

OUTCOME OF COLLAGEN DRESSING IN THE MANAGEMENT OF SCALD BURN IN UNDER 5 YEARS PAEDIATRIC POPULATION

Plastic Surgery

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ABSTRACT

Burns in the paediatric patients are usually caused due to accidental spillage and scalding by hot liquids. These are usually partial thickness burns. Collagen dressings have a better outcome in the management of partial thickness burns.

Methodology: 60 patients under 5 years age with scald burn were included in prospective observational study. Study was carried from September 2019 to August 2020. Patients were analyzed in terms of the age, sex, type of burns, time presentation, degree and percentage of burns, outcome and complications.

Results: Out of 60 patients 38% patients between age groups 2 to 3 years, in our study most common aetiology of scald burns in children are hot water 38% followed by hot milk 24% and hot liquid food 23%. Most common parts affected upper limbs. Collagen based dressing primary wound healed in 95% patients and its p value is < 0.0001 . The result is significant at $p < .05$.

Conclusion: We observed collagen based dressing is very useful for treatment of scald burn in children. It is well tolerated, less painful, required lesser number of dressing, short duration of hospital stay and it has fewer wound complications.

KEYWORDS

Collagen, scald burn, paediatrics burns

INTRODUCTION

Burn injuries continue to be one of the major challenges faced worldwide, more so in the developing countries and particularly among the paediatric population. Burn injuries present a major public health problem in both adults and children. The common causes of burn injuries are thermal burns, scalding, or direct contact with hot surfaces. Most children suffer burns involving small surface areas; 85% burns occur in children under 5 years of age, is due to hot drink spillages.¹ Burn injuries are common in children as thinner skin tolerates less heat at a shorter duration before full-thickness injury occurs.² A deep partial thickness injury has the capacity to heal if a moist wound bed and adequate circulation are maintained and there is no infection. In the absence of the above factors, a partial-thickness burn wound converts into a full thickness wound.³ One of the primary problems in the management of burns is a bacterial infection which invasive burn wound infection and colonization by opportunistic organisms can take place which delays wound healing, increases pain, increase chance of secondary infection and the risk of scarring. In developing countries, the sepsis related mortality associated with burn injuries is about 75%.⁴ During the last decade, various new dressing materials developed, like calcium alginate, hydro-colloid membranes and fine mesh gauze. These have a disadvantage in that they become permeable to bacteria. Biological dressings like collagen on the other hand, create the most physiological interface between the wound surface and environment, and are impermeable to bacteria.⁵ Covering of superficial thermal burn wounds by collagen sheets is a common practice in the present times. By applying it over the wound, exposed dermis and free nerve endings get covered leading to reduction in pain and infection.⁶ Also, it acts as an interface between the wound's internal milieu and the external environment. Collagen dressings have other advantages over conventional dressings in terms of ease of application and being natural, non-immunogenic, non-pyrogenic, hypoallergenic, and pain-free.^{7,8} In addition to providing mechanical support to the connective tissue, the collagens form an essential substrate for cellular adhesion and migration.^{9,10} Therefore, collagen is considered to be an important factor in the regenerative process.^{11,12} Collagen is haemostatic, has low antigenicity, and supports cellular growth. The importance of collagen in burn wound healing has been appreciated for a long time. Wound healing and regeneration involves cell proliferation, cell migration, cell differentiation and interaction between the different components in which collagen may affect healing not only at the final stage but also in the very early stage of healing.¹³⁻¹⁶

Aims of study

The aim was to observe healing of wounds, and to obviate the need for

frequent change of dressings, to observe wound infection post-collagen dressing; which besides being painful, is quite troublesome in paediatric population

Data collection

During the period of study, the data were collected and analysed regarding the age, sex of the patient, type of burns, time period for presentation, degree and percentage of burns, and complications

