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Early versus delayed escharectomy and skin grafting of the deeply burned hands.

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Summary

Early versus delayed escharectomy and skin grafting of the deeply burned hands.

Fifty-two patients were admitted to the Burn Unit of Mansoura University Hospital with burn injuries involving one or both hands. 22 patients required skin grafts to one or both hands resulting in 32 operated hands. Burns diagnosed on admission as full-thickness were generally treated by excision and grafting in 3 to 5 days post burn. Split-skin graft was harvested from a non-burned area, applied on the wound bed, and secured with staples. Surgery was delayed beyond 14th day if the diagnosis full-thickness depth of the burn was uncertain, to allow time for the wound to demarcate or when the general condition of the patient can not enable him to withstand the surgery. We applied the same post operative topic treatment and rehabilitation protocol in all patients. Fourteen patients of the 22 patients examined (63.6%) were treated early while 8 (36.4%) were cured conservatively and underwent surgery after the second week. Only 2 of the early treated cases (14%) needed late secondary correction for severe scars whereas 3 (37%), late treated patients, needed secondary surgery. The total amount of readmitted patients was therefore 5/22 (22, 7%). We confirm the importance of performing early surgery of deep burns of the hands, whenever possible, in order to achieve best results.

Key words: Escharectomy; Skin grafting; Deeply burned hands.

INTRODUCTION

Hands participate in everyday human's activities and they are the most vulnerable parts of a human body¹. Hands are often injured trying to cover other parts of a body from the fire or other destructive factors. As different authors stated the hand and digit injuries compromise 30-75% of industrial injuries². Hand burns compromise 6% of all hand injuries. Human loses up to 54% of function when he loses his hand function³. Treatment of the burned hand is a complex surgical challenge. Hands are frequently affected by serious and deep lesions, more often located on the dorsum⁴. Due to the functional, social and relational role of the hands, a rapid satisfactory functional recovery and a good aesthetic outcome are crucial for patients affected by deep burn lesions⁵. Traditional surgical approaches are early escharectomy and skin grafting within the first days after burn, or as an alternative an initial topical treatment followed by late eschare excision and skin grafting. The surgical strategy

was dedicated by patient's general conditions and overall extent of burn⁶. In spite of all precautions, a high number of patients require one or more secondary surgical corrections after few months for impairing and unaesthetic scars⁷. Therefore, burn treatment surgical protocols should be optimized and constantly updated in order to reduce patient suffering, surgeon's work and public costs connected to re-admission⁸. For this purpose, we retrospectively reviewed the patients with deep burn of the hands treated at the Burn Unit in Mansoura University Hospital over 2 years, by assessing functional and aesthetic outcomes in relation to surgical timing and evaluating how many of them required secondary surgical revision.

PATIENTS AND METHODS

From January 2004 to July 2006, 52 patients were admitted to the Burn Center of

Table 1
Age and sex distribution among patients with burned hands

	<20 years	20-40 years	>60 years	Total
Male	6	17	7	30
Female	3	14	5	22
Total	9 (17, 3%)	31 (59, 6%)	12 (23, 1%)	52

Table 2
Average of TBSA in early and late surgically treated patients

	No. of Patients	Average TBSA	Average TBSA3
Early surgery	14(63.6%)	22%	9%
Late surgery	8(36.4%)	37%	22%

Mansoura University Hospital with burn injuries involving one or both hands. 22 patients required skin grafts to one or both hands resulting in 32 operated hands (Table 1, 2). Patients who sustained a thermal injury of the hand were treated as follow: on admission, the depth and surface area of the burned hand were determined (HSA), as well as the depth and extent of the total body surface area burn (TBSA). Circumferential deep burns of the hand or digits were treated by escharotomy. Silver sulfadiazine cream was applied as a local antimicrobial treatment and dressings were changed daily. The hands were nursed in splints in a functional position and physical therapy was started as soon as possible. Burns diagnosed on admission as full-thickness were generally treated by excision and grafting in 3 to 5 days post burn preserving, when possible, the superficial venous system and the paratenon. Removal of the eschar was performed by either tangential or facial excision. Split-skin graft was harvested from a non-burned area, applied on the wound bed, and secured with staples. Surgery was delayed beyond 14th day if the diagnosis full-thickness depth of the burn was uncertain, to allow time for the wound to demarcate or when the general condition of the patient can not enable him to withstand the surgery.

Parameters recorded for each patient included age on admission, TBSA burn, full thickness TBSA burn (TBSA3), total burned hand surface area (HSA), full thickness HSA burn (HSA3), postburn day of operation, survival of the grafted skin (graft take, estimated 5±7 days postsurgery) and the need for reconstructive surgery after a postoperative follow up period of 6 months.

Intensive pre- and post-operative rehabilitation was set up in all cases. At night, the wrist and the finger joints were splinted in the anti claw functional position. Physical therapy, including active and passive exercises and occupational therapy, were performed under physiotherapist supervision and occupational scheme. Compression gloves were used at 15th postoperative day and were applied for 6 months. During admission, psychological support was offered to all patients.

RESULTS

The results are presented in Table 3. Fourteen patients of the 22 patients examined (63.6%) were treated early while 8 (36.4%) were cured conservatively and underwent surgery after the second week. Only 2 of the early treated cases (14%) need-

ed late secondary correction for severe scars whereas 3 (37%), late treated patients, needed secondary surgery. The total amount of readmitted patients was therefore 5/22 (22, 7%). Table 4 shows the type of secondary deformities, Table 5 the surgery performed.

