

**Original Research Article****An Autopsy Based Study of Burn Deaths with Histopathology of Kidneys in West Bengal**

Authors

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Email: [dralakeshalder@gmail.com](mailto:dralakeshalder@gmail.com), Telephone: +919804642412**ABSTRACT**

Every year a large number of deaths occur in India due to burn injuries. Burn deaths are a major public health problem in our country. Aim of this study is to find out the epidemiology of death due to burn injury associated with histopathological changes of kidneys in a medical college mortuary in eastern India. An autopsy-based cross-sectional study conducted from 1st April, 2013 to 31st March, 2014 in the department of Forensic and State Medicine, Nil Ratan Sircar Medical College, Kolkata. During this period total number of 2813 autopsies were carried out. Out of these 318 cases were associated with burn injury among which 100 burn injury cases were selected randomly and analyzed.

The majority of deaths (34%) occurred between 21 yrs to 30 yrs age group with preponderance of female (89%), maximum number of patients (33%) died within 2-5 days of following burn injury. The majority of burn incidence (57%) were accidental in nature. Macroscopically kidneys look congested (77%) most of the cases. Histopathological sections of kidneys showed interstitial oedema (34%) followed by tubular degeneration (29%).

**Keywords:** Burns, Epidemiology, Neurogenic shock, Septicemia, Body surface area, Histopathology.

**INTRODUCTION**

Man has invented fire in ancient time of human civilization. Fire was perhaps man's first double-edged sword, as it has developed as well as destroyed mankind from ancient age. Burn injuries the common manifestation of fire are one of the leading causes of death in all medico-legal cases in India. About 60,000 people suffer from burns annually in India, more than 50,000 come to

hospitals and about 10,000 succumb to thermal injuries <sup>[1]</sup>. India is the only country in the world where fire is classified among the fifteen leading causes of death in 1998 standing fourteenth in the list <sup>[2]</sup>. They are the 4th most common type of trauma worldwide, following traffic accidents; falls and interpersonal violence <sup>[3]</sup>. According to the World Health Organization, 238,000 individuals died of fire-related burns in 2000, and

95% of these deaths occurred in low and middle-income countries [4] and [5]. Histopathological examination of kidneys by autopsy reveals the truth from darkness of false interpretation about cause of death by observing the microscopical findings of kidneys rather than naked eye examination following burn injury.

## MATERIALS AND METHODS

The present retrospective Observational mortuary based study was carried out in the Department of Forensic Medicine & Toxicology, NRS Medical College & Hospital, Kolkata during the period from April 2013 to March 2014 and total 100 cases with burn injuries was chosen randomly out of 318 cases for autopsy used as a material for study purpose and collection of tissues for Histopathological examination. The information regarding age, sex, residence, occupation, time of incidence etc was gathered from the police inquest reports, hospital records, etc. Meticulous and complete post mortem examination was conducted on all the bodies autopsied with attempts made to establish the cause and circumstances leading to death. Decomposed and grossly charred bodies were excluded in this study. Tabulation, data and statistical analysis was done in the department of Forensic Medicine in collaboration with department of pathology.

## RESULTS

A total of 2813 medico-legal autopsies were conducted by the department during the period of study. Deaths due to burns comprised of 318 (11.3%) cases. The age group of 21-30 years accounted for the maximum number of cases(34%), followed by the age group 10-20 years 24% cases and then by 31-40 years 21% cases. (Table 1)

Out of 100 cases in the present study, 11 cases were Male (11%) and 89 cases were female (89%), which reflects a male: female ratio of 1:8.09. (Table 2)

The place of occurrence of burn injury of the deceased as per the inquest reports prepared by

the I.O, were mostly occurred at In-Law's house 75% cases. In 19% cases injuries occurred at paternal house, 5% cases at workplace & 1% case at unknown place. (Table 3)

Maximum number of burn incidences i.e. 35% occurred at 12.01-18.00 hrs; followed by 31% cases at 6.01-12.00 hrs. The number of incidences are 26% in between 18.01-23.59 hrs & minimum 8% at 00.00-6.00 hrs.(Figure 1)

