

A Study of Correlation between Pattern of Burn Injuries and Alleged Manner of Death

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Abstract

Original Research Article

As per Ministry of Health and Family Welfare, Government of India database, approximately 70 lakh people sustain moderate to severe burns in India every year. In most of the cases, the alleged manner of death is accidental. In many cases, manner of death is kept as a mystery. Aim of the present study is to establish correlation between pattern of burn injuries and alleged manner of death. Total body surface area of involvement of burn injury was measured by using Wallace rule of nine. It was further divided by using simple numerical method for better comparison. The mean values of percent areas involved were compared to establish correlation between pattern of burn injuries and alleged manner of death. Overall extent of involvement of total body surface area in burns was more in case of suicides than in case of accidental burns. Homicidal burn cases were not significant in number to compare with other manners of death. Frequency of involvement of both palms was more in suicidal burns than accidental burns. Frequency of involvement of soles was almost equal in accidental burns and suicidal and accidental burns. These findings might be due to the fact that suicide is a planned activity, intentionally performed to kill oneself. It was performed in closed places when the person is alone and hence chances of rescue are minimised. Accelerant used by suicide is also an additive factor.

Keywords: Burns; Pattern of burn injury; Manner of death; Numerical method.

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INTRODUCTION

World Health Organisation (WHO) defines burns as an injury to skin or other organic tissue primarily caused by heat or due to radiation, radioactivity, electricity, friction or contact with chemicals [1]. As per Ministry of Health and Family Welfare, Government of India database, approximately 70 lakh people sustain moderate to severe burns in India every year [2]. In most of the cases, the alleged manner of death is accidental [3-5]. Often, the manner of death is kept as a mystery [6]. Accidental burns are increasing with increasing overcrowding due to urbanisation. Literature shows that most of the accidental burns are among females cooking in a kitchen as they are exposed to fire regularly [3-5]. Alleged manner of death may not always be true. Sometimes suicidal or homicidal burns are also presented as accidental one to avoid legal consequences. Judiciary may ask treating doctors or the autopsy surgeons to comment on the manner of death. In order to comment on the manner of death, concrete database is yet to be available. The purpose of this study is to present numerical and universally acceptable data to comment on probable manner of death in case of death due to burns. To the best of our knowledge no

such study is found in the literature. This is completely new and innovative idea of the authors.

MATERIALS AND METHODS

Present prospective observational study was carried out in the department of forensic medicine of a tertiary care centre, during the period of January 2014 to July 2015. Ethical permission has been obtained from Institutional Ethics Committee for conducting the study. Total 107 cases of fatal thermal burns out of 1771 medico-legal post-mortems conducted during the study period were considered. Percentages of burn injuries were calculated by using Wallace rule of nine and tabulated in a specially prepared proforma. This was also documented diagrammatically for easy understanding and analysis. The involved surface area was divided in various parts for easy comparison. (Table no. 1).

Anterior surface of upper half of the body was calculated by adding anterior surface of head, neck and face (~ 5%), anterior trunk (18 %) and anterior surface of both upper limbs (9 %). It was 32 % burn surface area of total body surface area. Similarly posterior

surface of upper half of the body surface area was calculated. Lower half of the body was both upper limbs (36 %) plus perineum (1 %), totalling to 37 %.

Pattern of burn injuries were analysed by comparing the mean values of percentages of various areas involved. Mean values were converted to the uniform numerical values by dividing it by total surface area of that particular region. For instance, the mean involvement of head, neck and face region is 5 % according to Wallace rule of nine. The total burn surface area of this region is 9 %. So, for comparison it was converted into percent involvement in general term by dividing mean value by total burn surface area of that region i.e. $5/9 \times 100 = 55.55$ % of the whole area of head, neck and face.

Involvement of palms and soles was also considered separately in addition to the above.