DISCUSSION

In this series of 22 patients with deep burns of the hand, we operated 14 of them during the first 3 to 5 days after the admission while 8 of them were operated after two weeks. Our policy in the management of burned hands has always been oriented towards early surgical treatment. Our results, according with the literature, confirm that the best functional and aesthetic results are obtained with early surgery. The fact we valued functional and aesthetic results by clinically assessing joints and hand anatomic areas and furthermore considered the patient's need for functional and aesthetic improvement.

After the admission of these cases, identification of the depth of burn injury is essential. The estimation can be very difficult⁴. As a matter of fact, while the identification of full thickness lesions is normally easy, the judg-



Figure 1
A male patient aged 40 years sustain deep burns of the face both upper limbs and both feet with an average TBSA is 25%.

Figure 1a
shows preoperative view of burned right hand.

Figure 1b
intraoperative view after tangential excision of burn wound preserving viable structures.

Figure 1c
shows 1 week postoperative view.

Figure 1d
shows 6 months postoperative view.

Table 3
Patient's distribution according to time of surgery and secondary procedures

		No need for 2ry revision surgery	Secondary surgery	Total
Early treatment	No. of patients	12	2 (14%)	14 (63, 6%)
	No. of burned hands	14	5	19
Late treatment	No. of patients	5	3 (37%)	8 (36, 4%)
	No. of burned hands	7	6	13
Total	No. of patients	17	5 (22%)	22
	No. of burned hands	21	11	32

Table 4
Postoperative unfavorable outcomes

Complication	Number of patients
Keloid	4
Syndactyly	2
Flexion deformity	2
Boutonniere deformity	1
Joint stiffness	2

Table 5
The types of secondary procedures performed

Main secondary procedures	Number of patients
Z-plasty	4
Steroid infiltration	4
Scar excision + skin grafting	2
Arthrodesis	1

ment between superficial and deep dermal burns, in the first days after injury, demands more experience since the depth's evolution is often unpredictable⁶.

Although bedside clinical evaluation remains the most widespread method for depth diagnosis, it is accurate only about two thirds of the time.

Thermography, though less frequently employed, is about 90% accurate.

Indocyanine green (ICG) video angiography is unique in that it offers a dynamic portrait of vessel patency that fluctuates in real time.

Laser Doppler imaging (LDI) provides a static rather than dynamic perfusion map, but it retains other advantages over ICG video angiography. It is not only less invasive and faster but also more accurate, with validity as high as 99%⁷.

However, the timing of surgery is less clear. Optimally, if the condition of the patient allows, excision and grafting of the upper limb burn wound needs to begin as soon as the

depth of the wound is clear, usually by the 2nd or 3rd day postburn.

Wounds that are permitted to heal by secondary intention and take greater than two weeks to heal have a far greater incidence of abnormal (hypertrophic and keloid) scar formation. In some cases (hot metal, hot tar) where the deep partial thickness or full thickness nature of the injury is obvious, surgery may be undertaken immediately⁸.

Supporters of early debridement and skin grafting believe the benefits are also associated with a shorter, less costly hospital admission⁹.

If initial management is to monitor the burn wound, vigorous hand therapy must continue during the observational phase. With debridement within 72 hours where possible and a systematic team approach, 90% of patients with deep partial thickness or full thickness burns achieved normal post-injury function¹⁰. The use of dermal substitutes (i.e. engineered skin) can be a valid choice when delayed sur-

gery is an unavoidable choice.

Some Authors advocate the use of alloderm and ultrathin split thickness skin graft for coverage of deep and partial thickness burn wounds. With AlloDerm, only ultra-thin epithelial autografts are required from the patient. The clinical observations of "take" were confirmed with histological evaluation of the biopsies, which exhibited fibroblast cells infiltration, neovascularization and neopithelization without evidence of rejection¹¹.

In some series, 90% of patients with burns involving bone, joint or extensor mechanism were eventually able to perform activities of independent daily living. It is proposed that surgery within 2 weeks is associated with superior function and fewer reconstructive procedures¹².

Excision of deep partial thickness areas may be hazardous to promote survival if the total burn area is so large that any spontaneous healing should be allowed even with scarring. Some surgeons consider preservation of all residual, viable dermal elements is of critical importance for late surgery following eschar separation. Provided intensive hand therapy is administered, functional results at one year have been shown to be similar to series where early excision is done¹³.

Long term follow-up and re-operation rate for reconstructive problems is also an important consideration in determining an optimum time to operate. A ten-year follow-up study of deep hand burns found burns taking greater than 21 days to heal had a 100% need for subsequent reconstructive surgery. In contrast only 26% of patients initially operated on between 5 and 10 days required later reconstruction¹⁴.

The burn wound should be excised by the technique of tangential excision with preservation of the maximum amount of viable tissue¹⁵.

In deep partial thickness burns, the skin graft should be laid on the intact vascular deep dermis once adequate hemostasis has been achieved. Full thickness burns are treated with debridement of nonviable tissue preserving the maximum amount of dorsal veins and paratenon wherever possible. In such burns tangential excision may not be practical and sharp dissection can be used. In the arm and forearm, fascial excision may be indicated if the underlying fat is non-viable or blood loss is a limiting factor. Excision of either type can be done with or without the use of a tourniquet depending on the choice of the surgeon and position of the burn¹⁶.

When presented with a severely burned hand with necrotic digits, it may be preferable to allow auto-amputation of the affected parts rather than early surgical removal.

