

Study of Causes of Death, Histopathological and Microbiological Changes in Cases of Burns Brought for Autopsy at Gandhi Medical College, Bhopal

Rajendra Kumar Mourya¹, Priyamvada Kurveti Verma², Garima³, Pawan Rathor⁴, Dheeraj Singh Verma⁵

¹Assistant Professor, Department of Forensic Medicine and Toxicology, Government Medical College, Shivpuri, Madhya Pradesh, ¹Ex- resident, ²Associate Professor, ⁵Demonstrator; Department of Forensic Medicine and Toxicology, Gandhi Medical College, Bhopal, ³Associate Professor, Department of Microbiology, Gandhi Medical College, Bhopal, ⁴Ex-Resident, Department of Pathology, Gandhi Medical College, Bhopal, Presently, ⁵Medical Officer, District Hospital, Shivpuri, Madhya Pradesh

Abstract

Death may occur immediately after burns or may get delayed for days & weeks, where burns may not be the actual cause of death; but its sequels & its complications leads to death. In such cases, determination of exact cause of death may be difficult. Hence, this study was aimed to find out the causes of death in burn cases during autopsy utilizing histopathology and microbiology & its comparison with clinical causes of death. All cases of burns autopsied at Gandhi Medical College & associated Hamidia Hospital Bhopal, for a period of 1.6 years were included in the study.

Out of 100 cases included, 45 (45.00%) showed the cause of death as septicemia, followed by hypovolemic shock in 30 (30.00%) cases, hypovolemic shock with acute renal failure seen in 4% cases. Bronchopneumonia was seen in 29% cases, out of which 12% cases were associated with septicemia. Multiple Organ Failure with septicemia was seen in 11% cases and in 2 (2.00%) cases of spot death; cause was neurogenic shock with asphyxia.

On histopathological examination, lungs revealed congestion and alveolar edema in 48% cases; Liver showed sinusoidal congestion in (39 %) cases; Kidneys showed hydropic degeneration of tubules in 62 % cases; being the most common findings. Pseudomonas aeruginosa was the commonest isolate, 61% in blood and 47% in pus culture. So, there is need of strict and 100% implementation of aseptic measures in burn wards, along with adequate supply of appropriate drugs specially antibiotics to the all hospitals.

Keywords: burns, cause of death, septicemia, histopathology, culture.

Introduction

A severe burn injury is the most devastating injury a person can sustain and yet hope to survive. Burns are

the fourth most common type of trauma worldwide, following traffic accidents, falls and interpersonal violence.

Death may occur immediately after burns or may get delayed for days & weeks, where burns may not be the actual cause of death; but its sequels & its complications may result in death. The patient may survive in the initial post burn period, progressing satisfactorily and may even apparently become normal; even then sometimes death may occur suddenly as a result of sequel, complication

Corresponding Author:

Dr. Priyamvada Kurveti Verma,

Associate Professor, Department of Forensic Medicine and Toxicology, Gandhi Medical College, Bhopal, Madhya Pradesh, India, Phone- 7879793466, 8839367975, Email- rayan.priya@gmail.com

or some remote intervening cause.

Determination of exact cause of death may be difficult as external appearance may show the effect of burn as a cause, but internal findings may point to some other causes of death; for example, shock, electrolyte imbalance, septicemia, renal failure, hepatic failure, lung dysfunction and so many other causes.

So, to ascertain the exact cause, it needs meticulous autopsy to be done by autopsy surgeon along with gross and microscopic examination of relevant organs by pathologist, blood and pus culture by microbiologist & toxicological analysis in forensic science lab.

Hence, this study was designed to find out the causes of death in burn cases during autopsy; utilizing histopathology and microbiology & its comparison with clinical causes of death.

Material and Methods

Present study was carried out in the Department of Forensic Medicine and Toxicology in collaboration with Department of Pathology and Department of

Microbiology at Gandhi Medical College & associated Hamidia Hospital Bhopal, for a period of 1.6 years

All the burn cases either admitted or directly brought dead to the Hamidia Hospital Bhopal, cases with proper hospital records and the cases of spot death were included. Out of those, 100 cases were selected for the study by simple random sampling. Burn cases without proper hospital records, unknown, mutilated, decomposed bodies were excluded.

The relevant data was collected using a questionnaire that included demographic profile of deceased, history taken from the relatives and police, inquest papers, hospital records and autopsy findings. After gross examination, sections were taken from lungs, liver and kidneys (with due consent obtained from relatives). Histopathological examination of the sections was performed at department of Pathology; and blood and pus culture was done at department of Microbiology, Gandhi Medical College, Bhopal.

