

Epidemiology and Factors Related to Mortality in Patients Managed in the Adult Burn Unit at Mayo Hospital, Lahore: A Retrospective Review

Saqib Saleem, Hussan Birkhez Shami, Mehvish Aamer, Ijaz Ashraf, Hamid Hussain Ansari, Saadia Nosheen Jan, Muhammad Sohail, Muhammad Mustehsan Bashir

ABSTRACT

Objective/Purpose: To study the epidemiology and factors related to mortality in patients managed at the adult burn unit at Mayo Hospital, Lahore.

Patient and Methods: This retrospective review was conducted at the adult burn unit, between September 2013 and August 2017. Records of all hospitalized acute burn patients were included, while incomplete records were excluded. The patient's demographics, burn injury detail and outcomes were obtained from the records and entered in the Data collection form. Results were analyzed using SPSS v 16.

Results: A total of 514 adult acute burn patients were admitted, while complete data was available for 468 patients. Mean age was 28.56 yrs. (± 11.53) (11-75). They were mostly males (284 (60.7%)). The mean Percentage of burn calculated in these patients was 25.74% ($\pm 15.53\%$) (2%-95%). Most of the burns were of mixed thickness variety 377(80.6%). flame burn 303(64.7%) was the most common cause of burn followed by 68 (14.5%) scald and 66(14.1%) electrical. Medicolegal causes included mostly 428 (91.5%) accidental burns. The incident occurred most frequently at 332 (70.9%) homes. The duration of stay in hospital was 17.63 days (± 16.65) (1-111 days). 322 (68.8%) patients were discharged and 104 (24.41%) patients expired. 42 (9%) left against medical advice and their data was not used for outcomes analysis. Analysis of variables in relation to burn outcomes illustrated a statistically significant difference in patients age, percentage of burn, modified Baux score, length of stay, medicolegal causes, presence of inhalation injury and presence of comorbidity between the discharged and expired groups ($p < 0.05$).

Conclusion: Burn causes both death and deformity, and is a major problem in our part of the world. Despite this, improving both prevention and management can greatly reduce burden and outcome of this injury.

Key words: Burns, epidemiology, demographics, trends, causes, outcomes, mortality

Introduction

Without a doubt, burn is a devastating injury

*Department of Plastic Surgery
King Edward Medical University, Lahore.
Corresponding author: Hussan Birkhez
Email: hussanbirkhezshami@gmail.com*

afflicting both physical and psychological trauma. Causes include thermal, chemical, electrical etc.⁽⁰¹⁾

Every year approximately 265,000 lives are lost due to burns the world over. This loss of

life is not the only problem, hundreds and thousands more suffer from the scars of the body and mind every year decreasing their quality of life.⁽⁰²⁾

Mostly the underdeveloped and developing countries contribute the majority share of burn injuries.⁽⁰³⁾ As developed countries make progress in the field of burn prevention their share is decreasing day by day.⁽⁰⁴⁾ Whereas old burn centers are closing in countries like the USA, new burn centers have recently sprung up in Pakistan.

This has been due to both rising number of burn patients and the increasing media attention to this entity. In spite of this, Pakistan like other underdeveloped and developing countries lack adequate local policing and has been unable to develop proper protocols. While studies are available from some local hospitals, continued research is required to improve burn care in the country.⁽⁰⁵⁾

Rationale of this study is that burns is a challenging subject that warrants continuous research to gather local data, demographics and an ongoing study of the current patterns and outcomes. Moreover, due to recent establishment of burn centers in Pakistan more local data needs to be generated in this regard to improve our working. This retrospective review will help further our understanding of the local patterns and help in improving burn policing and management.

Patient and Methods

This retrospective review was conducted at the adult burn unit, Mayo hospital, Lahore between September 2013 and August 2017. Records of all hospitalized acute burn

patients were included, while incomplete records were excluded. The patient's age, gender, comorbidities, type of burn, percentage area of burn, depth of burn, place of the incident, anatomical site, inhalational injuries, number of surgeries, duration of stay, outcome and modified Baux score were recorded in a predetermined questionnaire. Demographics, burn injury detail and outcomes were obtained from the records and entered in the Data collection form. Results were analyzed using SPSS v 16.

