Original Article

Critical care of the burn patient: the first 48 hours

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Abstract

Background: The management of patients who have suffered burns is crucial in the clinical field. They have multiple complications which require treatment and have a high risk of mortality. Patients may survive, but they will need to live with the scars or deformities for a lifetime. Complications include edema, increased cardiac output, severe pain, and organ deformities. So, they require more comparative care than other medical complications. Treatment and nursing of burn patients is still a very challenging task for the health personnel.

Objective: This work aims to highlight the nursing methods used on burn patients and to identify the relationship between mortality and the physiological and other conditions of the patients.

Material and method: Different published data was collected and summarized, and the required data was extracted for further analysis using the statistical software.

Result: This study observed that patient mortality has different factors like total body surface, age group, burning area percentage, and hospital treatment duration which is the marking factor in the patient mortality. This study also found that there are no gender biases for the different age groups. No one factor is responsible for the patient's death.

Discussion: There are needs for prolonged and delicate treatment methods for the burn patients. As several complications arise, it is challenging for the nurses and health care personnel to keep tracking the patient's condition and giving the proper treatment. Despite the difficulties, the attentive nursing was desperately needed to properly treat burn victims.

Conclusion: Though the survival rate is very high immediate treatment is necessary for burn patients. It is crucial to give the initial therapy for burn patients due to other physical complications. Depending on the patient's condition, the mortality rate also varies. Despite all difficulties, good nursing and medication can completely cure burn injuries. [*Ethiop. J. Health Dev.* 2021; 35(3): 239-243]

Keywords: Shock**,** inhalation injury, interquartile range, total body surface area.

Introduction

Burns is a severe and persistent problem in society. According to Indian Database for a burn patient, an injury in the skin or other tissue occurs due to heat or any kind of chemical, fire, radiation, friction, or electricity (1). When skin is affected by some hot liquid or solid element or flame contact, this kind of burn is called Thermal burn. As per the WHO report, approximately 26000 deaths happen every year due to burns acquired from fires. In comparison, the other burn effects, such as electricity or chemical contact report, are not available (2). In the UK there are about 25000-30000 people that are admitted to hospitals due to burns. In India about 6.5 to 7.2 million people each year suffer because of burn injuries. The maximum number of burn deaths is found in the low- and middle-income society, while in the high-income region, this death rate is relatively low. Males and females have a somewhat similar rate of burn injury cases compared to other injury cases. In terms of women, the burn risk is mainly due to open fire cooking or using unsafe kerosene stoves and loose outfits. Children are also vulnerable to burn injuries along with women. There is a high risk of child injuries found among kids up to 9 years of age. Though burns can cause high morbidity, these cases are treated by good nursing care and valuable treatments. Those who survive burn injuries suffer from lifetime disability along with several deformities in their body parts. Burn patients require critical, multi-dimensional, complex therapy because they have different kinds of damage in the skin, nerves, and various tissue systems. In this review article, some critical resuscitation and unique approaches for burn patient nursing are highlighted.

Material and Methods

This research utilized a database, with previously published literature from 2011 to 2019 for the study purpose. Burn patients' data (n=13204) admitted in the district hospital of Kansas University Medical center between 2011 to 2019 recovered from the hospital's record system. Acute burn cases (n=3425) were not considered for the study. Data includes demographic information (area of living, gender, age, date of admission, date of release) cause of the injury, factors of injury, Pre-hospital treatment, injury data (e.g., burn condition, burn level, percentage of body surface effected), major complication and treatment result (No treatment, recovered, development, expired) were recorded. Data extracted from that literature was based on publication date, and different kinds of treatments provided to the patients, and the significant requirements for burn patients, and an approximate number of burn wards available for the treatment, the number of patients admitted every year. After analyses, researchers sought to find out the major physiological complications that arise after burning, such as infection types, condition of metabolism, first-line monitoring, and treatments given. An average number of patients survive after the treatment, researchers attempted to determine, whether they are increasing or reducing. All data was analyses using excel 2010 and other statistical software Rstudio (version: 1.3.1056).

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Result

From 2011 to 2019, there have been 13204 patients admitted to the burn unit of the Kansas University Medical center (Kansas City, USA). 3425 patients did not receive proper treatment to cure the burn, leaving 9779 patients who were considered for the study. Among them 6559 patients were male, and 3220 patients were female. Majority of the patients were within the 50-year age group, which was about 36.15%. The maximum numbers of patients were from Mission (73.99%). After a statistical test, the mortality rate was found to be deficient (0.705%)—the Interquartile range and median of total body surface area presented in Table 1. To formulate a burn preventive strategy, all factors, including burn characters, season, climate, and human factors, were needed. Burn patients were mostly admitted during the summer.

