Original Article

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Surgery Section

Effectiveness of Collagen Dressing in Second Degree Paediatric Burns: A Cross-sectional Descriptive Study

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ABSTRACT

Introduction: Most common cause of burns in paediatric age group is scalds. Though intentional paediatrics burns are reported, usually they are caused by accidental spillage of hot water. Along with fluid management, major part of managing burns involves repeated dressings. Biological dressings like collagen are impervious to bacteria and create the most biological interface between the wound surface and the environment, ensuing in better healing.

Aim: To determine the effectiveness of collagen dressings in second degree paediatric burns.

Materials and Methods: A cross-sectional descriptive study done at Mahabhodhi Burns Center, Bangalore Medical College and Research Institute, Bangalore, Karnataka, India, from January 2018 to December 2019, included 75 second degree paediatric burns patients. Re-epithelialisation rates, infection and progress to full thickness burns were evaluated. Statistical analysis was done using the Statistical Package for the Social Sciences (SPSS) software v.23.

Results: Out of 75 children, 8 (10.7%) of children had complete re-epithelisation by seven days, 55 (73.3%) between 8 to 14 days and 4 (5.3%) between 14 to 21 days. Total 67 (89.3%) of children had complete epithialisation by 21 days, with mean of 9.5 days.

Conclusion: Overall, collagen dressing helps in preventing infection, early re-epithelization, and avoids painful dressings. It minimises the psychological trauma on both patients as well as their parents.

Keywords: Burn dressing, Scald burns, Second degree burns, Re-epithelialisation

INTRODUCTION

Paediatric burns, are unintentional disaster. Though intentional paediatrics burns are reported, usually they are caused by accidental spillage of hot water. Other causes of paediatric burns are thermal burns, scalds due to hot oil spillage, direct contact with hot surfaces and cracker burns [1]. Burn injuries in children is a major epidemiological problem around the globe. Nearly a fourth of all burn injuries occur in children under the age of 16, of whom the majority are under the age of five [2,3]. Skin in children is thinner, tolerates less heat, hence full-thickness injury occurs even with short duration of exposure [4].

When moist wound bed and adequate circulation are maintained and there is no infection, deep partial thickness injury has the capacity to heal well. In the absence of the overhead factors, a partial-thickness burn wound changes into a full thickness wound [5].

Bacterial infection is a major problem which delays healing, increases pain and the risk of scarring. Along with fluid management, major part of managing burns involves repeated dressings. Biological dressings like collagen are impermeable to bacteria and create the most physiological interface between the wound surface and the environment [6]. Advantages of collagen dressing over conventional dressings are: ease of application and being natural, nonimmunogenic, nonpyrogenic, hypoallergenic, and pain-free [7].

Preservation of overall homeostasis is the primary goal of management. Major burn injury results in local damage from the inciting injury and if inadequately treated leads to multi system failure. Hence, wound care is a crucial aspect of treatment. Regular dressing changes and aggressive wound debridement are instrumental for early recovery. These measures protect the wound from further infection, provides comfort, and promotes healing [8]. It should be noted that a variety of dressings exist including standard fine mesh gauze, hydrocolloid, silver containing dressings, biosynthetic, and biologic dressings [9-11].

type I collagen is the main type of collagen in the skin. Chemically, bovine collagen is remarkably similar to the human form. Collagen sheets derived from bovine tissues comprise mostly Type I and III collagens [3]. Collagen dressings have other advantages over regulär dressings in terms of ease of application and being natural, non immunogenic, non pyrogenic, hypo allergenic, and subsequent pain-free dressings [12]. Once applied, it does not need frequent dressing change, effectively reducing number of dressing changes under anaesthesia.

The present study was conducted with an aim to determine the effectiveness of collagen dressings in second degree paediatric burns.

MATERIALS AND METHODS

A cross-sectional descriptive study was conducted at Mahabhodhi Burns Center, Bangalore Medical College and Research Institute, Bangalore, Karnataka, India, during January 2018 to December 2019. Seventy-five second degree paediatric burns patients were included. Informed consent was obtained from all parents [4]. Convenience sampling was adopted and all the patients who fit into the inclusion criteria and who came during the study period were included.

Inclusion and Exclusion criteria: Inclusion criteria was less than 12 years of age, second degree burns, presentation before 72 hours, no signs of infection, burn surface area less than 35%. Rule of nine was used to calculate the Total Body Surface Area (TBSA) of burns [1]. Children with full thickness burns, clinically infected burns, electric burns, delayed presentation beyond 72 hours and burns surface area more than 35% were excluded from the study.

Study procedure

After admission, initial fluid management was done. After stabilisation, under general anaesthesia wound was thoroughly cleaned, blisters were deroofed, wet collagen sheet of bovine origin in a sterile preserving solution was washed multiple times in normal saline. Meshed collagen sheets were applied over burnt area and fixed with absorbable suture when required. Over this, a layer of non-adherent gauze was applied followed by absorbent bulk dressing which was changed after three days to minimal or no dressing. As the wound started epithelialising, the collagen sheet dried, which was clipped off gradually. Re-epithelialisation rates, infection and progress to full thickness burns were evaluated. Re-epithelialisation was assessed by separation of collagen from the wound. Presence of purulent discharge below the collagen dressing was considered as infected wound. Wounds that failed to heal after three weeks were considered as full thickness burn wounds.

