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**Epidemiology and Evaluation of 1073 Burn Patients in the Southeast of Iran.**

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**Abstract:**

Background: Burn injury is one of the major causes of morbidity and mortality worldwide. In addition to the financial burden it inflicts on the health care system, it can lead to psychological, social and physical distress both to the patient and family members. The aim of this study was to determine the epidemiological parameters in hospitalized burn patient.

Methods: In a cross-sectional study we evaluated data of 1073 hospitalized burn patients in Zahedan Khatam Al Anbia hospital from 2005-2008. All data were extracted from medical record and analyze by SPSS software. A P-value less than 0.05 was considered significant.

Results: Among 1073 patient with acute burn, 55.4% were male and 44.6% were female. The mean age was 20.94 year old and mean size of burn area was 49.11±29.65 total body surface area (TBSA). Total body surface area burned was significantly higher in those with self-burn (p=0.0001). In children younger than 15 year-old scalds (hot liquid) was the most frequent cause of burn (44%). There was a higher incidence of self-burning in women (p=0.0001) and the mean length of hospital stay was 6.32±5.27 days. The mortality rate in self-burn patient was 87.34 % and in total cases was 41.47 %.

Conclusion: In the present study, most of the burns were noted in 16 to 20 years age group, and more in male than in female subjects. Burn was more frequent in children and adulthood and they are considered high-risk groups with higher mortality and morbidity. This shows a need for comprehensive burn prevention programs.

**Keywords: burn, epidemiology, hospitalized patients, trauma, surgery**

**Background:**

Burn injury is one of the major causes of morbidity and mortality worldwide. In addition to the financial burden it inflicts on the health care system, it can cause psychological, social and physical problems for patient and family. Although morbidity and mortality rate due to burns has decreased in developed countries, it is still a major health challenge in developing countries.<sup>(1)</sup> Annually, 1.25 million Americans are burned and around 50 thousands are hospitalized, which costs 7 billion dollars for the health system. Burn is the 5th cause of death due to accident in United States.<sup>(1, 2)</sup> Epidemiological reports in some counties show that thermal injury is more common in young age group and it's mostly due to fire, with a morbidity of 33.5%-54.8%.<sup>(3, 4, 5, and 6)</sup> There is no available data in Iran, but some studies have demonstrated its high incidence in younger's, female, and illiterate people. The mortality is 27.9%-34.4%.<sup>(7, 8)</sup> It is one of the major challenges of health system in Iran. We need more data from different parts of country to give us an estimate of epidemiology of thermal injury in country. Unfortunately, there are very few studies on prevalence and outcome of burn in Iran <sup>(2, 7)</sup>, with no data on epidemiology of burn in the Sistan va Baluchistan province. There are few causes that can lead to increase thermal injuries in our province. No accessible gas pipelines with subsequent need to use stove and other fuel consuming heaters, Neighbor with counties such as Afghanistan and Pakistan and fuel trafficking to these countries.

This study was designed to analyze the demographics and etiology of thermal injury and evaluate the outcome of different surgical interventions. We also aim to compare our results with other published data to apply in our burn preventing education programs and to increase the quality of health provided to these patients.

**Material and Methods:**

Sistan and Baluchistan province is located in the southeast of Iran and has a population of 2.2 million according to a 2006 statistics. It's the largest province with 11.4% (187.5 Km<sup>2</sup>) of country land. The Burn unit of Khatam Al Anbia hospital is the major regional referral center for all burns injuries in this province. All patients in need of in-hospital treatment are admitted here. The distance between this center and other closest burn unit, which is located in Kerman city, is 550 kilometers. This is why an epidemiologic study of this center will give valuable and clear prospective in further programming for prevention and treatment of burn patients.

In this retrospective cross-sectional study we reviewed medical records of 1073 burn patients admitted to Burn unit of Khatam Al Anbia hospital between March 2005 and November 2008. The data were collected through special forms contained age, sex, percentage of burn, etiology of burn (suicidal or accidental), duration of hospitalization, season, type of surgical intervention (non-surgical, debridement, debridement and primary graft), outcome (death or discharge).