Burn injury was defined as an injury to the skin or any tissue or organ primarily caused by heat or due to radiation, radioactivity, electricity, friction or contact with chemicals.⁽⁰⁶⁾ The three patient outcomes were discharged after treatment, dead or left against medical advice. Area of burn was calculated using the rule of nine.⁽⁰⁵⁾

Results were analyzed using SPSS v 16. Quantitative variables including age, percentage of burn, number of surgeries, duration of stay and modified Baux score were presented as mean, +/- standard deviation. Qualitative variables including gender, co-morbidities, type of burn, depth of burn, place of the incident, anatomical site, inhalational injury, and outcome of burn were expressed as frequencies and percentages. Chi-square test was used to analyze the qualitative variables, whereas T test was employed for the same for quantitative variables in relation to burn outcomes. P values ≤ 0.05 was taken as significant.

Results

A total of 514 adult acute burn patients were admitted, while complete data was available

for 468 patients. They were mostly males (284 (60.7%)). The mean Percentage of burn calculated in these patients was 25.74% ($\pm 15.53\%$) (2%- 95%). 34 (7.3%) suffered from comorbid conditions. Three hundred and eighty six 386(82.5%) patients underwent surgery.

The patients age, burn area, number of surgeries, modified Bauxscore, length of stay in hospital, depth of burn, type of burn, medicolegal causes, place of burn, number of occupational burns, presence of inhalational injury are demonstrated (Table 1).

Although the most common region involved was found to be the upper extremity, face was the most commonly injured anatomical sub-region. Complete detail is presented (Table 2).

322 (68.8%) patients were discharged, 104 (24.41%) patients expired, while 42 (9%) left against medical advice. The data of patients who left against medical advice was not used for outcomes analysis. The sub analysis

for the area of burn showed that the percentage of mortality rose rapidly from 16.51% to 50% as the area increased from 21-30 to 31-40 % group. This further increased to 66.67% in 41-50 %age group, while beyond that it reached 100% (Table 3/Figure 1)

The sub analysis for the age groups showed that 100% mortality was noted in elderly above 60 years of age. A peculiar finding was that females achieved a mortality of 52.38% in the 31-40yr group as opposed to 22.92% in males for the same age group. The opposite was true for the 41-50 year age group where the number almost halved to 21.43% for women, while it doubled for men to 40%. (Table 4)

Analysis of variables in relation to burn outcomes illustrated a statistically significant difference in patients age, percentage of burn, modified Bauxscore, length of stay, medicolegal causes, presence of inhalation injury and presence of comorbidity between the discharged and expired groups($p < 0.05$). (Table 5,6)

Table 1: Detailed burn injury demographics (Mt = Mixed thickness burn, Dpt = Deep partial thickness burn, Ft = Full thickness burn)

		Total	Male	Female
Age in years		28.56(11.53)11-75	29.47(11.64)	27.16(11.25)
Percentage of burn		25.75(15.53) 2-95	26.52(16.55)	24.52(13.76)
No of surgeries		1.25(.81)1-4	1.31(.85)	1.17(.75)
modified Bauxscore		56.11(22.54)19-164	57.73(23.82)	53.62(20.19)
Length of stay in days		17.61(16.64) 0-111	17.37(16.72)	17.99(16.56)
Depth	Mt	377(80.6%)	225	152
	Dpt	67(14.3%)	40	27
	Ft	24(5.1%)	19	5
Type	Flame	303(64.74%)	173	130
	Scald	68(14.53)	30	38
	Electrical	66(14.10)	58	8

