

Profile of Moderate and Severe Burns: Turkish Experience In A Tertiary Care Burn Unit

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Introduction: We aimed to analyze the demographic and treatment outcomes of severe burn patients admitted to the burn intensive care unit and moderate burn patients admitted to the burn service and to contribute to the national statistical burn accumulation.

Method: We retrospectively reviewed the information of 4745 patients hospitalized in our burn center between 2009-2017 from a prospectively maintained database.

Results: 3583 (75.51%) moderate burn patients admitted to the burn service and 1162 (24.49%) severe burn patients admitted to the burn intensive care unit (BICU). The ratio of female to male in burn service group was 33.4/66.6, while it was 25.1 / 74.9 in burn intensive care group. When we examined the causes of burn traumas, the first order received scalding burns with 52.65% (n=1886) in moderate burns while it was flame burns with 54.22% (n=630) in severe burns. Acinetobacter species were the most common pathogen in our burn intensive care unit, and Pseudomonas species were in burn service. The average hospitalization length was 10.09 days in the burn service and 11.82 days in the burn intensive care unit. Our mortality rate was 7.64% (n=350).

Conclusion: This is one of the most extensive series presented in our country. In the developed countries, death rates in burn series have been reported below 5% in recent years, while our mortality rate was found to be 7,37%.

Keywords: Burn injury, burn intensive care unit, scalding burns, flame burns, burn epidemiology

Introduction

Burn injury is a universal type of trauma around the world with significant morbidity and mortality rates. It has a high cost of treatment due to prolonged hospitalization for wound and scar treatment together with rehabilitation (1). It also has adverse effects on psychology and social lives of both patients and their family

members (2). Each year, nearly 6 million patients were treated for burns, and a significant portion of them was managed in outpatient services. But there are still controversies about a referral to burn units organized for specific treatment of these patients (3, 4). The predisposing factors, the demographical data and the epidemiologic coverage of the burn injuries dif-

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fer between various countries and different regions. The etiological factors for burn injuries also vary among different states (5). But for everywhere, the best approach to treat a burn-related injury is the prevention of the damage before occurrence (6).

The survival of a burn trauma individual differs due to the socioeconomic status of the region. In developed areas, an organized multidisciplinary approach including early hospitalization, proper fluid resuscitation and nutrition and infection control increases the survival (7,8). But unfortunately, the majority of the burn traumas occur in the middle and low-income countries (9) in which low education, limited health service inhibits adequate treatment and rehabilitation for these patients (10, 11). Consequently, we observe higher mortality rates were in these areas.

Patients with acute burn injuries are usually brought to the nearest local hospital first. Then the primary interventions take place and finally they are stabilized followed by their transfer to the burn centers. There are various studies in the literature which were designed to evaluate the epidemiologic features of burn injuries and to determine the specific risk factors (12, 13). This study aims to analyze the demographic and epidemiologic characteristics of patients admitted to our burn center, to identify the main etiologic factors and to reveal the preventive measures for burn injuries.

Material and Method

Study design

Our study is a retrospective study including, the information of 4745 patients hospitalized in our burn center between 2009 and 2017 reviewed from a prospectively maintained database. We compared the number of patients hospitalized in burn service or burn intensive

care unit according to years, the sex of patients, age, burn scars, causes of burns, days of hospitalization, occupancy rates according to years, infection rates and treatment outcomes.

Setting and sample

Kartal Dr.Lutfi Kirdar Education and Research Hospital Burns Centre is the most equipped burn center in Turkey with a multidisciplinary crew working due to the American Burn Association (ABA) criteria (14). The staff consists of general surgeons, plastic surgeons, anesthetists either in BICU or operating rooms, infectious disease doctors, pediatric surgeons, physiotherapists, psychologists, dieticians, and burn nurses. It has a helicopter landing field, and it accepts patients from every region of the country. It has six burns intensive care unit (BICU) rooms, 16 burn service beds, and two separate operating rooms all housed in one building.

All six bedrooms of our BICU were designed according to the American Burn Association (ABA) criteria with HEPA filters, laminar flows, and with cabin entrances. According to American Burn Association guidelines, the lesions of the patients treated in our burn center on an inpatient basis consisted of moderate and severe burn injuries.

