RESEARCH ARTICLE

The factors affecting mortality in intensive care unit of a burns center

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Abstract

Objective: To determine the characteristics of patients, mortality-affecting factors and mortality rate in follow-up burn-injured patients in an intensive care setting at a burns treatment centre.

Method: The retrospective study was conducted between May and November 2014 at Kocaeli Derince Training and Research Hospital Burn Treatment Centre, Kocaeli, Turkey, and comprised data from January 2008 to January 2013 of in-patients who had been treated at the intensive care unit. The therapy outcomes and the follow-up processes were evaluated. Data was analysed using SPSS 17.

Results: Of the 381 patients, 105(27.6%) were females and 276(72.4%) were males. The overall mean age was 28.4±21.1 years. There were 52(13.6%) mortalities, while 329(86.4%) survived. The mean total body surface area was 18.3±12.9% in those who survived compared to 52±24.3% in those who died (p<0.000). The highest rate of death was observed in those aged >66 years (p<0.000). The impact of flame burns on mortality was statistically significant (p<0.05). The impact of inhalation burns, suicide, abuse, operational requirements and systemic disease on mortality was statistically significant (p<0.05).

Conclusions: Older age, higher total body surface area, flame burns, presence of inhalation burn, third degree burn, suicide attempt, presence of systemic disease, duration of prolonged mechanical ventilation and operation requirements were found to be poor prognostic factors for survival in burn patients.

Keywords: Burn, Mortality, Risk factors, Intensive care, Burn centre. (JPMA 72: 763; 2022)

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Introduction

Burns are the fourth most common cause of trauma worldwide and one of the most important causes of disability and death. In developed countries, burn mortality rate is 2.1 per 100,000 person-years.[1] The most important indicators of survival in thermal injury are percentage of burnt body surface area and old age. In addition, inhalation injury, depth of burn, resuscitation protocol, timing of surgery, infection control and nutritional support also affect mortality. Factors such as psychological state, motivation and therapy participation of patients, family support and socio-economic history may affect the results.[2-5]

The prognosis for burn patients has improved significantly in terms of both survival and quality of life (QOL) over the last 20 years. This progress is dependent on appropriate corrective surgery timing which ensures removal of the deep wounds and rapid biological closure before the development of wound sepsis.[5] Improvements of burn care and understanding of some issues in the patho-physiological process of burns have motivated researchers to determine the risk factors for mortality. This would result in the development of various valuable models to predict mortality of burns. The development of these models may be effective in terms of triage and treatment of burn patients. Patients with high-risk mortality initially may be sent to the special burn care centres for more effective treatment.[6,7] Clinical programme and the evaluation of their results are necessary to support the health status and QOL in burn patients. Also, it will provide better knowledge about morbidity related to burn injuries.[8]

The current study was planned to determine the characteristics of patients, mortality-affecting factors and mortality rate in follow-up burn-injured patients in an intensive care setting.

Materials and Methods

The retrospective study was conducted between May and November 2014 at Kocaeli Derince Training and Research Hospital Burn Treatment Centre (BTC), Kocaeli, Turkey, and comprised data from January 2008 to January 2013 of in-patients who had been treated at the intensive care unit (ICU). Data of outpatients followed in the emergency department was excluded.

The BTC is located in Marmara, which is the most densely populated and industrialised geographical area in Turkey. The BTC not only accepts patients from the Marmara

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region, but also from across Turkey. It is designed as a completely separate department away from other patients on the hospital premises. The operating room (OR, ICU and inpatient services are located within the centre where multidisciplinary approaches are adopted, including mechanical ventilation and haemodiafiltration.

After approval from the institutional ethics review committee, data was retrieved from both electronic and manual patient files, including demographic characteristics, history of systemic disease, examination findings, and ICU follow-up processes, and treatment outcomes.

Data were analysed using SPSS 17. Mann Whitney U test was used for comparing the parameters. Comparison of qualitative variables was done using chi-square test. P<0.05 was considered statistically significant.

Results

Of the 381 patients, 105(27.6%) were females and 276(72.4%) were males. The overall mean age was 28.4±21.1 years (range: 1-91 years). There were 122(32%) patients aged 1-18 years, 236(62%) aged 19-65 years, and 23(6%) patients aged >66 years. The cases were also classified by burn agents and burned area (Table 1).