Results and Discussion

On analyzing the data, following results were obtained:

Table-1: Causes of Death in Burn cases revealed after autopsy

Cause of Death	Male	Female	Total
Asphyxia	0	0	0
Neurogenic Shock	3	8	11
Asphyxia with Neurogenic Shock	0	2	2
Hypovolemic Shock	9	17	26
Hypovolemic Shock with Acute Renal Failure	3	1	4
Septicaemia	3	6	9
Septicaemia with Acute Renal Failure	1	7	8
Bronchopneumonia	2	2	4
Bronchopneumonia with Acute Renal Failure	5	3	8
Bronchopneumonia with Septicaemia	8	4	12
Bronchopneumonia with Acute Renal Failure with Septicaemia	1	4	5
Multi Organ Failure	0	0	0
Multi Organ Failure with Septicaemia	2	9	11
Total	37%	63%	100%

In majority of cases i.e. 45 (45.00%) the cause of death was septicemia, followed by hypovolemic shock in 30 (30.00%) cases and hypovolemic shock with acute renal failure in 4% cases. Bronchopneumonia was seen in 29% cases in which 12% cases were associated with septicemia. Multiple Organ Failure with septicemia was seen in 11% cases and in 2 (2.00%) cases of spot death; the cause was neurogenic shock with asphyxia.

Burn shock is rapidly developing hypovolemic circulatory failure seen in the first 72 hours after burn injury.⁴ Infectious Complications are currently the principal cause of in-hospital death in burn victims. The infection usually is airborne and less often hematogenous from wound infection. Septicemia is another common cause of death and has a high mortality in burns patients. It usually is secondary to infection of the burn site.¹⁷

Septicemia was common in victims who survived for more than 3 days. Similar observation were made by Harish D et al (2013)⁵ in their study on 381 burn cases, where cause of death was given as Burns shock in 31 (08%) cases, Toxemia & shock in 67 (18%) cases and Septicemia in 269 (71%) cases. Chawla R et al (2011)² and Ande JD et al (2013)¹ also observed the major cause of death as septicemic shock in 56% cases and septicaemia as the leading cause of death in 52.38% cases; respectively.

Khandare SV and Pawale DA (2014)⁷ also observed cause of death as septicaemia in 76.7% cases and shock due to burns in 20% cases. Pawar V et al (2014)¹⁴ studied 348 admitted burn cases out of which 196 patients died during treatment. Commonest cause of death was septicemia alone or in combination with other causes constituting (84.69%) cases.

On the contrary, Mazumdar A and Patowary A (2013)¹⁰ observed shock as the most common cause of death (122 cases), followed by exhaustion (62 cases) and septicemia (58 cases). Mangal HM et al (2007)⁹ observed maximum percentage of victims 166 (55.33 %) died within first 24 hours due to hypovolemic shock (burns- shock). Only 16 victims (5.33 %) were found dead on spot due to neurogenic shock, while 19 victims (6.33%) died within a duration of 24-36 hours, followed by 46 victims (15.33%) in 36-72 hours, 31 (10.33%) in 3-7 days and only 22 victims (7.33%) could survive more than a week.

In this study, Bronchopneumonia was seen in 29% cases; which is similar to the study of Mostafa M. Afify et al (2006-2010)¹² who observed that the majority of deaths occurred within a week (82%) and most of the victims died from neurogenic shock (54.7%) followed by Septicemia and pneumonia (23.5%). Kumar and Tripathi (2004)⁸ in their study reported Bronchopneumonia in 22 (20%) cases.

Table-2: Clinical Causes of Death given in case files

Clinical Cause	Male	Female	Total
Asphyxia with Inhalational Injury	0	0	0
Shock (Neurogenic/Hypovolemic)	9	15	24
Multiple Organ Failure	22	39	61
Multiple Organ Failure with Septicaemia	06	09	15

Soot Particles	No. of cases	Percentage
Present (yes)	7	7.00%
Absent (no)	93	93 %
Total	100	100%

On studying the case files of admitted deceased, clinical causes of death mentioned were multiple organs failure in 61% cases and burn shock (neurogenic/hypovolemic shock) in 24% cases and multiple organ failure with septicemia in 15% cases. This was also seen in the study of Kallinen O, Maisniemi K et al (2012)⁶ who reported that, out of 71 burn deaths, 40% were caused by multiple organ failure (MOF). All 28 patients with multiple organs failure had acute renal failure, followed by liver damage, of which four patients had acute or chronic liver failure.

