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DEATHS IN BURN PATIENTS OF NAGPUR, INDIA: A 3 YEARS AUTOPSY STUDY

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ABSTRACT

Burns and death due to burns continue to be an important public health and social problem in India. This study aims to analyse the epidemiology of burns in central India. Data were obtained from all patients admitted to Department of Burns unit of Mayo Hospital during 2006–2009. A retrospective review was performed, including cause of burn, place of burn occurrence, anatomical areas involved, the extent of burn, date of injury, complications, length of hospital stay. A total of 100 hospitalised patients were examined. The majority of cases (46%) were 21–30 years old. The ratio of male to female was 1:3.5. Flame was the most common cause of burns in (98%), followed by electricity (2%). **Total body surface area of burns (TBSAB)** ranging from 34% to 98% accounted for 63.19% in total. Most of the burn victims are married females of the younger age group. In the present study, microscopic examination of the liver was carried out in all cases which showed hypoxic damage to liver due to disturbance of normal hepatic blood flow appears important.

KEYWORDS: Burns; TBSAB; Epidemiology; Survival; Autopsy.

INTRODUCTION

Burns and death due to burns continue to be an important public health and social problem in India. The incidence is particularly high among the ‘‘young married females’’[1,2] belonging to lower socio-economic groups.[3] Most of the victims, who survive including the initial 24 h after burns, succumb to infection of the burnt area and its complications.[4] Various factors

are responsible, disruption of the skin barrier, a large cutaneous bacterial load, the possibility of the normal bacterial flora becoming opportunistic pathogens[5], and severe depression of the immune system, all contribute towards the sepsis in a burns victim.[6] Despite various advances in infection control measures, early detection of microorganisms and newer, broader spectrum antibiotics, management of burn septicemia still remains a big challenge[7] and septicemia continues to be the leading cause of death in burn patients. Deaths due to burning are the problem of great concern in India and burn has been reported to be the second most common cause of death in all medico-legal cases. According to studies, burn was found to be the cause of death in 16.7% cases, in Punjab state[8], 18.1% cases in Maharashtra and 23.3% in rural India.[9]

Thus the higher incidence of burns in this region and high mortality rates in these cases even with advanced medical facilities, has prompted us to undertake this study. This study was undertaken to know the epidemiological aspects, pattern and other significant features of death due to septicemia due to burns, and compare with the observations of various authors in scientific discussion.

MATERIAL AND METHODS

Present study is carried out at the Department of Forensic Medicine & Toxicology in Indira Gandhi Government Medical College, Nagpur during the period of 2006 to 2009. Both male and female of all age group were taken in the study. The subjects are admitted in cases in the burn ward of Indira Gandhi Government Medical College, Nagpur.

The signs and symptoms of septicemia were recorded in the prescribed proforma from the day of admission to discharge or death. Related general information likes the age, gender, hospital stay and the history about the scene of crime, etc. of the cases was collected from relatives, eyewitnesses, concerned investigating police officer, and police report. At the time of post mortem, the gross features of burns during external and internal examination were noted. Every attempt was made to find out the source causing the casualty, types of burning with their duration, and manner of burns, area involved, and finally the cause of death in all cases. The liver tissues for histo-pathological examination were taken at the time of autopsy. Total burn patients were divided according to the extent (percentage) of burns to correlate clinical and autopsy findings of septicemia with histo-pathological examination of the liver tissues.

RESULTS

Table I- Distribution of study cases according to age & sex.

