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DEEP LOCALISED CONTACT HAND BURNS IN CHILDREN: TWO CASES REPORT

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ABSTRACT

The incidence of hand burns in children is high. In the overall cases of body burns, hand and wrist burns account for about 39%. They may constitute a part of a larger burn of the body, or an isolated injury of the hand and wrist. The choice between early and late eschar excision with skin covering is still a matter of debate. Two cases of deep burns of the hand were presented in this report. The report shows how to close the residual wounds of deep burns. One patient was a Malay child who sustained a deep contact burn in both hands. The other patient was a premature newly born Malay baby one-month-old, with Down's syndrome. He suffered from a gangrenous patch (eschar) over the dorsum of the left hand after extravasation of drugs (chemical burn or necrotizing fasciitis). The two patients were treated by covering with local skin flaps after eschar excision and debridement. The result was good as patients did not develop any contracture as usual in similar cases.

Introduction

The incidence of hand burns in children is relatively high if compared with other age groups. It is possibly due to the hyperactivity of children and their curiosity to explore things. Contact burns with hot objects have the greatest incidence. The common hot objects are hot electric ovens and ironing machines. Research done by couple of researchers showed that hand and wrist burns account for about 39% of all burns [1-2]. They may be a part of a major burn or an isolated injury. Ruth, et al., (2008) explained that early versus late eschar excision and skin covering is a matter of debate [3]. The burn of the volar aspect has a great challenge to the treating surgeons as the function of the hand can be greatly affected. The aim of treatment will consider the function and the shape of the hand [3]. Research done before showed that minimal complications could be accepted if it affects the shape but not the function [4]. On the other hands, Argirova and Hadzhiyski (2007) stated the use of skin grafting in burns of the hand is mostly a routine either meshed or non-meshed grafts [5].

Some researches listed the complications with skin grafting are contracture, color changes, and hypertrophic scarring [1]. Many complications were reported after the use of full-thickness grafts. In the

author's previous experiences, he observed many of these complications. The author preferred to use local flaps for the full thickness burns of the hand.

Case 1

A 1-year and 2-months old child was presented to the author by referral from the pediatrician on call who admitted the patient to a hospital in Kuala Lumpur. During the physical examination on 24/3/2009, the child was found to have a deep burn of the second and third degrees in the right palm involving the first web space over the adductor muscles (Zone III and IV). Another deep burn was found over the distal palm at the bases of the left index, middle, and ring fingers (Zone II). Both pulps of distal phalanges of both thumbs were involved. Most of the burn areas were deep (deep second and third degrees) and needed a time up to 2 weeks to clear up all dead tissues as shown in Fig. 1 to Fig. 3.

Fig. 1: Right hand with the deep burn at zone II and III over the adductor muscle

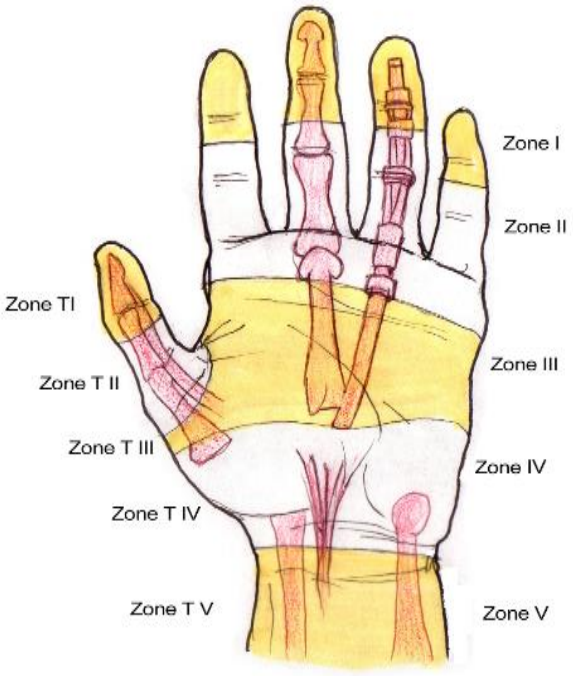

Fig. 2: Zones of the hand

Fig. 3: Deep Burn at Zone II over bases of the index, middle, and ring fingers

Case 2

A premature newborn female baby, one-month-old with Down syndrome who suffered from a gangrenous patch of full-thickness skin over the dorsum of her left hand. The gangrenous patch was due to localized gangrene after extravasation of drugs which may be considered as a chemical burn, or necrotizing fasciitis as in Fig. 4.

