

Outcome of second-degree burns in paediatric patients: Efficacy of antibiotic coating dressing

Habib Ullah Shah, Huma Gul, Muhammad Mukhtar Khan, Rashid Khan

Abstract

Objective: To determine the long-term outcome of burns in paediatric age patients for antibiotic coated dressing using a special technique with emphasis on its role in developing countries.

Methods: This is a retrospective review of prospectively collected data of paediatric age patients treated at Habib Burns Centre, Peshawar, Pakistan between January 2013 and December 2015. Data analysed included patient demographics, burn characteristics (burn type, body surface area, time to presentation and culture positivity of wound surface), treatment methods with dressing and debridement, in terms of total healing time, length of hospital stay, complications and mortality.

Results: 1,112 pediatric patients (49.2% males and 50.8% females) with mean age of 10.02 years \pm 3.37 SD. The mean total body surface area (TBSA) was 18.16% \pm 8.59 SD. Mean healing time was 14.41 days \pm 5.75 SD. Mean length of stay (LOS) was 8.13 days \pm 3.66 SD. Mean time to presentation was 40.13 hours \pm 43.06 SD. The majority of patients presented during the months of June and July. The overall mortality rate was 2.3% (26). Strong predictors of severe morbidity and mortality were concomitant inhalational injury, body surface area (<0.001).

Conclusion: Coating with a mixture of antibiotic and silver ointments followed by covering the wound with antibiotic impregnated mesh dressing gives favourable results in partial thickness burn wounds and due to its cost effectiveness should be utilised in economically developing countries.

Keywords: 2nd degree burns in paediatric, morbidity, mortality, antibiotic impregnated mesh dressing, silver ointment

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Habib Burn Centre,
Zia Medical Complex,
Peshawar, KPK, Pakistan
HU Shah

Khyber Medical
University Peshawar
H Gul

Hayatabad Medical,
Complex Peshawar
MM Khan
R Khan

Correspondence:
Dr. Habib Ullah Shah
MBBS, FCPS (Plastic
Surgery), Consultant
Plastic Surgeon, Habib
Burn Centre, Zia Medical
Complex, Peshawar, KPK,
Pakistan
Cell: +92 334 8800339
Email: drhabibullahshah@
gmail.com

Introduction:

Burn injury is a form of acute trauma with very unique presentation, associated prognostic factors, complications and methods of treatment. Children are one of the most commonly affected age group who are usually caught in house fires and accidental situations leading to serious morbidity and a considerable mortality.^{1,2,3} Management of a burnt child is entirely different than the adult patients due to physiological and pathological differences.⁴

Children in our community are more susceptible to the adverse consequences of burn injury due to limited physiological reserves, neglect by parents and guardians and non-availability of

specialist burn centres in the province of Khyber Pakhtunkhwa, Pakistan.^{3,4} All over the world, majority of affected children are below the 5-year age, contract scald burns and the upper limbs especially hands are frequently affected.⁵ Burns in children have immense consequences both in terms of physical dysfunction and mental trauma.^{3,6}

A variety of different treatment methods for partial thickness burns, both conservative and surgical, have been introduced over the last two decades, mostly depending upon the surface area involved and thickness of burns.⁷⁻¹¹ Almost all techniques whether surgical or non-surgical have their own merits and demerits. However,

the primary goal of all modes of treatment is to attain effective skin covering and rapid epithelialisation, which becomes more relevant in partial thickness skin burns.¹²⁻¹⁴ As a general rule, for partial thickness skin burns, dressing techniques are valuable while for full thickness burns or those patients where dressing has failed to achieve epithelialisation, split skin grafting is effective.^{11,15} In children, partial thickness burns are commonly reported and various dressing techniques with variable rates of success have been reported.

The aim of our study, therefore, is to determine the efficacy and outcome of paediatric patients of partial thickness burns, treated with antibiotic impregnated dressing in terms of wound healing time, length of hospital stay and the occurrence of short and long-term complications.