METHODOLOGY

A prospective study was conducted in 60 patients of scalds burns under 5 years of age, from September 2019 to August 2020, at IPGME&R and SSKM hospital Kolkata, which is a tertiary care hospital. Patients with clean, first- and second-degree burns with burn surface $< 50\%$ were included in the study. Patients with full-thickness burns, surface more than 50%, electric burns, and with infected wounds were excluded from the study. The patients were assessed clinically, and the percentage of burn was calculated by Lund and Browder formula. After initial stabilization, wound dressing was done. The affected area was thoroughly cleansed for the removal of any external contamination under strict aseptic condition. The blisters were deroofed by excision of the blistered skin. Collagen sheet of bovine origin available in sterile preserving medium were used. Collagen sheets were washed with normal saline before application to remove all traces of preservation fluid and then were applied firmly over the burn areas. Over stretching of the sheets was avoided. All air bubbles between the wound and the collagen sheet were pushed out using the back of the forceps. It was ensured that circumferential burn areas, especially in the extremities when dressed with collagen sheets have a linear gap in the entire length of the extremity. This was done to avoid compression effect secondary to oedema. Adequate drying of collagen sheet was confirmed. Absorbent dressing was given to avoid displacements of sheet and soakage of any exudates. Patients were managed with antibiotics and analgesics and intravenous fluids depending on the percentage of total body surface area involved. Patients with small areas of collagen sheet application were discharged and followed in the outpatient department. The collagen sheet dries at the periphery and peels; it is then clipped off gradually till the wound heals completely. This usually takes 10–14 days.

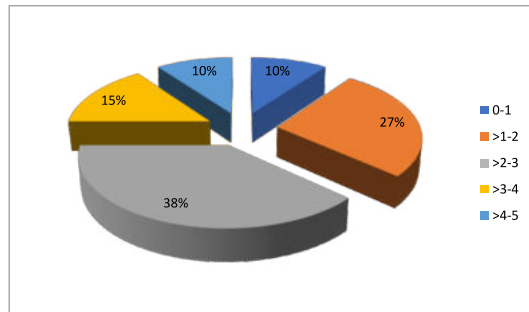
No complications of collagen were noted. Patients who had delayed presentation developed infection under the sheet which warranted sheet removal. The small patches of third-degree burns in otherwise superficial burn wounds had a delayed healing.

RESULTS

Table 1: distribution of age in years

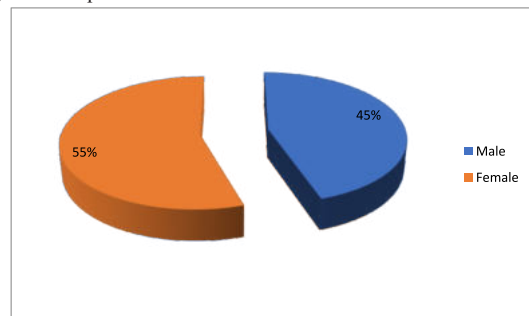
Age in years	Frequency
0-1	6
>1-2	16
>2-3	23
>3-4	9
>4-5	6
Total	60

The value of z is 1.3643. The value of p is .17384. The result is not significant at $p < .05$

**Table 2: distribution of Sex**

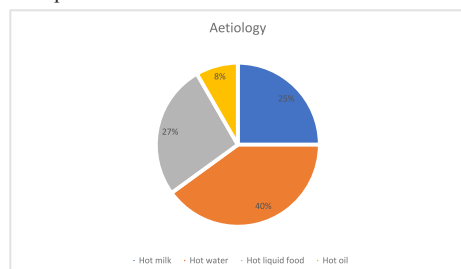
Sex	Frequency
Male	27
Female	33
Total	60

The value of z is 1.0954. The value of p is .27134. The result is not significant at $p < .05$.

