



# Deep burn of hand and forearm treated by abdominal wall flap

## A case report



*Ann. Ital. Chir.*

Published online (EP) 24 June 2015

pii: S2239253X1502397X

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### Deep burn of hand and forearm treated by abdominal wall flap. A case report

*AIM: Post-traumatic hand and forearm defects always represent a challenge for reconstructive surgeons, especially when multiple structures are involved, because of a high rate of amputation.*

*MATERIAL OF STUDY: A 21 years old woman arrived to the E.R. with a complex crush-burn trauma of the upper limb caused by an accident with an industrial ironing machine, resulting in a ulnar bone fracture, ulnar artery laceration and a wide burn of the dorsum of the right forearm.*

*RESULT: We achieved to TAL limb salvage with coverage of the "nobles" structures of the forearm.*

*DISCUSSION AND CONCLUSIONS: Different reconstructive methods have been used over time to treat these defects focusing the attention on both functional and cosmetic aspects.*

*The abdominal pedicle flap was one of the achiest reconstructive methods for hand and forearm defects. In an era in which microsurgery takes the lion's share, some basic procedure may be helpful, especially in certain cases.*

*In this study the authors reported a case of a young woman with a complex trauma of the right arm resulting from an occupational accident.*

KEY WORDS: Abdominal Flap, Hand Forearm burn Hand reconstruction

### Introduction

The reconstruction of skin defects of the hand and forearm aims at restoring their function with a good aesthetic appearance. Several surgical techniques based on

local flaps have been developed to resurface hand and forearm defects<sup>1</sup>. Several years ago, there was a declining in the use of abdominal flap for the reconstruction of soft tissue defects of the upper limbs due to marked bulkiness of the flap, frequently treated by secondary debulking. On the other hand, free flaps are a valid alternative option in these cases since they offer flexibility in size, shape, and positioning and without increasing donor site morbidity to the already injured hand<sup>2</sup>.

The authors report the case of a deep burn involving the distal third of the right forearm of a young woman, arrived to the E.R. and transferred to the Department of Plastic, Reconstructive and Aesthetic Surgery of Perugia in February 2012, after an occupational accident. After bone and vascular stabilization, the soft tissue loss of substance was repaired with an abdominal wall flap.

*Pervenuto In Redazione Marzo 2015. Accettato per la pubblicazione Maggio 2015*

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## Case Report

In February 2012 a 21 years old woman arrived at the Plastic Surgery Department with a complex crush-burn trauma of the upper limb caused by an accident with an industrial ironing machine. She remained 20 minutes with her arm closed into the ironing machine.

She arrived to the emergency with a distal ulnar diaphysis fracture and ulnar artery laceration together with a large 3rd degree burn of the hand dorsum (Fig. 1). Firstly was stabilized the fracture with external fixators and artery repaired, using a contralateral saphenous vein graft. It was also necessary to perform a fasciotomy in the volar side of the forearm. During the following days we medicated daily both the site of fasciotomy and the burn on the dorsum that progressively demarcates. Contextually, we also started a daily surgical debridement to remove the demarcated necrotic tissue, especially on the burn site (Fig. 2).



Fig. 1: Extensive burn involving the dorsum of the right hand and forearm.

Once we were able to remove all the necrotic tissue we noted that the burn injury was deeper in the central zone, resulting in a tendon exposure, and more superficial in the periphery; since that, we decided to proceed with a partial thick skin graft to cover the superficial part of the burn and the fasciotomy site. The tendon exposure was then covered with dermal substitute (Hyalomatrix® PA) that was colonized by *Pseudomonas Aeruginosa* after few days (Fig. 3). The patient underwent 10 days of Ceftriaxone 1 g X 2/daily. Once the infection resolved, we opted for the use of a fasciocutaneous flap.

Unfortunately, the clinical condition of the patients did not allow to perform a free microvascular flap and we had to move our reconstruction program toward an abdominal flap.

Once the plastic pattern was laid out on the abdominal wall, the skin was incised with a scalpel down to the abdominal aponeurosis and the flap was then raised back



Fig. 3: The dermal substitute (Hyalomatrix® PA) placed over the deeper zone to cover tendon exposure was then colonized by *Pseudomonas Aeruginosa* after few days. Please note the peripheral area where the skin graft fully attached.



Fig. 2: Aspect of the wound after multiple debridements. Please note the extensor tendons exposure.



Fig. 4: The wound was finally covered utilising an "ancient" abdominal skin flap.



Fig. 5: Outcome after 30 days from the operation.



