

THERMAL BURNS IN ADULTS- A RETROSPECTIVE DESCRIPTIVE STUDY

Akunuru Kishore Babu¹, Gurana Krishna Rao², Mallireddy Ramachandra³, Dhanya Charita Dwarapureddy⁴, R. Mahalakshmi⁵

¹Associate Professor, Department of General Surgery, Rangaraya Medical College, Kakinada, Andhra Pradesh.

²Senior Resident, Department of General Surgery, Rangaraya Medical College, Kakinada, Andhra Pradesh.

³Associate Professor, Department of General Surgery, Rangaraya Medical College, Kakinada, Andhra Pradesh.

⁴Junior Resident, Department of General Surgery, Rangaraya Medical College, Kakinada, Andhra Pradesh.

⁵Professor, Department of General Surgery, Rangaraya Medical College, Kakinada, Andhra Pradesh.

ABSTRACT

BACKGROUND

Burn injuries are of global concern. In India, over 10,00,000 people sustain burns every year. Most of them succumb to death, and the rest suffer with varying degrees of morbidity. A better understanding of the burden can help formulate appropriate steps aiming at prevention of these burn injuries. We wanted to study the socio-cultural aspects, causes, modes of injury, and outcome in thermal burn injuries and their preventive aspects.

METHODS

An elaborate study of 205 patients admitted into burns unit and casualty, Government General Hospital, over a period of two years from June 2016 to June 2018, was done and analyzed accordingly.

RESULTS

In the study, 67.6% were females, 77.6% were from the rural areas, 76.6% were illiterates, and 69.4% were of class 5 socioeconomic status. Accidental burns were 57.1%, and suicidal burns were 42.9%. Suicides were common between 21 to 40 years age group and mostly were literates and involved more TBSA. Most accidental burns occurred at their residence. Mortality was 73.2% overall and highest in patients with age greater than 60 years and in suicidal than accidental. Mortality was 100% if TBSA was >70%. Most deaths occurred in their 1st to 5th post burn day. The most common bacteria isolated in burn wound culture swab was klebsiella.

CONCLUSIONS

Personality development programs targeting illiterate females of age group 21 to 40 years can reduce suicidal burns. Patients with injuries involving head and neck and TBSA > 50% should be the priority as they have high mortality. Education regarding safety against dry flame burns, their prevention, and steps used in early control of dry flame burns, can control accidental injuries. Early resuscitation, nutrition, and wound management should be focused on managing burn victims. Deformities and contractures affect the normal functioning of the individual, and every step should be taken to prevent them.

KEYWORDS

Thermal Burns, Suicidal Burns, Accidental Burns

HOW TO CITE THIS ARTICLE: Kishore Babu A, Krishna Rao G, Ramachandra M, et al. Thermal burns in adults- a retrospective descriptive study. J. Evid. Based Med. Healthc. 2019; 6(34), 2316-2322. DOI: 10.18410/jebmh/2019/473

BACKGROUND

Burn injuries are of global concern. In India, over 1000000 people sustain burns every year; cause a massive burden to the nation through mortality and morbidity, including prolonged hospitalization and disabilities. Most of them succumb to death, and the rest suffer with varying degrees of morbidity.

An elaborate study of all possible socio-economic aspects of burn injuries can throw light on formulating

appropriate steps aiming at prevention of these burn injuries.

Burn injuries are one of the most devastating types of all injuries and a significant global public health concern.^{1,2} Non-fatal burns are a leading cause of morbidity, including prolonged hospitalization, disfigurement, and disability, often with resulting stigma and rejection. Burns are among the leading causes of disability-adjusted life-years (DALYs) lost in low- and middle-income countries. In India, over 1,000,000 people are moderately or severely burnt every year.³ But In high-income countries, the trend over the last several years has been a reduction in burn incidence, burn severity, length of hospital stay, and mortality rate.⁴ Approximately 90 percent of burns occur in low- to middle-income countries, regions that generally lack the necessary infrastructure to reduce the incidence and severity of burns.⁵ Females were the most common victims when compared with males.⁶ Rural population sustain more burn injuries when compared to the urban population.⁷ Adult males sustain burns mostly in outdoor or work locations, while

Financial or Other, Competing Interest: None.