	Chemical	23(4.91%)	16	7
	Flash	8(1.71%)	7	1
Medicolegal causes	Accidental	428(91.45%)	266	162
	Homicidal	28(5.98%)	11	17
	Suicidal	12(2.56%)	7	5
Place of burn	Home	332	158	174
	Factory	54	53	1
	Workplace	50	48	2
	Shop	16	15	1
	Vehicle	15	9	6
	Jail	1	1	0
Occupational burns		118	114	4
Inhalational injury		50(10.7%)	29	21

Table 2: Detail of anatomical site involved in injury

Site of burn	Grand total		Male	Female	Individual Total
Head and neck	417(21.12%)	Face	176	101	277
		Other	87	53	140
Upper limb	628(31.81%)	Arm	138	77	215
		Forearm	131	69	200
		Hand	148	65	213
Trunk	473(23.96%)	Chest	103	82	185
		Abdomen	88	76	164
		Back	70	54	124
Lower limb	401(20.31%)	Thigh	100	65	165
		Leg	95	50	145
		Foot	73	18	91
Perineum	55(2.79%)		35	20	55
Total	1974		1244	730	1974

Table 3: Outcome of burn injury further stratified according to percentage of burned surface area (M = Male, F = Female, T = Total, Lama = Left against medical advice)

% Age group	Total			Outcome								
	M	F	T	Discharge			Expired (mortality %)			Lama		
	M	F	T	M	F	T	M	F	T	M	F	T
1-10	38	31	69	34	31	65	0(0)	0(0)	0(0)	4	0	4
11-20	90	52	142	78	44	122	2(2.5)	5(10.2)	7(5.43)	10	3	13
21-30	73	53	126	59	32	91	6(9.23)	12(27.27)	18(16.51)	8	9	17
31-40	42	31	73	22	12	34	19(46.34)	15(55.56)	34(50)	1	4	5
41-50	21	11	32	6	4	10	13(68.42)	7(63.64)	20(66.67)	2	0	2
51-60	6	3	9	0	0	0	6(100)	3(100)	9(100)	0	0	0

61-70	7	2	9	0	0	0	7(100)	1(100)	8(100)	0	1	1
71-80	5	1	6	0	0	0	5(100)	1(100)	6(100)	0	0	0
81-90	1	0	1	0	0	0	1(100)	0	1(100)	0	0	0
91-100	1	0	1	0	0	0	1(100)	0	1(100)	0	0	0
Total	284	184	468	199	123	322	60(23.2)	44(26.35)	104(24.41)	25	17	42