OBSERVATIONS AND RESULTS

Out of the total 107 cases considered for the study, the alleged manner of death in 69 (64.49 %) cases was accidental, 32 (29.91 %) cases was suicidal, 4 (3.74 %) cases was homicidal and 2 (1.86 %) cases was unknown.

Considering the involvement of body surface area among these 107 cases studied, in 83 (77.57 %) cases more than 50 % of body surface area was involved while in 11 (10.28 %) cases 40-50 % body surface area was burnt and in only 13 (12.15 %) the involved body surface area was less than 40%. Out of total 107 cases studied, 5 cases of 100 % burn injury were reported.

Accidental burns

The body surface areas involved in case of alleged accidental burns were studied after dividing into different areas.

Head, Neck and Face

Out of total 69 cases of alleged accidental burns, head, neck and face was involved to varying extent in 59 (85.5 %) cases and spared totally in 10 (14.5 %) cases. Less than 50 % of the whole area was observed to be involved in 39 (56.52 %) cases, whereas in 20 (28.99 %) cases the area involved was more than 50 % of the total. Out of these 20 cases, whole area i.e. 9% according to Wallace rule was involved in 8 cases. The mean involvement was 4.49 % i.e. 49 % of whole area of head, neck and face.

Anterior aspect of upper half of the body

In 66 (95.65 %) cases out of total 69 cases of accidental burns, anterior aspect of upper half of the body was involved to varying extent. More than 50 % of the area, i.e. more than 16 % according to rule of Wallace was observed to be involved in 56 (81.16 %) cases. Out of these 56 cases, whole (32 %) was

observed to be involved in 3 cases. The mean involvement was 22.1 % i.e. 69.6 % of the total area of anterior aspect of upper half of the body.

Posterior aspect of upper half of the body

Posterior aspect of upper half of the body was involved in 67 (97.1 %) cases and spared only in 2 (2.9 %) cases. There were 45 (65.22 %) cases reported with involvement more than 16 % i.e. more than 50 % of total area and 22 (31.88 %) with involvement less than 16 % i.e. less than 50 % of total area. Whole posterior aspect of upper half of the body was observed to be involved in 3 cases out of 22 cases. Mean involvement of posterior aspect of upper half of the body was 18 % i.e. 56.25 % of the whole area.

Upper half of the body

Total area of upper half of the body was the sum of head, neck and face (9%), anterior trunk (18%), posterior trunk (18%) and both upper limbs (18%), totalling 63% of total body surface area.

It was observed that upper half of the body was involved in 68 (98.55 %) cases and spared in only 1 (1.45 %) case. More than 32 % i.e. 50 % of total area of upper half of the body was involved in 51 (73.91 %) cases and less than 32 % i.e. less than 50 % involvement was seen in 17 (24.64 %) cases. Out of 51 cases, whole upper half of the body was observed to be involved in 3 cases. Mean involvement of upper half of the body was 41.04 % i.e. 65.14 % of whole area of upper half of the body.

Lower half of the body

Surface area of lower half of the body was calculated by summing up the area of both lower limbs (36%) and perineum (1%), totalling to 37 %.

Lower half of the body was involved in 68 (98.55 %) cases and spared only in 1 (1.45 %) case. More than 18 % i.e. 50 % of total area was involved in 40 (57.97 %) cases and less than 18% i.e. 50 % of total area of lower half of the body was found in 28 (40.58 %) cases. Whole lower half of the body was observed to be involved in 2 cases. Mean involvement of lower half of the body was 21.8 % i.e. 58.92 % of whole area of lower half of the body.

Palms and Soles

Explained in table no. 2

Suicidal burns

Similarly the body surface areas of involved in case of alleged suicidal burns were studied after dividing into different areas.

Head, Neck and Face

Head, neck and face was involved in 31 (96.87 %) cases sparing only 1 (3.13 %) case. Less than 5 % i.e. less than 50 % of total area of head, neck and face

was involved in 6 (18.75 %) cases and more than 5 % i. e. more than 50 % of total area of head, neck and face involved in 25 (78.12 %) cases. Whole head, neck and face was observed to be involved in 16 cases. Mean involvement was 7.56 % i.e. 80.56 % of whole area of head, neck and face.