Statistical analysis was done using SPSS ver.15. We used Chi Square and T test and single tail variance to analyze demographic data. The risk associated with mortality was analyzed using logistic regression. A P-value of <0.05 was considered significant.

#### Results:

##### Age and sex

594 patients (55.4%) were male, and 479 patients (44.6%) were female (Table 1). 33.3% of patients (375 patients) were below 15 years old. Burn was more common in male. The most frequent age group was 16-20; with total of 229 burn patients.

##### Burn extent

The TBSA (total body surface area) burned range was from 3 to 100% with the mean of  $49.11 \pm 29.65$ . In patients with self-induced burn; the percentage was 10%-100%, with a mean of  $86.5 \pm 24.96$ . The other patients had a mean of  $41.06\% \pm 24.96\%$ . The percentage of burn was significantly higher in those with self-burn (attempted suicide) ( $P=0.0001$ ). 18.9% of the patients had above 90% of their body surface burned (table 2)

##### Burn etiology

75.8% of patients were burned due to flame, with oil being the most common cause (41.5%). In those under 15 years, the most common cause of burn was scalds (44%). 4 cases of 46 patients with electrical burning were due to lightning. Winter was the most common season with oil burn (Table 3).

##### Deliberate self burning (DSB)

Suicide is an act through which a person attempts to harm him/her self. Among

190 patients with self-burning, 51 (26.8%) were male and 139 (73.2%) were female, self-burning was statistically significant in female ( $p=0.0001$ ). The most common etiology of burning was oil ( $p=0.0001$ ) and the predominant age group in both sexes was 16-20 years. 62.56% of patient had above 90% burn. The mortality in those with self-burning was 87.34% (Table 4,5).

##### Inhalation injury

109 patients had burns due to inhalation. The diagnostic criteria for inhalation burn were;

occurrence in closed environments, hoarseness and expiratory wheeze, Soot in the saliva and excessive salivation and facial burn and signed nasal vibrissae.

The most frequent causes of inhalation injury in descending order were oil (53.2%), gas (25.7%), gasoline (20.2%) and scalds (0.9%). Out of 109 patients with inhalational injury, most were 16-20 years old (35 patient). 65 patients were female, 72.61% of patient with inhalational injury died. Self-burning caused increased inhalational injury ( $p=0.0001$ )

##### Type of surgical intervention

935 patients (87.13%) underwent conservative treatment, 30 patients (2.7%) surgical excision and were referred for delayed skin grafting to hospitals with plastic surgery centers. 108 patients (10%) underwent surgical excision and primary grafting (Table 6).

##### Duration of hospitalization

The duration of hospitalization was 1 to 41 days, with a mean of  $6.32 \pm 5.27$  and a median of 5 days. The mean hospitalization time in the patients who died was  $5.46 \pm 4.8$  days. In others, the mean was  $8.44 \pm 5.79$ . The mean time of hospital

admission in those with excision and grafting was  $6.06 \pm 2.85$  days. After the excision alone, it was  $5.16 \pm 3.32$  days. There was no significant difference between excision alone and combined excision with primary grafting ( $p > 0.05$ ) (Table 7).

#### **Mortality**

41.47% of the patients died, with 28.89% mortality in the accidental group (Table 8). Mean age and percentage of burn in those who died was  $23.37 \pm 13.10$  and  $80.09 \pm 23.58$ , respectively (Table 9). The percentage of burn causing 50% of death (LD50) was 65%.

#### **Seasonal variation**

Most hospital admissions were in winter (29%) follow by spring (27.1%), summer (25.6%) and fall (18.3%). There was no statistically significant difference between seasons. ( $P > 0.05$ )

#### **Discussion:**

Due to our common border with Afghanistan and Pakistan and significant fuel price difference., there is illegal fuel trafficking with unsafe methods.