A peculiar finding of the present study is that, if distribution of study population is compared between manner of death & factors causing burn injury, the majority of cases (57%) are accidental in nature which corroborates with the findings of stove burst (30%) & catch fire during cooking or prayer (23%). Next common circumstances of death are suicidal (39%) cases which tallies with the causative factor pouring kerosene oil (39%). (Table 4 & Figure 2)

Regarding the period of survivability the majority of deaths 33% cases due to burn occurred within 2-5 days followed by 29% cases in 6-10 days, 23% cases in <1day, 10% cases in 11-20 days, 3% cases in >30 days and minimum 2% cases in 21-30 days. (Table 5)

From the study it was observed that the major cause of death due to burn was Neurogenic shock in 54% cases, followed by Septicemia& pneumonia (23%), asphyxia and inhalation injury (12%), Hypovolaemic shock and Toxemia (7%) and multi-organ failure (4%).(table 6)

Out of 100 cases in the present study in 37 cases (37%), total body surface area involved was more than 70% but less than 90%, in 34 cases (34%) burned area was more than 50% but less than 70%, followed by 13 cases (13%) involved area more than 30% but less than 50% and the percentage of burned area was less than 30 in only 7 cases (7%), and in 9 cases (9%) almost whole body surface area i.e., more than 90% was injured.(Figure 3).

Macroscopically in 77% cases kidneys were congested and in 12% cases both the kidneys were pale in appearance and 7% cases granular in appearance.(Table7)

Histopathological sections of kidneys shown congestion 77 cases followed by interstitial edema in 34 cases, tubular degeneration in 29 cases, glomerular degeneration in 3 cases, acute tubular necrosis in 20 cases, normal in 32 cases.(Table 8)

**Table-1:** Distribution of the study population according to the age (n=100).

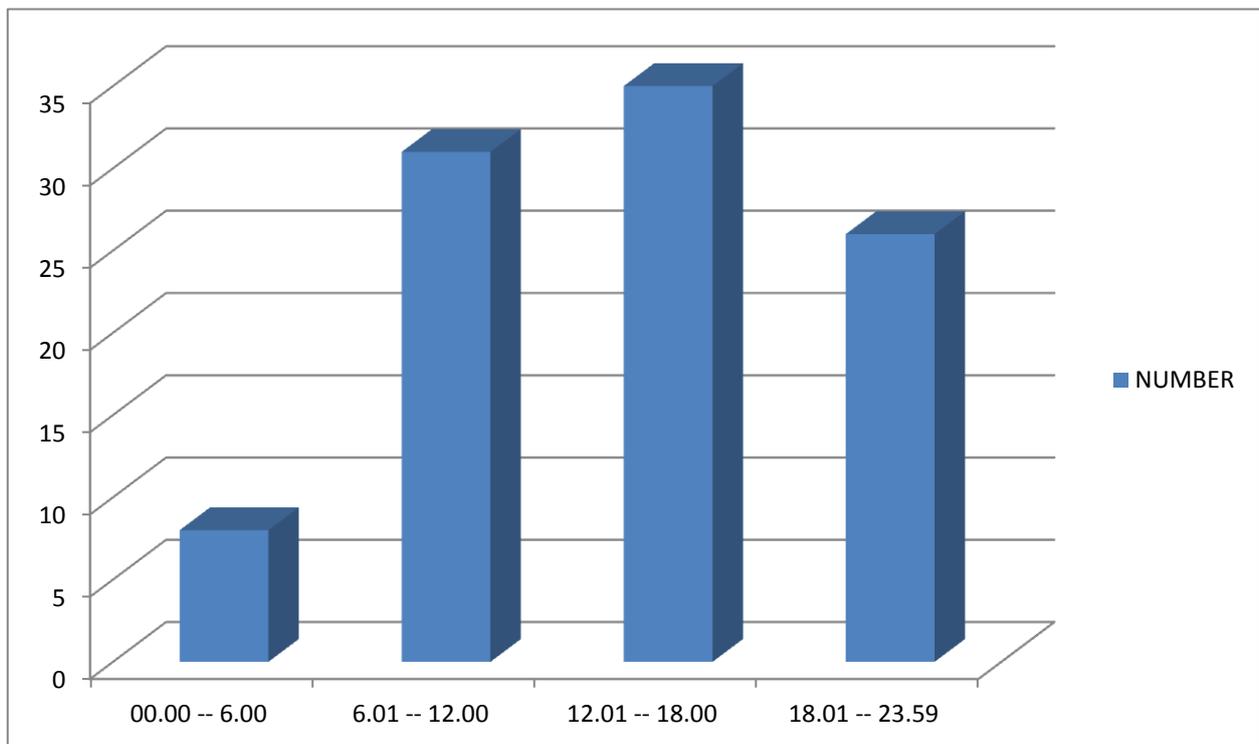
Age group (in years)	Number of cases	Percentage (%)
< 10	1	1
10 to 20	24	24
21 to 30	34	34
31 to 40	21	21
41 to 50	5	5
51 to 60	6	6
>60	9	9
Total	100	100

