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Evaluating the Mortality-Related Risk Factors in Patients with Burn Injuries Hospitalized in Shahid Motahari Burn Hospital of Tehran

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ABSTRACT

In addition to the considerable developments in medical and surgery techniques, patients with burn injuries are at risk of many complications such as mortality. The current cross-sectional study evaluated the effect of different variables, such as age, gender, pregnancy, underlying diseases, total body surface area (TBSA), burning degree, the burned member, motivation, addiction, inhalation injury, admission to the intensive care unit, intubation, initial fluid therapy, simultaneous trauma, the time elapsed from the burning to admission, and the name of referring center (if the patient was referred) on the treatment response. The current prospective study evaluated all patients hospitalized in Shahid Motahari Burn Hospital of Tehran, Iran, from Sep. 2014 for four months, due to severe burning. Hence, a checklist was completed for each patient. To evaluate the effect of the mentioned variables the univariate logistic regression was employed for statistical analysis. Four hundred-fifty-two patients were admitted to the hospital for burning within the four months period of the study. In the current study, the rate of mortality was 14.18%. Mortality was independently related to the inhalation injury (aOR: 11.6, P < 0.001), burning degree (aOR: 1.7, P = 0.006), TBSA (aOR: 1.1, P < 0.001) and age (aOR: 1.1, P < 0.001). Values are significant at P < 0.05. It is important to consider inhalation injury, burning degree, TBSA, and age of the patient in rapid evaluations. To reduce burning events, it is necessary to teach educational and preventing programs for the general public. It is also recommended to design and implement retraining programs regarding handling the patients with burning injuries for the medical staff.

Key words: Mortality, Burning, Risk Factor.

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1. INTRODUCTION

Burning means any kind of injury to the skin, mucosa and the tissues under the skin caused by direct and indirect heat. The Skin barrier protects against infectious agents and foreign bodies and prevents withdrawal of body fluids; but these mechanisms do not go properly in burnings and consequently complications such as body fluid loss, infection and shock occur. Burning is one of the most intensive injuries, which a human may experience. The intense burning is a high-risk condition that engages all body organs. Besides, treatment in hospital is associated with many difficulties for the patient. Burn is one of the most important healthcare issues, considered as important and specific causes of morbidity and mortality in the developing countries. Burn is one of the most devastating injuries and is a major public health crisis. Burns are the main causes of trauma in the world after traffic accidents, falling and violence between people (1). About 90% of the burns occur in the countries with medium and low economic level. According to the available statistics, the most and least of the burns occur in East Asia and USA, respectively (2). Burns annually cause 45`000 cases of hospitalization in the USA; 25`000 out of which are in burn hospitals (2). According to deputy minister of the Iranian Health and Medical Education, 150`000 burn cases are annually reported, out of which 15`000 need hospitalization. Comparing the 75 million population of Iran versus 320 million population of the USA with 500`000 annual burn cases, the rate of burn cases in Iran is higher. Also, 3000 people annually lose their lives due to burns, which this rate has decreased to 2000 cases in the recent years (2). The need to develop the

treatment of burns in Iran is quite tangible. Today, most of the burn cases in the Western countries are treated and the rate of mortality due to severe burnings (90% and over) is about 55% (3, 4). Unfortunately, while the Western countries investigate on the way to interact and communicate with the patients with burn injuries who undergo mechanical ventilation and tracheostomy (while or after separating from devices) (3), Iran still tries to cope with mortality in the lower burning degrees which indicates that the problem is very serious in Iran and needs more investigations. Heat burns and the following complications are among the common injuries and are considered as one of the main causes of death and disability all around the world. In different societies, burns are always associated with physical, mental and financial damages and are considered as a main healthcare issue. Initial hospitalization of fire victims is only a small part of the long way to treatment; most of these patients should undergo several reconstructive surgeries and need years of supervision and financial and mental supports. Any negligence in this regard may stop full treatment and lead to permanent disability and even death. Burns may be thermal, electrical or chemical and can be also caused by boiling water or other reasons. Most of the burns are preventable and most of the patients with burn injuries can be saved if treated properly. In the developing countries, burns are common problems associated with complications and considerable number of deaths. To supply and equip burn hospitals, and also proper and successful programming to prevent burns and reduce complications and deaths caused by burn, it is necessary to have detailed information about the epidemiology of burn. Armed with the sufficient and necessary information, the required human and financial resources can be assigned and to improve the situation more effective attempts can be made. Being aware of annual rate of mortality caused by burns in a certain region and comparing it with those of the different years may also be considered as one of the most important indices to evaluate the effect of provided services to the part of community who had burn injuries and are at high risk. The aim of the present study is evaluating the Mortality-Related Risk Factors in Patients with Burn Injuries Hospitalized in Shahid Motahari Burn Hospital of Tehran, Iran.

