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EFFECTIVENESS OF CRYOPRESERVED ALLOGRAFT FOR TREATMENT OF SCALDS IN CHILDREN

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Aim of the work: ***Burn treatment in children is associated with several difficulties. Scald injuries are very common and have significant clinical impact. However, the treatment regimen for superficial to deep partial thickness burns is not well defined. The purpose of this study was to investigate the effect of cryopreserved human allograft in treatment of partial thickness burn in comparison to standard care.***
Material and Methods: ***The study was done on 20 cases with scald injury. Their average age was 2.43 years old, nine female and eleven male. The mean TBSA was 27.3%, while the average partial-thickness burn was 22.75% and the FTB averages 4.65%. These cases were randomized into two groups, one group receiving early superficial debridement followed by coverage with cryopreserved human allograft. The other group received open treatment with silver sulfadiazine.***
Results and Conclusion: ***The healing rate and the re-epithelialization day were highly improved with allograft coverage, with less infection rate, early ambulation, and less hospital stay. Pain tolerance in the allograft group was good with minimal analgesic requirements.***
Partial thickness burns in children can be effectively treated with cryopreserved human allograft with good results and improved outcome.

Keywords: *allograft, scald, burn, pediatric burn*

INTRODUCTION

In any developing country, burn injuries present a major challenge to the available medical resources, especially that almost all these injuries occur in the lower and middle class socio-economic strata of the society.(1) Childhood burns in Egypt are a significant problem, especially in families of low socioeconomic status. These families live in overcrowded flats, which lack proper hygiene and lack any safety standards.(2)

The prevalence of burns and scalds in children comprise 45% of the total burns unit workload. Scalds are particularly prominent in the very young; as 79% of the under 5 year old admissions suffered from scald injury.(3) The great majority of these scalds are caused by bathwater, and as a consequence of 'reach and pull' of a variety of hot fluids containers.(4)

The burn wound is the same whether it occurs in an adult or a child, but the management of a pediatric burn differs considerably from that of an adult in many aspects. Burn treatment in children is associated with several difficulties, available skin replacement is small, donor area could expand, and subsequent hypertrophic scar and contracture could become larger along with their physical growth.(5) A small child cannot exist in isolation and is totally dependent. Buttock and thigh areas are always problematic for dressing application and bandaging which are usually slipped. Small children, who have not yet attained urinary continence, have higher incidence of infection rate. All these factors contribute in transforming superficial degree burns into deeper degrees with unsatisfactory results and the production of hypertrophic scarring.(6)

The main principles in the treatment of burn injuries are to control pain, infection, to provide and maintain moist environment, and to prevent heat and fluid loss. Auto graft is the ideal wound coverage, which can achieve all these principles, but they are not always available in sufficient amount. Allograft which is considered the best biological dressing can be applied either

temporarily until auto grafts become available, in conjunction with widely meshed auto grafts, or until complete healing and epithelialization of the burn wound.[7]

The use of cryopreserved allograft in the treatment of burns is a well-known technique and offers several advantages. Immediately after application it reduces the pain significantly, prevents desiccation of the wound, prevents water and electrolyte loss, and decreases protein leakage. Allograft provides immediate control then depletion of the bacteria at the wound dressing interface preventing the problem of strikethrough of the bacteria. It acts as a barrier to heat loss, exogenous bacteria.

From a practical point of view the burn wound is covered and the cells involved in healing process are protected and the body homeostasis is maintained.[8]

In this study we compared the use of cryopreserved human allograft with the standard therapy consisted of the antimicrobial ointment silver sulfadiazine (SSD) in treatment of scald burn injuries in children below the age of 4 years. We tried to evaluate the effectiveness of cryopreserved allograft in treatment of scalds and its advantages over standard methods.

PATIENTS AND METHODS

This study was done on 20 children with scald burn injury Table 1. The average age of patients was 2.43 years (range, one to 4 years), nine females and eleven males. All the patients were admitted in the burn center of Kasr Al-Aini Hospital immediately after the burn injury.

After proper resuscitation and photography, assessment of the depth of scald injury was expressed as superficial partial-thickness burn (SPTB), deep partial-thickness burn (DPTB), and full-thickness burn (FTB). The total surface area burned (TBSA) was assessed by the charts of Lund and Browder.[9]

The mean TBSA was 27.3% (from 20 – 35%) most of cases were SPTB and DPTB 18 – 27% (mean, 22.75%), while the FTB were between 0 – 15% (mean, 4.65%).