STATISTICAL ANALYSIS

Statistical analyses were done using SPSS v.23. Descriptive statistics was used and results were expressed in terms of frequency and percentages.

RESULTS

Out of 75 children, 42 children were male, 33 were female. Mean age of the patients was 5.04 years. Most common cause of burns was scalds, which constituted 69 (92%) followed by 6 (8%) of flames burns. In our study 60 (80%) of children had ≤20% of TBSA involved [Table/Fig-1].

Sex		Age		Type of burns		TBSA of burns	
Male	Female	1-6 years	7-12 years	Scald	Flame	≤20%	>20%
42	33	52	23	69	6	60	15

[Table/Fig-1]: Demographic details.

Total 8 (10.7%) of children had complete re-epithelisation by seven days, 55 (73.3%) between 7-14 days and 4 (5.3%) between 14 to 21 days [Table/Fig-2]. Mean time of complete epithelization with separation of collagen from wound was 9.5±3.29 days.

Time to complete epithelization	Number of patients
Within 7 days	8 (10.7%)
7 to 14 days	55 (73.3%)
14 to 21 days	4 (5.3%)

[Table/Fig-2]: Re-epithelialization rates (N=67).

Total 67 (89.3%) of children had complete epithelization by 21 days [Table/Fig-1,2]. About 5 (6.7%) progressed to deep or full thickness burns requiring surgery, and 3 (4%) developed infection, subsequently collagen was removed [Table/Fig-3]. No mortality was seen among our patients in the study. [Table/Fig-4-6] showed illustration of few cases which shows complete re-epithelisation.

Outcomes	Number of patients
Complete epithelization	67 (89.3%)
Progress to full thickness	5 (6.7%)
Developed infection	3 (4%)

[Table/Fig-3]: Outcomes of treatment.

DISCUSSION

Collagen is a biomaterial that helps in wound healing through deposition and organisation of freshly formed fibers and granulation tissue in the wound bed thus creating a favourable environment for wound healing [12].

Collagen sheets, when applied to a wound promotes angiogenesis and also enhances body's repair mechanisms. While acting as a mechanical support collagen reduces oedema, prevents loss of fluids from the wound site and facilitates migration of fibroblasts into the wound, which further enhances the metabolic activity of the granulation tissue [11,12].

[Table/Fig-4]: a) 10% partial thickness burns, b) After cleaning the wound, c) Post collagen application, d) Post collagen application-day 9 showing complete re-epithelization.

[Table/Fig-5]: a) 3-day old partial thickness burns, b) Post collagen application-day 4, c) Post collagen application- day 11 showing complete re-epithelisation.

[Table/Fig-6]: Complete re-epithelialisation in 8 days following collagen application in partial thickness burns.

In our study, out of 75 patients, no mortality was seen. Scalds was the most common cause of burns, which is a common finding in most studies [1,2,5,7]. Mean time of complete epithelialisation with separation of collagen from wound was 9.5 days. [Table/Fig-6] shows complete re-epithelialisation in eight days following collagen application in partial thickness burns. In a study done by Mehta MA et al., the mean complete healing time was 7.476 for collagen-based dressing and 12.88 for silver sulfadiazine-based dressing [13]. Shettigar UR et al., in their study on animal models, showed

that the collagen dressed burn wounds had faster epithelialization with dense fibrous tissue in growth in the subdermal layers and little inflammatory change [14]. Only three patients developed infection which required removal of collagen. Presence of infection was identified by the collection of purulent discharge underneath the collagen. Infection rate of 4% clearly signifies the effectiveness of collagen in burns wound healing. Church D et al., mentions "colonisation of burn wound occurs around 72 to 96 hours post burns, so early dressing with collagen helps in preventing infection, which may have devastating consequences in paediatrics age group [15].

Once done, collagen dressing doesn't require dressing change till re-epithelialisation completes, which helps in avoiding frequent painful dressing. This is particularly important in tertiary centers, where, due to over case load and shortage of staff, it's not always possible to change the dressing under anaesthesia. Singer AJ and Thode HC Jr, quotes "Pain management is critical in the overall care of the burn injured patient. Severe pain is a major consequence of burn injury, and it has been demonstrated that it is often inadequately treated". Anxiety and depression are confounding components in a major burn and can further decrease the pain threshold [16].

Mathangi Ramakrishnan K et al., also states that "Collagen dressing has many advantages like, ease of application and removal of the membrane after epithelization, painless dressing, and cost effectiveness compared to Integra®, Biobrane® and Acticoat®" [17].

Being tertiary center, most of our patients hail from distant places and they prefer staying till the wound heals completely, hence duration of admission was not included in our study.

A single stretch of membrane is not advisable to be placed on flexor surfaces as it cracks when it becomes dry and visible wound through the membrane may give rise to apprehension amongst care givers. One more disadvantage we have observed in our study is the difficulty in maintaining over all body hygiene when collagen dressing is used for smaller surface area of burns and collagen dressing is not suitable for gluteal and posterior thigh burns.

Limitation(s)

The study was limited by lack of long-term follow-up to asses scar quality and absence of comparison with other commonly used dressing materials.

CONCLUSION(S)

Over all, collagen dressing helps in preventing infection and early re-epithelization. It minimises the psychological trauma of both patients as well as their parents. Collagen dressing does not require great skills to master, being available easily, hence it should be the standard of care for burns dressing in paediatric patients.

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