**Table-2:** Distribution of study population according to sex (n=100)

Total Autopsy	Sex	Number of burn cases	Percentage (%)
2813	Male	58	18.24
	Female	260	81.76
	Total	318	100
100 case selected randomly out of 318 cases	Male	11	11
	Female	89	89
	Total	100	100

**Table-3:** Distribution of according to the place of occurrence study population (n=100)

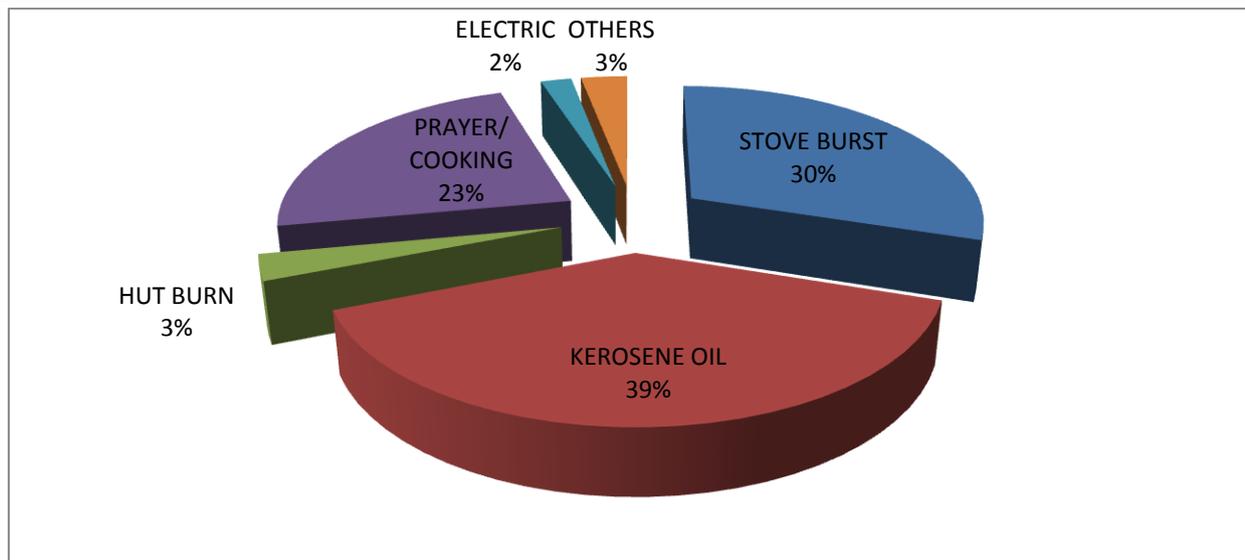
Place of occurrence	Number of cases	Percentage (%)
Paternal house	19	19
In-Law's house	75	75
Workplace	5	5
Others	1	1
Total	100	100