These patients were divided into two comparable groups as regard as age, size of burn, depth of burn.

Ten cases were selected to be treated with cryopreserved allograft coverage within 72 hours from the initial trauma after stabilization of the general condition of the patients and decrease of the exudation from the wound surface. The cryopreserved allograft was supplied by skin bank, a branch of the Center for Preservation And Transplantation of Musculoskeletal Tissue (CPTM), Cairo University.

The procedure of allografting was done in the operating room with general anesthesia or under sedation. The wound was gently cleaned with povidone iodine and mechanical debridement with saline. After that perforated sheets of allograft applied to the wound surface and extended across the borders of the wound. The sheets are fixed in place with sutures or suture strips if available. By the fifth day the child is bathed after removing the outer dressing layer and continued on daily application of povidone iodine ointment over the wound edges with daily inspection of the graft area.

The matched group (10 cases) was treated by application of a thick layer of SSD ointment covered with thick layer of dressing two times daily.

Both procedures were terminated when the treated burned area were completely epithialized or when it becomes clinically obvious that the wound needs surgical debridement, but not later than 21 days.

RESULTS

The selected 10 cases for cryopreserved allograft coverage were six females and four males Table 1. The average age of patients was 2.38 years, the TBSA ranged from 20 – 35% (mean, 27.9%), partial-thickness burn was between 20 – 27% (mean, 22.5%), and FTB between 0 – 15% (mean, 5.4%). Nine cases showed good adherence of the allograft to the burn surface area by day 7 after application of the graft. All adherent cases started peeling of the allograft from day nine to day 14 after application of the graft, exposing the underlying initialized surface (Fig. 1 and 2). Six cases showed complete peeling and epithelialization by day 15 while three cases completed the epithelialization by day 21 Table 2.

In 4 cases we did additional auto grafting for the associated FTB by the end of three weeks post burn.

One case (Fig. 3) showed loosening of the allograft by the fifth day after removal of the first dressing, by the tenth day there was non-adherence of 50% of the grafted area and it was excised and the patient continued on daily application of povidone iodine ointment with systemic antibiotics until control of infection, after that we did auto grafting for this area with the associated FTB by day 21.

In the group treated with application of silver sulfadiazine, there were three females and seven males Table 1. The average age of patients was 2.48 years, the TBSA ranged from 20 – 32% (mean, 26.7%), partial-thickness burn was between 18 – 26% (mean, 23%), and FTB between 0 – 9% (mean, 3.9%). Only 3 cases showed complete epithelialization by day 15 and another 2 cases showed complete epithelialization by day 21.

Three cases showed healing of 50-75% of the partial-thickness burned area, while two cases showed healing of less than 50% of the partial-thickness burned area by day 21 Table 2). In 5 cases we did additional auto grafting for the associated FTB.

In both groups we had no mortality.

Table 1. Demography of the patients included in the study

Method of treatment	Number	Sex	Mean age	Mean TBSA	Mean PTB	Mean FTB
All cases	20 cases	9 ♀ 11 ♂	2.43 years	27.3%	22.75%	4.65%
Cryopreserved allograft group	10 cases	6 ♀ 4 ♂	2.38 years	27.9%	22.5%	5.4%
SSD group	10 cases	3 ♀ 7 ♂	2.48 years	26.7%	23%	3.9%

Table 2. Final results of epithelialization in both groups

Method of treatment	Percentage epithialized surface area by day 21		
	75 -100 %	50 – 75 %	25 – 50 %
Cryopreserved allograft group	9 cases	0 case	One case
SSD group	5 cases	3 cases	2cases