Methods:

This is a retrospective review of prospectively collected data between January 2013 and December 2015. The study was conducted at Habib Burn Trust Peshawar, a private specialist centre for burns management. Informed consent was taken from all patients before inclusion in the study and before undergoing any interventional procedure.

Inclusion Criteria: All newly admitted paediatric age patients (1- 16 years), with second degree (superficial & deep) burns irrespective of their gender were included in the study.

Exclusion Criteria: Patients with chronic complications of burn wounds, those who were managed at other centres and those with small (< 3% TBSA) or first and third degree burns were excluded.

Procedures: Patients with more than 5% TBSA and 2nd degree burns (both superficial and deep) were admitted for further treatment after initial emergency resuscitation. Broad spectrum intravenous antibiotics were given prophylactically and dual analgesia was provided for relieving the background pain.

All patients with 2nd degree burns (both superficial & deep) were initially treated with antibiotic and silver coated mesh dressing technique. In this technique, we used antibiotic ointment (Polymyxin B) mixed with silver ointment (Silver Sulphadiazine). A coat was applied over the burnt skin surface, which was then covered with another layer of antibiotic coated mesh dressing. Initial dressing was left for five days in all patients. After first dressing removal, the condition of the wound was assessed for signs of infection or necrosis as well as the status of epithelialisation was noted. Patients who responded with granulation tissue growth and epithelialisation of the wound were treated with simple mesh dressing for another five days.

Patients who developed wound infection or necrosis and those who failed to respond with granulation and epithelialisation of the wound in three dressings (15 days) were listed for surgical excision of the wounds and ultimately split skin grafting once the wound was healthy and granulating.

Data Collection: Data was collected prospectively using a form detailing patient demographic data, duration between burn and presentation, extent of burn (% TBSA), type of burn and the primary body site involved. Data was also collected about healing time, total length of stay and complications. Mortality was recorded for both in-hospital and during follow-up.

Data Analysis: All data was entered and analysed using the IBM SPSS Statistics version 22.0. Frequencies and percentages were determined and displayed as tables and charts for the categorical variables. Descriptive variables were stated as mean±SD. Chi-square test was run for determining association between categorical variables while Mann-Whitney test was run for determining statistical significance between the occurrence of mortality and various clinical variables. The multivariate Spearman's rank correlation test was used to determine correlation between various continuous and ordinal variables. A p-value of ≤ 0.05 was regarded as value for statistical significance.

Table 1: Clinical features and their comparative representation for mortality

	No Mortality (n = 1086)	Mortality (n = 26)
Age	10.02 years \pm 3.93	9.96 years \pm 2.20
Time to presentation	39.69 hours \pm 42.65	58.15 hours \pm 55.82
TBSA	17.82 \pm 8.08	32.31 \pm 15.06
Total healing time	14.39 days \pm 5.75	15.38 days \pm 5.95
Total length of stay	8.04 days \pm 3.59	11.77 days \pm 4.58
	Frequency (%)	Frequency (%)
Gender		
Male	536 (49.4%)	11 (42.3%)
Female	550 (50.6%)	15 (57.7%)
Inhalational injury	15 (1.4%)	5 (19.2%)
Wound Infection	71 (6.5%)	5 (19.2%)
Burn Type		
Scald	966 (89.0%)	21 (80.8%)
Flame	522 (8.7%)	-
Chemical	199 (1.8%)	-
Electrical	125 (0.5%)	5 (19.2%)
Primary Body Site Involved		
Head, Neck, Face	240 (22.1%)	5 (19.2%)
Upper Limbs & Chest	522 (48.1%)	6 (23.1%)
Lower Limbs	199 (18.3%)	10 (38.5%)
Trunk (back/front)	125 (11.5%)	5 (19.2%)

