

Case Report

Antebrachial microvascular flap for reconstruction of the pelvic limb: case report

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ABSTRACT

Complex defects in the soft tissues of the foot and ankle caused by high-energy trauma, infection, cancer or diabetes require rapid and effective treatment which decreases the risk of infection, bone healing time, hospital stay and number total of surgical approaches. Authors report a clinical case of a 23-year-old female patient who suffers high-energy trauma due to a motorcycle accident which causes exposure of the distal third of the tibia, loss of the tibial joint face, and loss of tissue throughout the region of the malleolus medial of the right pelvic extremity. Tissue transfer to the pelvic limb is performed using left contralateral radial antebrachial free flap as donor area. This case report aims to emphasize the key aspects of the high energy trauma approach by using microvascular flaps, as well as the satisfactory evolution of the patient that directly affects the prognosis for life and function.

Keywords: Donor zone, High energy trauma, Radial artery, Receiving zone, Radial microvascular flap

INTRODUCTION

Complex defects in the soft tissues of the foot and ankle caused by high-energy trauma, infection, cancer or diabetes are common either alone or accompanied by tendons or exposed neurovascular bundles, it has been determined what type of injuries can affect vital functions such as standing position, support of body weight and

biomechanics of walking.¹ Therefore, it is essential to decide on the best strategy of therapeutic approach following the traditional reconstructive ladder that begins with the closure by second intention, followed by the primary closure, together with the dermal substitute derived from the skin graft, the flaps and the transfer of free tissue through microsurgery, although currently said approach is considered limited.² Early treatment of the

lesion reduces the risk of infection, the time of bone healing, the length of hospital stays and the total number of surgical approaches.³ In addition, free flaps can be considered the best reconstructive options for complex soft tissue defects since they are a unit of skin that often includes other tissues that are transferred from their donor site to the defective recipient while maintaining their own circulation, associated with a high success rate and a low complication rate, in addition to high plasticity and rapid adaptation to receptor areas.^{1,2,4, 5}

CASE REPORT

A 23 years old female patient, undergraduate student with history of schizoid psychiatric disorder in treatment with psychotherapy and psychotropic drugs, does not have a chronic degenerative history, without hemodynamic compromise.



Figure 1: Injury with bone exposure and total thickness skin lesion.

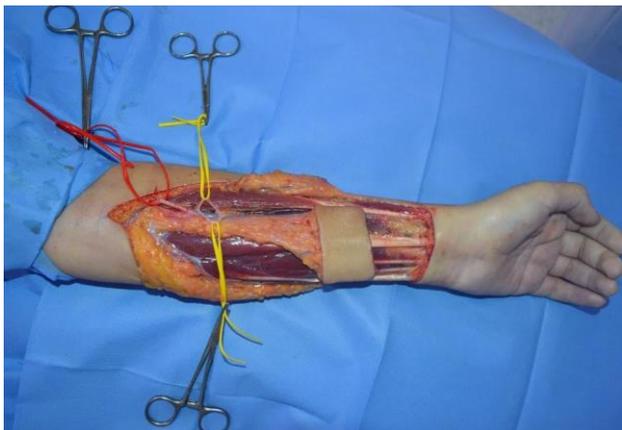


Figure 2: Free radial forearm flap dissected in donor area.

She enters the traumatology service due to a motorcycle accident which causes high-energy traumatic injury, characterized by exposure of the distal third of the tibia, loss of the tibial joint, loss of tissue throughout the region of the medial malleolus of the right pelvic extremity

(Figure 1), is attended at the National Institute of Rehabilitation (INR) where it is diagnosed with fracture exposed in medial malleolus with loss of the medial joint facet and cutaneous defect with a total thickness of 7x4 cm.

