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Case Report

Multimodal management of more than 50% mixed deep dermal and full thickness burns in a child

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Abstract

Introduction: Early tangential excision and wound coverage by autologous skin grafting is the mainstay of treatment for deep dermal and full-thickness burns. They are challenging in children with major burns involving more than 50% of the body surface area.

Aim: This article highlights a young boy who suffered from 52% mixed deep dermal and full-thickness burns after alleged thermal burns and we discuss his treatment strategies.

Case study: A 10-year-old boy suffered 52% mixed deep dermal and full-thickness burns after alleged thermal burns. After initial resuscitation, pain relief and fluid replacement, he underwent an emergent escharotomy of bilateral lower limbs followed by a series of surgeries. His treatment was complicated by many hurdles such as graft failure, difficult intravenous access, nutritional support and local wound infection which were tackled aptly with a multidisciplinary approach.

Results and discussion: A sequential excision of eschar tissue and advocation of multiple modalities of burn wound coverage, including glycerol-preserved cadaveric allograft (GPCA) and MEEK micrografting. GPCA decreases the bacterial load and helps to re-establish the skin barrier, normalise the physiological state and promote capillary ingrowth into the wound. MEEK micrografting allows better re-epithelization and has a shorter operation time.

Conclusions: Various modalities can be used to achieve skin coverage such as GPCA and MEEK micrografting. Extensive burns need to be managed in a tertiary centre with a combination of skin coverage techniques such as GPCA and MEEK micrografting in order to overcome the unavailability of normal skin for conventional skin grafting.

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1. INTRODUCTION

Early tangential excision and wound coverage by autologous skin grafting is the mainstay of treatment for deep dermal and full-thickness burns.[1] However, this becomes extremely challenging in children with burns of a total body surface area (TBSA) of more than 50% due to the large area that needs debridement and the scarcity of normal skin available for grafting.[2] Determining the TBSA is crucial as will affect the outcome and prognosis of burn patients especially among children.[3] Herein, we describe a 10-year-old boy who suffered from 52% mixed deep dermal and full-thickness burns after alleged thermal burns and we discuss his treatment strategies. This case report has been reported in line with SCARE 2020 criteria.[4]

2. AIM

This article highlights a young boy who suffered from 52% mixed deep dermal and full-thickness burns after alleged thermal burns and we discuss his treatment strategies.

3. CASE STUDY

A 10-year-old boy presented with alleged thermal burns after attempting to set a can of petrol on fire. His pants caught fire and rapidly spread to the back forcing him to jump into a nearby drain to put off the fire. On arrival, he was conscious and hemodynamically stable. Initial resuscitation, adequate pain relief and fluid replacement according to Parkland's regime were commenced. Primary and secondary surveys concluded that he had sustained 52% mixed deep dermal and full-thickness burns (Figure 1). There was no evidence of inhalational injury or distal neurovascular compromise of the limbs.

His wounds were scrubbed down and dressed in silver sulphadiazine cream. He underwent an emergent escharotomy of bilateral lower limbs in view of circumferential burns. Subsequently, he was subjected to a series of surgeries which involved sequential excision of eschar tissue and advocation of multiple modalities of burn wound coverage, namely, glycerol-preserved cadaveric allograft (GPCA) and MEEK micrografting.

The course of his treatment was complicated by many hurdles such as graft failure, difficult intravenous access, nutritional deficiency, wound infection as well as catheter-related bloodstream infection which were tackled aptly in a multi-disciplinary approach with the expertise of our surgical, paediatric, interventional radiology, anaesthetic, nutrition support, infectious disease, physiotherapy, occupational therapy and rehabilitation colleagues. He had an ultrasound-guided insertion of a peripherally inserted central catheter for venous access and received long-term parenteral nutrition support. He suffered a spectrum of local wound infections along the course of this treatment with wound cultures yielding various microorganisms ranging from *Staphylococcus aureus* infection in the initial phase to *Acintobacter baumanii*, extended spectrum beta lactamase and methycillin resistant *S. aureus* (MRSA) infections towards the later stages. Despite all the efforts, he finally succumbed to a severe multi-resistant catheter-related bloodstream infection 112 days later.

