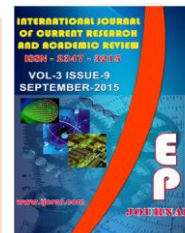




International Journal of Current Research and Academic Review

ISSN: 2347-3215 Volume 3 Number 9 (September-2015) pp. 221-226

www.ijcrar.com



Epidemiology of 100 patients with chemical burns in Isfahan University of Medical Sciences

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KEYWORDS

Chemical burn,
Complication,
Mortality

A B S T R A C T

Burning was one of the common and preventable problems that have high complication and mortality rate. Burning with chemical substance was one of the common causes at burning ward. The aim of this study evaluated patients with chemical substance burning and comparing with non chemical burn. In a retrospective study, all patients with chemical burn were under treatment at burning ward duration 2004 to 2014 in Emam-Mossa Kazem Burn center of Isfahan and Emam Burn center of Uremia, selected and necessary information collected from patients records and received result comparing with group of patients that were selected with random sampling from patients with non chemical burning. In this research, a total of 100 patients suffering from chemical burnings were studied. The 100 participants (88 male and 12 female) were experiencing chemical burning. 65 patients were suffering from grade II burning, 24 had grade III burnings and 11 were experiencing grade II and III burnings. Moreover, 2 patients, who were suffering from burning, died. The mean age of patients with chemical burning was 42.52 ± 15.98 years. The mean duration of hospitalization in patients with chemical burning was 12.31 ± 9.80 days. The mean percentage of burning among the patients with chemical burning was 12.23 ± 8.04 . The mean frequency of debridement for patients with chemical burning was 1.81 ± 1.09 . The mean percentage of skin graft in patients with chemical burning was 11.37 ± 9.16 . Chemical burning is one of the important causes of hospitalization in burning wards. Most of these patients experience grade II burnings and the mortality caused by grade II burning is lower than other types of burning. Grade II burning was the most common form of burning in patients with chemical burning. The rate of mortality in patients with chemical burning was also 1%.

Introduction

Chemical damage is the result of the heat released in a reaction between a strong acid or base and living tissues.

This destruction continues as long as the aforementioned chemicals are in contact with the tissue. Toxic chemical substances

also cause damage by drying out the tissues or absorbing through burned areas and causing systematic toxicity. To limit the resulting damages and reduce toxicity, the toxic factors shall be removed quickly. This is originally the task of first aid personnel and other staff at health care centers. The prevalence of chemical burning is increasing quickly and many incidents have led to legal problems and lawsuits. Chemical burnings that change the skin color are similar to skin burnings, but in most cases the entire skin and even subcutaneous tissues become unrecoverable. Except for some cases, the only effective method for limiting tissue damage is by quickly washing the region with large volumes of water or saline (1).

The first step in the treatment of chemical burning is to quickly remove the cause of burning. All of the clothes (even shoes and socks) must be quickly taken off. Except for cases in which the cause of burning is a small amount of chemical liquids or dry powders, all of the involved part of the body must be washed quickly with large amounts of water or saline. The washing phase dilutes and removes the chemical agent and prevents further skin damages and absorption of the chemical. The duration of washing depends on the burning type. For typical acids 30 to 60 minutes of washing is required. In burnings caused by alkaline substances hours of washing are required. In the head and face burnings, it is important to carefully clean the eyes, nose, ears, and oral cavity. In such cases, it is necessary to first wash the eyes (1, 2).

Although dilution of many chemicals leads to generation of heat, as the washing continues the temperature of the damaged tissue decreases compared to the temperature of the time of incident. Dry alkaline powders shall be cleaned by a brush before washing. Application of neutralizing

solutions is almost never allowed because this leads to the generation of excessive heat and an increase in tissue damage (1).

After washing, other forms of care provided to the wound are similar to other types of burning. Surface debridement is also necessary. The appearance of chemical burnings at first sounds increasingly benign and insignificant and only after several days the signs of vast destructions are revealed. Hence, after observing the gradual advancement of the wound it is necessary to inform the patient of the exact condition of damages. Topical anti-bacterial agents must be used for treatment purposes and if the burning is vast, fluid therapy becomes necessary. Some chemical substances cause systematic toxicity and must be treated immediately following diagnosis. If the chemicals causing the burning are in the form of aerosol, severe inhalation damages will be expected. Full-thickness wounds resulted from chemical burnings must be removed and shall be grafted in due time. Most sub-surface constructs such as tendons and bones are also involved in the burning. Therefore, it is necessary to conduct several surgeries by teams consisting of several specialists (1). The objective of this study was to study patients with chemical burnings.

Materials and Methods

In a descriptive cross sectional study that was carried out in Isfahan on patients with chemical burnings, the characteristic conditions of patients with chemical burnings were examined.