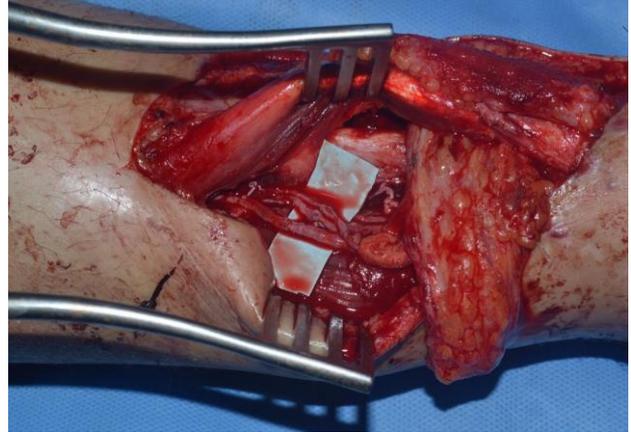


Figure 3: Vascular anastomosis.



Figure 4: Postsurgical receiving area.

She enters the operating room where, after aseptic protocol, surgical lavage, necrosectomy and reduction of the fracture are performed; based on the application of the MESS scale (Mangle extremity severity score) obtaining a score greater than seven, amputation is proposed as part of the boarding protocol, the patient not signing consent for amputation, so the traumatology service requests inter consultation to the microsurgery service to perform the transfer of tissue to pelvic member using as a donor zone the contralateral left radial antebraichial free flap with the objective of preserving the integrity and vitality of the greater amount of tissue and reconstructing the limb (Figure 2), the flap was anastomosed with microsurgical techniques using non-absorbable suture material, synthetic monofilament (nylon 9-0) to the anterior tibial artery (Figure 3), a 0.40 mm skin graft was placed in the donor area, using anticoagulation scheme based on

enoxaparin 1mg/kg/12hours for 7 days and acetylsalicylic acid 100 mg /24hours for one month (Figure 4).

Patient evolution, conscious, active and reactive without cardiopulmonary compromise, skin coverage is found with scar of eutrophic borders, performing movements of dorsiflexion of the foot allowing ambulation, the donor area of the graft is without any complication (Figures 5 and 6).

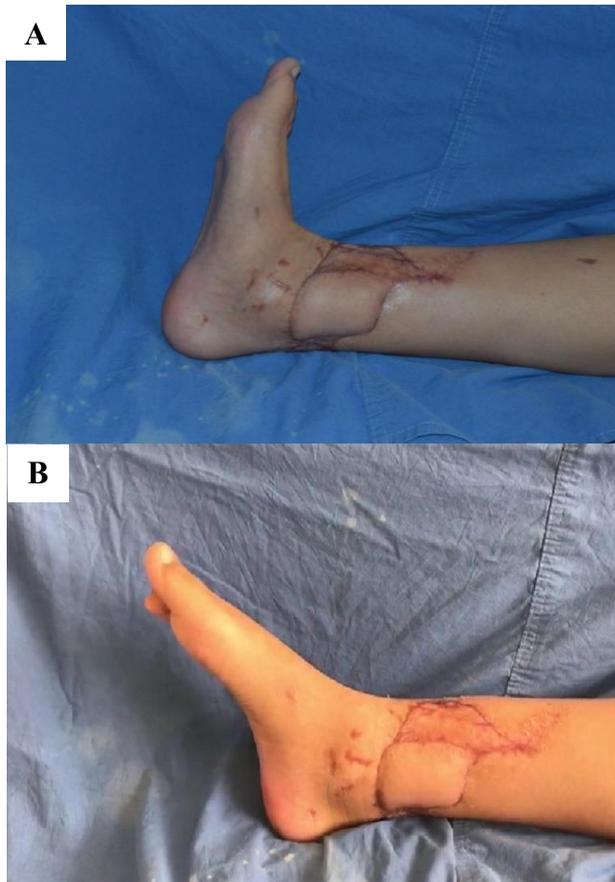


Figure 5: (A): Receiving area with preserved mobility arcs (flexion), (B): Receiving area with preserved mobility arcs (extension).

This case report aims to emphasize the key aspects of the high energy trauma approach through the use of microvascular flaps, as well as the satisfactory patient evolution that directly affects the prognosis for life and function.