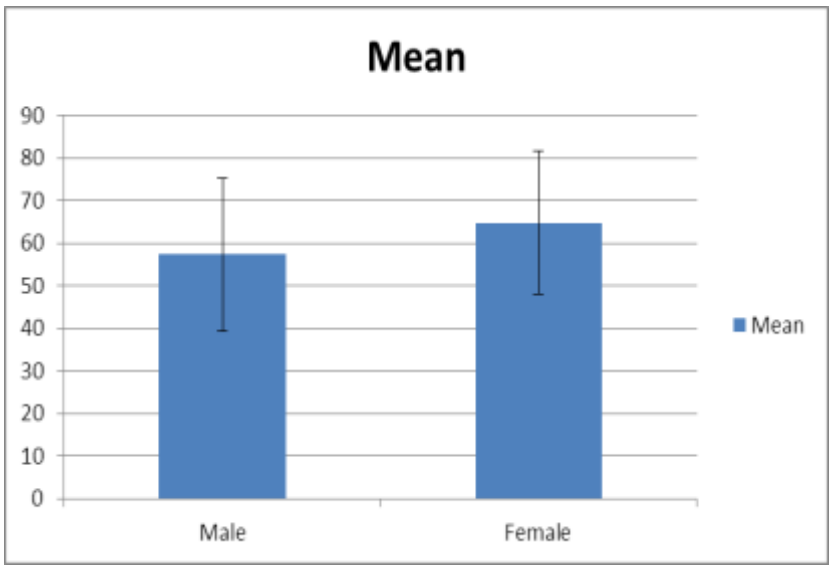
Age group(years)	Male	Female	Total
1-20	**04**	**12**	**1**
21-30	02	44	46
31-40	09	13	22
41-50	02	06	08
51-60	02	02	04
61-80	**03**	**01**	**04**
Total	22	78	100

Table II Causes of burn injury

Causes	Male	Female	Total
Flame	20	78	98
Electrical	02	00	02

Table III Manner of burn injury

Manner	Female	Male	Total
Accident	61	16	77
Suicide	11	06	17
Homicide	06	00	06



Graph 1. The histogram with error bar showing total body surface area burned (TBSAB) % in relation to sex

Table IV Total body surface area burned (TBSAB) % in relation to age group

Age group (years)	TBSAB %		
	Range	Mean	S.D.
1-20	40-88	58.6	14.94
21-30	36-98	65.5	17.62
31-40	34-94	63.72	18.59
41-50	48-93	68.5	16.79
51-60	44-76	60.25	15.19
61-80	38-56	44.25	8.09

Table V Survival period of patients & % TBSAB (n=100)

Survival period	Number of cases	% TBSAB	
		Mean	S.D.
3-4 days	18	68.22	17.17
5-6 days	47	64.82	17.79
7-8 days	19	60.57	17.18
9-10 days	8	58.37	16.66
10-12 days	3	63.00	17.72
13-15 days	3	48.33	17.22
16-19 days	2	46.00	18.16

Table VI Clinical symptoms and signs

Signs		
Temperature	Increased	100
	Decreased	00
Pulse	Increased	100
	Decreased	00
Respiratory rate	Increased	41
	Decreased	22
GIT disturbance		48
Oliguria		74
Mental status	Normal	64
	Disoriented	36

Table VII Survival period & postmortem findings

Survival period	Evidence of burn wound infection	Internal examination		
		Lung consolidation	Pus pockets in lung	Subcapsular pus pockets in spleen
3-4 Days	18	9	4	5
5-6 Days	47	21	13	10
7-8 Days	19	16	2	2
9-10 Days	8	6	1	1
11-12 Days	3	2	1	0
13-15 Days	3	3	0	0
16-19 Days	2	1	1	0
	100	58	22	18

Table VIII Microscopic findings in relation to survival period

Survival period	Microscopic Findings			
	A	B	C	D
3-4 Days	03	03	06	06
5-6Days	09	09	16	13
7-8 Days	03	07	07	02
9-10 Days	02	03	03	00
11-12 Days	02	00	00	01
13-15 Days	00	03	00	00
16-19 Days	00	02	00	00
Total	19	27	32	22

A - Fatty changes, B – Necrosis, C – Inflammation—D – No specific change

The present study was carried out in 100 cases of burn injury out of which 22 were males & 78 were females varying in age group of 18-74 years and 10-75 years respectively.

The table 1 shows that the maximum number of cases was from the age group of 21 - 30 years while in the age group from 1 -10 year, number of cases were minimum. In the age group of 71 - 80 years, there were only two cases of which one is male & one is female. While considering the sex, maximum numbers of males were in the age group 31 - 40 years and the maximum numbers of females were in the age group 21 - 30 years.