Statistical analysis

We used SPSS Windows version 22.0 software for the statistical analysis. The descriptive statistics of the data were performed with proportion and frequency values. Chi-square test and Mann-Whitney U test were utilized for the study of the variables. Data were expressed as a mean \pm standard deviation. $P < 0.05$ was considered statistically significant.

Results

A total of 4745 patients admitted to our burn center during the 6-year period. 1162 (24.49%)

of the severe burn patients were in intensive care unit, and 3583 (75.51%) of the moderate burn patients were hospitalized in the burn service. The mean annual admission to our burn center was 593.12, and these were 145.25 and 447.87 in burn intensive unit and burn service respectively (Table-1).

Table-1. Distribution of the patients according to years.

Years	BICU	%	BS	%	Total
2009	93	21.14	347	78.86	440
2010	152	28.20	387	71.80	539
2011	139	23.72	447	76.28	586
2012	157	24.65	480	75.35	637
2013	162	26.69	445	73.31	607
2014	138	21.84	494	78.16	632
2015	163	25.11	486	74.89	649
2016	158	24.12	497	75.88	655
Total	1162	24.49	3583	75.51	4745

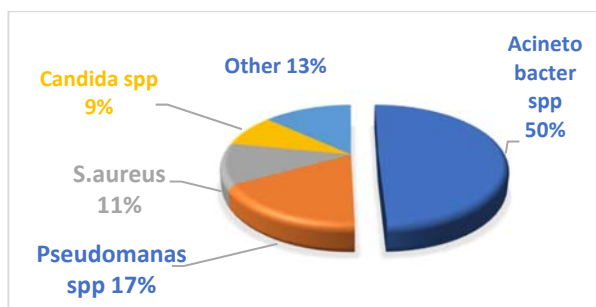
BICU: Burns intensive care unit, BS: Burn Service

Table-2. Distribution of the patients according to gender

	Female	%	Male	%	Total
BS	1197	33.4	2386	66.6	3583
BICU	292	25.1	870	74.9	1162
Total	1489	31.4	3256	68.6	4745

BICU: Burns intensive care unit, BS: Burn Service

In the burn service group, the ratio of female to male was 33.4/66.6 while it was 25.1/74.9 in the intensive care group (Table-2). The male to female ratio was found to be significantly higher in the intensive care unit when compared with service (2.9 versus 1.9 respectively; $p=0.003$).



Graphic-1. The distribution of pathogens in infections in our burn center.

The most common age range in the moderate burn group was 2-4.9 years with 17.38% (n:

622), but it was 20-29.9 years with 20.81% (n: 242) in the severe burn group (Table-3).

Table-3. Distribution of the patients according to the age

Age	BS	%	BICU	%	Total	%
0-0.9	164	4.58	28	2.38	192	4.04
1-1.9	564	15.73	33	2.85	597	12.58
2-4.9	622	17.38	108	9.27	730	15.40
5-15.9	324	9.04	95	8.09	419	8.81
16-19.9	157	4.38	70	6.06	227	4.80
20-29.9	475	13.27	242	20.81	717	15.11
30-39.9	481	13.42	203	17.48	684	14.41
40-49.9	363	10.12	146	12.61	509	10.72
50-59.9	185	5.16	97	8.32	282	5.93
60-69.9	125	3.50	52	4.52	177	3.75
70-79.9	77	2.15	45	3.92	122	2.59
≥80	46	1.27	43	3.69	89	1.86
Total	3583	100	1162	100	3441	100

The highest rate of admission was in moderate burned patients was 49.12% (n: 1760) with a burned body surface area of 0.1-9.9%, while in the severely burned group it was 16.77% (n: 195) with a burning body surface area of 40-49.9% (Table-4). The average percentage of burn surface area was calculated as 15.3%. The burn percentage was significantly higher in the intensive care unit ($35.2\pm 23.5\%$) compared to the burn service patients ($10.7\pm 8.5\%$) ($p<0.05$).