2. MATERIALS AND METHODS

The current cross-sectional, prospective-descriptive study evaluated 452 patients admitted to Shahid Motahari Burn Hospital of Tehran, Iran, for burn injuries from September 2014 to November 2014. The patients with older burn injuries who referred to treat burn complications were excluded from the study. The study was performed according to Helsinki principals. All patients were aware of the study and signed a written consent. The variables evaluated in the study were as follows: mortality, age, gender, burning cause, pregnancy, burning degree and TBSA, smoking, using alcohol, narcotics and psychotropic drugs, proper initial fluid therapy, type of performed surgical procedures, motivation, underlying disease, intubation during the hospitalization, admission in the intensive care unit (ICU), simultaneous trauma, inhalation injury, time elapsed until death and TBSA. The aforementioned information was transferred to the designed checklists through interviewing the patients by the researchers and preparing medical profile for each one. It is noteworthy that information such as mortality, changes in patient's clinical course which may lead to ICU admission, and number and type of the performed surgeries were extracted from the profile of the patients after discharge and recorded in the checklist. The collected data recorded in the checklist were transferred to the SPSS ver.23 and analyzed using Chi-two, T-test, regression and correlation tests. Regarding the quantitative data, the mean was considered as central index and standard deviation as distribution index. $P < 0.05$ was considered as the level of significance.

3. RESULTS AND DISCUSSION

The mean age of 452 patients with burn injuries evaluated in the current study was 32.13 ± 20.13 years, ranged from six month to 98 years old. It is noteworthy that, 201 subjects (44.5%) were in the age range of 20-40 years (age of productivity). The means age of male and female subjects were 33.18 ± 19.28 and 29.1 ± 22.2 years, respectively; there was no significant difference between the means. In the current study, 335 subjects were male (74.1%) and 117 were female (25.9%). There was no relationship between the gender and mortality in the current study. In the current study, 126 subjects (27.9%) had TBSA ≤ 11%, and 118 subjects (26.1%) had TBSA = 11%-20%; 77 subjects (17%) had TBSA = 21%-30% and 43 subjects (9.5%) had TBSA 31%-40%. The rest of the subjects (88 subjects, 19.4%) had the TBSA ≥ 40%. The results of the current study are shown in Table 1. The level of mortality based on burning cause and burning degree, and also mortality based on the number and type of performed surgery, motivation, type of associated trauma and the burned organ are shown in Table 1; since there was no information about some of the subjects (34 subject were discharged from hospital by personal request, two subjects were pregnant who were referred to the specialized burn clinic after performing initial medical cares), they were excluded from the study and analyses were conducted based on 416 subjects.

The frequency of mortality was categorized based on burning cause; accordingly, in the burn mortality group, fire with 33 subjects (55.9%) and explosion with 19 subjects (32.2%) were the main causes. in the burn survived group, hot liquid with 120 subjects (33.6%) and flame with 90 subjects (25.2%) were the main causes of burn; the difference between the groups in this regard was statistically significant ($P < 0.001$) (Table 1). The mean of TBSA in the burn mortality and burn survived groups were 59.9% and 18.6%, respectively; the difference was