While considering the causes of burn injury, it is observed that the flame was the most common cause of burns as compared to burns due to electricity (Table 2). Assessing the cause of burn in respect to sex, females outnumbered the males.

From the table 3, information regarding the manner of burn injury shows that accidental burn injuries were the most common manner of death, followed by suicidal and homicidal one.

While taking into consideration total body surface area in relation to sex, it is observed that in case of males, total body surface area of burn ranges from 34 to 98% with a mean (SD) of 57.36 (±17.91). Whereas in females, TBSAB% ranged from 36 to 98% with a mean (SD) value of 64.83 (±16.91). (Graph 1).

The TBSAB% was maximum in the age group of 41-50 years with a range of 48-93% and mean (SD) value of 68.5 (±16.79). Whereas it was found minimum in the age group of 71-80 years ranging from 40-43% with mean (SD) value of 41.4, (± 2.12).(Table 4).

Table 5 shows the survival period of patients' viz-à-viz total body surface area of burns. It was noted that cases who survived for 3-4 days had mean TBSAB of 68.22% whereas the persons who survived for more days had less percentage of TBSAB. Thus, it is evident that there is somewhat an inverse relationship between TBSAB and period of survival. As the TBSAB of burned patient increases, the period of survival decreases and vice a versa.

All the studied patients were seen in their clinical features during their hospitalization period. Fever & tachycardia considered to be most one. The incidence of clinical symptoms and signs is tabulated in Table 6.The temperature and pulse rate was raised in all cases whereas the respiratory rate was increased in 41 cases and decreased in 22 cases. 48 subjects were having GIT disturbance and 74 subjects were having oliguria. Regarding mental status, 64 was normal and 36 were disoriented.

Correlation between survival Period and Postmortem findings are shown in Table 7. All of the cases were given the evidence of infected burn injury present in all cases. On internal examination during postmortem, in 58 cases lung consolidation was found. There were 18 patients who survived for 3-4 days show evidence of burn wound infection along with consolidation of the lungs in 9 cases, pus pockets in the lungs in 4 cases & subcapsular pus pockets in spleen in 5 cases. The person who survived for 5-6 days were 47 in number, all of them showed burn wound infection, consolidation of lungs in 21 cases, pus pockets in the lungs present in 13 cases and subcapsular pus pockets were present in 10 cases. There were 19 patients who survived for 7-8 days showing evidences of burn wound infection, lung consolidation present in 16 cases, pus pockets in the lungs in 2 cases, & subcapsular pus pockets in the spleen in 2 cases. There were 8 patients in a group of 9-10 days in which consolidatory changes present in 6 cases & pus pocket in the lungs in 1 case, subcapsular pus pocket present in 1 case. There were three patients who survived for 11-12 days & 13-15 days each. Persons who survived for 11-12 days showed lung consolidation in 2 cases and pus pockets in 1 case. Persons who survived for 13-15 days, all of them show lung consolidation.Persons who survived for 16-19 days are 2 in number; one of them shows lung consolidation and other shows pus pockets in lung.

Microscopic examination of the liver was done in all burn cases. The findings are grouped as follows A - Fatty changes, B – Necrosis, C – inflammation, D– No specific change

From the table 8, it is clear that the most common microscopic finding in persons who died in 3-4 days consists of inflammatory changes in liver followed by fatty necrosis. Most common microscopic findings in this study are inflammatory changes followed by necrotic changes.

DISCUSSION

Burn injuries occur across the world and they have inundated humankind since ancient times. Burn poses not only medical and psychological problems but also severe economic and social burden on the victims' families and on the society in general either in the developed or developing world. In the present study, maximum patients were of age group 11-30 years with peak incidence in 21-30 years of age group. These findings concurred with the observation of El-Muhtaseb H. (1984), Ragheb et al (1984), Lari A. R. (2000), and Kachare et al (2005).[10,11,12,13] This age group is particularly more active and participative in daily chores. Resultantly they are more exposed to fire related activity whether it may be cooking or any other work. Thus, this group was found to be mostly involved in fire related fatalities in the present study.

