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OPEN ACCESS

Annals of Critical Care and Emergency Medicine

Case Report

Migue DLPM, et al. Ann Crit Care Emerg Med 2: 104.
DOI: 10.29011/ACCEM-104.000104

Combined Flap Phalloplasty for Penile Reconstruction in a Patient with a Single Upper Limb: Pedicled Anterolateral Thigh and Free Radial Forearm Flap

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Citation: Migue DLPM, Fernando REJ, Fernando RRJ, Jessica RR, Fernando FC, et al. (2019) Combined Flap Phalloplasty for Penile Reconstruction in a Patient with a Single Upper Limb: Pedicled Anterolateral Thigh and Free Radial Forearm Flap. Ann Crit Care Emerg Med 2: 104. DOI: 10.29011/ACCEM-104.000104

Received Date: 30 November, 2019; **Accepted Date:** 17 December, 2019; **Published Date:** 24 December, 2019

Abstract

Introduction: Electrical burns in genital area although presenting low incidence, can be devastating and even fatal; once solved the acute stage reconstruction is implemented according to gender, severity and affected areas. Penile reconstruction is one of the most defying procedures for reconstructive surgeons.

Case report: A 21-year-old male presents an electrical burn involving abdomen, upper limbs and genitals. The depth of the injuries caused necrosis of right forearm and penis, both requiring amputation. The use of conventional flaps for phalloplasty was restricted by the burn on donor areas; therefore, reconstruction with combined flaps was proposed: pedicled ALT (external coverage) and free radial forearm flap (neourethra), in a single procedure.

Results: Phalloplasty was satisfactory with adequate aesthetic and functional results, fulfilling the objectives of penile reconstruction.

Conclusion: Combination of both flaps can be an excellent option of reconstruction in patients with a single upper limb, decreasing morbidity of the donor area.

Keywords: Anterolateral Pedicle Flap and Free Radial Flap; Phalloplasty

Introduction

Burns in genital region present in 1.3-2.8% overall, being fire (24-77%), scalds (15-64%), and electrical injuries (<1%) the most important etiological agents [1-3]. Electrical burns may induce different tissue damage or even fatal. Those which affect genital area are predominant males; because of anatomical disposition, impairing sexual function and miction [4-6]. Total penile reconstruction has evolved over time, in patients with congenital agenesis, trauma, self-mutilation (Klingsor syndrome) and oncological surgery. The reconstruction is planned according to defect size and location; ranging from easiest options such as scar release or skin grafting, to pedicled or microvascular flaps for the most complex such as total reconstruction [7,8].

Phalloplasty must accomplish the following reconstruction goals: minimal morbidity of the donor area, aesthetically acceptable appearance, one surgical procedure, adequate sexual function and miction capability [9]. Currently, the free radial forearm flap is considered by many surgeons the "gold standard" for phalloplasty; because all the advantages it offers. The true challenge for the

plastic surgeon appears when flap donor zones are limited by local or regional injuries and personal risk factors such as single-handed patients [10,11]. Total penile reconstruction is reported in a patient with a single upper limb due to electrical burn, using a combination of flaps: Pedicled Anterolateral Thigh Flap (ALT) for external coverage and free radial forearm flap for the neourethra; with acceptable aesthetic and functional outcomes.

Case Report

A 21-year-old male presents at emergency department, after suffering high voltage electrical burn (> 10,000V) involving 20% of total body surface (abdomen, upper limbs, perineum and genitals), 6% were third degree and 14% second degree. He developed necrosis of the right forearm and penis; requiring supraepicondyleal amputation, phallectomy and cystostomy (Figure 1).

Figure 1: Total necrosis of the penis and upper limb requiring amputation and cystostomy.

Due to the severity of the burn, the patient was admitted in the intensive care unit for 20 days; he required split thickness skin grafts in burned skin. Once solved the acute stage, he was managed as an outpatient by our service and psychological assistance. Two months after the accident, penile reconstruction was proposed; but since right upper limb was missing, measures were taken to lower donor site morbidity of the forearm by combining two flaps; following the tube-in-a-tube principle, using a pedicled anterolateral thigh flap for the outer layer and free radial forearm flap for the inner layer (neourethra).