statistically significant (P < 0.001). The frequency of burning degree based on the highest degree of burning in each patient is shown in Table 1. The frequency of mortality in patients with burn injuries based on the type of performed surgeries (debridement, graft, early excision, amnion membrane, fasciotomy and other necessary surgeries performed in the first admission) is shown in Table1. The mean number of surgeries in the burn mortality and burn survived groups were 1.2 and 2 times, respectively; there was statistically significant difference between the groups (P < 0.001). Normally, less surgical performances were done on the subjects of burn mortality group due to their severe conditions. The highest frequency was about the debridement cases which was 20 subjects (33.9%) in the burn mortality group and 59 subjects (16.5%) in the burn survived group. In addition, debridement and grafting were done on 5 subjects (8.5%) and 129 subjects (36.1%) in the burn mortality and the burn survived groups, respectively; there was a significant difference between the groups in this regard (P < 0.001). The early excision graft was done on 7 subjects (11.9%) and 139 subjects (38.9%) in the burn mortality and the burn survived groups, respectively (P < 0.001). Amputation was performed in only one subject (1.7%) and 17 subjects (4.8%) in the burn mortality and the burn survived groups, respectively; there was no significant difference between the groups in this regard (P < 0.93). The frequency of mortality in patients with burn injuries based on the burning motivation was as follows: the suicide in the burn mortality and the burn survived groups were 9 subjects (15.25%) and 5 subjects (1.4%), respectively; the difference was statistically insignificant (P < 0.001). The frequency of mortality in patients with burn injuries was evaluated based on the simultaneous trauma and severe trauma. The type of diagnosed trauma in the patients with burn injuries included falling, blunt traumas, eye trauma, laceration and some cases of multiple trauma; the frequencies are shown in Table 1. Although the simultaneous trauma increases the rate of mortality, the number of trauma cases in the burn mortality group was 8 subjects (13.6%) versus 32 subjects (9%) in the burn survived group; there was no significant difference between the groups in this regard (P < 0.361). The frequency of mortality in patients with burn injuries based on the anatomic burned area (Table 1) was as follows: the head and face burns in the burn mortality and the burn survived groups were 50 (84.7%) and 166 subjects (46.5%), respectively; the difference between the groups was significant (P < 0.001). Trunk burns in the burn mortality and the burn survived groups were 50 (84.7%) and 203 subjects (56.9%), respectively; the difference between the groups was also significant (P < 0.001). There was an insignificant difference between the groups regarding the burn injuries in the right and left upper extremities, but the frequency of burn injuries in both left and right upper extremities in the burn mortality and the burn survived groups were 50 (84.7%) and 174 subjects (48.7%), respectively (P < 0.001). The situation in the lower extremities was similar to those of upper extremities. In other words, there was an insignificant difference between the frequency of burn injuries in the right and left lower extremities in both burn mortality and burn survived groups, but the frequency of both right and left lower extremities in the burn mortality and burn survived groups were 84.7% (50 subjects) and 46.2% (165 subjects) respectively; the difference between the groups was significant (P < 0.001). The frequencies of genital burns in the burn mortality and burn survived groups were 18.6% (11 subjects) and 3.9% (14 subjects), respectively; the difference between the groups in this regard was significant (P < 0.001) (Table 1). All statistically significant variables (P < 0.05) (except the time elapsed since the incidence of burn until admission to the hospital and also the number of performed surgeries considered as predictor factors) were analyzed by regression logistic test to determine the factors exactly affecting the mortality. Among the evaluated variables, only the inhalation injuries, TBSA, burning degree and age of the patient included in the model as factors affecting the mortality and the rest of the variables (cause of burn, motivation, intubation and TBSA) were excluded (Table 2). Hosmer and Lemeshow test showed that 96% (0.960) of mortality determining indices were considered in the current study.