When gender was considered, most of cases were females in the age group of 21-30 years. This was analogous to the findings of Ragheb et al (1984), Karyoute et al (1989), Kumar P. (2000), Kachare et al (2005), B. R. Sharma (2006), Harish D, Gupta R, Shinde AB, Vaghela.[11,13,14,15,16, 20, 21, 22, 23, 24] Burns are the only unnatural cause of death in India in which females outnumber males by a large margin.[8] This is in contrast to the findings of El-Muhtaseb et al (1984), Yi Sheng C (1985), Lari A.R. (2000) which showed male preponderance.[10,12,17]

The higher incidence of burn in young females was probably due to cooking on open unguarded flame such as stove, chulha, cooking gas etc. It was important to mention that the cooking responsibility is assigned to the newly married housewives in most of families. The use of loose, voluminous, highly inflammable synthetic garments, usually sari of victim catches the fire while cooking. It was also important to note that the dowry deaths and death due to family conflicts were frequent in this age group.

In the present study, the flame was the most common causative agent responsible for the burns almost in 98% cases. No case of scald burn injury was noted in the present study. These findings were in accordance with the findings of Ragheb et al (1984), Karyoute et al

(1989), Lari A. R. (2000), Kachare et al (2005) where the flame is the most common causative agent as compared to scald and electricity.[11,12,13,14,]

These findings were not in accordance with findings of El- Muhtaseb et al (1984) where they noted 53 % cases of flame burns and 42% of scalds burns. Whereas Kumar et al (2000) noted more scald burns than flame burns.[10,15]

This inconsistency in the findings was due to difference in the study population as they have included only paediatric age group, whereas in the present series the age group ranged from 10 years to 75 years. Ho Ws et al (2002) noted 148 cases of scald burns, flame in 124 cases, chemicals in 7, electricity in 3 and 4 cases cause remain unknown.[18]

While considering the manner of burn injuries, in 77% burn injuries occurred accidentally, while rest of burns were due to suicide and homicide. Kachare et al (2005), Karyoute et al (1989), El-Muhtaseb et al (1984), Ragheb et al (1989), Kumar P. (2000), Harish D, Gupta R, Shinde AB, Vaghela had also observed the same findings in their study.[10,11,13,14,15,20, 21, 22, 23, 24] In all cases, the females were more affected than males. As the females were mostly involved in cooking practices, more readily available contact with inflammable sources and due pattern of clothing they wear, they were most susceptible to burns. The incidence of suicidal and homicidal burns appears less as compared to the accidental burns. This might be due to hiding of proper history by patients and relatives. Also, the place of fire source usually placed at ground level while the cooking ingredients/ material in shelves exactly above the fire source may contribute further for the increase incidence of accidental fire related mortality.

The total body surface area burned ranged from 34% to 98% with mean value of 63.19%. In the case of males range varied from 34-98% with mean 57.36%, while in the case of females it varied from 36-98% with mean of 64.83. In the present study, the cases were divided depending on age group. The relationship between age group & TBSAB were studied & it was found that the maximum mean TBSAB % was in age group of 41-50 years which is 68.5 %.

The, TBSAB was correlated with survival period & it was found that there was a decrease in the survival period with increase in TBSAB. The probable reason might be the due to large body surface involved. Also, there was greater risk of shock and septicaemia because burn

injury causes damage to the protective barrier of skin and thrombosis of subcutaneous blood vessels, resulting in avascular bed, that act as a good medium for the growth of microorganisms that further leads to spread of these microorganisms and ultimately resulting in septicaemia. It was also observed that there was an increase in mortality rate with increase in TBSAB %. Our findings were similar to the findings noticed by Ragheb et al (1984), El-Muhtaseb et al (1984), Karyoute et al (1989), Lari et al (2000), Kumar P. (2000), Ho Ws (2002), Sharma B. R. (2006).[10, 11,12,15,18,19] Therefore, infection leading to secondary complications and eventually, multi organ failure was the main cause of death in the burn cases, which could be dealt with availability of better burn care facilities.