In this retrospective research, 100 patients with chemical burning were studied. The study population included all of the patients hospitalized in the burning ward Emam-Mossa Kazem Burn center of Isfahan and

Emam Burn center of Uremia from 2004 to 2014.

Results and Discussion

In this research, a total of 100 patients suffering from chemical burnings were studied. The 100 participants (88 male and 12 female) were experiencing chemical burning.

65 patients were suffering from grade II burning, 24 had grade III burnings and 11 were experiencing grade II and III burnings. Moreover, 1 patient, who was suffering from burning, died.

Demographic findings of patients with chemical Burning was shown in Table 1. Evaluation of finding with sides of burning was shown in Table II. Evaluation Sex, Degree of Burning and Agent Burn with sides of burning was shown in Table III.

The mean age of patients with chemical burning was 42.52 ± 15.98 years. The mean duration of hospitalization in patients with chemical burning was 12.31 ± 9.80 days. The mean percentage of burning among the patients with chemical burning was 12.23 ± 8.04 . The mean frequency of debridement for patients with chemical burning was 1.81 ± 1.09 . The mean percentage of skin graft in patients with chemical burning was 11.37 ± 9.16 .

In a study by Asaria et al. in Toronto (Canada), patients burned with acid were studied. The mean age of patients was 33.1 years and the percentage of the burned area in these patients was 14.1%. The most common place of burning in these patients was the face. All of the patients were released following relative recovery and the average duration of hospitalization of patients was 49.5 days (4).

Similar to the aforementioned study, in our study, the average age of patients with chemical burnings was also 42.32 ± 16.79 years. Chemical burning mostly involves people in the 15-60 years age group and this finding was also similar to the findings of the aforementioned research.

In an epidemiologic study carried out by Xie et al. on 377 patients with chemical burning, it was found that 89.2% patients were in the 15-60 years age range. 94.4% of burnings happened at home and in 60.8% of the cases the causes of burning were strong acids (5). In the present study, acids were among the most common causes of chemical burning and most patients were in the 15-60 years age range.

In 65.7%, 40.6%, and 21% of the patients the burnings were deep (II), full-thickness (III) and superficial (I), respectively (5). In our study, 65% patients were diagnosed with grade II burning and 24% patients were suffering from grade III burning. Similar to the results of the aforementioned study, the prevalence of grade II burning was higher in patients with chemical burning.

Lower limbs (56.6%) and upper limbs (51.4%) were the common places of burning in the patients under study. The rate of mortality was also 0.7% (5). In our study, the extent of burning in the upper limbs was higher than lower limbs and the rate of mortality among patients with chemical burning was 1%. Similar to the aforementioned study, the rate of mortality was lower in patients with chemical burning. Han et al. carried out 18 years of research in Korea on 19157 patients with burning. They stated that most patients were experiencing minor burnings which were treated with support treatments. Moreover, the male gender was also dominant in all age groups (6).

Table.1 Demographic findings of patients with chemical Burning

	Degree of Burning			Sex		Mortality	
	II	III	II&III	Male	Female	Discharged	Died
Age	41.73 ± 16.32	44.54 ± 16.66	42.77 ± 13.15	42.80 ± 16.40	38.50 ± 11.51	42.32 ± 15.94	62.50
Duration of Hospitalization	8.75 ± 4.45	14.83 ± 9.32	27.82 ± 16.20	11.97 ± 10.23	14.36 ± 5.35	12.36 ± 9.84	7.00
Percentage of Burning	10.53 ± 5.29	11.54 ± 6.86	23.77 ± 13.65	12.25 ± 8.39	11.41 ± 4.57	12.01 ± 7.76	34.50
Frequency of Debridement	1.55 ± .50	1.63 ± .56	2.30 ± 1.84	1.83 ± 1.16	1.80 ± .58	1.80 ± 1.11	2.30
Percentage of Skin Graft	5.02 ± 2.89	9.73 ± 5.69	16.71 ± 13.60	11.65 ± 9.59	10.35 ± 6.78	11.05 ± 9.07	23.35