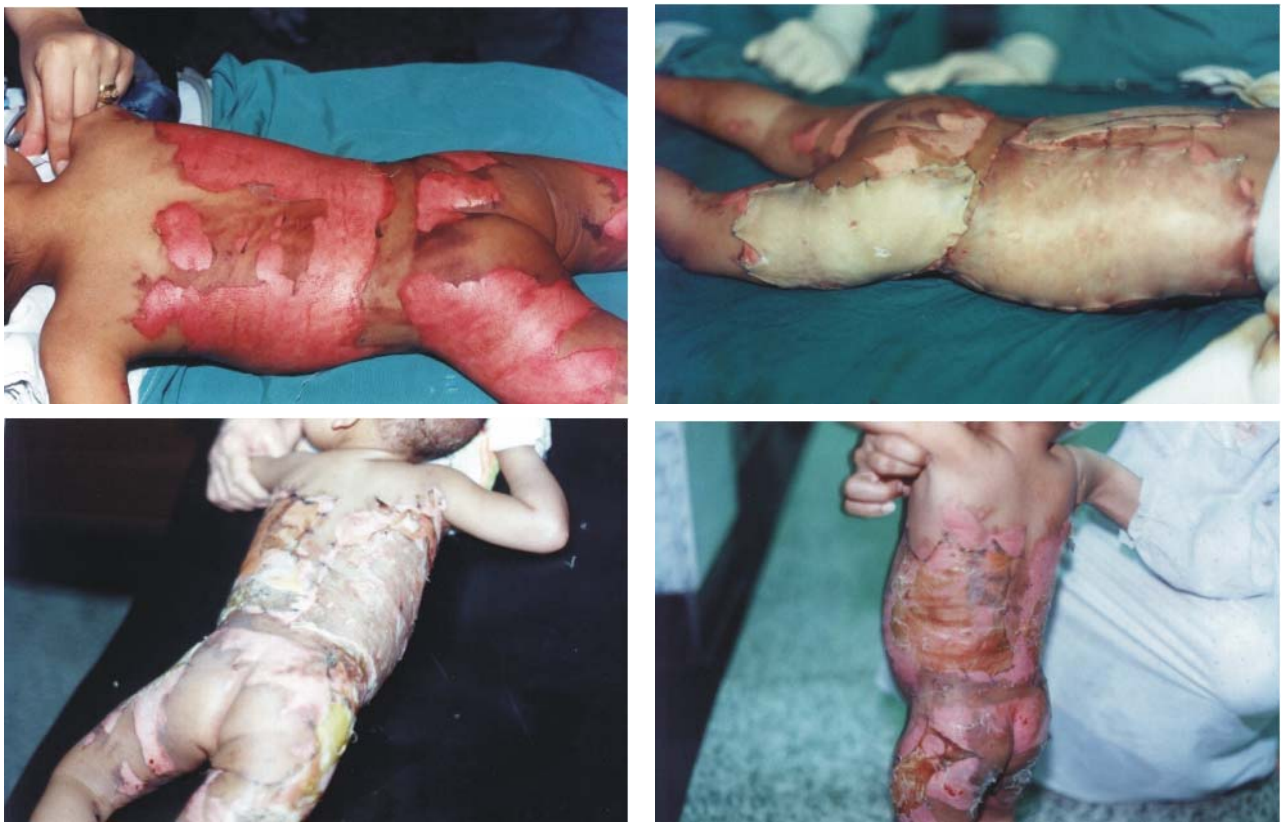

Fig. 1. A 1.6 years old child, with 28% TBSA, 25% Partial Thickness Burn, and 3% FTB.
a: Show preoperative figure after resuscitation and cleaning of the wound
b: Immediately after application of sheets of allograft secured in place by sutures
c: Peeling of allograft 10 days after application showing a well epithialized surface.
d: Complete peeling occurring by day 15 without residual raw area

Fig. 2. A 2 years old child with 20% TBSA, and all the burn was Partial Thickness with no Full Thickness burn.
a: Preoperative photo after cleaning the wound
b: After application of the allograft sheets over the chest wall and upper arm
c: Peeling starts after 10 days with a completely healed skin underneath