Table 1. Mortality Frequency in the Studied Patient

	Population	Prevalence in the current study (452)	Prevalence in the rest of the patient (416)	Prevalence in dead patients (59)	Prevalence in alive patients (357)
Cause Of Burn					
	Hot Liquid	132 (29.2%)	120 (33.6%)	3 (5.1%)	123 (29.6%)
	Flame	103 (22.8%)	90 (25.2%)	3 (5.1%)	93 (22.4%)
	Fire	72 (15.9%)	37 (10.4%)	33 (55.9%)	70 (16.8%)
	Explosion	67 (14.8%)	42 (11.8%)	19 (32.2%)	61 (14.7%)
	Electricity	39 (8.6%)	33 (9.2%)	1 (1.7%)	34 (8.2%)
	Hot Objects	25 (5.5%)	21 (5.9%)	0	21 (5%)
	Caustic Agents	14 (3.1%)	14 (3.9%)	0	14 (3.4%)
Max. Grade of burn					
	GRADE 2	14 (3.1%)	186 (44.7%)	0	187 (49.9%)
	GRADE 3	203 (44.9%)	197 (47.3%)	8 (13.6%)	153 (42.9%)
	GRADE 4	212 (46.9%)	33 (7.9%)	44 (74.5%)	26 (7.2%)
Surgery					
	Early Excision Graft	37 (8.18%)	146 (35.1%)	7 (11.9%)	139 (38.9%)
	Debridement & Graft	-----	134 (32.2%)	7 (11.9%)	129 (36.1%)
	Just Debridement	-----	79 (19%)	5 (8.5%)	59 (16.5%)
	Late Excision Graft	-----	73 (17.5%)	20 (33.9%)	71 (19.9%)
	Amnion Dressing	-----	34 (8.2%)	2 (3.4%)	33 (9.2%)
	Amputation	-----	18 (4.3%)		17 (4.8%)
	Fasciatomy	-----	6 (1.4%)	1 (1.7%)	6 (1.7%)
		-----	4 (1%)	1 (1.7%)	4 (1.1%)
	Flap Insertion	-----	46 (11.1%)	0	36 (10.1%)
	Others	-----	2 (0.5%)	0	2 (0.6%)
	•	-----	45 (10.8%)	10 (16.9%)	19 (5.3%)
	•	-----	161 (38.7%)	0	147 (41.2%)
	Amnion + Others	-----	97 (23.3%)	26 (44.1%)	86 (24.1%)
The number of surgeries					
	No surgery	-----	48 (11.5%)	14 (23.7%)	47 (13.2%)
	1 Time	-----	65 (15.5%)	11 (18.6%)	58 (16.3%)
	2 Times	-----	395 (95%)	1 (1.7%)	346 (96.9%)
	3 Times		7 (1.7%)	7 (11.9%)	6 (1.7%)
	4 Times and more	----	14 (3.4%)	49 (83.1%)	5 (1.4%)
Mode					
	Accidental	-----	14 (3.4%)	1 (1.7%)	12 (3.4%)
	Homicide	-----	6 (1.4%)	9 (15.3%)	6 (1.7%)
	Suicide	----	5 (1.2%)	2 (3.4%)	3 (0.8%)
	Falling down	----	1 (0.2%)	0	1 (0.3%)
	Serious eye injury	----	5 (1.2%)	2 (3.4%)	3 (0.8%)
	Laceration	----	8 (1.9%)	0	6 (1.7%)
Associated Injury					
	Falling down + Laceration	----	216 (51.95%)	2 (3.4%)	166 (46.5%)
	Multiple Trauma with Fractures	----	253 (60.8%)	2 (3.4%)	203 (56.9%)
	Other blunt trauma	-----	(1.5%) 48	50 (84.7%)	
Site of Burn					
	Head, Face, Neck	----	53 (12.7%)	50 (84.7%)	51 (14.3%)
	Torso	----	48 (1.5%)		44 (12.3%)
	Upper limb		224 (53.8%)	2 (3.4%)	174 (48.7%)
	. Only right			4 (6.8%)	
	. Only left		38 (9.1%)	50 (84.7%)	37 (10.4%)
	. Both	-----	42 (10.1%)		39 (10.9%)
	Lower limb		215 (51.7%)	1 (1.7%)	165 (46.2%)
	. Only right		25 (6%)	3 (5.1%)	14 (3.9%)

Table 2. Risk Factors Affecting the Mortality

Risk Factor	OR	P Value
Inhalation Injury	11.6	< 0.001
Grade	1.7	0.006
Age	1.1	< 0.001
Percentage	1.1	< 0.001