Submission 01-08-2019, Peer Review 08-08-2019,

Acceptance 20-08-2019, Published 26-08-2019.

Corresponding Author:

Dr. G. Krishna Rao,

Senior Resident,

Department of General Surgery,

GGH, Kakinada, East Godavari,

Andhra Pradesh.

E-mail: krishna.gemini558@gmail.com

DOI: 10.18410/jebmh/2019/473



burns to adult females occur primarily at home.⁶ Suicidal burns, although low in incidence, carries a significant risk of death, with an overall mortality rate of 65% worldwide. Preventing deadly burn-related violence requires a multifaceted approach, including legislation and enforcement, education, and advocacy. Better standardized assessment tools are needed to screen for risks of abuse and psychiatric disorders in perpetrators.⁸

Rates of intentional burns are unevenly distributed throughout the world. India has an unusually high rate of young women involving in suicides.⁹ Burns have very high mortality rates. Age-specific mortality is high in people >75 years.¹⁰ Significant risk factors for burns included low socioeconomic status, being younger, wearing loose, flammable clothing and the use of kerosene.¹¹ Prevention is the best way to decrease the burden of burns over society. BPP (burns prevention programs) play a significant role in reducing the incidence of burns.¹² Participatory community seminars, shop floor visit to industrial locations, use of print and electronic media, lectures and demonstrations in schools can be used in the preventive programs.¹² Severe burns with more than 40% of TBSA lead to hyper metabolic/stress response as of other insults like trauma, surgery and as in critically ill patients but their severity, length, and magnitude are unique for burns.¹³

The following are the practical guidelines for burn shock resuscitation are recommended by the American Burn Association.¹⁴

- Adults >20% TBSA, infants >10% TBSA and older children.
- >15% TBSA should undergo formal fluid resuscitation using estimates based on body size and surface area burnt.
- Standard formulas used to initiate resuscitation estimate a crystalloid need for 2-4 ml/kg body weight/ % TBSA during the first 24 hours.
- Fluid resuscitation, regardless of solution type and estimated need should be titrated to maintain a urine output of approximately 0.5-1.0 ml/kg/hour in adults and 1.0-1.5 ml/kg/hour in children.

We wanted to study the socio-cultural aspects of thermal burn injuries, evaluate the causes and mode of injury in thermal injuries and study the outcome in thermal burns and their preventive aspects.

METHODS

Patients were selected from the 'Burns Unit' and Casualty, Government General Hospital, Kakinada over a period of two years from June 2016 to June 2018.

Inclusion Criteria

- All patients with age more than 12 years admitted to burns unit/ casualty with the diagnosis of thermal burn injuries.

Exclusion Criteria

- All pregnant women were excluded.

- Brought dead patients with burns.
- Electrical burns were excluded.
- Patients with age less than/equal to 12 years were excluded.

An elaborate history of the cases regarding age, sex, literacy, locality, associated illness, place of injury, Time of injury, mode of injury, time of hospital admission, time of initiation of treatment was taken. Modified Kuppaswamy socio-economic scale was used to calculate socioeconomic status. On admission, Vitals were recorded, calculation of total body surface area of burns was done, and depth of burn injury was noted. Necessary Investigations like Haemoglobin, Random blood sugar, Serum creatinine, Blood Urea, serum electrolytes and albumin, Electrocardiogram were done. Period of hospital stay, infection patterns during the stay were noted. Morbidity at the time of discharge and mortality of admitted cases were recorded.