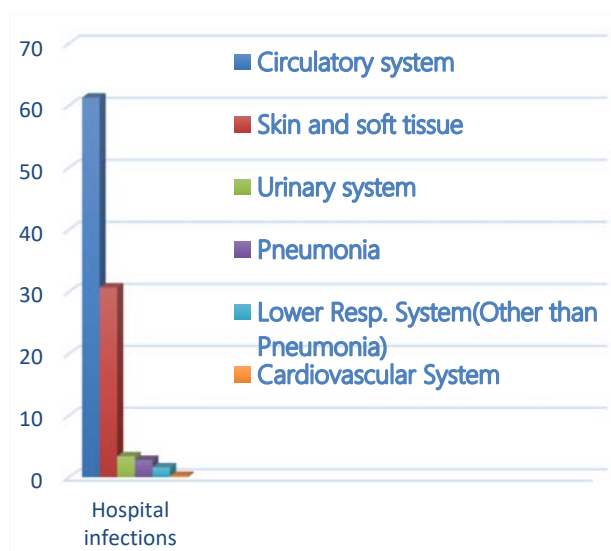
Table-4. Distribution according to burn percentage

BURN (%)	BS	%	BICU	%	TOTAL	%
0.1-9.9	1760	49.1	84	7.25	1844	38.89
10-19.9	1322	36.8	160	13.79	1482	31.24
20-29.9	343	9.58	177	15.22	520	10.96
30-39.9	96	2.69	188	16.17	284	5.99
40-49.9	55	1.54	195	16.77	250	5.26
50-59.9	7	0.19	122	10.46	129	2.70
60-69.9	-	-	83	7.14	83	1.74
70-79.9	-	-	62	5.35	62	1.31
80-89.9	-	-	44	3.81	44	0.93
≥90	-	-	47	4.04	47	0.99
TOTAL	3583	100	1162	100	4745	100

BICU: Burns intensive care unit, BS: Burn Service

When we examined the causes of moderate burns, the first order received scalding burns

with 52.65% (n: 1886), and in severe burns, it was flame burns with 54.22% (n: 630) incidence (Table-5). For patients with the electrical burn and flame burn injuries, the rate of admission to the intensive care unit was significantly higher than other types of burn injuries ($p < 0.05$).



Graphic-2. The distribution of infections in burn center

In the first eight years, the rate of burn intensive care infections was 56.04% on average, while it was 8.26% in our burn services. The incidence density of infection was 5.48% in our burn intensive care unit and 0.76% in the burn service. The most frequent infection in burn intensive care patients was blood circulation infection as 31.93%, while it was skin and soft tissue infections as 5.72% in burn service. Acinetobacter species were the most common pathogens in burn intensive care unit, and Pseudomonas species were the ones in burn service (Graphic 1, 2).

The annual average occupancy rate of the burn service was 89.39%, and the burn intensive care unit was 74.70%. The average hospitalization length was 10.09 days in burn service and 11.82 days in the intensive care unit. The duration of stay at the hospital was significantly

higher in the electrical burn injuries (12.2 ± 15.1 days) and flame burns (15.5 ± 13.9 days) compared to the other types of burn injuries ($p < 0.05$).

Table-5. Distribution of the patients to burn etiology.

Etiology	BS	%	BICU	%	Total	%
Scalding	1886	52.6	216	18.5	2102	44.2
Flame	1021	28.4	630	54.2	1651	34.8
Electrical	179	4.9	242	20.8	421	8.8
Chemical	170	4.7	18	1.5	188	3.9
Contact	167	4.6	17	1.4	184	3.8
Other	160	4.4	39	3.3	199	4.1
Total	3583	100	1162	100	3441	100

BICU: Burns intensive care unit, BS: Burn Service

Our mortality rate was 7.37% (n:350) in our series (Table-6). The burn percentage was found to have a positive correlation with the mortality risk. The rate of mortality was significantly higher for electrical burn injuries (17.1% of all deceased patients) and flame burns (69.4% of all deceased patients) compared to other types of burn injuries ($p < 0.05$).

Table 6. Mortality rates of our patients.