Abbreviations: OR; Odd's Ratio

Burn is an irrecoverable event followed by physical, mental, social and economic complications, but in half of the cases the event and the following complications are preventable (5). The frequency of mortality in patients with

burn injuries hospitalized in Shahid Motahari Burn Hospital was 59 subjects (14.18%) out of 416 after excluding the subjects discharged by their personal request (34 subjects) and the ones referred to a burn clinic (2 pregnant subjects). In a three-year-study conducted by Phillipo et al. (1) on 342 children with age range of 10 years and lower admitted to the pediatric surgical ward due to severe burn injuries, in Bogando, Tanzania, the frequency of mortality was reported 11.7% which is lower than that of the current study. This difference may result from the difference between the populations under study (age group, racial differences, etc.) and the status of Shahid Motahari Burn Hospital as the referral hospital in the territory and also admission of critically ill patients which other clinics could not provide medical services to them. In a systematic review (6) performed on a European population, covering all European regions including 800 million people and 250 specialized burn clinics, based on the references available in PubMed, Web of Science and Google, 76 studies are conducted on 186'500 subjects from 22 countries from 1985 to 2009. The annual burn rate was 0.2%-2.9% per 10`000 people, with a decreasing trend. Almost 50% of the patients were under 16 years old and 60% were male. In the majority of hospitalized population with severe burn injuries, the frequency of mortality was 1.4%-18% (maximum 34%) which was inconsistent with the results of the current study. In seven studies of the aforementioned systematic review (6) the frequency of mortality in female subjects was higher, but in another seven studies the difference was insignificant or even the mortality was higher in males. Finally, there was no relationship between the gender and mortality, which was similar to that of the current study. In the current study, 47 subjects (79.7%) were male and 12 subjects (20.3%) were female which the relationship was statistically insignificant ($P = 0.173$). The frequency of mortality in the elderly patients evaluated in some cohort studies of the mentioned systematic review (6) was 13%-39%. Evaluating some studies showed that older age was one of the most important risk factors in the mortality (7-10). Another by Ryan et al. evaluated the effect of different variables such as patient's age on mortality, in a prospective study on 265 patients admitted to ICU with different types of burn injuries and TBSA $\geq$ 15% or the 3rd-degree burns with TBSA $\geq$ 5%, in Texas, USA,. Age (aOR: 1.91, $P < 0.001$) is strongly correlated with the risk of mortality, along with the TBSA (aOR: 1.069, $P < 0.001$) and inhalation injuries (aOR: 4.348, $P = 0.002$);on the other hand, carrying IL-10 promoter genotype is associated with significant reduction in the risk of mortality (aOR:0.404, $P = 0.014$). In the current study the mean age index was used; the mean age of the subjects in the burn mortality and the burn survival groups were 39.4 ± 19.03 and 31 ± 20.08 years, respectively, which was statistically significant ($P = 0.003$). In the aforementioned systematic review (6), the frequency of mortality in the patients with flame burns was higher than those of other ones, since it was associated with a much broader and deeper level of burns and inhalation injuries; while, in the current study, fire and explosion were the most frequent causes of death in the burn mortality group with 33 (55.9%) and 19 subjects (32.2%) respectively, which may result from different cultures and social manners of the population under study. Also, in a study conducted by Frans et al. in Netherland (11), fire was the most frequent cause of death (54.5%) in the burn mortality group which was inconsistent with the results of the current study. In a study performed by Sheikh Azadi et al. (12) on the bodies referred to the Legal Medicine of Tehran province and evaluating their hospital records, fire was the most frequent cause of death in the burn mortality group, which was compatible with the results of the current study and may result from the same culture, social habits and beliefs of the population under study. In a three-year-study conducted by Phillipo et al. (1) on 342 children admitted to the pediatric surgical ward in Bugandi, Tanzania, due to severe burn injuries with the age range of 10 years and lower, although there was a significant relationship between the TBSA and burning degree, and length of stay in hospital, there was only a relationship between the burning degree and rate of mortality ($P < 0.001$). In the current study, the means of TBSA in the burn mortality and burn survival groups were 59.9% and 18.6%, respectively; the difference was statistically significant ($P < 0.001$). In the current study, TBSA and the burning degree were finally considered as risk factors associated with mortality, which was inconsistent with the results of Phillipo et al. The frequency of mortality in the patients with burn injuries was as follows: amputation, as a surgical performance, was done on one subject (1.7%) and 17 subjects (4.8%) in the burn mortality and the burn survived groups, respectively; there was no statistically significant difference between the groups in this regard ($P = 0.93$). The difference is that since the main cause of amputations was electrical burns and electrical burn is usually not fatal if does not lead to death in the place of electrocution, it may lead to loss of body organs, and wide and permanent disability. The frequencies of mortality based on the motivation for self-immolation were 15.3% (9 subjects) and 1.4% (five subjects) in the burn mortality and the burn survival groups respectively, which was statistically significant ($P < 0.001$). In a study conducted by Sheikh Azadi et al. (12) on the bodies referred to the Legal Medicine of Tehran province and evaluating their hospital records, the main motivating factor could be the self-immolation, which was inconsistent with the results of the current study. The reason can be that the self-immolation is the real reason to hurt oneself. Most of the self-immolation cases had higher rates of TBSA and burning degrees due to the serious motivation of the patients; accordingly, inhalation injuries are more possible in such patients. There was no similar study in the available references to evaluate the frequency of mortality in patients with burn injuries, based on simultaneous trauma. In most of the cases, burn injuries in association