**Figure-1:** Diagrammatic representation of cases according to the time of burn injury (n=100)

**Table-4:** Distribution of study population according to the manner of death (n=100).

Manner of death	Number of cases	Percentage (%)
ACCIDENTAL	57	57
SUICIDAL	39	39
HOMICIDAL	1	1
UNKNOWN	3	3
TOTAL	100	100



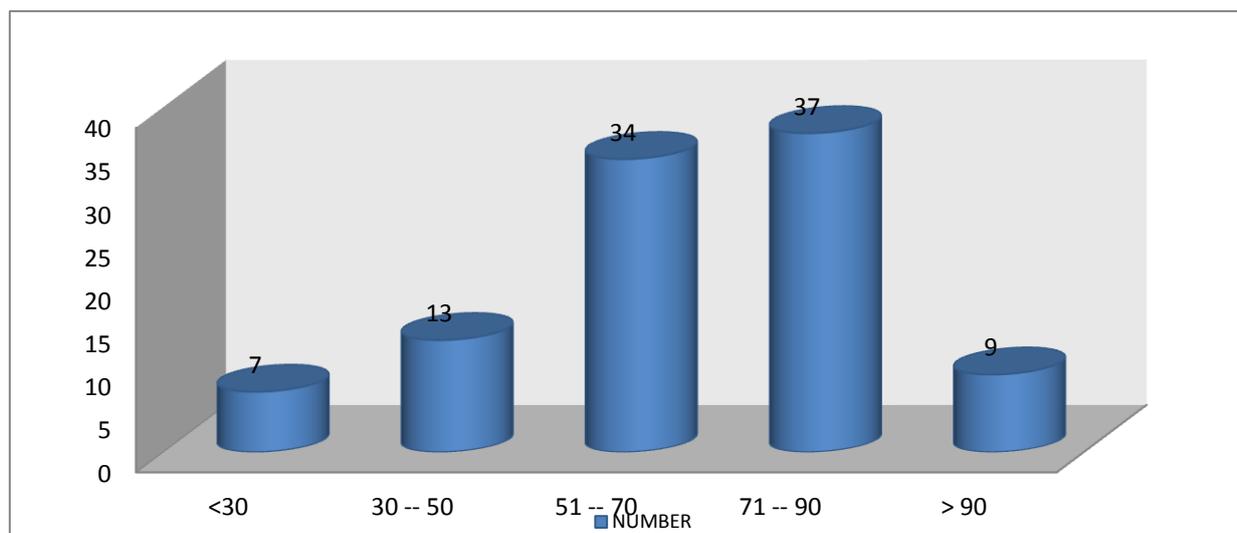
**Figure-2:** Diagrammatic representation of cases according to the factors causing burn injury (n=100)

**Table-5:** Distribution of study population according to the period of survivability (n=100)

Period of survivability	Number of cases	Percentage (%)
< 1 Day	23	23
2--5 Days	33	33
6-- 10 Days	29	29
11-20 Days	10	10
21--30 Days	2	2
>30 Days	3	3

**Table- 6** Distribution of study population according to Cause of burn death

Cause of Death	Number of cases	Percentage
Neurogenic Shock	54	54
Septicemia and Pneumonia	23	23
Asphyxia	12	12
Hypovolumic shock and Toxaemia	7	7
Multiorgan failure	4	4



**Figure-3:** Diagrammatic representation of cases according to the percentage of body surface area burnt (n=100).

**Table 7:** Distribution of study population according to the macroscopic findings of kidneys

Macroscopic Feature	Number of cases	Percentage (%)
Normal	2	2
Congestion	77	77
Pale	12	12
Granular	7	7
Pus	1	1
Cyst/SOL	1	1
Total	100	100

**Table-8:** Distribution of study population according to the Histopathological findings of kidneys

HISTOLOGICAL FINDINGS	NUMBER
NORMAL	32
INTERSTITIAL OEDEMA	34
CONGESTION	77
TUBULAR DEGENERATION	29
TUBULAR REGENERATION	3
VASCULAR SCLEROSIS	8
GLOMERULAR DEGENERATION	3
TUBULAR NECROSIS	20
PYELONEPHRITIS	1

## DISCUSSION

The most important one is seeking for evidences of the incidence of Acute Kidney Injury (AKI) as a complication of burn injury causing deaths, which can be diagnosed or confirmed with the help of ancillary investigations and Histopathological examination which play a vital role in autopsy.