Table1: **Data for Hospital admitted burn patients Values are expressed as n= total and percentage and median (interquartile range)**

Characteristics	Number of patients	Percentage or Interquartile range
Age Group		
0-1	1808	18.4886
2-14	2026	20.71786
15-24	807	8.252378
25-49	3536	36.15912
>50	1603	16.39227
Patients Area of living		
Mission	7236	73.9953
Shawnee	1629	16.65815
Gladstone	517	5.286839
Others	397	4.05972
Time of year		
spring	2521	25.77973
Summer	2769	28.31578
Autumn	2172	22.21086
winter	2319	23.71408
Outcome of Treatment		
Death	69	0.705594
Cure	9628	98.45587
No treatment	73	0.746498
Improvement	7	0.071582
Burn Shock		
Yes	229	2.341753
No	9550	97.65825
Inhalation injury		
Yes	411	4.202884
No	9369	95.80734
complication		
Yes	140	1.431639
No	9639	98.56836
burn area%	8	4-15
Full-thickness burns %	0	0-2
Length of hospital stay(days)	18	9-33

Among all burn patients, 25-49 age group were the majority. In the below two years age group, no significant alterations were observed. But a considerable difference in the male to female ratio was observed in the below two-year age group. With the age increase the patient number decreased. About 263 male and 899 females burn patients introduced in the 25-49-year age group (table 2). The male patient's number is respectively higher than female patients. Table 3 shows an increase in Total body surface area and number of deaths also increased. At the same time, Total body surface analysis with the respective gender did not differ (P value>0.05 Table 4). The minimum Total body surface percentage among patients was 0.1%, while the maximum percentage was 100%. Total body surface area 0 to 5 group had more burn patients. In case the entire body surface area >50% group has a high number of mortalities. However, the number of patients is much less than the lower body surface group in table 4. Among the different types of burning, death, flame burn, scalding burn, and electric burn patients were maximum. In comparison, burn cases vary with the body surfaces. While among all other burn cases, chemical burn deaths were at the top. Health experts face several obstacles during burn patient's treatment. The extensive complications, age, area of the burn affect and the treatment of the patients. Determining the primary cause of the burning patients' death is very difficult. Two problems account for 4% of all complications, whereas three or more complications account for more than 60% of all deaths. There are mainly three complications which have been observed such as, infection, shock, and smoke inhalation during the injury. In this study, shock is nominated as key for

multivariate analysis. After sorting the fact, odds associate found that the odd ratio it was found that shock, age, explosion, total body surface and burn area thickness are a risk factor for burn death. As in the expansion, injured patients have the highest odd ratio indicating that patient mortality is also the highest in this case. During an explosion an injured, patients' death was 38.5% more likely. Increase in hospital stay decreased mortality (regression coefficient is -0.025; P-value 0.001).

Table 2: Values are given as a percentage. Chi-square test performed. P≤0.05 is a significant level.

Age /Gender	Scalds		Flame		Electric		Solid Materials		Steam		Explosion		Others		Chi-squared	P-value
0-1																
Men	950	9.5%	77	0.77 %	7	0.03 %	13	0.11 %	4	0.03 %	0		28	0.3%	0.542	0.0995
women	641	6.5%	53	5.41 %	5	0.5%	10	1.01 %	2	0.2%	0		18	1.83 %		
02-14																
Men	734	6.5%	299	3.04 %	86	0.87 %	13	0.14 %	6	0.06 %	11	0.13 %	45	0.048 %	30.92	<0.001
women	598	5.1%	149	1.54 %	30	1.31 %	11	0.11 %	5	0.04 %	3	0.05 %	27	0.029 %		
15-24																
Men	94	0.98 %	198	2.02 %	169	1.81 %	40	0.41 %	7	0.07 %	4	0.06 %	70	0.73 %	84.84	<0.001
women	73	0.77 %	79	0.8%	4	0.03 %	13	0.13 %	6	0.07 %	2	0.04 %	29	0.3%		
25-49																
Men	265	2.7%	806	7.3%	889	9.2%	275	2.82 %	32	0.35 %	31	0.30 %	332	3.4%	521.0	<0.001
women	318	2.3%	325	2.32 %	45	0.46 %	40	0.3%	20	0.20 %	5	0.07	144	1.46 %		
>50																
Men	167	1.7%	414	3.27 %	229	2.32 %	71	0.73 %	14	0.14 %	14	0.13 %	134	1.4%	171.1	<0.001
women	221	2.3%	223	2.3%	21	1.21 %	17	0.19 %	7	0.096 %	2	0.02 %	60	0.6%		
Total																
Men	2215	22.65	1798	18.39	1390	14.21	418	4.27	67	0.69	59	0.6	613	6.27	807.114	<0.001
women	1853	18.95	834	8.53	106	1.08	93	0.95	42	0.43	14	0.14	277	2.83		

Table 3: **Outcome of burns by sex and total burn area**

Total body surface area	SEX	Discharge	Death	% Death
	Men	2464	0	0
0-5	women	1187	3	0.252738
	Men	2510	2	0.079681
6-15	women	1307	2	0.153022
	Men	702	2	0.2849
16-25	women	374	0	0
	Men	541	9	1.663586
26-50	women	243	3	1.234568
	Men	92	1	1.086957
51-60	women	43	2	4.651163
	Men	63	3	4.761905
61-70	women	19	4	21.05263
	Men	132	42	31.81818
>71	women	34	7	20.58824