In the present study, most of the burns were registered in 16 to 20 years age group, and more in male subjects. The degree of burn was more in those with self-burning. Oil was the most frequent cause in adult, and scalds (boiling water) were the most frequent cause in pediatric age group. Self-burning was significantly higher in females. Surgical treatment by excision and primary skin graft reduced the time and cost of hospitalization compared to delayed type.

Mortality was 28.89% in accidental burn, 87.34% in self-burning and 72.61% in inhalation burn patients. LD50 was 65%.

#### **Age and sex**

Burns were more common in male than in female subjects, as in reports from Catalonia, Dublin and other regions.<sup>(8, 9, 10, 11, 12)</sup> Other studies reported higher number of burns in females.<sup>(4, 11, 13-15)</sup> It seems that the high number of burns in males in our study is related to the transportation and trafficking of fuel to neighboring countries. Similar to other reports<sup>(10, 13, 16-38)</sup>, this study demonstrated high frequency of burn in pediatric age group. This mandates an educational program regarding burn which should start at school levels, sustaining the conclusions of Keswani's study which showed that educating children is effective in the prevention of burns.<sup>(39)</sup>

#### **Extent of burn**

There was a paradoxical relationship between the extent of burn and survival.<sup>(34, 40, and 41)</sup> The cut off point for the percentage of burn that lead to death was between 20 to 50% in different studies.<sup>(42, 43, 44)</sup> All quoted studies had the same opinion: a burn on more than 70% of the body surface has a high rate of mortality.<sup>(42, 43)</sup> In the present study, there was a significant relationship between the extent of burn and mortality ( $P = 0.0001$ ). The extent of burn was higher in females than in males, a result that has previously been obtained by other studies.<sup>(3, 45, 46)</sup> In our study, mortality was mostly due to self-burning.

#### **Etiology of burn**

The most common cause of burn was flame followed by scalds (mostly boiling water), concurring to some previous reports. (3, 8, 47-50) Oil was the most common cause of burn. This might be due to the consumption of oil as a common fuel in our houses. In a few other

reports, scalds followed by flame were common cause of burn. <sup>(6, 8, 51)</sup> Burning with scalds was the most common etiology in pediatrics age group, as previous studies had already mentioned. <sup>(16, 18, 36, 37, 47, 49)</sup> In most of the villages in our provinces there are no physical places that can be called kitchens and the cooking materials are kept on the ground. This might be the cause for the high number of scald burns in the pediatric age group. **Self-burn**

There is an increase in the number of self-burns in both males and females.<sup>(52)</sup> In the present study, like in other studies <sup>(7, 53)</sup>, self-burn was more common in females than in males ( $P=0.0001$ ). The most common age was 16 to 20 years, which is less than European and American countries.<sup>(53)</sup> The high incidence of self-burn seems to be due to forced marriage, age differences between husband and wife, family problems, the husband's addictions and the high numbers of wives. The most common instrument of self-burn, like other countries <sup>(7, 53)</sup>, was oil which is easily available in this region. In different part of world, 18 to 84% mortality due to self-burn was reported <sup>(3, 28, 52, 54-64)</sup>, whereas, in our study, it was 87.34.

#### **Inhalation injury**

The mechanisms by which inhalation can cause injury are carbon monoxide poisoning, airways injury and burning and inhalation of soot particles. In this study, 10.2% of the patients developed inhalation injuries. In two previous studies, the incidences of inhalation injuries were 5.1% and 19.6% respectively. <sup>(65, 66)</sup> In our study, the mortality rate due to inhalation injury was 72.61%, while the mor-

tality rate in North Carolina was only 31%. <sup>(66)</sup> Self-burn was one of the major causes of inhalation injury; this shows that those with self-burn should be investigated for inhalation burn.

#### **Type of treatment**

In our center, the studied patients who needed debridement were either only excised, or excised and then got either a delayed or a primary graft. For a delayed graft, the patients were transferred to better-equipped facilities. Delayed graft was performed in first 20 month of study.