4. RESULTS AND DISCUSSION

The incidence of paediatric burns in Malaysia has been on the rise over the last decade with a reported 62% in 2009 as compared to 34% during the period 1999–2001.[5] This increase can be attributed to factors such as increased awareness leading to more patients seeking medical attention for burns and the increasing accuracy in national burns data collection or on the contrary the swelling cost of living in Malaysia forcing parents to chase after wealth to support the family at the expense of their children who are left unsupervised and vulnerable to burn injuries. Among the predictors of mortality which were associated with guarded prognosis

Figure 1. A total of 52% mixed deep dermal and full thickness burns.

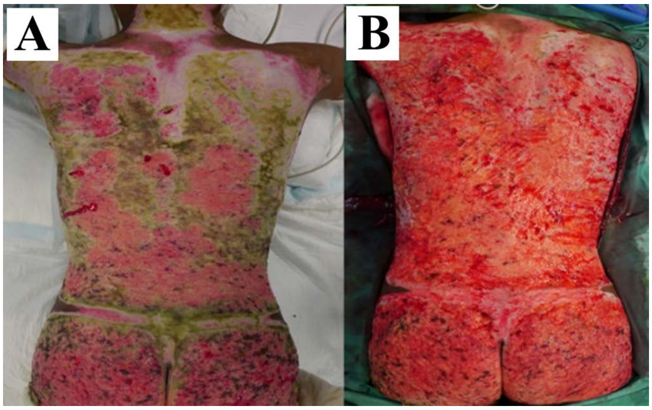

Figure 2. Before (A) and after (B) wound debridement using Versajet hydrosugery system.

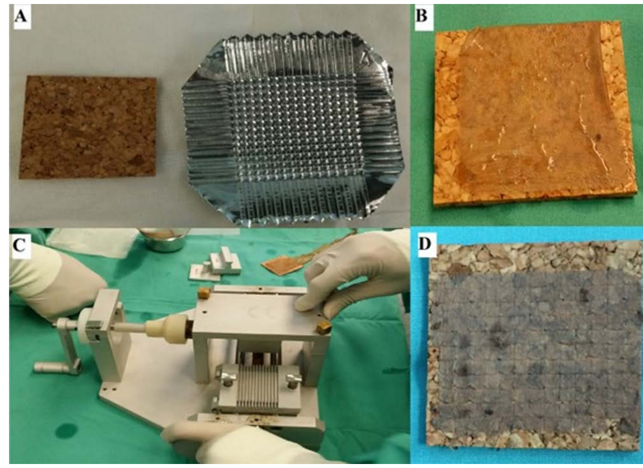

Figure 3. Cork template carrier and pre-folded polyamide gauze with aluminium backing (A), SSG cut into 3x3cm squares and placed on cork template for cutting (B), SSG with cork template being passed through a cutting machine (C), SSG that has been cut into 3 × 3 mm micrografts (D).

include TBSA of more than 20%, early systemic inflammatory response syndrome, mechanical ventilation and inhalation injury.[6] Hence, these parameters reflect our case very well. In addition, older age and revised Baux score were also able to predict burn mortality.[7]

Sequential excision of eschar is crucial in burns. Escharectomy is performed in a sequential manner with deeper burns being debrided first.[8] In this case, it appears to be in an ascending manner which corresponds to the mechanism of injury. Some areas need a second debridement and this was done along with the neck, genitalia and upper limb regions using Versajet hydrosugery system (Smith and Nephew, Victoria) as it provides versatility in areas with contours and allows control over the depth of debridement to preserve as much dermis as possible (Figure 2).

The sequence of wound debridement was determined by clinical assessment of the burns wound and the timing of surgery was based on the patient's clinical condition and the availability of GPCA and MEEK consumables needed for wound coverage post-debridement. Areas with more profound burn injury were prioritized as these tissues have a higher bacterial load and removing them first aids in the reduction of the bioburden thereby minimizing the risk of critical colonization and infection. In this case, the sequence of debridement according to the depth of burns appears to be in an ascending manner from the lower limbs upwards to the neck which corresponds to the mechanism of injury. A similar sectional approach to wound debridement in extensive burns has been described by Hsieh et al., who arbitrarily divides the body into 6 regions according to topography: head and neck, anterior torso, posterior torso, right and left upper extremities as well as right and left lower extremities.[1] The extremities; both upper and lower are debrided first, followed by the torso and the head and neck region last because the extremities are the most convenient site for wound care and hemostasis as compared to the vascular patterns and contours of the head and neck region which make open wounds difficult to manage.