RESULTS

A total of 205 patients were studied, out of which 139(67.8%) patients were females, and 66 (32.1%) were males

Age Group	Males	% (Males)	Females	% (Females)
12 to 20 yrs.	7	10.6	7	5.0
21 to 40 yrs.	32	48.4	100	71.9
41 to 60 yrs.	20	30.3	12	8.6
>60 yrs.	7	10.6	20	14.3

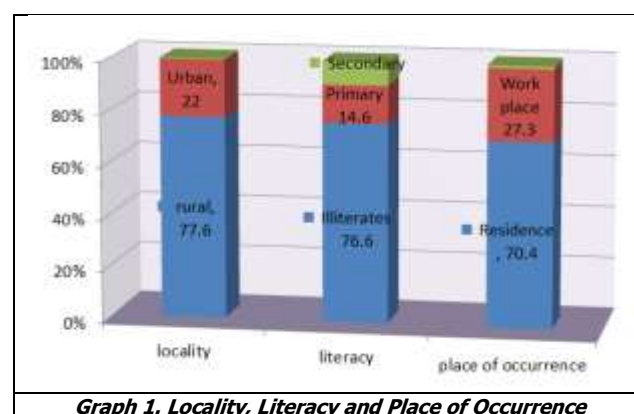
Table 1. Age and Sex Distribution

Locality

Most of the victims were from the rural population, with a percentage of 77.6%. 22% were from urban, and 0.4% were from the tribal areas.

Literacy Rate

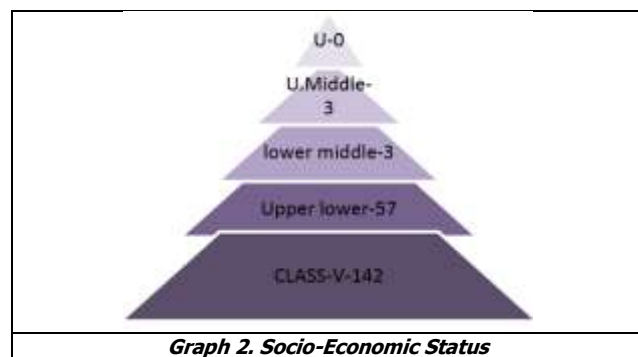
Most of the victims (157) were illiterates (76.6%), primary educated were 14.6%, secondary trained were 4.9% and higher secondary educates were 3.9%



Graph 1. Locality, Literacy and Place of Occurrence

Socio-Economic Status

Among 205 patients, 142(69.4%) patients belonged to socioeconomic class-V according to Kuppaswamy socioeconomic classification of patients.

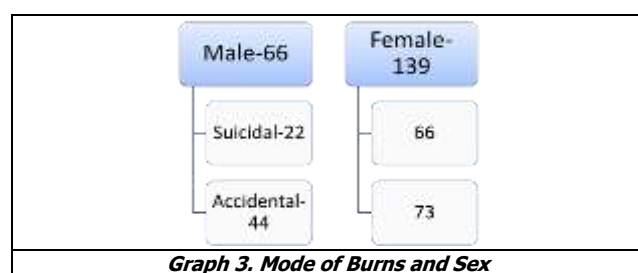


Mode of Burns

Out of 205 victims, accidental burns constituted 57.1% (117 in number) and suicidal burns constituted 42.9% (88 in number)

Sex Group and Mode of Injury

In males, most of the victims sustained accidental burns (44 out of 66) In females, most of the victims sustained accidental burns (73 out of 139) In suicidal burns (66 out of 88), females were common. In accidental burns (73 out of 117), females were more common.



Age Group and Mode of Injury

In the age group 12 to 20 years, accidental burns were common. In the age group 21 to 40 years, suicidal burns were more common. In the age group 41 to 60 years, accidental burns were more common. In age group >60 years, accidental burns were more common.

Age Group	Total	Suicidal	% Specific to Age Group	Accidental	% Specific to Age Group
12 to 20 yrs.	14	5	35.7	9	64.3
21 to 40 yrs.	132	71	53.8	61	46.2
41 to 60 yrs.	32	9	28.1	23	71.9
>60 yrs.	27	3	11.1	24	88.9

Table 2. Mode of Burns in Relation to Specific Age Group

Literacy and Mode of Injury

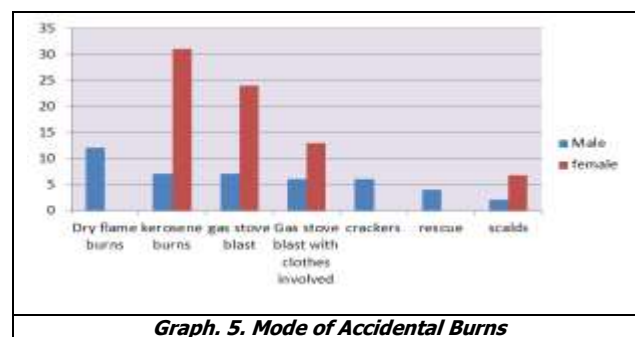
In illiterates, accidental burns (60.5%) were more common than suicidal burns (39.5%). In literates, suicidal burns (52.1%) were more common than accidental burn.