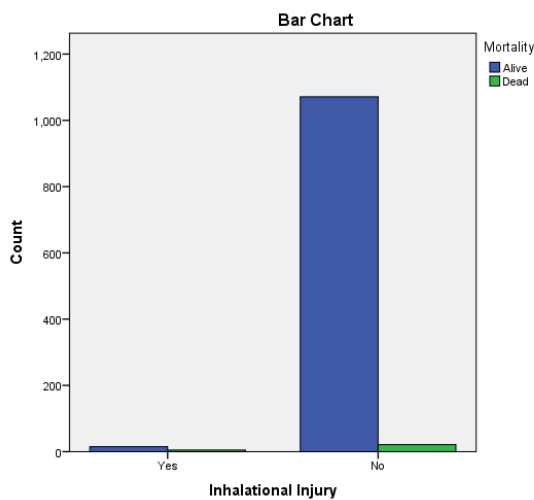


Figure 1: Mortality and inhalational injury association (chi-square)

Results:

Patient Demographics: 1,112 patients were included during the 3-year period with 547 (49.2%) males and 565 (50.8%) females. Mean age was 10.02 years \pm 3.37 SD with mean time to presentation 40.13 hours \pm 43.06 SD.

Injury Patterns: Burn patterns (TBSA, burn type and body sites stratified for mortality) are

summarised in Table 1

Outcome Measures: Overall mean length of stay (LOS) was 8.13 days \pm 3.66 SD while overall mean total healing time was 14.41 days \pm 5.75 SD. The mean TBSA was 18.16% \pm 8.59 SD.

Superficial skin infection occurred in 76 (6.8%) patients while 94 (8.5%) cases of scar hypertrophy and contractures development. Overall mortality was 2.3% (26) patients. (Table 1)

Detailed Analysis: On Chi-square analysis for association between various variables, it was noted that scalds were associated with a high number of superficial wound infection ($p=0.16$) while there was also a higher number of hypertrophic scar development as compared to other modes of burn ($p=b0.026$). Inhalational injury was frequently associated with early death of the patients ($p < 0.001$, OR = 13.0, 95% CI, 5.4 to 31.0). (Figure 1)

A bivariate Spearman's rank correlation test was run to determine association between TBSA to outcome in terms of healing time and length of stay. A positive correlation ($r^2 = 0.34$) was noted between TBSA and total healing time ($p < 0.001$) as well as TBSA and total length of stay ($r^2 = 0.70$, $p < 0.001$).

Discussion:

Paediatric age burns have serious consequences in terms of physical dysfunction and mental suffering. An important clinical aspect of paediatric burns is their physical and mental fragility to major trauma like burns, their inability to correctly express their pain and suffering and the limited ability to cope with increasing physical and psychological demands imparted by the significant trauma of burns.^{3,4} Moreover, chronic sequelae of burns upon the growing body and mind are particularly of concern taking into account the physical and mental limitations which they can incur over the course of time.¹⁶ The caveats in paediatric burns management are the lack of specific and effective outcome measure instruments which can be used to quantify patient distress, mental and physical dysfunction and the

effect of treatment.^{17,18} The need of the moment is extensive nationwide research and particular attention to the rehabilitation of the paediatric age patients in our country where burn management lags behind as compared to the developed countries.¹¹

Most studies on paediatric age burn patients have recorded increased incidence of scald burns as compared to flame burns and majority of female patients.^{2,19,20} Children are increasingly affected due to decreased comprehension of hazard and curiosity for holding and turning things.²¹ Lack of safe home environments, a responsibility of parents and the regulatory bodies, is the leading reason resulting in such a high incidence of burns in paediatric age groups.²² Our findings are similar to most of the study where majority of patients were affected by scald burns with a median age of 10 years or lower most of the patients presented after more than 50 hours were spent. The prime reason for late presentation is lack of specialist burns centres in peripheral areas of our country, where patients due to lack of good transportation reach very late. Most of our patients are also from the neighbouring Afghanistan, where healthcare facilities are even in more detrimental conditions. Another reason for delayed presentation is personal beliefs of the parents and guardians who initially consult the local quacks before consulting specialists.