Fig. 4: Gangrenous patch over the dorsum of the left hand after drug extravasation of drugs or necrotizing fasciitis

Method

Case 1

The author saw the patient after one week from the onset of burn, and immediate debridement and cleaning of the wounds were done under general anesthesia. Wounds were seen to be deep involving all skin layers. Subcutaneous tissue was involved, and the wound was not ready for skin covering. Tendons were not exposed but covered with debris. The patient was discharged with daily dressing in the outpatient clinic for another 10 days until the wounds became clean with fresh granulation tissue.

The patient was readmitted and operated on for skin flap covering of the deep raw areas. Under general anesthesia debridement of the wounds was done. In the right hand, the raw area on the adductor space was covered by a sliding flap from the near dorsum of the right hand. The flap was designed as in Fig. 3 and 4. and it was sutured using 5/0 nylon. A sliding flap was designed depending upon the local underlying perforators to be moved from the dorsum of the hand and to be sutured to its original attachment as well as the raw area. The flap is undermined with the deep fascia proximally and distally by one to one and a half centimeters keeping its central attachment to the underlying perforators as in Fig. 5 to Fig. 8. The size of the flap was designed in a way that it could be moved safely to cover the whole defect and to be sutured to the same area again.

Fig. 5: The defect

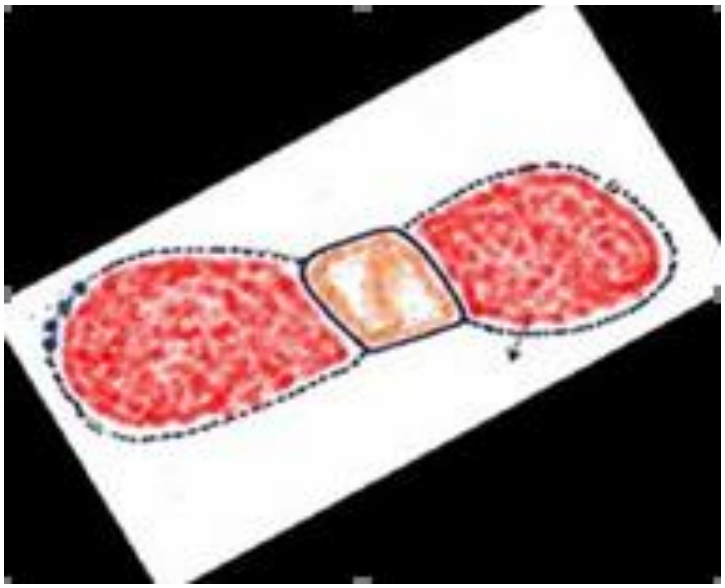

Fig. 6: Mapping for bilateral sliding flaps

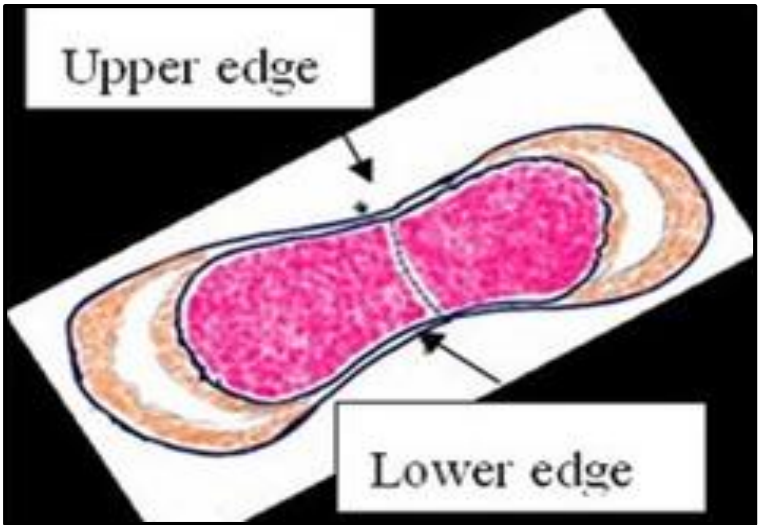

Fig. 7: Flap dissection with the deep fascia

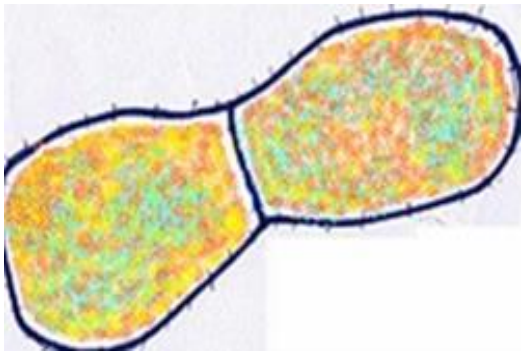

Fig. 8: Closure is complete

For the left hand, debridement was done and local random flaps from the lateral aspects of the ring and little fingers were taken down to cover the distal part of the palm. The donor sites were closed primarily. Flaps were fixed with 5/0 nylon sutures to the debrided areas as in Fig. 9 and Fig.10.

Fig. 9: The hand after random flaps covering from sides of fingers

Fig. 10: Post-operative appearance after stitch removal

Case 2