**Table 3: distribution of Etiology of burn**

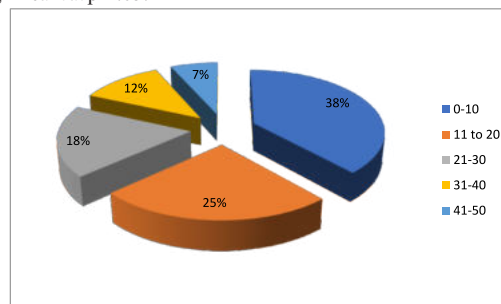
Aetiology of burn	Frequency
Hot milk	15
Hot water	24
Hot liquid food	16
Hot oil	5
Total	60

The value of z is 1.7791. The value of p is .07508. The result is not significant at $p < .05$

**Table 4: distribution of TBSA burns**

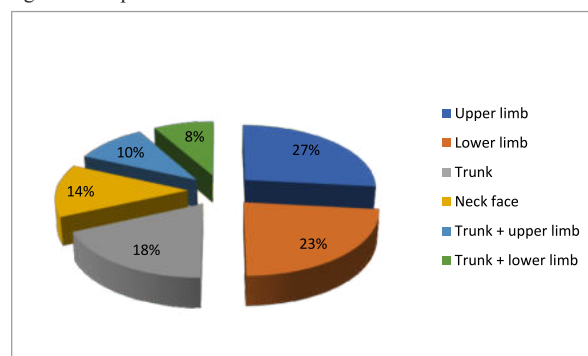
TBSA Burns	Frequency
0-10	23
11-20	15
21-30	11
31-40	7
41-50	4
Total	60

The value of z is 1.5699. The value of p is .11642. The result is not significant at $p < .05$.

**Table 5: distribution of patients as per body surface was affected due to burns**

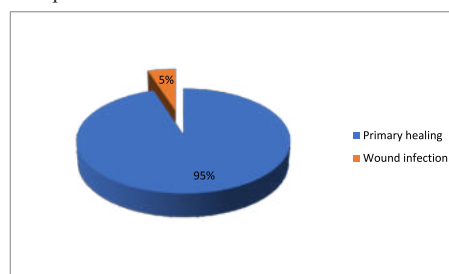
Body surface was affected due to burn	Frequency
Upper limb	16
Lower limb	14
Trunk	11
Neck face	8
Trunk + upper limb	6
Trunk + lower limb	5
Total	60

The value of z is 0.4216. The value of p is .67448. The result is not significant at $p < .05$.

**Table 6: distribution of outcome of the patients**

Outcome	Frequency
Primary healing	57
Wound infection	3
Total	60

The value of z is 9.859. The value of p is $< .00001$. The result is significant at $p < .05$.

**Figure 1**

A- At time of presentation. B - After collagen sheet application. C- Present after 5 days

D- After 10 days of collagen application- wound healed

Figure 2



After 14 days of collagen application wound - wound healed

In our study total of 60 patients were included. In which there were 45% male and 55% female patients. Out of 60 maximum patients between 2 to 3 years is 38 %, TBSA burns most of patients < 11% i.e 38%, most common body parts affected upper limbs 27% followed by lower limbs. In our study scald burns in children under 5 years age are hot water, hot milk and hot liquid food and hot oil are 40%, 25%, 27% and 8% respectively. After collagen dressing 95 % wound healed primary i.e significant $p < .05$. Only 2 patients have wound infections.