Table.2 Evaluation of finding with sides of burning

	Age	Duration of Hospitalization	Percentage of Burning	Frequency of Debridement	Percentage of Skin Graft
Face	33.36 ± 9.40	16.48 ± 17.18	18.21 ± 11.45	3.13 ± 2.23	23.68 ± 15.77
Neck	34.25 ± 9.95	31.00 ± 22.61	27.50 ± 15.03	2.80 ± .71	33.85 ± 14.85
Head	32.50 ± 2.00	23.00 ± 24.25	22.83 ± 2.89	3.30	23.35
Right arm	36.50 ± 8.86	23.00 ± 22.93	20.10 ± 15.63	3.63 ± 3.21	21.85 ± 23.33
Right forearm	46.64 ± 18.85	14.29 ± 15.45	15.79 ± 11.66	2.30 ± 2.07	13.92 ± 12.45
Right hand	44.83 ± 17.98	12.00 ± 11.07	12.89 ± 9.66	2.23 ± 1.53	13.68 ± 13.12
Left arm	31.75 ± 4.99	24.50 ± 26.60	21.00 ± 17.54	3.30 ± 3.46	19.02 ± 17.21
Left forearm	42.39 ± 13.11	22.56 ± 17.42	20.28 ± 12.89	2.68 ± 2.00	15.73 ± 11.41
left hand	40.04 ± 14.30	13.38 ± 12.30	14.80 ± 10.66	2.38 ± 1.68	16.77 ± 13.37
Right thigh	28.25 ± 2.22	27.25 ± 19.48	26.00 ± 16.58	2.63 ± .58	23.35 ± 18.52
Right leg	40.14 ± 14.56	14.73 ± 9.08	17.95 ± 8.89	1.87 ± .79	13.92 ± 7.21
Right foot	43.15 ± 12.04	13.00 ± 6.89	13.50 ± 8.56	1.74 ± .73	14.02 ± 7.42
Left thigh	44.10 ± 11.57	23.20 ± 16.57	22.90 ± 15.52	1.63 ± .58	20.35 ± 20.78
Left leg	42.58 ± 12.32	14.67 ± 8.45	16.75 ± 8.75	1.52 ± .44	12.91 ± 6.41
Left foot	41.75 ± 12.62	12.25 ± 6.03	13.05 ± 8.39	1.41 ± .33	11.79 ± 6.04
Trunk	39.36 ± 12.60	25.43 ± 22.90	29.64 ± 8.65	3.55 ± 2.63	25.85 ± 8.66
Genitalia	29.50 ± 1.41	20.00 ± 5.66	8.00 ± 3.54	2.30	9.35

Table.III Evaluation Sex, Degree of Burning and Agent Burn with sides of burning

	Sex		Degree of Burning			Agent Burn					
	Male	Female	II	III	II & III	Bitumen	Cement	Unknown	Acid	Alkaline	Thinner
Face	19	1	15	2	4	12	0	2	7	0	0
Neck	3	1	2	1	1	0	0	1	3	0	0
Head	3	0	2	1	0	1	0	1	1	0	0
Right arm	5	0	3	1	1	2	0	0	2	1	0
Right forearm	14	0	7	5	2	9	0	2	2	0	1
Right hand	42	7	36	10	3	39	0	3	6	1	0
Left arm	4	0	1	2	1	1	0	0	3	0	0
Left forearm	5	3	2	4	3	6	0	0	3	0	0
left hand	32	4	26	6	5	26	0	3	7	0	1
Right thigh	4	0	1	1	2	2	0	0	2	0	0
Right leg	8	3	5	4	2	8	0	0	1	2	0
Right foot	15	5	11	5	4	13	0	3	3	1	0
Left thigh	5	0	2	0	3	2	0	0	3	0	0
Left leg	11	1	4	4	4	4	1	1	4	2	0
Left foot	16	4	11	6	3	9	1	4	4	1	1
Trunk	7	0	3	2	2	2	0	1	3	1	0
Genitalia	2	0	1	1	0	0	0	0	2	0	0

In our study, the prevalence of chemical burnings in males was significantly higher than females similar to the findings of the above study. In the aforementioned study, the rate of post-burning mortality was about 2.8-13.9% (6).

In our study, the rate of mortality in patients with chemical burning was 1%, which was lower than the result of the above study. This difference reflects the higher quality of services and health care provided in our burning ward. In a study that was conducted by Dr. Maqсуди et al. in the burning ward of Sina Hospital, a total of 2963 patients with burning were studied during 3 years. In their study, 79.8% of patients were diagnosed with burning lower than 40% (7). In the present study most patients were suffering from chemical burning and the level of non-chemical burnings was below 40%.

In the aforementioned research, the average duration of hospitalization was 13 days (7).

In our study, the duration of hospitalization of patients with chemical burnings was 12.31±9.80 days which were lower than the hospitalization duration in the above study. Sheridan et al. conducted a study and introduced sepsis as a common complication in children with burning. They also stated that sepsis increases mortality and morbidity in these children (8).

In the present study, wound infection and its secondary complications were among the most common complications of burning in most patients with burning.

Conclusion

Chemical burning is one of the important causes of hospitalization in burning wards. Most of these patients experience grade II burnings and the mortality caused by grade II burning is lower than other types of burning. Grade II burning was the most

common form of burning in patients with chemical burning. The rate of mortality in patients with chemical burning was also 1%.

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