Occupation

Among male victims, most of them worked as coolies (86.4%). Among female victims, most of them were housewives (71.2%).

Mode of Accidental Burns

In males, most of the accidental burns occurred due to dry flames, and in females, kerosene stove was the most common source of accidental burn.



Accidental Burns and Place of Occurrence

In female patients who sustained accidental burns, 100% of them occurred at their residence. In males who sustained accidental burns, 70% of them occurred at their residence, and 27% occurred at their workplace. 3% occurred at other places.

Suicidal Burns and Mode / Place of Occurrence

In all suicidal burns (100%), all occurred at residence. 100% females used kerosene for suicide. Out of 22 men, 20 men used kerosene and 2 used petrol.

Suicidal Burns and Time of Occurrence

Suicidal burns occurred mostly in the night-time (43.2%), 25% occurred in evening, 22.8% occurred in morning and 9% occurred in afternoon.

Accidental Burns and Time of Occurrence

Accidental burns most commonly occurred in the evening time (29.9%), 29.1% occurred at morning, 22.2% occurred at night and 18.8% occurred at afternoon.

Mortality and Sex

In males, the mortality percentage was 54.5%. In females, the mortality percentage was 82%.

Mortality and Age Group

In the age group of >60 yrs., mortality percentage was highest (88.5%), followed by age group 21 to 40 years with mortality percentage of 75.7%.

Age Group	Total	Mortality	Mortality % of that Group
12 to 20 yrs.	14	7	50
21 to 40 yrs.	132	100	75.7
41 to 60 yrs.	33	20	60.6
>60 yrs.	26	23	88.5

Table 3. Age Group Specific Mortality

Mortality and Mode of Injury

The death rate was high in suicidal burns (92.1%) when compared with accidental burns (58.9%)

TBSA and Mortality

Most victims (27.3%) sustained less than 50% TBSA. Mortality was 100% in victims with more than 70% TBSA.

TBSA	Total	Percentile	Mortality	Percentile
<50	56	27.3	9	16
51 to 70	49	23.9	41	83.7
71 to 90	55	26.8	55	100
>90	45	22	45	100

Table 4. TBSA Related Mortality

TBSA and Mode of Injury

Suicidal Burns- 70.4% of patients with suicidal burns involved more than 70% TBSA. 11.3% of patients had less than 50% TBSA. 18.3% of patients had 50% to 70% TBSA

Accidental Burns- 39.3% of accidental burns involved less than 50% TBSA. 32.4% patient involved more than 70% TBSA. 28.2% involved 51 to 70% TBSA

Hospital Stay in Expired

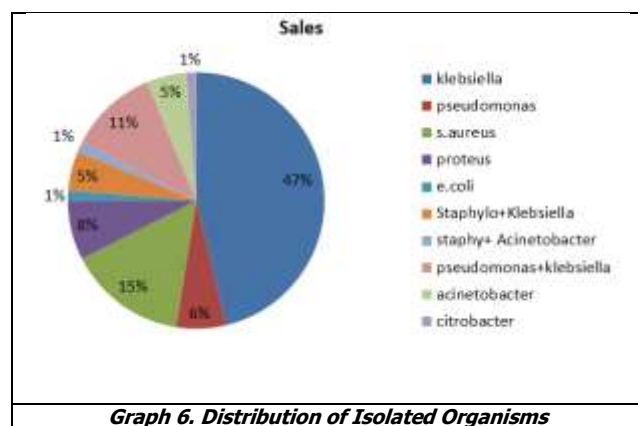
In patients who suffered death, most of them died in their 1st to 5th post burn day (63.3%), 6% died in less than 1 day and 30.4% died after 5 days

Hospital Stay in Discharged

In patients who were discharged, most of them stayed for 20 to 40 days in the hospital (45.5%) 36.3% patients stayed for > 40 days. 18.2% patients were discharged in less than 20 days

Culture Organism

Most common organism isolated from the burns wound after four days was klebsiella followed by staphylococcus.