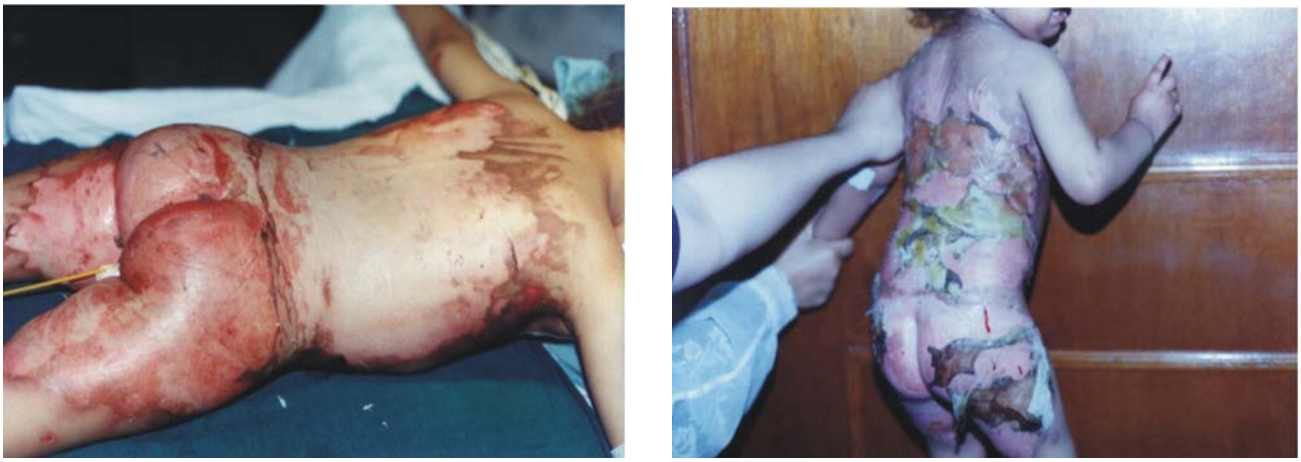

Fig.3. A 4 years old female, with 35% TBSA, 20% PTB, and 15% FTB
a: Preoperative photo showing the burn wound after debridement and cleaning
b: Showing adherent areas of allograft with epithialized skin underneath and loose area of allograft leaving a raw area behind

DISCUSSION

Following the destruction of large areas of the body skin by thermal injury, the child remains at threat of lethal infection until the wound is closed by functional epidermis.[7] Partial-thickness scald injuries normally re-epithelializes autogenously from the surviving remnants within the wound bed, providing that bacterial infection or other impediments to epithelial migration do not intervene. Provision of a dressing often provides some physical protection and helps to contain exudates.[10]

Despite the enormous technological advances in dressing materials, remain major concerns about dressing slippage, exudates leakage, bacterial strikethrough, unexplained fever, foul smell, high cost, and swelling of peripheral tissue. There is still no artificial burn dressing that even approaches the performance of split-thickness auto graft. The use of human allograft is still among the preferred means of temporary burn wound closure.[11] When used on partial-thickness burns, allograft do not prevent epithelialization even if they become well adhered to the wound. In fact epithelial cells migrate and proliferate under the graft, gradually undermining and ejecting the attached allograft. The allograft prevents desiccation of the epithelial cells prior to stratum conium formation, and provides a physical protection barrier.[7]

By reviewing the result of this study we found a good difference between the results of both groups in the acute stage of partial-thickness treatment.

The healing rate and re-epithelialization day were highly improved with the use of cryopreserved allograft. Six patients showed complete epithelialization by day 15 and three cases by day 21 versus only three cases in SSD treated group healed completely by day 15 and only 2 cases by day 21. Infection rate was less in allografted cases with only one

case with significant infection, while 5 cases in SSD group were infected by different degrees.

Pain tolerance in the allografted group was good with minimal analgesic requirements and there was no need for repetitive dressing changes. Those children were able to resume their daily activities, there was no need to keep the child in isolation and they were allowed to mix and socialize with other children and their families. This had a good psychological impact on the child and hastened the rate of healing. Daily wound inspection could be carried out without the need of painful changing of the dressing. They were discharged after adherence of the allograft. The dressing changing was easily done on out-patient basis; therefore; the hospital stay and probably the ultimate cost of the burn care was reduced.

In SSD treated group the painful daily dressing changing and the lesser rate of healing, as well as the higher incidence of infection lead to longer hospital stay and more suffering child.

In conclusion, partial-thickness scald injuries in children can be effectively treated with cryopreserved allograft with good results and early outcome, even in infants and toddlers. Cryopreserved allograft markedly simplifies burn wound care for the patient and his family and seems to significantly decrease pain, rate of infection, and achieves early closure of the wound. It would be worth full to perform more clinical studies with a larger number of patients and long term follow up to evaluate as well the functional and aesthetic results of cryopreserved allograft in treatment of scald injuries in children.

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