#### **Duration of hospitalization**

The duration of hospital admission in our study was 5 days that is less than other centers in Iran <sup>(4, 51)</sup> and also other countries. <sup>(9, 10, 65, 67)</sup> There was no significant difference between excision alone and excision and primary graft in relation to the duration hospitalization.

In a study conducted in Harare there was a reduction in the duration of hospital admission from 42 to 17 days in those patients who underwent primary grafting. <sup>(14)</sup> This shows that primary closing of the wound will lead to a reduction in the time and costs of hospitalization. <sup>(68)</sup>

We referred our patients to other centers to undergo delayed grafting, which would naturally increase the time and cost of hospitalization.

#### **Morbidity and mortality**

The overall mortality and morbidity in present study was 41.47% that is more than previous reports <sup>(8, 13, 14, 31, 38, 47-49, 69, 70)</sup>, which might be due to the high number self-burns, hospital admissions and high percentage of burned body surface area.

#### **Seasonal changes**

Winter was the most common season with burn occurrence. Like previous studies <sup>(31, 71-73)</sup>, there was no significant relationship between the season and the burn occurrence.

In our province, oil is a common source of smuggling. Educating people regarding how to protect themselves from the causes and outcomes of burns can reduce the number of burns in our society.

Reducing the smuggling may also reduce the number of burns occurring in car accidents.

Since burning causes key accidental injuries and it is a major cause of pain, psychosomatic problems, disability and death, there must be educational programs in our society (schools, family and work place) to prevent the acute injury and increase the quality of patient care, by equipping the emergency departments and educating the doctors and nurses.

Table 1: age, sex and extent of burn

Age Groups	Percentage Of burn Mean -SD	Sex				Total	
		Female		Male		%	Number
		%	Number	%	Number		
0-5	29.82 -17.40	33.3	60	66.7	120	16.8	180
6-10	36.96 - 23.97	46.4	32	53.6	37	6.4	69
11-15	52.59 - 29.85	53.7	58	46.3	50	10.1	108
16-20	58.19- 30.94	50.7	116	49.3	113	21.3	229
21-25	51.80- 30.06	42.3	85	57.7	112	18.1	194
26-30	57.20 - 29.39	42.3	44	57.7	60	9.7	104
31-35	49.44 - 31.53	50.0	27	50.0	27	5.0	54
36-40	56.97 - 30.24	37.8	114	62.2	23	3.4	37
41-45	53.21 - 31.06	42.9	12	57.1	16	2.6	28
46-50	50.62 - 29.78	53.1	17	46.9	15	3.0	32
51-55	47.92 - 28.08	41.7	5	58.3	7	1.1	12
56-60	47.00 - 33.09	40.0	4	60.0	6	0.9	10
61-65	45.83 - 31.84	16.7	1	83.3	5	0.6	6
66-70	33.00 - 32.91	66.7	4	33.3	2	0.6	6
>70	32.75 - 22.80	75.0	3	25.0	1	0.4	4

Table 2: Extent of burn and sex

Sex Percentage Of burn	Female		Male		Total	
	%	Number	%	Number	%	Number
< 9	18.2	6	81.8	27	3.1	33
10-19	35.2	38	64.8	70	10.1	108
20-29	38.2	65	61.8	105	15.8	170
30-39	37.3	59	62.7	99	14.7	158
40-49	48.8	60	51.2	63	11.5	123
50-59	43.6	48	56.4	62	10.3	110
60-69	48.3	29	51.7	31	5.6	60
70-79	51.8	29	48.2	27	5.2	56
80-89	50.0	26	50.0	26	4.8	52
>90	58.6	119	41.4	84	18.9	203