Graph 6. Distribution of Isolated Organisms

DISCUSSION

In our study, out of 205 patients, females were predominantly involved consisting of 67.8%. This was consistent with many reference studies^{15,16,17,18,19,20} (females of 87.5%). From the present study, females were more commonly involved in burn injuries. So females should be focused more during health education in preventing burns, their activities to be addressed and accordingly modulated. In the present study, the most common age group involved in burns was 21 to 40 years accounting to 71.9%, followed by the age group of >60 years accounting

to 14.3%. These results were consistent with the following studies.^{15,16,17,21,22,23} The age group of 21 to 40 years was the most productive population of the society with females being involved in household works and males being bread winners for their families, thus predisposing this age group more vulnerable for burns. In the present study, most patients were from a rural community with 77.6%.^{15,16,24} references correlate with this finding. As the present study was done in a tertiary teaching hospital which meet the needs of a large rural population, more burn patients from the rural communities was not surprising.

The present study focused that most of the victims were illiterates with 77.6%. The results were consistent with references.^{17,25} Our present study showed that most illiterates sustained accidental burns. Precautions of fire-related activities can be a cause of the high incidence of accidental burns in illiterates. In literates, there was a relatively high incidence of suicidal burns (total number of literates were 48, suicidal burns were 25, and accidental burns were 23). Victims with only primary education were found to have more suicidal ideas (18 suicides in 30 primary educates). Psychosocial education at primary level can reduce suicidal thoughts. Improving the literacy rate in the community can give a good impact on reducing the incidence of burns. 69.4% patients of our present study belong to class 5 of Kuppaswamy socioeconomic classification.^{17,18,24,25} references pointed out the high incidence of burns in low socioeconomic groups. This indicated that areas with more number of people from low socioeconomic status should be focused on regular fire safety education to prevent accidents. In the present study, accidental burns were more common (57.1%) and suicidal burns constituted 42.9%.^{15,17,18,19,22,23,25,26,27,28} reference studies showed accidental burns were more common.

In our present study, accidental burns were more common in age groups less than 20 years and more than 40 years when compared to suicides. Accidental burns were more common in females (62.4%), in the rural population and illiterates. So accidental burns can be prevented by addressing illiterates of rural population with low socioeconomic status between age groups >40 years and less than 20 years. Suicidal burns were found to be 42.9% in our study, more common in females (75%) of 21 to 40 years of age group and literates. So addressing literates within age groups 21 to 40 years regarding psychosocial behavior, stress management, and personality development skills can decrease suicides. Among a total of 66 male victims, 57 males were coolies by occupation (86.4%) and nine male victims are dependents (13.6%). In females, most of the females were housewives (71.2%) followed by dependent population (23%) followed by female coolies followed by working ladies.¹⁵ and¹⁸ pointed that housewives were commonly involved. Regarding suicidal burns, pouring kerosene was the most common mode of suicide in females (100%) and males (20 males used kerosene, and two victims used petrol). These results correlated with the study by Kumar V et al.²⁹ In accidental burns, most of the burns were due to the dry flame. These results showed a

relationship with many studies like²⁴ of 38.5%,¹⁶ study of 82.3%, study²⁵ with 81%, and many other studies,²⁶ with 67.9%,¹⁸ with 92%,²² with 76%,²⁰ with 60.1%,²³ with 82.2%.