GPCA is a biological dressing or skin substitute that dates back to World War II. Glycerolisation destroys vital structures, suppresses immunogenicity and has antibacterial and antiviral properties.[9] Besides decreasing the bacterial load, it helps to re-establish the skin barrier, normalise the physiological state and promote capillary ingrowth into the wound.[10] We used GPCA post initial debridement to reduce the physiological losses, prevent infections, prepare the wound bed and at the same time test the readiness of the wound to take a skin graft. If the allograft adheres and bleeds upon removal, it indicates the wound bed is ready to accept a skin graft and vice versa.

MEEK micrografting was first described in 1958 but did not take off initially as it was too cumbersome.[1] However, it was later found to be very effective in treating extensive burns. Split skin grafts (SSG) are cut into 3x3cm squares and placed onto a cork template carrier which is then passed through a cutting machine that cuts the grafts into a hundred 3x3mm squares (Figure 3). After spraying an adhesive, the cork with micrografts is placed against a pre-folded polyamide gauze with aluminium backing. The pre-folded gauze is then pulled in both directions causing the folds to open and evenly spread the grafts over a larger area before fixing it to the wound which is ready for grafting (Figure 4).

Addressing the wound healing is very imperative especially on complex and extensive burn.[11] A secondary dressing which may be changed when soaked is applied over it and the grafts are left undisturbed for a week. Subsequent graft inspection and dressings are done every 3 days using a combination of paraffin-coated gauze and silver-coated dressings with culture swabs taken accordingly when there are signs to suggest local wound infection. Our MEEK micrograft uptake was 50% (Figure 5) as compared to those described in the literature with uptakes of 90–95%.[1] We attribute this to our inexperience as it was the first time MEEK micrografting was performed in our centre. In addition, other factors that likely hampered the uptake of the grafts in our patient, in particular, were frequent local wound infection and poor nutritional status in a child with limited reserves.

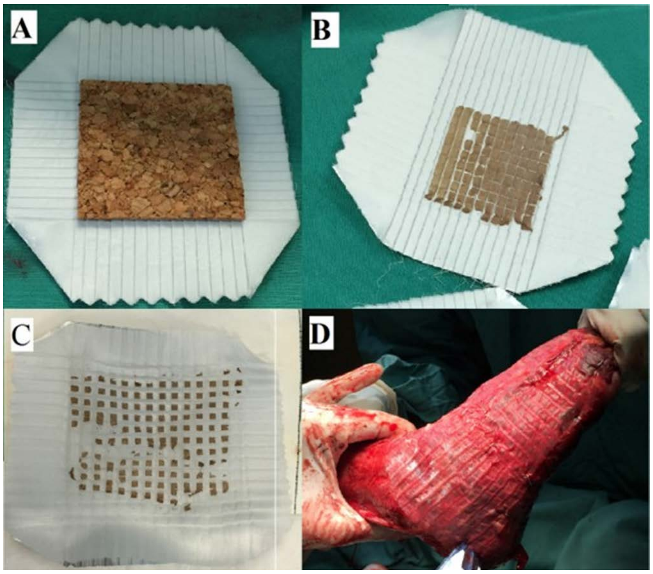

Figure 4. (A) Cork with micrografts placed face down on the pre-folded polyamide gauze with aluminium backing, (B) Cork template is removed leaving the micrografts on the pre-folded gauze, (C) The pre-folded gauze stretched in both directions to evenly space the micrografts, (D) The polyamide gauze with evenly spaced micrografts is applied to the debrided wound and fixed with staples.

5. CONCLUSIONS

(1) Managing children with burns of TBSA of more than 50% is challenging due to the large area that needs debridement and the scarcity of normal skin available for grafting.
(2) They need to be managed with a multidisciplinary approach in a tertiary centre using a combination of skin coverage techniques such as GPCA and MEEK micrografting in order to overcome the unavailability of normal skin for conventional skin grafting.

Conflict of interest
The authors declare that there are no conflicts of interest.

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Ethics
The informed consent and ethical clearance to publish the images were obtained from the next of kin.

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Figure 5. A total of 50% wound coverage achieved with neo-epithelisation seen around micrografts of the arm (A) and back (B).

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