Anterior aspect of upper half of the body

Involvement of anterior aspect of upper half of the body was observed in all 32 (100 %) cases. The involvement was more than 16 % i. e. more than 50 % of total area of anterior aspect of upper half of the body in all 32 (100 %) cases. Whole anterior aspect of upper half of body was involved in 6 cases. Mean involvement of anterior aspect of upper half of the body was 27.9 % i.e. 87.19 % of whole area of anterior aspect of upper half of the body.

Posterior aspect of upper half of the body

Posterior aspect of upper half of the body was involved in all 32 (100 %) cases. In 5 (15.63 %) cases involvement was less than 16 % i. e. less than 50 % of the total area of posterior aspect of upper half of the body and in 27 (84.37 %) cases the involvement was more than 16 % i.e. more than 50 % total area of the posterior aspect of upper half of the body. Whole posterior aspect of upper half of the body was observed to be involved in 3 cases. Mean involvement of posterior aspect of upper half of the body was 23.44 % i.e. 73.25 % of whole area of posterior aspect of upper half of the body.

Upper half of the body

Involvement of upper half of the body was in all 32 (100 %) cases. More than 32 % i.e. more than 50 % of total area of upper half of the body was involved in 29 (90.62 %) cases and less than 32 % i. e. less than 50 % of total area of upper half of the body was involved in 3 (9.38 %) cases. Whole upper half of the body was involved in 3 cases. Mean involvement of upper half of the body was 51.62 % i.e. 81.93 % of whole area of upper half of the body.

Lower half of the body

Involvement of lower half of the body was observed in all 32 (100 %) cases. More than 18 % i.e. more than 50 % of total area of lower half of the body was involved in 22 (68.75 %) cases and less than 18 % i.e. less than 50 % of total area of lower half of the body was involved in 10 (31.25 %) cases. Whole lower half of the body was observed to be involved in 2 cases. Mean involvement of lower half of the body was 25.21 % i.e. 78.78 % of whole area of lower half of the body.

Homicidal

Only 4 (3.67 %) cases of alleged homicidal burns were reported during the study period. It is difficult to establish the pattern with so small sample size. One of the victim was a child. So, Lund and Browder chart was used to calculate the percentage of burn injuries. The average involvement of total body surface area was 71.5 %. Average involvement of anterior aspect of upper half of the body was 29.25 % and posterior aspect of upper half of the body was 25 %. Mean involvement of upper half of the body was 54.25 % and that of lower half of the body was 17.25 %.

Table-1: Division of body surface area and percentage of burn injuries

Sr. No.	Area of body involved	Total percentage
1	Head, neck and face	09
2	Anterior aspect of upper half of the body	32
3	Posterior aspect of upper half of the body	32
4	Upper half of the body	63
5	Lower half of the body	37

Table-2: Involvement of palms and soles in correlation with alleged manner of death

Area of involvement	Manner of death Extent of Involvement	Accidental	Suicidal	Homicidal
		69 Cases (100 %)	32 Cases (100 %)	4 Cases (100 %)
Palms	Spared	32 (46.38 %)	14 (43.75 %)	0
	Single involved	18 (26.09 %)	4 (12.5 %)	4 (100 %)
	Both involved	19 (27.53 %)	14 (43.75 %)	0
	Either involved	37 (53.62 %)	18 (56.25 %)	4 (100 %)
Soles	Spared	60 (86.96 %)	27 (84.38 %)	4 (100 %)
	Single involved	2 (2.90 %)	1 (3.12 %)	0
	Both involved	7 (10.14 %)	3 (9.38 %)	0
	Either involved	9 (13.04 %)	4 (12.5 %)	0

DISCUSSION

The interpretations of the observations drawn from the present study are authors own views in combination with the existing literature. Even though, the observed conclusions are not statistically significant, it can be used as a general guide by treating doctors or autopsy surgeons to opine about manner of death whenever necessary.