	% of Females	Mean Age	Rural (%)	Illiterate (%)	Accidental Burns (%)	Mortality (%)
Present Study	67.8	21 to 40 yrs.	77.6	77.6	57.1	73.2
Shanker Gowri, Naik Vijaya, Rajesh et al ¹⁵	52.63	29.32 yrs.	58.58	-	81.15	31.58
RR Shanmugakrishnan Narayanan V et al ¹⁶	58.7	31 yrs.	68	-	-	57.33
Gowri shanker, naik VA, Powar et al ¹⁷	54.7	27±15 yrs.	-	30.5	81.6	41.6
Subramanyam M et al ¹⁸	57	-	-	-	79.4	56.5
Kumar V, Mohanty M K, Kanth S et al ¹⁹	74.8	-	-	-	75.8	-
KumarS, Ali W, Verma AK et al ²⁰	87.5	-	-	-	-	-
ArpanM, Amarjyothi P et al ²¹	-	21 to 30 yrs.	-	-	-	-
Singh D singh A et al ²²	-	21 to 40 yrs.	-	-	80	-
Kumar N, kanchan T, Unnikrishnan B et al ²³	-	32 ± 3 yrs.	-	-	79.2	-
Khongwar D, Hajong R, Saikia J et al ²⁴	-	-	69	-	-	75
Jaya Raman V, Ramakrishnan KM et al ²⁵	--	-	-	39.5	79.6	52.33
Gupta M gupta Ok et al ²⁶	-	-	-	-	95.5	48.3
Ambade V N godbole HV et al ²⁷	-	-	-	-	75	-
Ganesamoni S, Kate V, Sadasivan et al ²⁸	-	-	-	-	52.5	60.8
Kumar V et al ²⁹	-	-	-	-	-	40.9
Sarma BP, Sarma N et al ³⁰	-	-	-	-	-	18.3

Table 5. Comparison of the Present Study with Various Studies

In males who sustained accidental burns, the dry flame burns with clothe involvement (27.3%) was the most common mode. It was followed by kerosene stove (15.9%), and gas stove blast (15.9%), followed by gas stove (13.6%), and crackers (13.6%), then by rescue act (9.2%) then followed by scalds (4.5%). Among illiterate males from rural population, use of fire for warmth was the most common cause. In our study, accidental burns in females (73 cases) were due to kerosene stove leading to catch of fire to clothes (42.5%), followed by gas stove blast (32.3%), followed by the gas stove with clothing involvement (17.8%), followed by scalds (6.8%). Similar results were seen in studies of reference.^{16,30,22,27} Addressing young homemakers about kitchen safety, use of advanced/good quality kitchen utensils, and fire safety precautions can help in reducing accidental burns in females. In the present study, all suicidal burns (100%) occurred at their residence. Even in accidental burns, most of the events occurred at their residence, followed by the workplace. Shankar Gowri and Naik

Vijaya et al study showed that 97.5% of cases occurred at their residence in females, but in males, most of the events occurred at outdoor (36.11%).^{18,23,24,25,26,30} studies showed that most burns occurred at home/residence. Most suicidal burns occurred at night-time (43.2) as people remain lonely. Most accidental burns occurred in the evening (29.5%), as this was the time when they start preparing

food for dinner. Gowri Shanker Vijaya A Naik and Rajesh Powar et al.¹⁷ study showed that most of the burns occurred at night of 31%. Singh D. Singh²² A et al. study showed that in females, most burns occurred between 5 am to 11 am, but in males, most burns occurred at 11 pm to 5 am. In the present study, most of the victims sustained less than 50% TBSA (total body surface area) burns (27.3%) followed by TBSA 50% to 70% (26.8%). These results correlated with reference studies.^{15,17,24,28} In the present study, out of 88 suicidal burns studied, 31 victims sustained 71 to 90% TBSA, and another 31 victims sustained >90% TBSA. It was found that most of the suicidal burns caused involvement of >70% TBSA. In accidental burns, out of 117, 46 victims sustained only less than 50% TBSA burns. So, most of the accidental burns caused TBSA less than 50% burns. In the present study, the mortality of burns victims was found to be 73.2%. Reference studies^{16,18,24,25,28} documented mortality of >50%. High mortality in our present study can be explained by more number of victims with more TBSA. In our present study, victims within age groups more than 60 years had the highest mortality of 88.5%, followed by victims within the age group of 21 to 40 years with mortality of 75.7%. Age group within 12 to 20 years had the least mortality of 50%. Regarding sex-related mortality, in females, the mortality was 67.8%, and in males, the mortality was 32.2%. Regarding mode of injury-related mortality, suicidal burns (mortality rate of 92.1%) had more mortality when compared with accidental burns (mortality of 58.9%). These results can be compared with Kumar N Kanchen T Unnikrishnan et al.²⁸ study. It was found that mortality was high in female sex and suicidal burns.