Figure 1: Number of Discharges and expiries according to percentage of burn

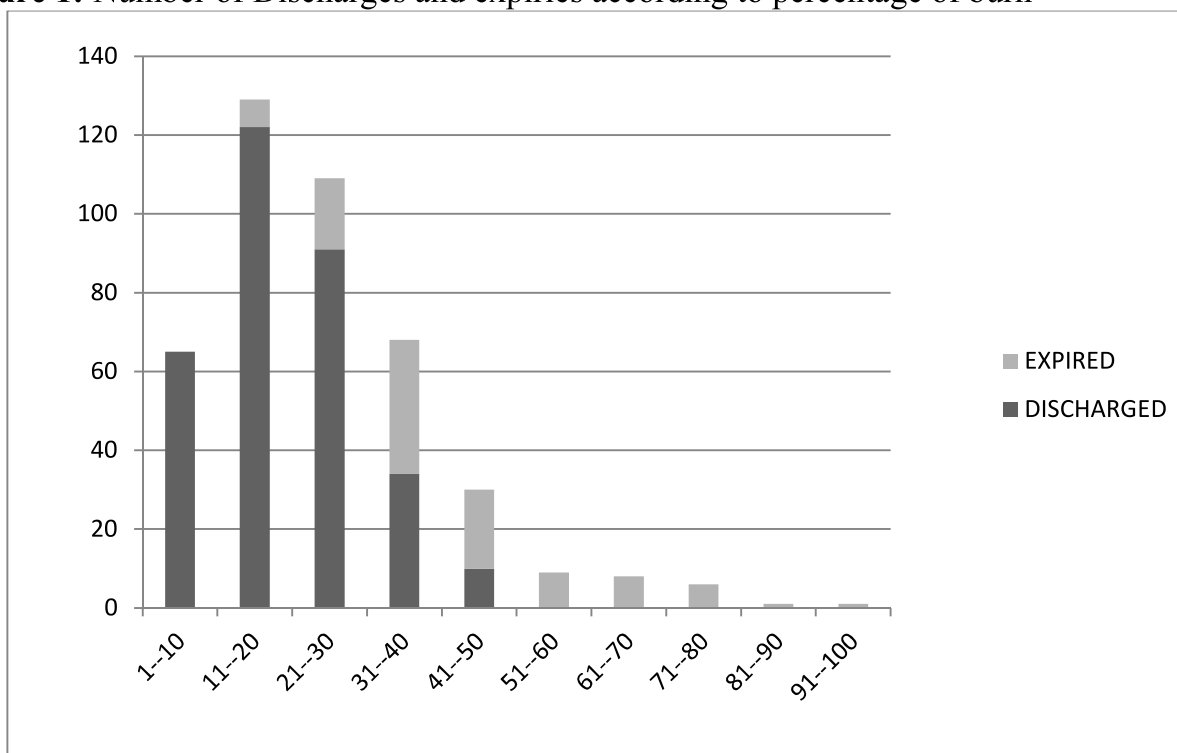


Table 4: Outcome of burn injury further stratified according to age of patients(M = Male, F = Female, T = Total, Lama = Left against medical advice)

Age group in years	Total			Outcome								
				Discharge			Expired (mortality %)			Lama		
	M	F	T	M	F	T	M	F	T	M	F	T
11-20	75	60	135	58	44	102	12(17.14)	12(21.43)	24(19.05)	5	4	9
21-30	111	80	191	79	57	136	21(21)	16(21.92)	37(21.39)	11	7	18
31-40	51	22	73	37	10	47	11(22.92)	11(52.38)	22(31.88)	3	1	4
41-50	34	17	51	18	11	29	12(40)	3(21.43)	15(34.09)	4	3	7
51-60	12	2	14	7	1	9	3(30)	1(50)	4(33.33)	2	0	2
61-70	0	2	2	0	0	0	0(0)	1(100)	1(100)	0	1	1
71-80	1	1	2	0	0	0	1(100)	0(0)	1(100)	0	1	1
Total	284	184	468	199	123	322	60(23.2)	44(26.35)	104(24.41)	25	17	42

Table 5: Factors related to burn(LOS = Length of stay)[*P value < 0.05 using T test]

	Outcome of Burn	N	Mean	Std. Deviation	Std. Error Mean
Age of Patient*	Discharge	322	27.25	10.429	.581
	Death	104	31.26	12.635	1.239
Percentage of Burn*	Discharge	322	20.18	10.073	.561
	Death	104	43.62	17.243	1.691
Modified Baux Score*	Discharge	322	48.22	15.724	.876
	Death	104	80.43	24.632	2.415
LOS*	Discharge	322	21.0000	17.28756	.96340
	Death	104	10.2885	12.84839	1.25989

Table 6: Factors related to burn (S = Suicidal, A = Accidental, H = Homicidal)[**P value < 0.05 using Chi Square test]

Outcome of burn	Total	Inhalation injury**		Co-morbidity**		Medicolegal causes**		
		Yes	No	Yes	No	S	A	H
Discharge	322	15	307	14	308	3	297	22
Death	104	34	70	16	88	6	95	3
Total	426	49	377	30	396	9	392	25

Discussion

Burn injury causes both physical and psychological trauma, both to the patients and their families. Indeed, it is a source of great morbidity and mortality.⁽⁰⁷⁾ We carried out this study to better understand the epidemiology of burns and the variables related to patient outcomes at our adult burn center, mayo hospital, Lahore.