Table 3: self burning

Self burning Age group	No				Yes			
	Female		Male		Female		Male	
	%	N	%	N	%	N	%	N
< 10	98.45	91	100	157	1.55	1	0	0
11-15	60.3	35	98.0	49	39.7	23	2.0	1
16-20	52.6	61	82.3	93	47.4	55	17.7	20
21-25	68.3	56	89.3	100	31.7	26	10.7	12
26-30	61.4	27	87.3	47	38.6	17	21.7	13
31-35	70.4	19	96.3	26	29.6	8	3.7	1
36-40	78.6	11	87.0	20	21.4	3	13.0	2
41-45	66.7	8	93.8	15	33.3	4	6.3	1
46-50	94.1	16	100	15	5.9	1	0	0
51-55	100	5	100	7	0	0	0	0
56-60	100	4	100	6	0	0	0	0
61-65	0	0	100	5	100	1	0	0
66-70	100	4	100	2	0	0	0	0
>70	100	3	100	1	0	0	0	0
Total	71.0	340	91.4	543	29.0	139	8.6	51

Table 4: cause of burn

Age Cause of Burn	>15 years		<15 years		Mean age N	Total		
		%	N	%		%	N	
Flame	Oil	49.7	356	24.9	89	23.45	41.5	445
	Gas	22.2	159	15.7	56	25.12	20.0	215
	Petrol	17.5	125	6.7	24	25.71	13.9	149
	Gasoline	0.3	2	0.6	2	20.25	0.4	4
Scalds	Boiling water	3.4	24	44.0	157	7.06	16.9	181
	Others	1	7	4.5	16	11.09	2.2	23
Electricity		5.2	37	2.5	9	21.80	4.3	46
Chemical		0.4	3	0.3	1	20.00	0.4	4
Others		0.4	3	0.9	3	13.61	0.6	6
Total		100	716	100	357		100	1073

Table 5: extent of burn and sex

Self burning Percentage of burn	Sex							
	Female		Male		Female		Male	
	%	N	%	N	%	N	%	N
<50	97.02	219	99.2	361	2.98	9	0.8	3
50-59	81.3	39	98.4	61	18.8	9	1.6	1
60-69	79.3	23	96.8	30	20.7	6	3.2	1
70-79	75.9	22	92.6	25	24.1	7	7.4	2
80-89	34.6	9	69.2	18	65.4	17	30.8	8
>90	23.5	28	57.1	48	76.5	91	42.9	36
Total	71.0	340	91.4	543	29.0	139	8.6	51

Table 6: Type of treatment and extent of burn

Type of Treatment Percentage Of burn	Excision and grafting		Excision		Conservative	
	%	N	%	N	%	N
<9	3.5	1	10.7	3	85.8	24
10-19	14.6	17	0.8	1	84.6	98
20-29	14.6	24	3.6	6	81.8	124
30-39	15.9	24	2	3	82.1	124
40-49	11.2	12	5.6	6	83.2	89
50-59	24.75	25	3	3	72.25	73
60-69	2	1	2	1	96	48
70-79	6	3	6	3	88	44
80-89	2	1	3.9	2	94.1	48
>90	0	0	0.8	2	99.2	253
Total	10.06	108	2.8	30	87.14	935

Table 7: type of treatment and duration of hospital admission

Type of treatment Duration of admission	Conservative		Excision and grafting			Excision	Total	
	%	N	%	N	%	N	%	N
>5	98.5	485	0.3	1	1.2	6	100	492
5-10	86.3	305	11.3	40	2.5	9	100	354
10-15	65.7	95	28.3	41	6.1	9	100	145
15-20	61.1	30	36.1	19	2.8	4	100	53
>20	70.0	20	25.0	7	5.0	2	100	29

Table 8: mortality and outcome according to sex

Sex outcome	Female		Male		Total	
	%	N	%	N	%	N
Discharged	37.7	237	62.30	391	100	628
Died	54.4	242	45.6	203	100	445

Table 9: frequency of causes of mortality

	Variable	Number of death	Number of Patients	P value
Percentage of burn	≤ 40	34	505	0.0001
	>40	262	568	
Cause of burn	Non-flame	17	257	0.0001
	Flame	286	816	
Type of Burn	Accidental	165	571	0.0001
	Self burning	138	158	
Sex	Male	140	594	0.0001
	Female	163	479	
Age	≤ 15	66	357	0.0001
	>15	237	716	
Inhalational injury	Yes	61	109	0.0001
	No	242	964	

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