Medicolegal Evaluation of Burn Injuries- An Autopsy Based Study

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Abstract

Even before the primitive man learnt to use fire, he has been a victim of it. Our study was carried out over a period of 2 years starting from 1st September 2012 to 31st August 2014 at SCB Medical College, Cuttack, Odisha on burn deaths. Aim and objective of the study was to know demographic pattern, cause of death and relation of body surface involved.

The rate of burn death was 16.7% of the total autopsy. Female victims outnumbered male victims with a female to male ratio approximately 3.2 : 1. Majority of the cases belong to adolescent and young adult (11-40 years) age group. Maximum no. of victims were married. In most of the cases fatal period was within 24 hours. Most of the deaths occurred when >40% of TBSA is involved. Most of the victims died within 1 week. More than 80% of TBSA are involved in majority of cases of shock, whereas a wide range of TBSA(30-100%) is involved in cases of septicaemia. Major cause of death in burn was septicaemia.

Key words: *Burn, demography, cause of death, body surface involved*

Introduction

A Burn is an injury which is caused by application of heat or chemical substances to the external or internal surfaces of the body, which causes destruction of tissues[19].Thermal burns and related injuries are a major cause of death and disability affecting the entire world and more so to the developing countries like India. According to The estimated annual burn incidence in India is approximately 6-7 million per year. The high incidence is attributed to illiteracy, poverty and low level safety consciousness in the population[17].

The problem of burn in developing countries like India, are largely related to the nature of domestic appliances used in our country. Conventional methods like using wood, leaves, straw, open chullha, kerosene stove, kerosene lamps, LPG and natural gas stove are used for cooking, heating and lighting purpose. Various socio- cultural factors present in our country also contribute at times. In our society, accidental burns in women occur commonly, which they are more vulnerable to, as most of the women (housewives) spend their time in the household especially in the kitchen. Mortality due to burn injuries is higher because of lack of awareness among people and lack of availability of health care services.

Suicidal trend is also increasing in our country due to many socio-economic factors like abolition of joint family, domestic quarrel, mental depression due to failure in exam/love, drug addiction, mental illness, chronic disease and disability etc. Sometimes people resort to criminal act like murder, rape and to conceal the crime, they burn the body to report it as a post-mortem burn. Rapid industrialization and increasing fire disasters due to many causes are other factors contributing to the burden of disease in developing countries like India. Many established factors decide the fate of burn affected patients, but still some hidden factors are there which decide their mortality. Assessment of outcome in burn patients following admission to a burn centre may be

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useful to determine the requirements of nursing care, diagnostic modalities, medical treatment, surgical interventions and rehabilitation therapy.

Aim and Objective

1. To determine the demographic distribution of burns.

2. To study the various causes of death in burn injuries.

3. To link the survival rate to the body surface involvement.

Material and Method

This study was conducted at S.C.B Medical College & Hospital, Cuttack, Odisha during the period of September 2012 to August 2014. In this study all burn cases brought to the Central Morgue, SCBMCH, Cuttack irrespective of alleged manner were taken into consideration. Case history was taken from the attendant in Burn Unit as well as from the attendant of the deceased, accompanying police personnel, inquest report & dead body challan in the mortuary during autopsy. In this study, the treatment record as well as all the necessary laboratory investigations there in are also taken into consideration. The detail case history, circumstantial evidence where available, treatment records, laboratory investigation reports, autopsy findings were analysed and compared.

Exclusion Criteria-

Instantaneous deaths due to burns involving muscles, bones, showing features of charring as well as features of post-mortem burns are excluded from the study. Also all the Paediatric burn cases admitted to the Department of Paediatrics, S.C.B Medical College & Hospital are excluded from this study.

Results

A total of 301(16.7%) cases of burns had been reported out of 1799 cases of all types of autopsies. Sex wise distribution of burn cases in the study period wherein the females represent 230(76.4%) cases and males represent 71(23.6%) cases. The average female to male ratio is found to be 3.2:1.