Almost 60 percent patients were male, whereas the rest were females. Our findings are similar to that of Ali et al⁽⁰⁵⁾ who reported 56.6% males suffered from burns. Furthermore, studies from the neighboring country India also demonstrate similar data.⁽⁰⁶⁾

In our study, younger people suffered the most from burn injuries. Almost 70% of our patients were aged between 11-30 years.

Similar findings have also been noted by Ali et al⁽⁰⁵⁾. Their 16-30 year age group made up 58.2% of the patient total. Gupta et al and Shanmugakrishnan et al have also reported similar findings in their studies on burn injuries.^(08,09) from literature and our own findings it can be surmised that people of younger age groups are more prone to burn injuries.

In our study, residential burns were the most common type followed by occupational or work related burn injuries. Ali et al⁽⁰⁵⁾ also reported similar findings. Moreover, Gupta et al. reported that of the 72% closed spaced fires more than half occurred in kitchen.⁽⁰⁸⁾ These findings highlight the fact that poor safety conditions exist and a lot is needed to improve health and safety of homes as well as workplaces. We believe that strict rules and safety regulations should be put into effect for preventing burn

injuries from happening. Educating the masses especially women working in kitchens, and laborers at their workplace can greatly reduce the incidence of burns. An almost 10% reduction in occupational burns due to improved fire safety and prevention has been reported in literature.⁽¹⁰⁾

Our patients suffered mostly from flame burns (64.74%), followed by scald and electric (almost 14% each), chemical (4.9%) and flash burns (1.7%). These findings are different from Song et al which demonstrated scald to be the number one cause of burn, the second being flame burns.⁽¹⁰⁾ There are, however, other reports by Ali et al and Gupta et al which have shown results similar to our study. Both these studies show flame to be the most common cause of burns.^(05, 08)

Accidental injuries (91.45%) were the most common in our study, followed by homicidal and suicidal burn injuries. Many studies in the previous literature demonstrate similar if not exactly the same trend.^(5,11,12) This clearly demonstrates the fact that health and safety measures are lacking and need to be improved to avoid fire accidents.

Mean percentage of total body surface area burned was 25.75% ($\pm 15.53\%$). This is less than that reported by Ali et al ($35.49 \pm 27.276\%$)⁽⁰⁵⁾, nevertheless, similar to that reported by Larietal (30.6%)⁽¹²⁾ more than half of our patients were 11-30% burned, and this finding is consistent with the findings of Ali et al.⁽⁰⁵⁾

Mixed thickness burns were most common in our study population and encompassed 80.6% of the total. Wani et al, in their study,

have also reported mixed thickness burn to be the most common type of burn (60.98%).⁽¹³⁾

Upper limb (31.81%) was the most common region involved in our study, and face was the most common sub region. This is matching the findings of Waniet al who have also displayed upper limb to be the most common site of burn injury (30.19%).⁽¹³⁾ Parts of upper limb and face are normally exposed, and thus are injured more frequently.

The mean length of hospital stay of our patients was 17.61 (16.64). This is similar to Ali et al 16.45 and Larietal 16.7 days.^(5,12)

A total of 104 patients expired (24.41%) during the period under study. Although this is less than the percentage reported by Ali et al 36.9%, it is more than that reported by Iqbalet al (14%)⁽¹⁴⁾. Also, in our study, males had a lower mortality rate as compared to females. This finding is consistent with the findings of Ali et al.⁽⁰⁵⁾

Mean age of patients, percentage of burn area and modified Bauxscore of deceased group was significantly higher than that of the discharged group ($p < 0.05$). We have found similar observations in previously published studies. Osler et al and Ali et al in their study demonstrated that patient's age is an important outcome determinant.^(05,15) Percentage of burn is another important factor, and while Shanmugakrishnan⁽⁰⁹⁾ demonstrated that all patients with 55% burned area and above could not survive, our own findings showed a similar 50% or above figure led to 100% mortality. 50% patients in the 31-40% group expired, while

this statistic rose to 66.67% for the 41-50% group in our study.

