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Management Strategies of Major Burns and Learning Curve

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ABSTRACT

Large total body surface area burns can have a substantial impact on morbidity and mortality, but with early management and intervention by a skilled surgical team, outcomes can be favorable. The purpose of our study is to discuss the management of extensive burns and review the experience at our center. A review of patients admitted to this hospital in the previous two years, with burns greater that 50% was done. From July 2022 to July 2024, 43 patients with burn sizes more than 50% TBSA were admitted. The female and male ratio was 1.047:1 and with an average age of 28.674 ± 9.37 years (range 9-58 years). There was an average delay of 2.053 ± 2.19 days between the burn and arrival at our centre (Range of 3 hours to 9 days). Esharotomies and fasciotomy was done in 20 and 8 patients, respectively. All patients expired in the hospital except one, who went LAMA. 20 patients survived for 2 to 5 days. Major cause of death in most of the patients was Sepsis. The two most significant risk variables affecting a burn victim's survival and clinical outcome are burn size and depth. Because donor sites are insufficient for the necessary grafting procedures, burns with a size greater than 80% of the total body surface area (TBSA) provide daunting surgical obstacles. Comfort care may be the best choice when clinical predictors indicate no likelihood of success.

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INTRODUCTION

The TBSA can be used to calculate and measure the related morbidity and mortality of burns, which is considered an independent factor.[1,2] The morbidity and mortality rate increase with increasing surface area.[3,4] According to Jeschke *et al.*, TBSA greater than 40% is linked to a high risk of morbidity and mortality.[5] The modified Baux Score can be used to predict the chance of mortality due to burns, taking into account the age, surface area burned and presence of inhalational injury. Large total body surface area burns can have a substantial impact on morbidity and mortality, but with early management and intervention by a skilled surgical team, outcomes can be favourable.[6] In this study, we discuss the management of extensive burns and review the experience at our centre.

MATERIAL AND METHODS

This research was done at our department, in Burns Intensive Care Unit of the Plastic Surgery Department. A review of patients admitted to this hospital in the previous two year with burns greater that 50% was done. Information was collected using a pre-prepared questionnaire and collected in Microsoft Excel.

INITIAL RESUSCITATION

Resuscitation of total body burns provides its own unique challenge. Routine formulae for resuscitation

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would overestimate the amount of fluid delivered and hence these are capped at 50% TBSA. No separate guidelines exist for massive burns.[7] The fluid of choice is crystalloids but recent evidence suggests that there is a role of giving early colloids in large burns. This reduces the amount of fluid that needs to be given, reducing edema and helping in maintaining the zone of stasis.[8] Hypertonic saline has also been used in severe burns, helping draw fluid from the third spaces. However, it is to be used with caution and hence not routinely used. Patients in our group who presented with poor or delayed resuscitation usually succumbed to acute kidney injury (AKI).

SURGICAL MANAGEMENT

The practice is to make the patient as comfortable as possible. Interventions must be judicious and with rationale. Unnecessary interventions further burden the family draining them of precious resources. Although the treatment is to remove the dead skin and replace it with cover, there is no skin available to cover. Repeated debridements can be performed but still the problem of cover exists. Escharotomies and fasciotomies can be done to reduce the constricting pressure over chest and limbs, to help in chest expansion and preserve the vascularity of the limb.

Skin substitutes[9] are available in the market but can be prohibitively expensive. Biological dressings are available like collagen and amniotic membrane. Cadeveric skin, stored in skin banks, is a promising alternative.[10] It is the need of the hour to actively establish as many skin banks as possible and spread awareness among the common public regarding their possibilities. Skin allotransplantation[11] has also been performed, usually in children from mothers, which helps to tide over the initial burn. However, it has not been reported in whole body burns. More research is required before such type of allotransplantation becomes a viable alternative. Tissue engineering is another exciting branch that may make the need for allotransplantation redundant inhale distant future. Scalp is a relatively protected area due to the presence of hairs, with burns here being superficial compared to the rest of the body. Once healed, this can be a source of grafts, with repeated harvest possible after a period of time. The authors believe that debridement without cover would only unnecessarily burden the patient and attendants.