Debridement was done on 5/6/2009, to remove the eschar. After eschar excision the wound was not suitable for skin covering as in Fig. 11 as subcutaneous tissue was nonviable. The author did not remove tissues until the level of tendons. He preferred to leave a layer of dead subcutaneous tissue covering the tendons. The author had to wait for10 days for dressing to get a clean fresh wound. After 10 days wound was clean enough to be covered. The author preferred to use a local flap rather than skin graft. A sliding flap was designed to cover the defect as in Fig. 12. The flap was moved from the normal skin lateral to the ulcer (from the radial side) to cover the defect completely and there was no need to move a medial (ulnar) side. Undermining of the medial skin was done.

Fig. 11: After initial debridement. The subcutaneous tissue is gangrenous and is not suitable for cover

Fig. 12: one week after surgery. Flap was moved from radial side to cover the defect

Results

Case 1

The raw areas were completely covered in a nice way. No signs of any contracture. Follow up one month after surgery, Fig. 13, 14 and 15 showed normal function of the hand and all fingers including the right thumb and all fingers in the left hand. Follow up after 15 months show excellent results with no sign for any contracture Figure 16 and 17.

Fig. 13: One month after Surgery

Fig. 14: Full abduction after one month with no contracture

Fig. 15: Full extension without contracture or fibrosis

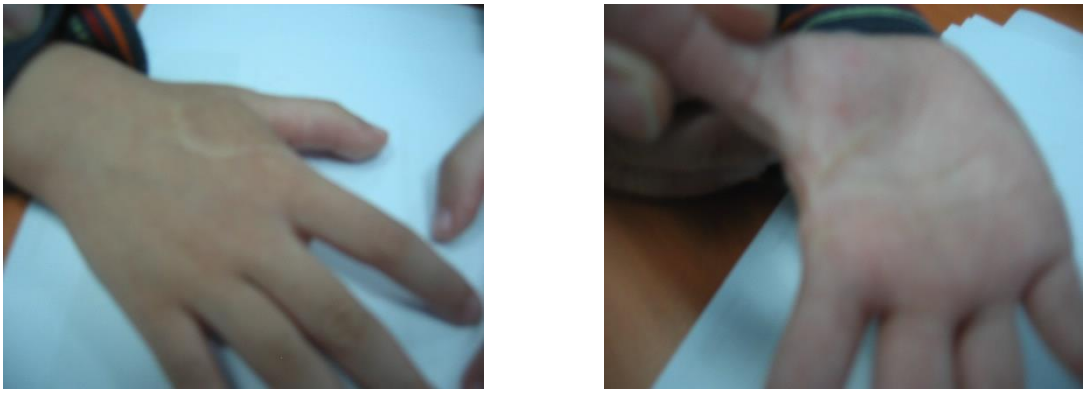

Fig. 16: The right hand on 21/07/2010 (15 months after discharge)

Fig. 17: The left hand 15 months after discharge, no sign for any contracture

Case 2

The wound was covered after treating mild infection which was controlled by antibiotics and the result is shown in Fig. 17 and Fig.18 shows the hand after one year, no contracting scar and the hand has full free movement.

Fig. 17: Three months after surgery. The wound healed with a small infected area

Fig. 18: The baby one year after discharge, with nearly normal hand

Discussions

Argirova et al. (2005) showed that hand and wrist burns have absolute treatment priority [5]. The main principle in deep hand burn treatment is to remove all necrotic tissue and to perform skin cover. He explained the importance of early debridement of deep dermal or full thickness burns in the hand and recommended early cleaning of the area prior to skin covering. Early treatment of the deep burns gives excellent function.