with simultaneous trauma were considered as exclusion criteria. In a prospective study conducted by Ryan et al. (13) in Texas, USA, 265 patients admitted to ICU with different types of burn injuries, TBSA ≥ 15% or the 3rd-degree burns with TBSA ≥ 5% were evaluated. The effects of different variables were studied using multivariate logistic regression; results showed that inhalation injuries were highly associated with the risk of mortality (aOR: 4.348, P = 0.002); the results of the current study were inconsistent with those of Ryan et al. (aOR: 11.6, P < 0.001). In a retrospective study conducted by Frans et al. (11) on 336 patients with burn injuries, from 1992 to 2002, the frequency of engaged areas was in the following order: arms, thoracic, legs and face. The order of engaged areas in the current study was as follows: upper extremities, lower extremities, trunk and head, face and neck. The results of the current study were consistent with those of Frans et al., regarding the most frequent engaged organs (upper extremity). In a retrospective study conducted by Hollingsed et al. (14) on 572 patients with burn injuries admitted within four years in a local burn center, the possibility to have respiratory failures such as hypoxemia, numerous pulmonary infections and/or need for prolonged ventilator support in patients with inhalation injuries was high and 20% of the subjects had higher chance for acute respiratory distress syndrome. The frequency of mortality reported for acute long injury caused by smoke inhalation-associated with acute lung injury (SI-ALI) was 11%-80% (15, 16). In the current study, the inhalation injuries were observed in 76.3% (45 subjects) and 6.4% (23 subjects) of the burn mortality and burn survived groups, respectively; the difference was statistically significant (P < 0.001) which was inconsistent with the results of Hollingsed et al. In the current study, the risk of mortality for the inhalation injuries was OR: 11.6; it means that patients with inhalation injuries are at risk of mortality 11.6 times more than the patients without such injuries. The difference in the frequency of mortality in different regions of the world and also at different times probably results from the heterogeneity of population under study (age, associated diseases, degree of primary and secondary damages and different medications) (17). In a three-year-study by Phillipo et al. (1) on 342 children admitted to the pediatric surgical ward due to the severe burn injuries in Bugando, Tanzania, with the age range of 10 years and lower, the frequency of mortality was 11.7%; 45.9% of the subjects were under two years old. In this study, using multivariate logistic regression analysis showed a relationship between age, type of burning, cloths burning, delayed referring, significant TBSA, burning degree and the length of stay in the hospital. While there was only a relationship between age, type of burning, burning degree, inhalation injury, positive HIV with stigmata of AIDS and CD_4 independently and significantly with the frequency of mortality (P < 0.001); the results were along with those of the current study just regarding age, grade of burning and inhalation injuries (HIV was not evaluated in the current study). The TBSA was finally considered as a risk factor associated with mortality, in the current study. In the aforementioned systematic review (6), the flame, scald and contact burns were considered as the most frequent causes of burning in the population under study. The frequency of mortality in the majority of population hospitalized due to severe burn injuries was 1.4%-18% (maximum 34%). Some studies indicated that although there were variables related to the high frequency of mortality, older age, more TBSA and inhalation injuries were three important risk factors of mortality (7-10). The TBSA was 11%-24% in two studies, which reduced in the recent years. TBSA was higher in died patients (44%-50%); in some studies, the mean of TBSA was perfectly higher (55%) which may result from strict