Surgical Technique

Preoperative marking was performed for the anterolateral thigh flap, at the midpoint of a line from anterior superior iliac spine to the lateral border of the patella, the perforators were located with the assistance of Doppler (7.5 MHz); a skin paddle of 16 x 20 cm was drawn around it. Neourethra was designed by marking the radial forearm flap from the anterior aspect of the elbow to the scaphoid's tuberculum, drawing a 6 x 10 cm skin paddle in the middle third. Surgical procedure was performed under general anesthesia, starting with the dissection of the radial forearm flap in the subfascial plane; until the septocutaneous perforators were located between the pronator teres and brachioradialis, preserving the radial nerve. Skin paddle was tubulized around a Foley's catheter obtaining the shape of the neourethra, afterwards vessel anastomoses were made with interrupted suture (radial artery and cephalic vein to superficial circumflex iliac artery and femoral vein) using 9-0 nylon (Figure 2).

Figure 2: Radial Forearm Flap tubulizing for the neourethra around a foley catheter.

Anterolateral thigh flap was dissected in a suprafascial plane, including cutaneous femoral nerve to provide sensibility. Once the perforator vessels were identified in an intramuscular course through lateral vastus, dissection of the pedicle was carried to its origins (Figure 3). This flap was used to offer coverage to the previously tubulized radial forearm flap in the groin area, and epineural neurorrhaphy to ilioinguinal nerve was performed using 8-0 nylon, in order to reestablish erogenous sensibility (Figure 4).

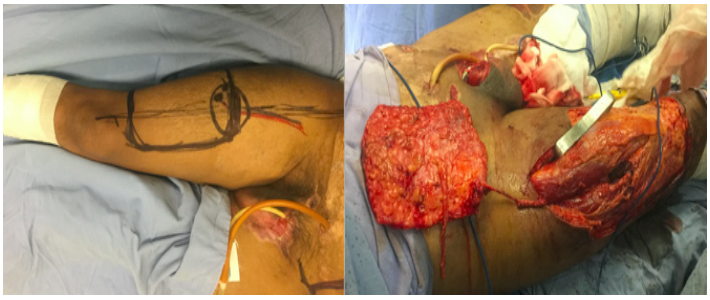

Figure 3: Pedicled ALT dissection reaching the groin area.

Figure 4: Penile Reconstruction with two flaps: pedicled ALT and free radial forearm flap.

Results

Healing of the donor site was observed after 21 days by means of split thickness skin grafts, Foley's catheter was removed 2 months after surgical procedure enabling miction through the neourethra; movements and sensibility of the upper limb was preserved (Figure 5). After 6 months of follow-up no complications were present (stenosis or fistula), the outer layer of the flap demonstrated sensibility and satisfaction of the patient. An erection enhancing prosthesis will be implemented in the future for improving patient's sexual function.

Figure 5: After 6 months of follow up excellent aesthetical appearance and miction.

Discussion

Advances in microsurgical techniques have allowed to reach countless possibilities in phalloplasty, being the free radial forearm flap described by Gao in 1984, the gold standard because presents a good degree of aesthetic and psychological impact. On the other hand, surgeons prefer it for its advantages: simple access, a single procedure, sensibility when brachial cutaneous nerve is preserved, thin coverage, constant anatomy and long pedicle with large-diameter vessels. Pathologies that affect the forearm encourage the plastic surgeon to look for reconstruction alternatives or modifications of this flap [12,13].

Regional flaps have been used throughout history without achieving similar aesthetic and functional outcomes like the radial forearm flap, for example: rectus abdominis, gracilis and groin flaps. An innovation is the use of a pedicled anterolateral thigh flap that follows the principle "tube in a tube", its thickness and size make it unfit for reconstruction [14]. When the forearm is unavailable other microsurgical options must be applied such as: deltoid, scapular, osteocutaneous peroneus and anterolateral thigh flaps. Each of these flaps has their respective advantages and disadvantages; including the experience of the surgeon as well as long term outcomes [15-17].

Literature reports less than 4% complication rates in penile reconstruction using the free radial forearm flap, including: urinary fistulae, stenosis, infection, donor site morbidity and total or partial necrosis [18]. Prosthesis complementation allows the patient to reestablish reproductive functions, achieving excellent interpersonal relationship [19-21].

Conclusions

Total penile reconstruction in patients with a single upper limb represents a real challenge for reconstructive surgeons, due to the restriction of donor areas; searching for alternatives that fulfill the reconstructive principles. The use of a large forearm flap might leave serious disabling motor and sensitive sequelae. Therefore, a combination of a small radial forearm flap as a neourethra and an anterolateral thigh flap as an external coverage is proposed, achieving all the principles in reconstruction, patient satisfaction and without functional limitation of the remaining upper limb.

The authors have no financial interest to declare in relation to the content of this article. The Article Processing Charge was paid for by the authors.

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