Our present study showed that in TBSA <50%, mortality was 16% and in victims with TBSA 51 to 70%, mortality was found to be 83.7%, but in victims with TBSA >70%, mortality was 100%. Gupta M Gupta OK et al.²⁶ also quoted that in victims with TBSA >40%, mortality was 80% but in victims with TBSA >70%, mortality was 100%. Subrahmanyam M et al.¹⁸ also showed that in victims with >70% TBSA, death was 100%. So, during mass casualty triage, victims with TBSA of 51 to 70% should be given prior medical attention. In our present study, among the patients who suffered death, most death occurred in less than 3 post burn days (37.5%), followed by 3 to 5 post burn days (32%). Overall, most of the deaths took place in within 5th post burn days, contributing to 69.5%. Kumar V et al²⁹ study showed that most deaths occurred within 1 day in suicidal burns. Studies with reference^{19,20,22} study showed that majority of deaths occurred within 1st week. In patients who survived, most of the patients (45.5%) stayed in the hospital for 20 to 40 days, about 36.3% for >40 days morbidity. 18.2% for <20 days. In our study, the most commonly isolated organism from burns wound was Klebsiella, followed by staphylococcus, followed by pseudomonas and Klebsiella. Institutional wise study of culture organism and their antibiotic resistance pattern helps combat sepsis in early-stage and helps in decreasing the mortality.

CONCLUSIONS

Thermal burns are a significant public health problem with a mortality of 73.17%. The ignorance about safety measures is causing these burn injuries. High-risk groups of 21 to 40 years of age should be educated regarding fire safety. Personality development programs targeting illiterate females of age group 21 to 40 years can reduce suicidal burns. Improvement of literacy can decrease the incidence of burns by improving the psychological status and increasing the awareness of the complications. Homemakers involved in cooking should be taught safety and measures to prevent accidental burns. Newer kitchen devices with safety measures should be encouraged. Fire safety should be of prime importance during cooking in the evening hours. Males should be educated regarding safety against dry flame burns, their prevention, and steps used in early control of dry flame burns. Patients with TBSA >50% should be promptly resuscitated and appropriately managed as the mortality is increased ten-fold when compared with patients with TBSA <50%. People should be educated that early medical attention improves survival and early post-burn time should not be wasted trying home remedies. While managing burn victims, focus should be on initial resuscitation, nutrition, and wound management. Deformities and contractures affect normal functioning of the individual, and every step to prevent them should be focused. Empirical therapy with antibiotics against *Klebsiella* and *staphylococcus* is useful.