So the study reflects the fact that the majority of deaths due to burn injury between 10yrs to 40yrs of age (79%), with peak incidence in 21 to 30yrs (34%) of age group. Moreover, it closely tallies with the observations of N.P.Zanjad et.al (2007)<sup>[6]</sup> & S. Sevitt<sup>[7]</sup>. Kamran Soltani et al<sup>[6]</sup> observed the highest incidence of burns in the age group of 16-25 years. Singh et al<sup>[8]</sup> reported that most burn deaths occurred in the age group of 21-40 years (66.1%), with female preponderance (61%) in all age groups except in the extreme age groups.

Out of 100 cases in the present study, 11 cases are Male (11%) and 89 cases are female (89%), which reflects a male: female ratio of 1:8.09 and during the period April 2012 to March 2013, 318 cases of burn death of which 260 were females and 58 were males; having the female: male ratio of 4.5:1

In the similar study, N.P. Zanjad et.al (2007)<sup>[6]</sup> observed male: female ratio of 1:2.5, S. Sevitt<sup>[7]</sup> observed male: female ratio 1:1.59, which is not close to the observation in the present study [Table-2]. Dalbir Singh<sup>[8]</sup> reported that most burn deaths occurred in female (61%) in all age groups except in the extreme age groups. Similar findings was observed in studies in Delh<sup>[9]</sup>, Maharastra<sup>[10]</sup> West Bengal<sup>[11]</sup> suggesting 'female dominance'. It is a very well known fact that women are more susceptible to burn injury than men due to their place of work that is the kitchen where they are to spend a big time for the purpose of cooking foods and making tea etc.

Table-3 shown that the place of occurrence of burn injury of the deceased as par the inquest reports, mostly occurred at In-Law's house 75% cases. This reflects the circumstances of death of women with the accidental and suicidal in nature and also reflects the preponderance of dowry-deaths that are still prevalent in the rural area of West Bengal.

Figure-1 shown that the time of burn injury i.e. maximum number of incidence 35% occurred at 12.01-18.00hrs; followed by 31% cases at 6.01-

12.00hrs. So the study reflects the fact the majority of incidents happened at the day time in between 6.00hrs & 18.00hrs when people are usually engaged in domestic works in kitchen and professional works in factory.

Regarding the period of survivability Table-5 shown that 33% cases, patients died within 2-5days following burn injury due to epidermal to dermo-epidermal burn which were most painful resulting in neurogenic shock, followed by 29% cases in 6-10days. But the interesting fact that the most of the 33 cases died during that period (2-5days) when secondary shock due to fluid loss from the burned surface is the commonest cause of death according to most of the authors of different standard textbooks<sup>[12],[13],[14]</sup>. Similarly Virendra et al<sup>[22]</sup> also reported death from burns within a week in 60.8% victims. Next common period of death is 6-10 days which corresponds to the time when toxemia and sepsis are the most important factor of deaths<sup>[15],[16],[17]</sup> and 23 cases died within 24hrs of burn injury, some of them are brought dead cases and rest died few hours after admission in the hospital which corresponds to the causes of death like primary (neurogenic) shock and smoke inhalation<sup>[12]</sup>. A peculiar finding of the present study is that, if distribution of study population is compared between Table-4 (manner of death) & Figure-2 (factors causing burn injury), the majority of cases (57%) are accidental in nature corroborating with the findings of stove burst (30%) & catch fire during cooking or prayer (23%). Next common circumstances of death is suicidal (39%) cases tallies with the causative factor pouring kerosene oil (39%). Moreover, it closely matches up with the observation of N.P.Zanjad et.al (2007)<sup>[6]</sup>.