Years	Total patient in BICU	Exitus number in BICU	Exitus percent in BICU	Total patients in BS	Total patient number	Total exitus (%)
2009	93	42	45.16	347	440	9.54
2010	152	61	40.13	387	539	11.31
2011	139	38	27.33	447	586	6.48
2012	157	41	26.11	480	637	6.43
2013	162	45	27.77	445	607	7.41
2014	138	36	26.08	494	632	5.69
2015	163	47	28.83	486	649	7.24
2016	158	40	25.32	497	655	6.11
Total	1162	350	30.12	3583	4745	7.37

BICU: Burns intensive care unit, BS: Burn Service

Similarly, the patients with electrical burns and flame burn injuries had a significantly higher burn percentage in comparison to the patients with other types of burn injuries ($23.3 \pm 19.9\%$ and $28.6 \pm 24.5\%$ respectively; $p < 0.05$).

Discussion

The management of burn patients is quite tricky and an organized multidisciplinary approach is required to cope with the additional complications. So, it results in a prolonged hospitalization. Many different complications may occur during this process like extremity loss, repetitive surgical interventions, infections. The best way to the management of burn trauma is the prevention of the injury before its occurrence. First of all, a collection of data about these burn injuries in society is crucial for the production of ways of management of these burns. Our country as a developing country demands individual efforts on burn injuries; so in recent years, there are several studies about the burn epidemiology and the management of statistical data (15-17). Our study consisting of 4745 patients is one of the most extensive series presented in our country.

In our study, adult male patients constituted the majority of patients admitted to our burn center. This finding was similar to various other study results (18, 19). We can interpret this result as since women do not work in heavy industry. But in some other reports, female patients were more than males (20, 21). Our data resulted in the scalding burns as the highest percentage of burn cases. This was compatible with several other studies (22, 23), but in another study (24), flame burns constituted the majority of burn injuries. In our study scalding burns were followed by flame burns and electrical burn injuries as second and third most frequent types of

burn injury. Our burn center is close to the industrial zone which explains the relatively increase frequencies of flame burns, electrical burns and contact burn injuries. Scalding burns commonly observed at home. The families with low socioeconomic status in a crowded environment may neglect their children, so these children are vulnerable to burn accidents with hot water, tea, milk or soup (25).

The highest mortality rate among our cases was in the flame burns group, followed by the electrical burn injuries. The level of burn percentage showed a direct correlation with the mortality rate. The highest burn percentage was in the flame burns group and the most prolonged duration of hospitalization in the electrical burn injuries group. Our mortality ratio was calculated to be around 7.37% which was higher than various other study results in developed countries (26-28).

In burn trauma, opportunistic infections are common due to the interruption of the skin integrity resulting from a way of penetration of microorganisms together with the suppression of the immune system. Antibiotic prophylaxis is routine for all patients under the direct control of our doctor of infectious disease and cultures from all sites were taken. *Acinetobacter* spp were the most common microorganism in our results. Several studies reported different organisms as most common organisms growing in burn sites as *S.aureus*, *Pseudomonas* sp., and *Klebsiella* spp (19, 29, 30). Our results are different from previous findings.

In Turkey, Burn and Fire Disasters Association was established to conduct studies, education programs, national and international scientific activities on burns and fire disasters. We think that the conduction of appropriate notifications

and education programs will provide significant benefits to protection from accidents.

This study revealed that the majority of burn patients in our region consisted of middle-aged male patients. The type of burn injury with the highest mortality risk was found to be the flame burns. The most common type of injury was scalding burns, and the largest group of patients experienced the burn injury while actively cooking in the evening. We believe that the traditional methods for preparing meals and tea brewing in Turkey should be re-evaluated and necessary precautions have to be undertaken.

Conclusion

Burn injuries are preventable disasters with physical and psychological scars. Thus the efforts for preventive measures and education programs should be increased. All social assistance foundations and burn associations should also work toward this goal.

Authorship Contributions

Concept: Y.Y., O.K.; Design: Y.Y., O.K.; Data collection &/or processing: Y.Y., O.K.; Analysis and interpretation: Y.Y., O.K.; Literature search: Y.Y., O.K.; Writing: Y.Y., O.K.; Critical review: Y.Y., O.K.

Conflict of Interest

The authors declare no conflict of interest

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