Tab.1: Age wise distribution

Age in years	Male	Female	Total
0-10	4 (5.6%)	7 (3%)	11 (3.6%)
11-20	7 (9.8%)	72 (31.3%)	79 (26.2%)
21-30	26 (36.6%)	94 (40.8%)	120 (39.8%)
31-40	19 (26.7%)	28 (12.2%)	47 (15.6%)
41-50	9 (12.6%)	12 (5.2%)	21 (7%)
51-60	3 (4.2%)	8 (3.4%)	11 (3.6%)
61-70	2 (2.8%)	8 (3.4%)	10 (3.3%)
>70	1 (1.4%)	1 (0.4%)	2 (0.7%)
Total	71 (100%)	230 (100%)	301 (100%)

Tab.1 depicts the incidence of burn cases according to age and sex. 81.6% of the total cases belong to adolescent and young adult (11-40 years) age group. The peak incidence is observed in the age group 21-30 years involving 120(39.8%) victims, followed by 11-20 years comprising of 79(26.2%) victims. On sex wise analysis, the peak incidence in males is found to be in 21-30 years age group, comprising 26 (36.6%) cases followed by 19(26.7%) cases in 31-40 years age group. In females also the sufferers are mostly encountered from 21-30 years age group comprising 94 (40.8%) cases, followed by 11-20 years age group accounting 72 (31.3%) of the cases. This indicates that the susceptible age group for both male and female is 21-30 years.

Tab.2: Marital Status

Marital Status	Male	Female	Total
Married	40(56.3%)	171(74.3%)	211(70%)
Unmarried	31(43.7%)	59(25.7%)	90(30%)
Total	71(100%)	230(100%)	301(100%)

Tab.2 above represents the marital status of the sufferers. 70% of burn victims are married and 30% are unmarried. On sex wise distribution, maximum sufferers are married in both sexes comprising 171(74.3%) females and 40(56.3%) males.

Tab.3: Duration of Survival

Duration of Survival	Male	Female	Total
Spot Death	10(14.1%)	17(7.4%)	27(9%)
<12 hrs	14(19.7%)	49(21.3%)	63(20.9%)
12-24hrs	10(14.1%)	34(14.8%)	44(14.6%)
2-3days	9(12.7%)	24(10.4%)	33(11%)
4-7days	12(16.9%)	45(19.6%)	57(18.9%)
1-2weeks	8(11.3%)	39(17%)	47(15.6%)
>2weeks	8(11.3%)	22(9.6%)	30(10%)
Total	71(100%)	230(100%)	301(100%)

Tab.3 describes the survival period of the burn victims. Most of the victims 224(74.4%) died within 1 week of the incidence, among which 134(44.5%) cases died within 24 hours. This indicates that,in most of the cases fatal period is within 24 hours.

Tab.4- Considering the fatal body surface area involvement to be 40% or more, 290 cases out of 301 are selected for analysis of TBSA.

Tab.4: Percentage (%) of TBSA involved

% TBSA Burnt	Male	Female	Total
≤ 30	0(0%)	2(0.9%)	2(0.7%)
31-40	6(9.7%)	5(2.2%)	11(3.8%)
41-50	7(11.3%)	21(9.2%)	28(9.7%)
51-60	4(6.4%)	18(7.9%)	22(7.6%)
61-70	8(12.9%)	20(8.8%)	28(9.7%)
71-80	9(14.5%)	21(9.2%)	30(10.3%)
81-90	11(17.7%)	45(19.7%)	56(19.3%)
91-100	17(27.4%)	96(42.1%)	113(39%)
Total	62(100%)	228(100%)	290(100%)

Tab.4 represents the percentage of total body surface area involved in burn deaths. In majority of the burn deaths 113(39%) more than 90% TBSA is involved, followed by 56(19.3%) death when 81-90% TBSA is involved. In 277(95.5%) cases, percentage of burn is >40% TBSA. 13(4.5%) cases are found with percentage of burn < 40% TBSA.