Figure-3 shown in 37% cases total body surface area involved was more than 70% but less than 90%, in 34% cases burned area was more than 50% but less than 70%, followed by 13% cases involved area more than 30% but less than 50% and the percentage of burned area was less than 30 in only 7% cases and in 9 cases (9%) almost whole body surface area i.e., more than 90% was

injured. In the similar study, N.P. Zanjad et.al (2007)<sup>[6]</sup> observed in 189 cases (41.4%), total body surface area involved was more than 80% which is very close to the observation in the present study.

Table-7 shown that the kidneys were congested macroscopically 77% cases, which is as close as the observation of a similar study done by the authors, Shinde A.B. and Keoliya A.N<sup>[18]</sup>. In 'Text book of Pathology'<sup>[19]</sup> by W.A.D. Anderson said that the gross appearance of the kidneys is not specific. There are usually some swelling and enlargement, with increase of weight. The outer and cut surfaces of the cortex are pale, but the medulla is dark or dusky and shows accentuated striations. Kidneys looked pale in 12% cases and it was mainly seen in elderly cases, and the surface of the kidneys became granular in 7% cases those survived more than 20 days.

Table-8 shown that, Histopathological changes has been detected in the kidneys, acute tubular necrosis (ATN) and tubular degeneration were present 20% and 29% cases respectively, which was as close as the observation of a similar study done by *the authors*, Shinde A.B. and Keoliya A.N.<sup>[18]</sup> and Lobna AL Juffali<sup>[20]</sup>. In all standard textbooks<sup>[12],[13],[14]</sup>, according to the most of the authors, the one of the early complication of burns is hypovolemia due marked fluid loss (mainly water and proteins) which causes hypo perfusion of different vital organs including kidneys. If this hemodynamic change is not corrected immediately, it will lead to acute renal failure (ARF) and death, which is morphologically characterized first by the reversible degenerative changes of the tubular epithelial cells and then followed by the destruction of the said epithelium, the acute tubular necrosis (ATN), and causing death due to acute renal failure. Among the delayed complications of burns, the renal failure is mainly due to ischemic nephropathy caused by renovascular occlusion and septicemia where systemic absorption of toxins in blood occurs and systemic infections after bacterial growth respectively produced at ulcerated areas after burn in both the

conditions, the clinic pathological entity is ATN [21]. This Histopathological changes are commonly seen in the periods of 2-5 days & 6-10 days survivability which is as per statements of different textbooks [15],[16],[17].

## CONCLUSION

This study ruled out importance of Histopathological examination of kidneys in burn cases. Microscopical pictures of kidney reflect both hemodynamic and metabolic changes of the injured person preceding death and guide the autopsy surgeon to rule out the opinion about the cause of death due to Hypovolaemic or septicemic shock or SIRS which ultimately leads to ARF. Data on cause of death written in the PM reports serve many purposes like it helps in assessing the effectiveness of management, provides a feedback for better treatment protocol, guides for deciding priorities of health and medical research programmers.

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## Declarations

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Conflict of interest: Nil

**Ethical approval:** The present study was approved by “Institutional Ethics Committee” of N.R.S. Medical College, Kolkata under west Bengal University of Health Sciences. All the information has been taken under consideration of medical ethical committee.