Inhalational injury, comorbidities and suicide were also found to be more prevalent in our deceased group ($p < 0.05$). Also, post stratification results showed that mortality rate in women may be higher as compared to men for certain age group. A study by Newburry et al highlighted inhalational injury, intentionality and gender to be associated with increased mortality.⁽¹⁶⁾

There are certain limitations in our study. First and foremost, delay in start of treatment was not taken into account. Next, detail of the exact causative agent is not presented in our study.

Conclusion

Burn injury is a frequent problem in our part of the world, and leads to high mortality and morbidity. In spite of this, relevant legislation and their implementation at the highest national level; proper health and safety measures with burn prevention education programs and improved infrastructure; and proper management and total burn care can contribute to a dramatic decrease in burn incidence, morbidity and mortality.

References

1. Jan SN, Ansari HH, Mir ZA, Khan BA, Shami HB, Nasir M. Bacteriological Trends And Culture and sensitivity patterns of burn wounds at burn unit, mayo hospital, lahore. *Annals of King Edward Medical University*. 2015;21(2):67-.
2. Cheng W, Wang S, Shen C, Zhao D, Li D, Shang Y. Epidemiology of hospitalized burn patients in China: A systematic review. *Burns Open*. 2018 Jan 1;2(1):8-16.
3. Peck MD. Epidemiology of burns throughout the world. Part I: Distribution and risk factors. *Burns* 2011;37:1087–100.
4. Mock C, Quansah R, Krishnan R, Arreola-Risa C, Rivara F. Strengthening the prevention and care of injuries worldwide. *Lancet* 2004;363:2172–9.
5. Ali SA, Hamiz-ul-Fawwad S, Al-Ibran E, Ahmed G, Saleem A, Mustafa D, Hussain M. Clinical and demographic features of burn injuries in Karachi: a six-year experience at the burns centre, civil hospital, Karachi. *Annals of burns and fire disasters*. 2016 Mar 31;29(1):4.
6. World Health Organization. Burns http://www.who.int/violence_injury_prevention/other_injury/burns/en/
7. World Health Organization, Fact sheet N°365. <http://www.who.int/mediacentre/factsheets/fs365/en/>
8. Gupta AK, Uppal S, Garg R, Gupta A, Pal R. A clinico-epidemiologic study of 892 patients with burn injuries at a tertiary care hospital in Punjab, India. *J emergencies, trauma and shock*. 2011 Jan;4(1):7-11
9. Shanmugakrishnan RR, Narayanan V, Thirumalaikolundusubramanian P. Epidemiology of burns in a teaching hospital in south India. *Indian j plasticsurg*: 2008 Jan;41(1):34-7.
10. Song C, Chua A. Epidemiology of burn injuries in Singapore from 1997 to 2003. *Burns*. 2005 Jan 1;31(1):S18-26.
11. Subrahmanyam M. Epidemiology of burns in a district hospital in Western India. *Burns*. 1996 Sep 1;22(6):439-42.
12. Lari AR, Alaghebandan R, Nikui R. Epidemiological study of 3341 burns patients during three years in Tehran, Iran. *Burns*. 2000 Feb 1;26(1):49-53.
13. Wani M, Mir MA, Mir SA, Banotra A, Watali Y, Ahmad Z. Epidemiology of burns in teaching hospital of Northern India. *Indian Journal of Burns*. 2016 Jan 1;24(1):47.

14. Iqbal T, Saaiq M, Ali Z. Epidemiology and outcome of burns: Early experience at the country's first national burns Centre. *Burns*. 2013 Mar 1;39(2):358-62.
15. Osler T, Glance LG, Hosmer DW. Simplified estimates of the probability of death after burn injuries: extending and updating the baux score. *Journal of Trauma and Acute Care Surgery*. 2010 Mar 1;68(3):690-7.
16. Newberry JA, Bills CB, Pirrotta EA, Barry M, Rao GV, Mahadevan SV, Strehlow MC. Timely access to care for patients with critical burns in India: a prehospital prospective observational study. *Emerg Med J*. 2019 Mar 1;36(3):176-82.
- 17.