Fig. 6: Aspect after 2 years. The patient refused any further surgical treatment to improve the aesthetic result.

with a pedicle from the right lower abdominal region based on the superficial inferior epigastric vessels. Bleeding was carefully controlled. The flap was not thinned until the donor area was completely closed and until the flap was ready to be placed onto the recipient site (Fig. 4). This prevents desiccation of the final thinned flap and protects the subdermal plexus.

The donor area was closed by undermining in the abdominal aponeurosis and advancing the edges. The dermis was tacked down to the deep fascia after maximum advancement with multiple 2-0 Vicryl® sutures and the cutaneous plane was then closed with 3-0 interrupt Nylon sutures. If complete closure is not possible with this advancement, then a split thickness skin graft is sutured to the edges of the donor area and carried up onto the stem of the pedicle and placed with a tie-over dressing.

After 28 days the flap was healing perfectly to its recipient site and it was ready for division at the level of the pedicle origin (Fig. 5). The donor site was closed by primary intention.



Fig. 7: Aspect of the abdominal donor area after 2 years from the operation.

The functional outcome after 6 months after the trauma is good, and the aesthetic result is acceptable (Figs. 6, 7). The patient refused any further treatment to improve the aspect of the flap.

## Discussion

Soft tissue reconstruction of the hand and forearm remains a challenge for plastic and reconstructive surgeons. Dorsal skin defects on the dorsum of the hand as well as defects of the forearm may be covered by local, distant, or free flaps, depending on the general condition of the patient and the local condition of the wound and donor site<sup>1,2,3</sup>. Several surgical techniques use local flaps to resurface dorsal skin defects of the hand.

Complex injuries of the upper limbs still remain a challenge for the surgeon and, unfortunately, the amputation rate is up to 60%. A key point in these cases is certainly represented by the reduction in the overall time of ischemia through an early revascularization<sup>4,5</sup>.

Local flaps are preferable to distant flaps but are limited for use by area requirements, rotation limitations, and blood supply which may be compromised by the original trauma.

In general, distant pedicle flaps are indicated for coverage of exposed bones, joints, tendons and nerves if these vital parts are to be retained and recover their maximal function in the restoration of the essential ingredients of pinch and grasp. Flaps may also aid recovery of motor or sensory nerve function by replacing firm constricting scar tissue with soft, well-vascularized tissue.

It is very important that the donor flap be of the exact same size as the defect to be covered on the dorsum of the hand. It is important because if the flap is not the exact same size and shape, there may be some oblique traction applied to the flap which may impede the arterial supply and venous return to the thinned abdominal pedicle flap.

## Conclusions

Hand coverage in microsurgical urgency must be decided carefully considering various parameters such as the risk of infection, the lengthening of the operating time, patient's surgical stress and the probability of getting a concrete result. Coverage and reconstruction of soft tissue after complex crush trauma like our case is weighed down with complications. The early closure of these areas may be dangerous for the high infective risk. For this reason it is not always possible use a free flap in urgency, especially in the hand's area. Free flaps are alternative option to reconstruct soft tissue defects of the hand and forearm; they offer flexibility in size, shape, and positioning and do not add donor site morbidity to the injured hand. Free flap coverage is a time-consuming procedure, requires a more difficult technique and complicated postoperative care<sup>4,5</sup>.

The abdominal flap is safe, easy to harvest, gives a good skin that match the quality of skin of the dorsum of the hand and forearm, has no donor site morbidity of local flaps based on the forearm so we firmly think that this procedure, although in decline, represent a valid arm "salvage" reconstructive procedure in selected patients<sup>5</sup>.

## Riassunto

Le ustioni della mano sono sempre state uno dei maggiori problemi per i chirurghi ricostruttori a causa della sua particolare anatomia e delle sue complesse funzioni. Una guarigione spontanea di lesioni profonde in queste aree può portare a risultati catastrofici: una copertura

cutanea adeguata è fondamentale per tutte le funzioni. La copertura precoce dei tessuti molli residuanti è fondamentale al fine di evitare la formazione di contratture disabilitanti che con il tempo potrebbero determinare anchilosi articolare e retrazione tendinea. Escissione precoce e innesti cutanei rappresentano la terapia standard per le ustioni della mano; in alcuni casi quest'approccio è inapplicabile e, pertanto, il ricorso ai lembi diventa inevitabile. In questo articolo riportiamo un caso di ustione complessa del dorso della mano trattata in prima istanza con innesti cutanei e, quindi, con un lembo addominale, riuscendo ad ottenere un'ottima copertura ed un buon recupero delle funzioni.

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