DISCUSSION

Burn-related injuries are the leading cause of morbidity and mortality in children. In India, paediatric burns account for 17–25% of the total burns admissions.¹⁷ Approximately, 90% of burns are caused by household accidents. In children <3 years, scald burns are more common. Accidental burns are common in low socioeconomic class due to overcrowding and unsafe cooking habits and lack of adult supervision for the children. Scald burns usually occur when children unknowingly pull utensils containing hot liquids. Burn injuries produce coagulative necrosis of the skin and underlying tissues which are very painful and are associated with complex local and systemic pathology and a high mortality. Superficial burns, i.e., first-degree burns heal in 5–7 days without any scarring. While superficial dermal or deep dermal burns, i.e., second-degree burns take 2–4 weeks to heal and are extremely painful. Second-degree burns if not treated promptly and properly may get infected and converted into third degree, i.e., deep burns resulting in scarring and contracture formation. The goal of burn therapy in children is to prevent infection, limit pain, decrease metabolic demand, promote healing, and minimize disability. The use of a biologic wound covering in pediatric burns reduces the number of dressing changes and minimizes all components of standard burn therapy. By protecting the wound, a biologic dressing may accelerate healing and decrease the development of a hypertrophic scar.¹⁸ A biological dressing like collagen is a unique protein with a triple helical structure, and each helix has over 1000 amino acids. The main type of collagen in the skin is Type I collagen.¹⁹ Chemically, bovine collagen is very similar to the human form. Collagen sheets are produced from bovine tissues comprising mostly Type I and III collagens. Collagen sheet is prepared from a bovine collagenous tissue by treating tissues with a series of chemical and enzymatic procedures. This is followed by chemical crosslinking, packing, and sterilization. Granulation tissue developed at a normal rate and the cellular events were precisely the same as those occurring in normal wounds.¹⁹ Collagen sheets are very useful in first- and second-degree burns. The cost factor comes down, and the pain associated with dressing can be avoided.¹⁹ Daily dressing in pediatric age group is painful and requires sedation. The cost incurred by both the parents and the hospital associated with multiple dressings can be avoided by a single collagen dressing. It is especially useful in children since the psychological trauma to the child and parents is minimized. Biologically, the collagen sheet is non-inflammatory, nontoxic, has low antigenicity, has minimal degradation, facilitates migration of fibroblasts and microvascular cells, and helps in synthesis of neodermal collagen matrices, thus minimizes scarring. Physiologically, it is elastic, soft, supple, and has good tear strength. It is impermeable to bacterial migration, modulates fluid flux from the wound, and has enough strength to be peeled off from the wound.¹⁹ Collagen sheet has been found to be well tolerated in clinical trials. There have been no reports of clinically significant immunological or histological responses to the implementation of collagen sheet and no reports of rejection of collagen sheet.¹⁹ There is no threat of HIV or hepatitis infections as bovine material is obtained

from countries free of bovine spongiform encephalopathy and possesses a long shelf life under normal storage conditions.¹⁹ The use of collagen dressing has been found to inhibit the action of metalloproteinases. Collagen sheets, when applied to a wound, not only promote angiogenesis but also enhance body's repair mechanisms. Collagen serves as a template for the infiltration of fibroblasts, macrophages, and lymphocytes and attracts additional monocytes to the wound, thus increasing the amount of debris removed and capillaries forming the neovascular network. As healing progresses, collagen is deposited by the fibroblasts, replacing the collagen portion of the collagen sheet.¹⁹ Moreover, it is easy to apply and has the additional advantage of stopping bleeding. A study done by Singh *et al.*²⁰ has shown that the use of collagen dressings hastens the wound healing in various types of wounds, reduces scar contracture, and reduces the need for skin grafting. In a study by Gupta *et al.*²¹, collagen sheet cover was used in 32 cases of fresh burns and 26 cases of post-burn contractures. It safeguards against exogenous infection, prevented exudation from the raw areas, and provided rapid epithelialization and healing. Gerding *et al.*, Barret, and Jaun *et al.* concluded that Biobrane therapy can significantly decrease pain, total healing time, and length of hospital stay with improve compliance.²² Demling and Desanti, *et al.* in their study concluded that a bioengineered skin substitute significantly improves the management and healing rate of partial thickness facial burns compared to the standard open topical ointment technique.²³ In our study, the outcome of pediatric burns managed by collagen dressings. It is well tolerated, less painful, required lesser number of dressing, short duration of hospital stay and it has fewer wound complications. There were no side effects of collagen application.

CONCLUSION

Most paediatric scald injuries are accidental and therefore preventable with adequate public education regarding safety methods. We conclude that collagen based dressing is a very good modality of treatment for the burn wounds with advantages of being cost effective and can be done as a part of first aid requiring no special needs. Burnt area requires lesser number of dressings, patients need lesser blood transfusions and have shorter duration of hospital stay. Also, it minimizes the psychological trauma of both, the paediatric patients as well as their parents, by the need for change of lesser number of dressings; which is more painful for the parents on seeing their children in agony than the pain of the affected children itself. Management of paediatric fresh burns of first and second degrees with collagen sheet yields good recovery and avoids trauma and pain of the conventional dressings

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