Epidemiology

Motorcycle accidents have a higher mortality rate compared to motor vehicle accidents, since they are eight times more likely to suffer injuries compared to car occupants or other accidents, in which injuries of the lower limb predominate with more than 300,000 injuries per year, 3 being injuries to the head, chest and abdomen that represent the highest mortality.⁶

Flaps

The most commonly used flaps for the reconstruction of the lower limb are the muscles, rectus abdominis, dorsal, anterolateral thigh, deep inferior epigastric, radial forearm, among others being the anterolateral free thigh flap the most frequent (19.6%), followed by the free latissimus dorsal flap (11.9%).⁷

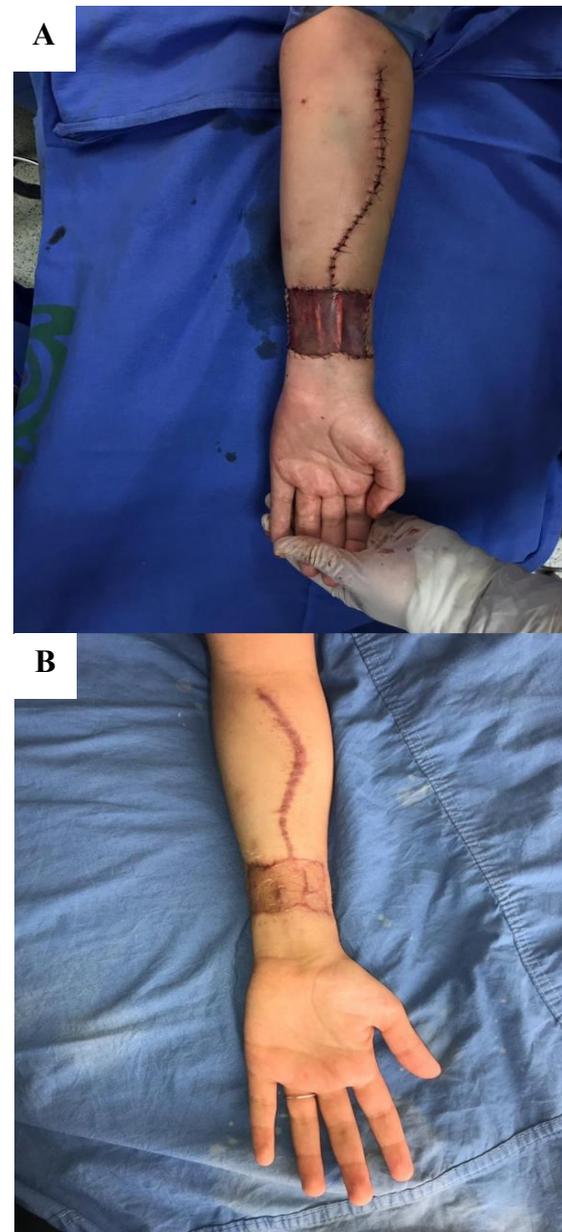


Figure 6: Donor area with scarring without complications and preserved mobility. (A): End of surgery, (B): 1 month.

In this patient, the radial forearm free flap was used since it has more than one characteristics for the reconstruction of the distal third of the pelvic limb, which are: thin flap, presents little morbidity of the donor area, anatomy of the constant vascular pedicle, the caliber of the large vessels, can be configured to be a sensitive flap.⁸

Its anatomy includes forearm skin, underlying adipose tissue, sensory cutaneous nerves, superficial and deep veins, and part of the deep fascia; its use has two main foundations, the first, its original, thin and flexible vascularization with high-caliber vessels that provides a rich anastomotic network, and secondly, its rich vascular network allows the reconstruction of pluritissular defects, including large defects of the skin. The vascularized bone segment, the tendons (brachioradialis, flexor carpus radialis and palmaris longus) and the nerves (the lateral and medial antebrachial cutaneous nerves) can be elevated in the flap, in addition to which their collection can be done quickly and simultaneously for the surgery.⁹⁻¹¹ To perform the procedure the patient must have adequate recipient vessels in the lower extremities and be able to withstand prolonged time under anesthesia; age,

gender, BMI and flap type did not show a correlation with walking ability.¹² Diabetic patients, with advanced age, poor scarring and peripheral neurovascular disease potentially increase the risk of surgery.⁷

Donating zone

The reconstruction of the donor area can be with local flaps or the use of skin graft, while the primary closure is only possible with a cutaneous flap of less than 2 to 3 cm. It is possible to perform skin grafts of partial thickness, but they do not always guarantee the best aesthetic appearance that is why to cover the donor area, it is usually preferable to use a full thickness graft with the radial flexor tendon covering of the carpus with muscle fibers.^{13,14}

Table 1: Complications of the flap at the reception site.