Head, Neck and Face (HNF)

Comparing involvement of head, neck and face, it was observed that it was higher in cases of alleged suicidal burns as compared to alleged accidental burns in terms of extent of involvement and mean involvement.

This is consistent with the study done by Chawla *et al.* [7], in which head, neck and face was observed to be involved in 94% cases. Dhiraj Buchade *et al.* [8], observed that head, neck and face was most commonly affected region of the body involved in 86.91 % cases. This might be due to the fact that maximum victims of suicide in present study are using the method of pouring kerosene on self. Persons prefer to pour kerosene from above downwards and also ignite at the head or facial area. The flames on virtue of their characteristic travels in upward direction.

Anterior Aspect of Upper Half of the Body

Involvement of anterior aspect of upper half of the body is higher in alleged suicidal burns as compared to alleged accidental burns. This might be due to the fact that, suicide is intentionally performed act, preferably in closed spaces such as living room or bathroom where the chances of rescue are reduced.

Posterior Aspect of Upper Half of the Body

Posterior aspect of upper half of the body was involved more in alleged suicidal burns as compared to alleged accidental burns in terms of both extent of involvement and average involvement.

Upper Half of the Body

Involvement of upper half of the body was more in alleged suicidal burns as compared to alleged accidental burns in terms of both extent of involvement and average involvement.

In suicidal cases, fire accelerant like kerosene is used. Kerosene travels in downward direction but flames travel in upward direction. In accidental burns due to stove explosion or other causes, there was mostly no unburnt accelerant present over the body. This may be the reason behind the observations of more involvement of upper half of the body in suicidal burns than accidental burns.

Lower Half of the Body

Similarly, lower half of the body was more in alleged suicidal burns as compared to alleged accidental

burns in terms of both extent of involvement and average involvement.

Palms

The frequency of involvement of both palms is more in suicidal burns than the accidental burns. This might be due to the fact that suicide involves use of accelerant and usually both hands for pouring kerosene and igniting the fire.

Soles

Involvement of soles has no any significant correlation with manner of death. This may be because of the fact that the soles are mostly covered and placed firmly over the ground. On comparison, frequency of involvement of soles was almost equal in accidental burns and suicidal burns.

Accidental versus Suicidal Burns

Overall extent of involvement of total body surface area was more in suicidal burns as compared to accidental burns. This might be due to the fact that suicide is a planned activity, intentionally performed to kill oneself. It was facilitated by some fire accelerant like kerosene. It is mostly performed in closed places when the person is alone and hence the chances of rescue are minimized.

The similar findings were observed in study done by Anamika Nath *et al.* [9]. They observed that suicide was the alleged manner of death in 81.94 % cases and 74.46 % of the victims sustained burns more than 80 % of total body surface area.

Overview

In all types of thermal burns, upper half of the body was observed to be involved more than lower half of the body. Similar findings were also observed in study done by Jayant Deshpande *et al.* [10], who observed that anterior and posterior trunk were most commonly affected followed by lower extremity. In study done by Mustafa H Ali [11], maximum involvement of upper limbs (66.8 %) was observed followed by lower limbs (49.1 %).

In present study, soles were least affected in all manners of burn injury whether accidental, involved only in 9 (12.68 %) cases, suicidal, involved in 4 (12.5 %) cases and sparing in all four cases of alleged homicidal burns.

This is in contrast to study done by Chawla *et al.* [7], Jayant Deshpande *et al.* [10] and Mustafa H Ali [11], where genitals and perineal areas were least affected areas. This might be due to the fact that these studies did not consider soles as a separate entity while estimating the surface burn. These studies have considered soles as a part lower extremity region only.

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