SURGICAL MANAGEMENT OF THE BURNED HAND:
AN UPDATE AND REVIEW OF THE LITERATURE

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SUMMARY. In wartime or following mass accidental casualties characterized by large numbers of burn victims, and whenever hand burns are associated with a life-threatening extensive burn or other injury, hand burns are often neglected. Although it is generally accepted that the management of critical burn patients should be primarily directed towards the patients' survival, burned hands should also be regarded seriously since the majority of cases of post-burn morbidity, as well as the most devastating sequelae of thermal injuries, are related to hand burns. It is difficult to adhere to strict management protocols, except in isolated, relatively minor hand burns, and there is an urgent need to formulate easily applicable guidelines and develop simple treatment modalities and dressings that are practical to use in most situations, without compromising the final outcome. The "Moist Exposed Burn Therapy" (MEBT) principle seems to be very promising in this regard. It offers the advantages of a moist environment for wound healing, which promotes rapid infection-free re-epithelialization, in addition to the advantages of the open treatment technique, avoiding cumbersome, bulky, and expensive dressings and allowing early and frequent range-of-motion exercises.

Introduction

Even though the hands constitute only 5% of the total body surface area (TBSA),¹ thermal injury in the hands is not only one of the commonest burns but also one of the most difficult pathologies for burn surgeons to treat. ² Although rarely life-threatening, thermal trauma to the hands affects the extensor surface in the majority of cases and constitutes a major trauma that is disproportionate to the small body surface areas involved." In mass casualty incidents characterized by large numbers of burn victims, and when hand burns are associated with a life-threatening extensive burn or other injuries, there is a tendency to attribute less priority to hand burns. Restoration of normal hand function in these patients is a goal that is necessarily subordinate to sustaining life. Although it is generally agreed that the management of a critical burn patient should be primarily directed at the patient's survival, burned hands should never be neglected, since the majority of cases of post-burn morbidity, as well as the most devastating sequelae of thermal injuries, are related to hand burns. ⁵ Short- and long-term hand morbidity is incalculable in terms of pain, functional impairment, cosmetic appearance, and financial loss.- The negligent, "do-nothing" mode of treatment has had devastating end results, with functionless hands and disabling deformities. Patients so affected are unable to resume their pre-burn functions and their quality of life is unquestionably compromised.

Material and methods
Between 1975 and 1993, 787 burn patients were admitted to our Medical Centre in Beirut, representing 0.25% of all hospital admissions and 1% of all surgical admissions. Many more patients were treated on an ambulatory basis and several others had to be transferred to other hospitals owing to lack of space; however, nearly all non-transferable critically burned patients presenting to our emergency room were admitted. All patients admitted to the hospital were entered into the hospital computer system on the basis of the 9th Revision of the International Classification of Diseases. Of these patients, 59.34% were male and 40.66% female. Patients under the age of 30 years of age accounted for 70.65% of the total number, and 32.15% were younger than 9 years old. Thirty-eight percent had burns in more than 50% TBSA. Information about burns to specific areas of the body was available in 466 patients only. Of these patients, 51.5% had burns involving the upper extremities, of whom 29% had second- and third-degree burns involving the hands. Despite the relative frequency of hand burns, the main objective of therapy in our admitted burn patients was directed towards proper resuscitation, life preservation, and wound healing. Adherence to a strict hand burn management protocol during the study period was not possible owing to the physical restraints and restrictions imposed by the war situation.