In male, majority of victims 17(27.4%) are found with involvement of 91-100% TBSA followed by 11(17.7%) cases where 81-90% TBSA is involved. 6(9.7%) cases are found with percentage of burn < 40% TBSA.

In female majority of victims 96(42.1%) are found with involvement of 91-100% TBSA followed by 45(19.7%) victims where 81-90% of TBSA is involved, and least number of victims 7(3.1%) where <40% TBSA is involved.

Tab.5: Distribution of survival period according to TBSA involved

Duration of survival	TBSA Involved								Total
	≤30%	31-40%	41-50%	51-60%	61-70%	71-80%	81-90%	91-100%	
Spot death	0	0	0	0	1	0	1	18	20
<12 hrs	1	0	2	4	2	6	13	32	60
12-24hrs	0	0	4	2	1	5	9	22	43
2-3days	0	2	3	3	0	6	5	14	33
4-7days	0	2	7	3	9	7	15	14	57
1-2weeks	0	2	5	4	10	4	10	12	47
>2weeks	1	5	7	6	5	2	3	1	30
Total	2	11	28	22	28	30	56	113	290

Above table represents the relation between TBSA involved in burn injuries and duration of survival. Most of the victims 208(71.7%) died within 1 week when >40% of TBSA is involved. 18(6.2%) cases died at the spot where >90% of TBSA is involved.

Tab.6: TBSA involved and Cause of Death

Period of survival	TBSA Involved								Total
	≤30%	31-40%	41-50%	51-60%	61-70%	71-80%	81-90%	91-100%	
Neurogenic shock	1	0	2	3	3	6	14	64	93
Hypovolaemic shock	0	3	6	7	1	11	17	21	66
Septicaemia	1	8	20	12	24	13	25	28	131
Total	2	11	28	22	28	30	56	113	290

Tab.6 depicts the relationship between total body surface area involved and cause of death. More than 80% of TBSA are involved in majority of cases of shock, whereas a wide range of TBSA (30-100%) is involved in cases of septicemia.

Discussion

The reason for gradual rise in burn death cases could be due to increase in population, lack of awareness and other social as well as environmental factors.

These workers got similar result for sex ratio as our study ,*Chakraborty S et al (2010)*[3], *Kaulapur V V et al (2011)*[12] ,*Chawla R. et al (2011)*[4], *Jain R et al (2011)*[10],. *Haralkar S J, Tapare V S, Rayate M V (2011)*[8], *Singh P, Dasari H (2012)*[22] and *Gupta R et al (2012)*[6].

In contrast to our study *Shkrum and Johnston (1992)*[12] in Canada, *Olaitan P B and Jiburum B C (2006)*[18] , *Hilal A et al (2008)*[9] in Turkey noticed male preponderance.

Females are more prone to the burn incidences because of their involvement in kitchen work. Moreover in a developing country like India, females are married earlier than males in the family and are exposed to social and family stress much earlier than males. The other reasons which contribute significantly for female preponderance are traditional clothing pattern in Indian women, illiteracy, lack of awareness, mental stress, suicidal and dowry deaths.

Literatures so far available from outside India regarding age variation reveal different findings in comparison to our study like *Tedeschi C.G (1977)*[23] , *Liu EH et al (1998)*[13] in Nepal and *Hilal A. et al (2008)*[9]. Literature so far available from our country reveal almost similar finding with little variation like *Memchoubi Ph., Nabachandra H. (2007)*[15] in Imphal , *Jaiswal AK et al (2007)*[11] , *Kaulapur V V et al (2011)*[12] and *Hansda M, Sahoo N, Panda BB, Mishra SN(2017)*[7]. In contrast to this, studies by the authors like *Chakraborty S et al (2010)*[3], *Haralkar S J, Tapare V S, Rayate M V (2011)*[8], *Gupta R et al (2012)*[6] are not consistent with our study.