Analgesia

Few case reports suggest the effective use of regional anaesthesia in patients of burn. High quality evidence that regional anaesthesia is considered superior to opioids. Placement of continuous catheters for opioids for long term pain control. Multimodal analgesia strategy includes NSAIDs, acetaminophen, non-opioid analgesics, like alpha-2 agonists, and gabapentinoids are important for managing acute pain.[12] No specific recommendation for extensive burns. They should receive high-dose analgesia intravenously. Mechanical Ventilation can be aided by paralyzing the patient with muscle relaxants. This can be a major component of comfort care.[13,14]

Antibiotics

Extensive burns patients are at a risk of developing infections. To decrease its risk, prophylactic antibiotics can be prescribed, controversy exists.[15] Proper wound care, hygiene, and infection control measures are considered essential. Systemic antibiotics is indicated for patients with proven burn wound infection or sepsis.

In Cochrane database Systematic Review 2013, effects of other forms of antibiotic prophylaxis on burn wound infection are unclear. There is no evidence that prophylactic antibiotics improve outcomes for burn with inhalational injury.[15]

Tracheostomy

Tracheostomy is another decision that needs to be made in these patients. The airway is frequently affected in these patients. Securing an airway is important to make the patient comfortable. A compromised airway makes the patient restless and troubled. Although tracheostomy is a surgical procedure, it can be performed relatively quickly and even at bedside if required. Inability to speak is a major drawback of tracheostomy and must be explained to the attendants. This becomes especially important in medicolegal cases, where declarations may get hampered.

Nutritional support

A nasoenteric tube placed upon admission to start early enteral nutrition, within first 48 hours.[16] Nutrition to be delivered enterally, to avoid need for parenteral nutrition; which is correlated with increased mortality in burn patients.[17]

Survival

Survival in extensive/whole body burn is difficult to achieve but not impossible. There are centers that have a LD50 of > 90%, especially in pediatric patients. These serve as guiding lights which others centers can look to emulate. Other reports also exist of extensive burns survival.

RESULTS

Total 43 patients with burn sizes more than 50% TBSA were admitted to the department (Figures 1 and 2). Female: male ratio was 1.047:1 and the average age was 28.674 ± 9.37 years (range 9 to 58 years) (Table 1).

There was an average delay of 2.053 ± 2.19 days between the burn and arrival at our centre, ranging from a minimum of 3 hours to a maximum of 9 days. Inhalational injury was a part of the burn in 40 patients (93%). 11 patients (25.4%) had tracheostomies, while all patients were kept on ventilatory support. Surgical intervention done is shown in Table 2 and Figure 3.

Figure 1: Patient with > 80% burns and with tracheostomy and Escharotomy done.

Figure 2: Escharotomy done over chest and bilateral upper limbs in a patient with whole body burn

Table 1: Demographics of Burn Injury.

Type of burn injury	Mode of Burn Injury	No. of Patients
Thermal	Flame burn	37(86.04%)
	Kerosene oil burn	3 (6.9%)
	Sanitizer burn	1(2.32%)
	Scald burn	0
Electrical	High voltage	1(2.32%)
Chemical		1(2.32%)

Table 2: Surgical Intervention

Procedure	No. of Patients
Escharotomy	20
Fasciotomy	8
Debridement	8
Amputation	0
Grafting	0

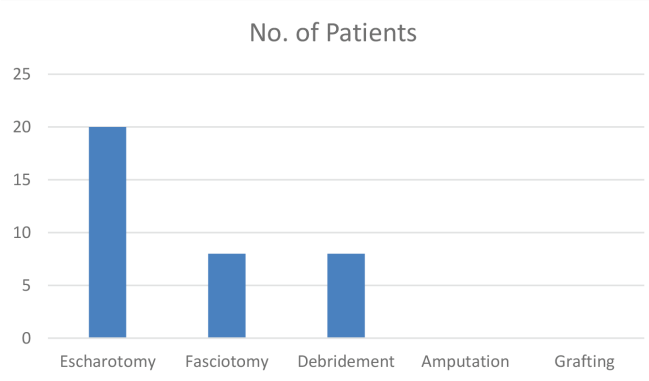

Figure 3: Bar diagram showing surgical procedures done.

All patients expired in the hospital except one, who was taken home against medical advice.