In the present study, clinical symptoms and signs of septicaemia were recorded during their hospitalization period. The temperature and pulse rate was raised in all cases. The respiratory rate was increased in 41 cases and decreased in 22 cases. GIT disturbance was found in 48 cases and oliguria in 74 cases. Mental status of 64 persons was normal, while 36 people were disoriented. Our findings were in agreement with findings of Dagwade A. et al (2002).[20]

In the present study, microscopic examination of the liver was performed in all cases. Among 100 cases, fatty changes were noted in 19 cases, necrosis found in 27 cases, inflammation observed in 32 cases whereas in 22 cases, the microscopic changes were unremarkable. The exact reason for such microscopic changes remains speculative, however hypoxic damage causes to liver due to disturbance of normal hepatic blood flow appear important. The microscopic findings of the present study were in agreement with the findings of Artorson (1963), Talat et al(1973) ,Chen Yi sheng (1985); whereas the findings were not consistent with Baker (1944), Argamaso R V(1967) Miyoshi K (1985), Li M.(1986), Okabayashi K et al (1990).[25,26, 17,27,28,29,30,31]

Argamaso R V (1967) noted oedema of hepatocytes and cloudy degeneration. The reason for this difference might be due to the fact that he had included a small sample size and most of the cases were in the paediatric age group and the TBSAB was small in comparison with the present study.[28]

Miyoshi (1985) noted mobilisation of kupffer cells, scattered spotty necrosis, acidophile necrotic cells and mild disorganization of the cytoarchitecture. The reason attributed for the difference in findings was due to fact that they had included patients who had already hepatic disorder with their SGOT level raised.[29]

Baker R. (1944) noted minimal degree of hepatic necrosis only in 4 cases.[27] Li M. et al (1986) noted dilation and congestion of central veins and sinusoids of the liver.[30] The reason for inconsistent findings was that Li.M. et al had carried out a study in rats.[30] Okabayashi et al (1990) noted structural changes in kupffer cells in form of phagocytic vacuoles.[31] In present study the necrotic changes, inflammatory changes, fatty changes were noted. These findings were not consistent with the findings of Okabayashi et al as they studied the liver changes within a short period after burn and they employed rats as study subjects.[31]

By analyzing the post-mortem findings, it was observed that all the burned patients had infected wounds whereas consolidation was noted in 58 cases and multiple pus pockets in the lungs were observed in 22 cases. There was evidence of subcapsular pus pockets in spleen in 18 cases. The cause of death was labelled as septicaemia due to burns. Argamaso (1967), El-Muhtaseb (1984), Karyoute (1989), Weber (2004) had observed similar findings whereas Silverstein (1970) had noted more death due to respiratory complications. The difference might be due to improved shock therapy and surgical treatment with appropriate control of wound sepsis.[28,10,14,32,33]

In the present series, we had noted that the time required for wound infection and resultant septicaemia was more than 3 days and the observation was in accordance with the observation made by Bang et al (1998).[34]

CONCLUSION

Distribution and causes of burns in the present study are more or less similar to the pattern found in most of the other Indian studies. This similarity is there in almost all parameters used throughout this study. Most of the burn victims were married females of younger age group, for planning and implementing prevention programs the approach have to be multi-disciplinary and coordinated and may be largely accomplished by providing immense amount of education so as to build awareness in the mind set of general population, school education programs, male concerning risk in work locations, the family especially the housewives and parents. Steps should be taken not only to minimize burn mortality but also to prevent and reduce their incidence at least in cases where human error and human greed play a role. In the present study, microscopic examination of the liver was performed in all cases. Among these cases, fatty changes, necrosis as well as inflammation were noted. The exact reason for such microscopic changes remains speculative, however hypoxic damage causes to liver due to disturbance of normal hepatic blood flow appear important.

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