Antibiotic and silver coated dressings are a simple measure for managing the partial thickness burns and it can even be done in far flung dispensaries where provision of antibiotics and silver ointments is not a difficult task. Multiple studies^{7-9,10,23} have compared the effectiveness of a diverse array of dressing techniques in treating partial thickness burns. Although, the issue is a controversy with some authors^{11,24} advocating early wound excision and grafting, in view of our local situation where patients present late and can barely afford prolonged surgical treatments, antibiotic and silver impregnated dressings are the need of the moment. Most of our patients at presentation are generally reluctant to go for immediate wound excision and split skin grafting and they expressly prefer that initially dress-

ings be applied to wounds. In our society, surgical interventions and anaesthesia are viewed by people as having serious complications in the form of haemorrhage and death. On top of these, most of the patients are poor and cannot afford prolonged surgical care and they prefer that the wounds be treated in conservative manners unless there is failure of dressing or larger and deeper skin defects. In view of these factors, we tried to determine the effectiveness of our technique and its applicability in terms of healing rates and length of stay, which correspond to overall healthcare costs for these patients.

Toussaint J et al,⁷ in a randomised controlled trial compared modelled partial thickness burn wounds to be treated with topical antibiotic ointment versus silver containing foam dressing. Their results were complete re-epithelialisation in antibiotic ointment group at day 21 while only 55% wounds re-epithelialized in the silver impregnated dressings. They favoured the antibiotic impregnated dressings on the grounds that silver dressed wounds were dry and slow on re-epithelialisation as compared to the antibiotic dressed wounds. On the other hand, a study by Glat PM et al,²⁵ compared the silver impregnated foam dressing to historical controls and found speedy re-epithelialisation, shorter hospital stay and less need for dressing changes. On the basis of these and other numerous studies^{9,26,27} where differences exist on the use of purely antibiotic coated or silver coated dressing techniques, we combined the two in order to utilise the effectiveness of both the ingredients. In our technique, the antibiotic ointment provides a sterile environment while silver provides for rapid healing conditions as well as antiseptis and coating. Ointments are also superior to creams in supporting the local humidity of the wound which facilitates good epithelialisation.

In our study we achieved a mean total healing time of 14.41 days (\pm 5.7 SD) for the dressing only group. More than half of patients heal within the first two weeks of dressing while the rest healed within the second to third week. Moreover, since the wound must be prepared for and will require repeated excision in delayed

presenting patients, it is better to effectively intervene using the dressing only technique. If, however, the dressing techniques fail or the wound doesn't re-epithelialize within a predictable range of time, then grafting can be considered. This will decrease the burden on hospitals, patients and families as well as provide for a cost effective approach in managing partial thickness burn wounds. We, however, found that flame and electric burns are difficult to treat with the dressing only technique, majority of patients will still require wound excision and early grafting in these cases, especially if it involves hands, feet, perineum and the face.

Like most of the studies,^{1,28,29} we found a significant correlation of total body surface area and total healing time/length of stay as well as the association of inhalational injury to high rates of mortality ($p < 0.001$). These findings suggest that patients with extensive burns and those with a component of inhalational injury should be managed aggressively in all aspects and not merely from the aspect of wound management, more effectively in an intensive care setting.

The weaknesses of our study are its descriptive nature, no blinding, no randomisation and inclusion of only the partial thickness burns. A cause and effect relationship would have been more effectively obtained if it was a randomised controlled trial, with blinding of the investigator regarding wound status assessment in order to minimise selection and observer bias.

Conclusions:

Partial thickness burns in paediatric population are extremely common with significant mortality and morbidity. Our dressing technique is effective in reducing healing times, length of stay and costs and is a viable choice for patients of second degree burns. Grafting or other methods could be considered once the dressing technique has failed or if there are clear indications for it.

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Role and contribution of authors:

Dr Habib Ullah Shah, MBBS, FCPS (Plastic Surgery), Consultant Plastic Surgeon, did collected the data, references and wrote the initial writeup.

Dr Huma Gul, MBBS, M-Phil Scholar (Anat), helped in collection of data and in introduction writing

Dr Muhammad Mukhtar Khan, MBBS, FCPS-II (Neurosurgery), collected the data and references and helped in discussion writing.

Dr Rashid Khan, MBBS, FCPS-II (Plastic Surgery) trainee, collected the references and helped in methodology and discussion writing.

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