Complications	Causes
Complete failure of the flap	Failure of microvascular anastomosis or potential instability of recipient vessels, late reconstructions and post-traumatic thrombophilia
Partial flap failure	Part of the flap is lost due to thrombosis partial necrosis, acute infection or wound dehiscence
Survival without results	Survives, but fails to fully achieve the desired goal
Dissatisfied patients	All the objectives are achieved. all the surgical objectives are achieved, but the patient is not satisfied, due to poor functionality or aesthetics

Table 2: Complications of the donor site.

Type of complications	Most frequent complications
Functional	Edema in hand
	Reduce wrist movement
	Reduce wrist strength
	Persistent rigidity of the wrist
	Injury with or without nerve dysesthesia (radial 70.6%, medium and ulnar 29.4%)
	Upper limb motor failure
	Cold intolerance
	Change in arm temperature
Aesthetics	Partial loss of the graft with flexor forearm tendon exposure
	Scar infection
	Tension in the skin of the surgery site
	Hypertrophic scar formation
	Healing problems due to movement of the tendons

Surgical technique

Microsurgery is associated with prolonged surgical times ranging from 5 to 20 hours, subjecting patients to prolonged anesthesia with an increased risk of deep vein thrombosis, pulmonary embolism and myocardial infarction.² As a pre-operative feasibility study only, Allen's T-test is used, it consists of performing an ischemia of the extremity to be studied and thus evaluating the perfusion of the hand by its different tributaries in a separate way in addition to the donor area,

it must be well debrided, clean and with well-defined margins of the skin, with adequate vascular flow.^{4,5} The flap is marked on the skin of the forearm and a tourniquet is placed on the arm, the de-epithelialization should extend around the planned proximal end.¹¹ Care should be taken to include the cephalic vein and the cutaneous nerve before lateral brachial with flap elevation and to identify and preserve the superficial branch of the radial sensory nerve below the flap. The perforating cutaneous vessels of the radial artery must be ligated, the dissection of the concomitant proximal veins proceeds until the 2

veins join in 1, this added dissection makes it possible for a large caliber vein to drain both venous systems, the tourniquet is removed to restore the perfusion and be able to perform hemostasis, at this moment the flap is joined only by its proximal radial vascular bundle and proximal superficial veins, in the donor site the reconstruction of the radial artery is not indicated.^{9,11,14}

Postsurgical

Elevation of the limb represents a critical component of postoperative care in the reconstruction of the lower extremities, after which the viability of the flap is evaluated by clinical signs including skin color, turgor and capillary refill, in addition to the controls of pulse per hour and Doppler ultrasound.^{1,11} Physiotherapy is recommended from the first postoperative week, the removal of dressings and sutures 10 days.⁹ A high rate of return to the previous function level was demonstrated, but late revascularization, closed traumatism and high-speed penetrating trauma are associated with higher rates of amputation.³

DISCUSSION

The best treatment for traumatic injuries should be chosen as quickly as possible, to avoid possible complications (Tables 1 and 2), safeguarding in the first instance the life followed by the function and finally the aesthetic, currently and especially in the distal third of the pelvic limb it is not advisable use of the reconstructive ladder as a reconstruction algorithm, since all the objectives of reconstruction, when there is substantial loss of tissue secondary to high-energy trauma, can only be achieved through tissue transfer with microsurgical techniques, the choice of amputation should be always be the last therapeutic option.^{2,8}

CONCLUSION

The free radial brachial flap is an advisable option since its correct use ensures the function and aesthetics of the affected area, it is easy to adapt and has plasticity, resolving the injuries permanently. The surgical experience in the use of flaps is essential for a successful surgery.

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