As the hand is the most mobile part in the body and every part in the hand has its own function which is integrated with other parts. Any burn scarring will leave a bad significant effect on the whole hand function. Basic treatment in every hand burn must assure the recovery of optimal function with a stable soft tissue cover. Early debridement is needed and then waiting for having a clean surface to have a good result of skin covering. To have a rapid clearing of the wound, the patients should be treated for any deficiencies and promote leukocytes production to accelerate the demolition phase to clean the debris faster. In these two cases, fresh blood and or fresh plasma transfusion was performed.

The skin of the hand has unique characters, dorsal skin is loose, thin, can be mobilized easily and tendons are superficial, while volar skin is thick, compact, tight, and difficult to be mobilized and the tendons are deeper. Regarding motility of the hand, all parts are highly mobile and active, if any scarring or contractures occur will affect the function. The only fixed parts of the hand are the volar aspect of the hypothenar eminence and distal pulps of fingers, while all other parts of the hand either volar, dorsal, or palmar are highly mobile [6-7].

The dorsal surface seems to be fixed but because of the superficial position of tendons, it always needs a flap cover as grafts tend to stick with adhesions and fibrosis limiting tendons mobility. Complications of skin graft cover include color changes, contractures, and the development of hypertrophic scars. Use of full-thickness or split-thickness is associated with multiple complications. The complications include skin color un-match and variable degrees of contractures. To avoid these complications in these cases, flaps were used to give a matching color and avoid any contracture and scarring in the future. Rehabilitation after surgery is important in deep burns recently use leap motion for the hand [4].

A report described the early management of deeply burned hands in children and reported fairly good results with early tangential excision and skin grafting. Other methods of covering hand defects, a work was reported the way of managing deep extensive burns of the hand by pocket flap technique [1]. It depends upon using a defatted abdominal skin flap and putting the bare hand inside. The author has his own series for the management of extensive burns by using flaps as groin pedicle flaps, free vascular flaps, and skin grafting. From records, he declines the use of skin grafts split or full-thickness as still possible

complications were encountered. Many methods are used to close any defects which may be small or extensive. Among the recorded methods which are used by the author in other patients, free flaps, abdominal pockets [8].

A reported the use of reversed radial artery flaps, flaps based on the dorsal branch of the ulnar artery (Becker's flap), tubed pedicle flap from the groin or supraclavicular region, cross finger flaps, island finger flap based on the digital vascular pedicle, dorso-lateral flaps for fingertip injuries, random inter-digital small flaps, Z-plasty, sliding flaps, osteo-facial-cutaneous flaps utilizing iliac crest bone and overlying skin and fascia, and other composite flaps [9]. Skin graft could be used if we treat an area away from joints and not affecting the motility like the hypothenar eminence or distal pulps of fingers only. All other areas of the hand are considered critical zones and need early covering by flaps [6-7, 10].

Nhat et al. (2005) achieved good results only in 33% of a series of 150 patients suffering from severe hand post-burn deformities using skin grafting [8]. The new era of use of sliding flaps is popularized in the world [11]. Rahoma and Anis (2009) used it in covering deep wounds of the hand [12]. The author performed early debridement but there was nonviable subcutaneous tissue. Waiting for a week until the nonviable subcutaneous tissue was removed by frequent dressing, allowing fresh tissue. The nonviable subcutaneous tissue was removed by promoting the polymorph nuclear leukocytes and treating any blood element deficiencies to enhance the demolition stage of wound healing. The size of the wound was not a problem to the author but the state of cleaning of the wound as any dead tissue makes the healing difficult. The second case was treated in the same way by debridement and waiting for a time for cleaning of the wound by frequent dressing. The later sliding flap was moved to cover the wound. Healing in this patient was relatively slow as the patient has Down's syndrome and she was premature. Follow-up of the two cases showed excellent results without any residual complications as contractures or movement limitations. In these two patients, the author did not use early tangential excision and did not use full-thickness grafts.

Conclusion

The flap cover is a better alternative for skin graft. The flaps are of different types, and they help much to achieve early and full function of the hand if they are done properly and in the correct time. Skin graft needs to be very limited and restricted in hand covering after burns or trauma. Around the hand many flaps can be utilised.

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