inclusion criteria (for example, only for ICU admitted patients or those with TBSA > 30% which was in association with increased mortality). The current study showed that the frequency of mortality increased by increasing the mean of TBSA among the matured and older patients (r = 0.742; P < 0.001). Age was another important factor affecting the frequency of mortality and had significant relationship with the frequency of mortality as 13%-39% in the elderly cohorts. In contrast, the frequency of survival among pediatric series was reported 98%-100%. Evaluating matured age range, showed a weak positive relationship between age and TBSA (r: 0.195; P = 235) which was improved adding the results of the studies performed on the elderly to the analyses (r: 0.646; P < 0.001). Besides age and TBSA, inhalation injury was also numerously associated with increasing the frequency of mortality 8-10 times (11.6 times in the current study) (16). Inhalation injury is caused by inhalation of fumes and is frequent, especially among the population with flame burns (13, 18, 19). Generally, inhalation injury occurs in 0.3%-43% of the patients admitted due to severe burn injuries, which were 13%-18% among the elderly and 3.3%-69% among the children. The final analyses of the current study extracted the same three aforementioned factors, inhalation injuries, high TBSA and older age, as the risk factors associated with the mortality in addition to the burning degree. A prospective study performed by Ryan et al. (13) in Texas, USA, on 265 patients admitted to ICU with different types of burn injuries with TBSA ≥ 15% and/or 3rd-degree burn with TBSA ≥ 5%. It evaluated the effect of different variables such as age, TBSA, inhalation injuries, gender, race and IL-10 promoter genotype on the mortality, using multivariate logistic regression. From the mentioned factors, only age (aOR: 1.91, P < 0.001), TBSA (aOR: 1.069, P < 0.001) and inhalation injuries (aOR: 4.348, P = 0.002) were correlated with increasing the risk of mortality and carrying IL-10 promoter genotype was associated with the significant decrease in the risk of mortality (aOR: 0.404, P = 0.014). In the current study, age (aOR: 1.1, P < 0.001), TBSA (aOR: 1.1, P < 0.001) and inhalation injuries (aOR: 11.6, P < 0.001) were significantly correlated with increasing the risk of mortality which was inconsistent with the results of

Ryan et al. Also in the current study, the burning grade was associated with increasing the risk of mortality (aOR: 1.7, P = 0.006). Although the survival rate of patients with burn injuries improved in Iran following the development of hospital equipment, there is a long way to achieve the status of developed countries (20); it may result from weakness in different sections such as preventative actions, lack of human resources and medical facilities, numerous problems in controlling the infections, TBSA and burning grade, etc. which needs more attention of the authorities. It should be noticed that most of the burn injuries happening in the age of productivity, is followed by the numerous physio-mental complications, and impose medical costs and socio-economic disruption to families. Hence, it is inevitable to perform further investigations on different and new fields to better cope with burn crisis, implementing the training programs for the general public, even the students, promote healing process, reduce hospital stay, reduce hospital complications such as infections, etc., reduce psycho-mental complications, reduce treatment and rehabilitation costs, reduce mortality and quick return to the normal lifestyle.

4. CONCLUSION

It is important to consider inhalation injury, burning degree, TBSA, and age of the patient in rapid evaluations. To reduce burning events, it is necessary to teach educational and preventing programs for the general public. It is also recommended to design and implement retraining programs regarding handling the patients with burning injuries for the medical staff.

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