Discussion

Although there is universal agreement that early burn wound closure is mandatory if maximal functional return is to be expected and scarring minimized, application of these treatment principles to hand burns has not been universally adopted. The delineation of clear indications for early excision and grafting, as opposed to delayed wound coverage for thermal injuries in general and not in particular for hand burns, remains debatable. The treatment of the burned hand has been one of the most controversial topics in modern burn therapy. However, irrespective of the treatment modality adopted, the objectives should always be the prevention of infection, the protection of viable tissues, and the preservation of function. Successful hand rehabilitation is often the result of maintaining, and not of correcting, small joint function, in particular the preservation of proximal interphalangeal joint motion by avoiding the stiffness and fibrosis that are secondary to a combination of joint immobility and fixation of oedema fluid in connective tissue. Systematic excision and early autografting of thirddegree burns to the dorsum of the hand were first reported by Moncrief in 1964. Since spontaneous healing should not be expected in such injuries, and since dermis does not regenerate, few argue against the necessity of skin grafting in cases of obvious full-thickness skin loss. Such wounds produce extensive scarring and contracture, resulting in a significant reduction of hand function. Some surgeons still however prefer to delay the skin graft until after natural eschar separation and the formation of healthy granulation tissue. The greatest treatment dilemma, however, is related to second-degree thermal hand injury, which accounts for the majority of hand burns seen in practice. Superficial burns may heal spontaneously without the need of extensive surgical excisions. Spontaneous reepithelialization of a deep second-degree burn, however, is equivalent to delayed wound closure. Although in many anatomic areas this type of healing is of no consequence, its effect on hand rehabilitation and function may be disastrous unless extensive and prolonged physical therapy and proper splinting in the anti-claw position of protection are instituted, which imposes additional burdens on the treating team. Tangential excision of deep dermal burns was introduced by Janzekovic, Jackson, and Lawrence. Early tangential excision of hand burns with skin grafting has been demonstrated to ameliorate hand function compared to conventional conservative therapy. However, later studies have demonstrated that the results of non-surgical therapy with a well-planned extensive physiotherapy regimen are at least as good as early excision and grafting. The balance between surgical and non-surgical treatment of each hand must be based on cautious evaluation and the skilled clinical judgement of the treating physicians. The pathological changes produced by thermal injury to the hands are of multiple origin. Some are unavoidable, as a result of...
direct injury to various tissues and structures. However, progressive loss of hand function as a result of immobilization, disuse atrophy, soft tissue loss, contracture formation, bacterial wound colonization, decreased circulation, inadequate or inappropriate splinting, or the formation of oedema in connective tissue must all be avoided or reduced by achieving speedy and complete wound healing and the judicious institution of hand elevation and early motion. Treatment should be directed towards minimizing subsequent deformity. Irrespective of whether early excision and grafting are performed or a more conservative non-surgical approach is adopted, the need for secondary reconstructive procedures is decreased by proper attention to the positioning and ranging of joints during the acute phase of burn wound care, and the success rate of such procedures increases in direct proportion to the degree of motion preserved before reconstruction."X Burn reconstruction must not be an isolated phenomenon that occurs after the hand burn wound has healed. The main undisputed advantage of early tangential excision and skin grafting is the reduction in hospital stay.34 "2?It also reduces the pain associated with a prolonged period of dressing changes and physiotherapy, in addition to decreasing the incidence of complications associated with prolonged immobilization. It also has a significant nutritional and psychological impact on the patient's recovery by rapidly allowing them to become less dependent on hospital personnel. Conversely, the hazards of radical excision and grafting, apart from the inherent danger of general anaesthesia, include the possibility of major blood loss and the loss of the graft owing to infection or haematoma, as well as the use of donor skin that could be applied elsewhere in the body in order to reduce the burned area, with profound effects on survival. The exposure of joint capsules and injury to extensor tendons at the time of surgical excision should also be seriously considered if the partially burned hand is to be protected from the impatient surgeon's knife. The most important objection to surgical excision remains the unavoidable sacrifice of viable tissues and the potential transformation of a partial-thickness burn to a full-thickness third-degree burn owing to the inaccuracy of the clinical estimation of the burn's real depth." Edgerton, however, has stated that in burns of the dorsal surface of the hand, removal or debridement of a modest amount of tissue that would otherwise be viable is of no consequence.22 Nevertheless, this is not a safe policy for the volar surface of the hand. Advocates of early surgical excision and grafting have long stressed the fact that their technique obviates the major disadvantage of conservative therapy, namely joint stiffness and fibrosis secondary to a combination of joint immobility and fixation of fluid in connective tissue."2 Although this may be overcome by hand elevation and meticulous physiotherapy," conservative therapy is not easily applied, as it requires frequent, painful dressing changes to allow at least four physiotherapy sessions a day. It has long been stressed that as long as the wound remains unhealed, oedema will persist.2" Moreover, an open wound is also painful when the joints are extended or flexed. This increases the patient's apprehension and makes strict adherence to a daily protocol of intensive physiotherapy rather difficult without massive administration of narcotics and analgesics, which in turn may limit the patient's co-operation. Recently, a new topical ointment, MEBO (moist exposed burn ointment) (Julphar Gulf Pharmaceutical Industries, Ras Al-Khaimah, United Arab Emirates), has been introduced by the Chinese. MEBO is the basis of MEBT (moist exposed burn therapy), popularized two decades ago by Xu Rongxiang" of the Beijing Burn Centre in China. This offers the advantages of a moist environment for wound healing which promotes rapid infection-free re-epithelialization with less pain,"28 in addition to the advantages of the open treatment technique, avoiding cumbersome, bulky, and expensive dressings. In addition to its proven antiseptic properties,"28 the ointment has a profound non-narcotic analgesic effect, probably due to its inhibitory action on smooth muscle cells in blood vessels and on the erector pili muscles, the contraction of which is believed to be the major cause of pain in burn wounds." Regular application of this ointment as indicated has been observed to dramatically reduce tissue oedema and to speed up non-surgical debridement of burned skin layers.
Integrated with existing conservative non-surgical management protocols of hand burns, this new treatment modality can be extremely helpful in the management of hand burns. The main advantage of this new treatment modality is, however, the total elimination of dressing changes. Application of the ointment on exposed hand burns, though frequent, is not time-consuming and can easily be performed in the time of the four or five daily physiotherapy sessions.

**Conclusion**

Out of all the conflicting reports in the literature regarding the optimal treatment of hand burns, one major principle can be deduced: the prevention of subsequent deformity is crucial for good functional recovery. The most important objective in treating hand burns is to maintain, and not to correct, small joint function, in particular proximal interphalangeal joint motion. This can be achieved by stressing first of all the fact that the wound must be healed in the shortest possible time and secondly that motion and not positioning is most required. An integrated flexible treatment protocol combining both surgical and non-surgical treatment modalities is most appropriate. Since both modalities yield comparable results when expertly applied, is the management of hand burns must be individualized with the goal of completing wound closure by day 14. The decision to defer the excision and grafting of hand burns expected to heal within 14 days is based on studies showing excellent functional recovery when healing occurs within this time frame. Burns that are not expected to heal within 14 days are excised and grafted, even if the advantages of excision and grafting of burns that have not healed in two weeks have not yet been well defined. Early excision and grafting of selected deep burn injuries of the hands may also be indicated in patients with small TBSA burns in order to shorten hospital stay. Splitting and active or passive range-of-motion exercises are individualized on a daily basis in relation to repeated measurements of hand function. As soon as wound healing is complete, physiotherapy, splints, and pressure garments with or without silicone gel must be applied whenever indicated.

**BIBLIOGRAPHY**


