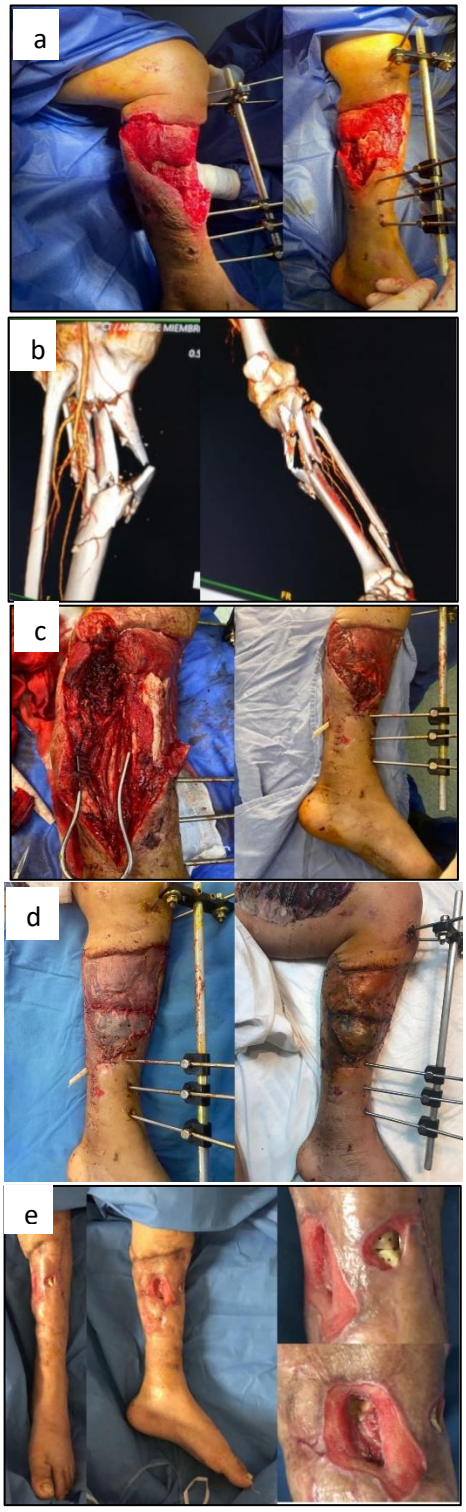

Figure 1: (a-e) First surgery: pedicled gastrocnemius flap and soleus flap with skin grafts.

Figure 2: (f-o) Second surgery with cross-leg free latissimus dorssi flap.

DISCUSSION

Reconstructive options are available when there is vascular risk. For example, an anterolateral thigh flow-through flap, a pedicled cross-leg flap or a latissimus dorsi muscle-sparing free flap, as we performed in this clinical case.[8] Other free flaps, such as a free cross-leg flap, can also be considered, depending on the clinical case to determine the most ideal approach.[9-11] The choice of reconstruction should be individualized for each case, taking into account the surgeon's preferences based on their experience and the capabilities of the facility where the reconstruction will be performed. The advantage of performing a free cross-leg flap is that it allows for a more anatomical and physiological positioning of the joints, potentially resulting in less injury and requiring less rehabilitation. On the other hand, a pedicled cross-leg flap is technically simpler to execute. The decision between these options depends on the resources of the facility where the reconstruction will be performed and the experience of the surgical team.

CONCLUSION

Our conclusion is that in challenging cases where obvious recipient vessels are not available, we recommend using all possible diagnostic methods, including angiography and color duplex ultrasound. For us, ultrasound is particularly valuable as it provides critical information on vessel diameter, vein quality, flow velocity and the distance between the optimal anastomosis site and the injured area. This helps us calculate the pedicle length safely and accurately.

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