## REFERENCES

- Gupta R, Kumar V, Tripathi SK. Profile of the fatal burn deaths from the Varanasi region, India. *J Clin and Diag Res.* 2012 May (Suppl-2), 6(4): 608-611.
- Batra. A.K. Burn Mortality; Recent Trends and Sociocultural determinants in rural India *Burns.*2003; (29): 270-275.
- Pekka S, Knight B. *Bernard Knight's Forensic Pathology*, 2004, 3rd Ed, Oxford University Press Inc, New York, p322.
- World Health Organization. *Injury: A leading cause of the global burden of disease*, 2000. World Health Organization: Geneva; 2002.
- S. N.Forjuoh *Burns in low- and middle-income countries: a review of available literature on descriptive epidemiology, risk factors, treatment, and prevention* *Burns*, 32 (5) (2006), pp. 529–537.
- Zanjad N. P, God bole H V. Study of fatal burn cases in medico-legal autopsy. *Journal of Indian Academy of Forensic Medicine*, 2007; 29(3): ISSN; 0971-0973.
- Sevitt S. Distal tubular and proximal tubular necrosis in the kidneys of burned patients. *Clinical journal of Pathology*1956,Vol.9 (4), p.279-94.
- D. Singh, A. Singh, A.K. Sharma, L. Sodhi *Burn mortality in Chandigarh zone: 25 years autopsy experience from a tertiary care hospital of India* *Burns*, 24 (1998), pp. 150–156
- Sagar MS, Sharma RK, Dogra TD. Analysis of changing patterns of unnatural fatalities in south Delhi *J Punjab Acad Forensic Med Toxicology* 2013;13(2) 72 (comparative study of 1977 – 80 & 1988 – 91). *J For Med Toxicol* 1993;10(1):21- 5.
- Chavan KD. Study of suicidal deaths in rural bead districts of Maharashtra. *Int J Med Toxicol Legal Med* 1999;1:29-31.
- Chakraborty S, Bisoi S, Chattopadhyay D, Mishra R, Bhattacharya N, Biswas B. A study on demogra phic and clinical profile of burn patients in an Apex Institute of West Bengal. *Indian J Public Health* 2010; 54:27-9.
- Di Maio V J, Di Maio D. *Forensic Pathology*. 2<sup>nd</sup> ed. New York: CRC Press; 2001. Chaptel3, Fire Deaths; p.386-92.
- Gonzales T A, Vance M, Helpem M, Umberger C J. *Legal Medicine Pathology*

- and Toxicology. 2<sup>nd</sup> ed. New York: Appleton Century Crofts; 1940. Chapter 20 Thermal trauma; p.527.
14. James J P, Jones R, Kerch S B, Manlove J. Simpson's Forensic Medicine. 13<sup>th</sup> ed. London: Hodder Arnold; 2011. Chapter 17, Heat, cold and electrical trauma; p.172.
  15. Mahanta P. Modern Textbook of Forensic Medicine and Toxicology. 1<sup>st</sup> ed. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd ; 2014. Chapter 15, Thermal Injuries; p.309-15.
  16. Guharaj P V. Forensic Medicine. 2<sup>nd</sup> ed. Hyderabad: Universities Press (India) Private Limited; 2012. Chapter 12, Injuries from Physical Agents; p. 195.
  17. Vij K. Textbook of Forensic Medicine and Toxicology. 3<sup>rd</sup> ed. New Delhi: Published by Elsevier; 2005. Chapter 9, Thermal Deaths; p.250.
  18. Shinde A B, Keoliya A N. Study of burn deaths with special reference to histopathology in India. Indian Journal of Basic & Applied Medical Research, 2013; 8(2): 1153-1159.
  19. Anderson W A D. Textbook of Pathology. 2<sup>nd</sup> ed. St. Louis: The C.V Mosby company; 1953. Chapter 21 The Kidneys; p.588-90.
  20. Lobna Juffali A L. MSc. Candidate. Clinical pharmacokinetics in burn patients. Faculty. Ksu. Edu. Sa/ hisham/ documents/ PHCL-510/ students works/ clinical.
  21. Kumar V, Cotran R S, Robbins S L. Robbins Basic Pathology. 7<sup>th</sup> ed. New Delhi: Published by Elsevier; 2004. Chapter 4,8,14, Hemodynamic Disorders, Thrombosis, and Shock; Environmental Diseases; The Kidney and its Collecting System; p.99,286,531-32.
  22. K.Virendra, K.M. Manoj, K. Sarita Fatal burns in Manipal area: a 10 year study J Forensic Leg Med, 14 (2007), pp. 3–6.