Overall, 52(13.6%) patients died and 329(86.4%) survived. In terms of mortality, there was no significant difference between the genders (p>0.05), but age, burn agent and burnt area has significant impact (p<0.05).

Overall, 296(77.86%) patients had burn surface <40% and 85(22.14 %) had >40%. mean total body surface area (TBSA) was 18.3±12.9% in those who survived compared to 52±24.3% among those who died (p=0.000). The mean duration of hospital stay was 19.2±17.1 days in those who survived compared to 22.4±33.1 days in the other group. The mean length of stay in ICU was 12.9±15.1 days in those who survived compared to 15.2±24.5 days in those who died. Mean duration of mechanical ventilation was 0.7±1.6 days in the former group compared to 5±2.7 days in the latter group (Table 2).

Mortality rate had close relation with burn degree and burn area (Table 3).

Table-1: Mortality rates according to gender, age group, burn agent and burned area.

		Exitus n (%)	Survived n (%)	*p*-value
Gender	Female	13(12)	92(88)	0,66**
	Male	39(14)	237(86)	
Age	1-18	6(5)	116(95)	<0,000*
	19-65	35(15)	201(85)	
	66+	11(48)	12(52)	
Burn Agent	Scald	4(3)	121(97)	<0,000*
	Flame	27(27)	73(73)	
	Electrical	7(10)	63(90)	
	S+F+E	14(17)	67(83)	
Burnt Area	Scalp	1(11)	8(89%)	<0,000*
	Extremity	8(6)	132(94)	
	Body	18(24)	58(76)	
	Face + Neck	2(3)	58(97)	
	Genital	4(17)	19(83)	
	Multiple	18(26)	51(74)	

Table-2: Total body surface area (TBSA), duration of hospitalisation and mechanical ventilation in patients.

	Exitus	Survived	*p*-value
TBSA %	52±24.3	18.3±12.9	<0.000*,†
Hospitalization (Day)	22,4±33.1	19.2±17.1	0.205**,†
ICU (Day)	15,2±24.5	12.9±15.1	0.944**,†
Mechanical ventilation (Day)	5±2.7	0.7±1.6	<0.000*,†

*p<0.05=There is a significant difference; **=p≥0.05: No significant difference (given as mean±standard deviation [SD] and as distribution); †=Mann Whitney-U test was used.

Table-3: Mortality rates according to thinner burn, exploitation, suicide, work accident, presence of inhalation burn, multi-trauma, burn degree and operation requirement.

		Exitus n (%)	Survived n (%)	*p*-value
Thinner burn	Not	27(15)	153(85)	0,1**,††
	Yes	8(29)	20(71)	
Exploitation	Not	28(14)	168(86)	0,001*,††
	Yes	7(58)	5(42)	
Suicide	Not	31(16)	169(84)	0,03*,††
	Yes	4(50)	4(50)	
Work accident	Not	22(17)	106(83)	0,86**,††
	Yes	13(16)	67(84)	
Presence of inhalation burn	Not	19(11)	157(89)	<0,00*,††
	Yes	16(50)	16(50)	
Multi-trauma	Not	31(16)	167(84)	0,067**,††
	Yes	4(40)	6(60)	
Burn Degree	2. degree	20(12)	141(88)	0,003*,††
	3. degree	15(33)	31(67)	
Operation Requirement	Not	1(3)	31(97)	0,046*,††
	Yes	34(19)	142(81)	

**=p≥0.05: No significant difference (given as mean±standard deviation [SD] and as distribution); ††=Chi-square test was used.

Discussion

Mortality rate is a prominent indicator of the quality pf patient care in a hospital. However, it is necessary to detect the independent factors affecting mortality before the quality of care. Patients categorised as high-risk for mortality during burn centre admission, should primarily be admitted to ICU.

The mortality rate related to burn injury varies between the developed and the developing countries. It was reported 20% in Nigeria, 28.4% in Kuwait, 6.9% in the Netherlands and 5.6% in the United States.[9-11] In the current study, the mortality rate was 13.6%.