REFERENCES

- [1] Forjuoh SN. Burns in low-and middle-income countries: a review of available literature on descriptive epidemiology, risk factors, treatment, and prevention. *Burns* 2006;32(5):529-537.
- [2] Peck MD, Kruger GE, van der Merwe AE, et al. Burns and fires from non-electric domestic appliances in low and middle-income countries Part I. The scope of the problem. *Burns* 2008;34(3):303-311.
- [3] Burns fact sheet updated august 2017. <http://www.who.int/mediacentre/factsheets/fs365/en/>
- [4] Hwee J, Song C, Tan KC, et al. The trends of burns epidemiology in a tropical regional burns center. *Burns* 2016;42(3):682-686.
- [5] Peck M, Pressman MA. The correlation between burn mortality rates from fire and flame and economic status of countries. *Burns* 2013;39(6):1054-1059.
- [6] Mabrouk A, Maher A, Nasser S. An epidemiologic study of elderly Burn patients in Ain Shams University Burn Unit, Cairo, Egypt. *Burns* 2003;29(7):687-690.
- [7] Mashreky SR, Rahman A, Chowdhury SM, et al. Non-fatal burns a major cause of illness: findings from the largest community-based national survey in Bangladesh. *Inj Prev* 2009;15(6):397-402.
- [8] Peck MD. Epidemiology of burns throughout the World. Part II: intentional burns in adults. *Burns* 2012;38(5):630-637.
- [9] Laloë V. Patterns of deliberate self-burning in various parts of the world. A review. *Burns* 2004;30(3):207-215.
- [10] Hussain A, Dunn K. Burn related mortality in Greater Manchester: 11-year review of Regional Coronial Department Data. *Burns* 2015;41(2):225-234.
- [11] Golshan A, Patel C, Hyder AA. A systematic review of the epidemiology of unintentional burn injuries in South Asia. *J Public Health (Oxf)* 2013;35(3):384-396.
- [12] Sarma BP. Prevention of burns: 13 years' experience in Northeastern India. *Burns* 2011;37(2):265-272.
- [13] Herndon DN, Tompkins RG. Support of the metabolic response to burn injury. *Lancet* 2004;363(9424):1895-1902.
- [14] Pham TN, Cancio LC, Gibran NS. American Burn Association practice guidelines burn shock resuscitation. *J Burn Care and Res* 2008;29(1):257-266.
- [15] Gowri S, Vijaya NA, Powar R, et al. Epidemiology and outcome of burn injuries. *J Indian Acad Forensic Med* 2012;34(4):312-314.
- [16] Shanmugakrishnan RR, Narayanan V, Thirumalaikolundusubramanian P. Epidemiology of burns in a teaching hospital in south India. *Indian Indian J Plast Surg* 2008;41(1):34-37.
- [17] Shankar G, Naik VA, Powar R. Epidemiological study of burn injuries admitted in two hospitals of North Karnataka. *Indian J Community Med* 2010;35(4):509-512.
- [18] Subrahmanyam M. Epidemiology of burns in a district hospital western India. *Burns* 1996;22(6):439-442.
- [19] Kumar V, Mohanty MK, Kanth S. Fatal burns in Manipal area: a 10 year study. *Journal of Forensic and Legal Medicine* 2007;14(1):3-6.
- [20] Kumar S, Ali W, Verma AK, et al. Epidemiology and mortality of burns in the Lucknow Region, India--a five-year study. *Burns* 2013;39(8):1599-1605.
- [21] Mazumder A, Patowary A. A study of pattern of burn injury cases. *J Indian Acad Forensic Med* 2013;35(1):44-46.
- [22] Singh D, Singh A, Sharma AK, et al. Burn mortality in Chandigarh zone: 25 years autopsy experience from a tertiary care hospital of India. *Burns* 1998;24(2):150-156.
- [23] Kumar N, Kanchan T, Unnikrishnan B, et al. Clinico-epidemiological profile of burn patients admitted in a tertiary care hospital in coastal South India. *J Burn Care Res* 2012;33(5):660-667.
- [24] Khongwar D, Hajong R, Saikia J, et al. Clinical study of burn patients requiring admission: a single-center experience at North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences. *J Family Med Prim Care* 2016;5(2):444-448.
- [25] Jayaraman V, Ramakrishnan KM, Davies MR. Burns in madras, India: an analysis of 1368 patients in 1 year. *Burns* 1993;19(4):339-344.

- [26] Gupta M, Gupta OK, Yaduvanshi RK, et al. Burn epidemiology: the Pink City scene. *Burns* 1993;19(1):47-51.
- [27] Ambade VN, Godbole HV. Study of burn deaths in Nagpur, Central India. *Burns* 2006;32(7):902-908.
- [28] Ganesamoni S, Kate V, Sadasivan J. Epidemiology of hospitalized burn patients in a tertiary care hospital in south India. *Burns* 2010;36(3):422-429.
- [29] Kumar V. Burnt wives--a study of suicides. *Burns* 2003;29(1):31-35.
- [30] Sarma BP, Sarma N. Epidemiology, morbidity, mortality and treatment of burn injuries--a study in a peripheral industrial hospital. *Burns* 1994;20(3):253-255.