Table 4: **The table represents the IQR values of the mean. Mann-Whitney U test performed within IQR values. Significance level indicated P ≤ 0.05**

Parameter	TBSA%	Chi-squared	P-value
Men	9(3-16)		
women	9(3-16)	-0.45	0.67
0-1	9(6-14)		
2-14	9(6-14)		<0.001
15-24	7(3-16)		
25-49	9(2-16)		
>50	8(3-17)	56.309	

Discussion

There are several steps involved in the nursing of burn patients. The primary step resuscitation by fluid, then first-line monitoring, then different physiological condition observation, and additionally, few therapies are applied. Burn shock is a combined result of hypovolemic and distributive shock (3). It has symptoms like reduced intravascular volume, low occlusion pressure of pulmonary artery, high vascular resistance, and low cardiac output (4). Simultaneously, low cardiac output is due to low plasma volume and reduced contractility (5). According to a study, myocardial contraction happens due to tumor necrosis factors like circulating mediator (6) and abnormal Ca^{2+} levels (7). After a burn injury, the microcirculation system losses protein, and their wall of vessels (8). The protein loss results in reduced osmotic pressure so, the body fluid runs out from the circulatory system (9). Osmotically active molecules releases from the cells resulting in the interstitial pressure declining and a vacuum that draws the fluid from plasma. There is also a high increase in the fluid movement into the interstitium, which reduces interstitial pressure and increases permeability in the capillary part. This creates a disparity in the oncotic and hydrostatic forces. These events result in the outgoing of the fluid, proteins, and electrolytes into the interstitium (8). These changes cause reduced plasma volume, edema formation, less urine formation, and low cardiovascular function (10). Maximum edema occurs after 24 hours of the burn injury in adjacent areas (11). Ample fluid treatment can cure hypovolemia, but it also increases edema (12).

In contemporary burn care, resuscitation by a fluid is the foundation of treatments and improves the patient's conditions. Appropriate fluid treatments are given to avoid burn shock. Resuscitation does not help in complete recovery because of other body conditions like hormonal balance and cytological dysfunction. The main goal for providing plenty of fluid is to maintain fluidity over the whole body without excess fluid. If the burn happens to more than 15% of the body surface area, then hypovolemia can occur (11). At the same time, delayed resuscitation can increase mortality for burn patients (13). Excessive resuscitation can cause complications like myocardial edema. A superficial burn can convert to deep burn and abdominal compartment syndrome.

Though the urine amount and heart rate are the primary modalities for observation, the recent standard for fluid therapy surveillance for large burn patients is not supported by data (14). Relying on urine formation rate per hour can be the only index for optimal resuscitation. According to the ABA guideline-recommended burn shock Resuscitation is 0.5 mL/kg/hr. Urine output in adults is 0.5 to 1.0 mL/kg/hr. For a child (15). Low urine in the first 48 hours after burn results in less resuscitation.

For measuring the blood pressure, cuff utilization is less appropriate. For this measurement arterial catheter is kept in the radial artery. The same condition is applicable for the pulmonary or central venous catheter. Left ventricular and end-diastolic pressure or preload is the most reliable for measuring cardiac output variables. However, the pulmonary artery and central vein do not adequately show preload (3).

There are some preventable complications like Compartment Syndromes, hypothermia, deep venous thrombosis, and Heparin-induced thrombocytopenia.

Besides the medication, burn patients also require maintaining nutrition by consuming nutritious food and obtaining good care. Due to the hypermetabolism which can result in more energy spending, nutrition should be delivered using the feeding tube. Patients with below 20% total body surface area cannot meet the nutritional needs through oral intake of food. Glucose levels should be controlled by 110 mg/dL (16). As beta-blockers reduce heart rate, beta-blockers need to be administered to relieve the cardiac index.

Additionally, several other therapies are also provided for the patients like wound management, Pain management, and Physiotherapy for the better quality of life patients. For wound management, the wounds must be washed with chlorhexidine and warm water. The main reason for the wound management is to clean the injured tissue and prevent the newly formed epidermis from contracting bacteria that can quickly spread from the fecal fall-out area, so during the wound treatment, the immediate application of the antimicrobial agent is needed. Burn patients have undergone severe pain situations, so pain management is crucial. An opioid is applied in the guided dose for pain management. Benzodiazepines like anxiolytics reduce procedural and background pain.

Along with several other medications, physiotherapy is also required for the complete recovery of burn patients. Nurses are needed for the splinting positioning, strengthening, and endurance for recovery (17). Little research has been conducted on the management of burn patients.

Conclusion

Burn patients need to be carefully handled and need more treatment due to other complications which develop due to burn injuries. Though the mortality rate is shallow in burn patients, severe burn patients' survival is significantly less. The patient survives with special nursing and care rather than prolonged medication. Burn injury survivors live with several abnormalities. More research needs to be done, to inform health indicatives aimed at providing a better quality of life for these patients.

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