There were three risk factors detected in burn deaths; elderly patients (>60 years), >40% TBSA, and inhalation injury.[2] Mortality was statistically higher in patients aged >65 years, >40% TBSA and inhalation injury. Bloesma et al. reported that age, TBSA and inhalation injury had significant impact on survival.[9]

Although burns are more prevalent in people aged 19-65 years, mortality was observed most frequently in those aged >66 years in the current study. Gender superiority in burn mortality varies between countries. Female superiority has been reported in India, Iran, Kuwait and Bangladesh, while higher burn mortality in females with mostly flame burns was associated with traditional cooking of women, social conventions, low socioeconomic status and educational level in these countries.[12,3] Burn cases in Argentina, Thailand, Saudi Arabia and Uruguay were reported higher in the male gender.[14] However, no significant difference was found between the genders in the current study.

An important factor to determine the mortality in burn patients is the percentage of the burnt area. Ryan et al. highlighted that >40% TBSA is an important risk factor in mortality of burn patients.[2] Ercan et al. reported 100% mortality rate in patients with >70% TBSA in Turkey.[15] In the current study, the mortality rate was 52% in patients with >40% TBSA.

Scald burns (33.2%) were reported most frequently, but the lowest mortality rate was obtained from scald burns (3%) in the current study. On the other hand, consistent with published data,[16] the impact of flame burns on mortality was statistically significant.

Mortality rate (34%) of third degree burns were found higher than the mortality rate (9%) of second degree burns in the current study.

Han et al. defined burn injuries with more than two body part as 'multiple burns'.[16] Although the isolated extremity burns were most frequently observed, mortality was higher in body and multiple burns.

In the current study, surgical operations, such as debridement, eschar excision, fasciotomy, escharotomy and amputation, were applied for the majority of ICU inpatients. A proportion of patients did not need surgery. Electrical burns have been reported to be associated with high amputation and more operative intervention in Turkey.[17] Mortality was 18% in the operated group which was statistically significant. The findings were consistent with previous studies in Turkey.[18]

The most frequently reported burn scene was houses, followed by workplace, in the current study. There was no significant difference according to the site of burn injuries in terms of mortality. Zarei et al. reported that burn occurring inside the home was a mortality-affecting factor in Iran.[19] There is a relationship between the fatal burns and people's behaviour. Burn factors change with seasonal variation.[20] According a study in Bangladesh, almost all deaths related to flame burns were observed in winter.[13] A potential limitation of the current study is that it did not evaluate mortality seasonally.

Mortality was reported in 5 of 10 patients, who attempted self-immolation by pouring flammable material, and mortality was reported in 8 of 15 patients who were abused and burned by someone else in the current study. In addition, mortality was statistically higher in abuse and suicidal patient groups. The suicidal burns constituted 27% of burn-related deaths in India. It was 11% in Kuwait, 13% in Jordan, and 10% in the current study. In Taiwan, the average burnt body surface and mortality were reported higher in burns related to suicide.[21,22]

There were 44 hospitalised patients with inhalation burn injury in the ICU. In addition, 48% mortality rate was significant in patients with inhalation burns. Comert et al. compared radiological and bronchoscopic evaluation of survived and exitus patients with inhalation burns. There was no pathological findings on 5th day chest radiograph and acute respiratory distress syndrome (ARDS) in survived patients. Conversely, radiographic abnormalities were reported 79.1% on the 5th day, and ARDS was 50% in exitus patients.[23] In addition, the possibility of inhalation injury in burn patients is parallel to burn rate indicated by TBSA. Inhalation injury in patients with burns >80% was reported as 75-93%.[24,25]

There were systemic co-morbid diseases, such as hypertension and diabetes mellitus, in 25(6.56%) patients in the current study. The mortality rate of patients with co-morbid diseases was 32%, which was significant.

There was multi-trauma in 15(%3.9) patients, and the mortality rate in such patients was 31%, which was not significant.

There was no significant difference in mortality according to evaluation of ICU stay and length of overall hospital stay. Al et al. reported that mortality significantly increased in patients spending >15 days in hospital in Turkey.[18] Moreover, mortality increased significantly due to the long duration of mechanical ventilation in the hospitalised patients.

Another Limitation of the current study is its inability to perform a survival analysis.

Conclusion

Older age, higher TBSA, flame burns, presence of inhalation burn, third degree burn, suicide attempt, presence of systemic disease, duration of prolonged mechanical ventilation and operation requirements were poor prognostic factors for survival in burn patients.

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Conflict of Interest: None.

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