DISCUSSION

A total body burn is a disaster for the victim as well as the patient's family. With awareness in initial resuscitation, most patients survive the first week. Sepsis is caused by the lack of barrier function, which, when combined with the weight of dead tissue, overwhelms the body and results in the patient succumbing within the second week. Although regularly seen in all burns centres, few literature exists to guide the provider in this scenario.

Most of the burns in our group were flame burns, usually while cooking, followed by suicidal burns using kerosene oil. We found almost an equal incidence of male and female patients in our groups. Although burns by themselves are more common in males,[18] severe burns had an almost equal incidence.

Table 3: Duration of survival.

Duration	No. of Patients
Less than 2 days	10 (23.2%)
2 to 5 days	24 (55.8%)
6 to 9 days	6 (13.9%)
More than 9 days	2 (4.65%)

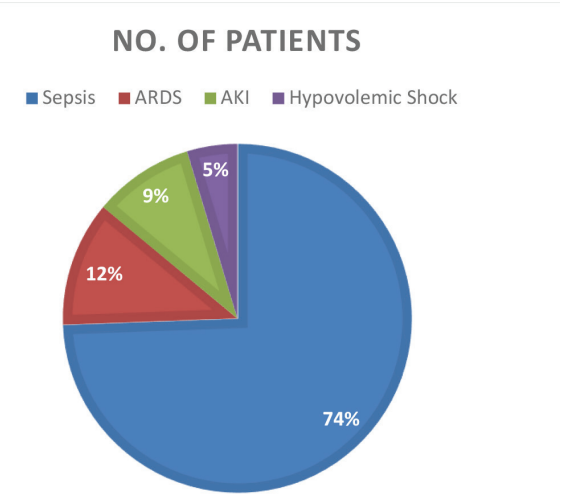

Figure 4: Pie chart showing the proportion of the various major causes of death

The reasons may lie in their etiology. These burns are commonly household burns, traditionally the domain of women. More women may be at risk and hence more women may be affected. In our society, the possibility of foul play and its subsequent reporting as accidental burns can also not be ruled out.[19] The most common cause of death in these patients was sepsis (Table 3 and Figure 4).

Table 4: List of survived patients around the world.

Alalwan *et al.*[2]	95% TBSA	24-year-old man	Gas flame burn	Fluids, oxygen, escharotomies, tracheostomy
Hahn *et al.*[21]	80% TBSA	40-year-old plumber	Burnt by hot water and hot steam	50% ability to work, he survived and went back to work in 92 weeks.
Thomson *et al.*[22]	85% TBSA	4-month-old female child	Smoke Inhalation due to a house fire	Complicated by pneumonia, generalised osteoporosis, ARDS, and sepsis
Robenpour *et al.*[23]	95% TBSA	21-year-old male	Gas explosion	Recovered in 18 months
Chai *et al.*[24]	55%-98% TBSA	Total of 8 patients, 4 men and 4 women	Explosion of aluminium dust	Seven patients survived
Li *et al.*[25]	99.5% TBSA	29-year-old man	Furnace explosion	Impaired vision in his left eye and was unable to walk or hold objects due to contracted scars.
Burke *et al.*[8]	>98% TBSA	6 pediatric patients	Thermal burn	Three out of 6 survived

One of the largest series of extensive burns published was that of 54 patients by Guo *et al.*[20] Their patients were divided into two groups, 24 people were admitted over 1987–1996 and 30 during 1997–2006. The reason for this division was an upgrade in their facilities around 1996 after which they had access to ventilators and adopted practices of early excision. They found improvement in outcomes in the second period and demonstrated that the survival of patients is indeed possible consistently in such a population. Evidence of survival around the world has been enlisted (Table 4).

CONCLUSION

The two most significant risk variables affecting a burn victim's survival and clinical outcome are well-known to be burn size and depth. Because donor sites are insufficient for the necessary grafting procedures, burns with a size greater than 80% of the total body surface area (TBSA) provide daunting surgical obstacles.[20] Comfort care may be the best choice when clinical predictors based on prior experience and the literature indicate no likelihood of success for the treatment or a limited possibility of success, but with the certainty of the greatest amount of patient pain, disfigurement, and future handicap.

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