The reason for maximum sufferers encountered from the age group 21-30 years followed by the age group 11-20 years may be due to the fact that it is the productive age, when they are generally active and exposed to hazardous situations both at home and work. Females in this age group are mostly engaged in cooking and wear clothes like sarees, dupatta which catch fire easily.

Maximum sufferers are married in both sexes and similar results are found by *Batra A.K. (2003)*[2] , *Ambade V.N. et al (2006)*[1] , *Dasari H et al (2008)*[5] and *Gupta R et al (2012)*[6].

The triggering factors for suicidal burns in married females could be young age at the time of marriage combined with inability to cope with the physical and psychological stress of marriage, harassment from in-laws. Accidental burns may be due to inadequate precautions during cooking and wearing of the loose clothes like sari. Burn as a convenient means of bride killing also contributes towards the higher incidence in the said age group and sex.

On analysing the data further, and concentrating on the duration of marriage of the married females, it is observed that majority of deaths occurred within 7 years of marriage and among them maximum within the first three years of marriage.

In most of the cases fatal period is within 24 hours and the studies conducted by *Mangal H.M. et al (2007)*[14], *Memchoubi Ph., Nabachandra H. (2007)*[15] ,*Chakraborty S et al (2010)*[3] ,*Koulapur V V et al (2011)*[12] ,*Chawla R. et al (2011)*[4] reported similar finding as of our study. In contrast to our study, studies by *Dasari H et al (2008)*[5] differ on this.

In 95.5% cases, percentage of burn is >40% TBSA. Studies outside India like *Mzezewa S et al (1999)*[16] and *Shirkhoda M. et al (2011)*[21] reported quite similar findings. Inside India also reveal quite similar results from *Gupta M. et al (1993)*[6], *Mangal H.M. et al (2007)*[14], *Memchoubi Ph., Nabachandra H. (2007)*[15], *Kaulapur V V et al (2011)*[12], *Jain R et al (2011)*[10] and *Gupta R et al (2012)*[6] . However studies like *Dasari H et al (2008)*[5], *Chawla R. et al (2011)*[4] , *Singh P, Dasari H (2012)*[22] are contradictory to our study.

From above presentation it is found that most of the fatality occurred when >40% of TBSA is involved and the percentage of burn surface area increasing the duration of survival is decreasing.

While relating total body surface area involved to the cause of death we found more than 80% of TBSA are involved in majority of cases of shock, whereas a wide range of TBSA (30-100%) is involved in cases of septicaemia. As regards the cause of death, maximum number of victims died as a result of Septicaemia followed by Neurogenic shock and Hypovolaemic shock. *Jain R et al (2011)[10] and Gupta R et al (2012)[6]* agree with our study. But *Dasari H et al (2008)[5], Kaulapur V V et al (2011)[12], Chawla R. et al (2011)[4]* reported dissimilar results as compared to our study.

The finding of the present series depicts septicaemia as the most important factor for the cause of death as it cause devitalisation of tissue leaving extensive raw areas, which usually remain moist due to the outflow of serous exudates. The exposed moist area along with the dead and devitalized tissue provides the optimum environment favouring colonisation and proliferation of numerous microorganisms, which is further enhanced by the decrease of the immune response.

Conclusion

In our study, we observed that most of the victims are married females of younger age group. Majority of the victims died due to septicemia within 1week of hospitalization with burns involving more than 40% of the total body surface area. Each factor has got some influence on the fatality of the burnt victims. However, the factors like feminine gender of younger age group and most importantly the percentage of burn are the prime factors which are mainly responsible for mortality in the burn victims. Development of burn wound infections, indicating the decrease in natural defences responsible for counteracting them, is another major factor influencing the mortality of patients.

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Ethical Clearance: Taken from Hospital Ethical Committee at SCB Medical, College, Cuttack, Odisha.

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