Table-3: Soot particles in Trachea

Soot particles were found in trachea in only 7 (7.00%) cases, out of 100, the rest 93% cases were devoid

of the soot particles in the trachea. This observation was different from the findings of Mazumdar A and Patowary A (2013)¹⁰ who found soot particles in trachea in 19% of cases, Das. K.C.(1998)³ who observed soot particles in trachea in 18.05% cases, Nath D (2007)¹³ who reported soot particles in trachea in 34.07% cases and Kumar and Tripathi (2004)⁸ who noted soot particles in 26% of cases studied.

Most of the victims in the present study died in the hospital after receiving treatment, which included intravenous fluid and some oral medication. Many of the cases might have occurred in some open spaces. These two may be the reason for absence of soot particles in the trachea in most of the victims.

Table-3: Gross Pathological Findings in Major Vital Organs

Pathology	Liver	Lungs	Kidneys
Congestion	95%	48%	48%
Edema	-	31%	-
Petechial Hemorrhages	-	-	03%
Consolidation	-	58%	-
Multiple Abscesses	05%	52%	-
Fatty change	08%	-	-
Loss of Cortico-medullary Demarcation			29%

Table-4: Histopathological Findings in Liver, Lungs, Kidneys

Findings	Liver	Lungs	Kidneys
Congestion & Enema	39%	48%	15% (congestion only)
Inflammatory Cell Infiltration	21%	43%	-
Necrotic Zone	15%	21%	-
Cloudy Degeneration	-	-	62%
Tubular Necrosis	-	-	48%
Tubular Casts	-	-	27%

Lungs revealed congestion and in alveolar edema in 48% cases, inflammatory cell infiltrate in 43% and necrotic zone in 21%, macrophages in 16% cases. In most cases, these changes were observed more frequently after 72 hours of survival, alveolar edema had been increasing with increasing duration of survival whereas macrophages were more frequent after 7 days of survival.

Liver showed sinusoidal congestion in 39 % cases, inflammatory cell infiltrate in 21 %, necrotic changes in 15% and fatty change in 8 % cases. Sinusoidal congestion was prevalent throughout, irrespective of the duration of survival. In Kidneys, hydropic degeneration of tubules was seen in 62 % cases, tubular necrosis in 48%, tubular casts seen in 27% cases.

Similarly, Shinde AB and Keoliya AN (2013)¹⁷ studied 110 burn cases and observed similar findings in major vital organs. In lungs, bronchopneumonia was seen in 22 (20%) cases, pulmonary oedema in 61 (55.45%) cases, atelectasis in 16 (14.54%), emphysema

in 19 (17.27%), interstitial haemorrhage in 42 (38.18%), intra alveolar hemorrhage in 39 (35.45%), interstitial pneumonitis in 30 (27.27%), macrophages in 51 (46.36%), congestion in 81 (73.63%), hemorrhagic necrosis in 5 (4.54%). these changes more frequently after 72 hours of survival.

In liver, they found congestion in 64 (58.18%) cases, fatty change in 17 (15.45%), centrilobular necrosis in 39 (35.45%), dilated and congested sinusoids in 42 (38.18%), infarction in 16 (14.54%), degenerative changes in 21 (19.09%) focal necrosis in 21 (19.09%), focal hemorrhage in 21 (19.09%), portal inflammation in 11 (10%), fibrin deposition in 2 (1.81%) and periportal necrosis in 6 (5.45%) cases.

In kidneys, they reported acute tubular necrosis in 18 cases and in 12 cases it was observed in death within first 5 days. Tubular casts in 35 and in 21 cases it was observed in death within first 5 days. Cloudy degeneration was present in 17 of 110 cases and in 12 cases it was observed in death within first 5 days.

Table-5: Blood /Pus Culture Findings

Findings	Blood culture	Pus culture
<i>Pseudomonas aeruginosa</i>	61%	47%
<i>Klebsiella</i> sp.	30%	8%
<i>E.coli</i>	9%	-
<i>Proteus</i> sp.	04%	1%
<i>Staphylococcus aureus</i>	-	12%

Pseudomonas aeruginosa was the commonest isolate 61% in blood and 47% in pus culture, followed by *Klebsiella pneumoniae* 30% in blood and 8% in pus; *Staphylococcus aureus* seen in 12% cases. Similarly, Rajbahak S et al (2014)¹⁵ identified total of 215 bacterial isolates from 168 pus swabs. *P. aeruginosa* accounted for the highest percentage 98 (45.6%) from the burn wounds followed by *S. aureus* 41 (19.1%) and *Acinetobacter* spp. 38 (17.7%).

Skin burning causes general immunosuppression.¹¹ The denatured protein in burn injured tissue provides a good substrate for microbial growth. The relative avascularity as a consequence of thermal thrombosis further promotes infection. Not surprisingly, the risk of burn infection is proportional to the area burned.¹⁶ Full-thickness skin burns usually are colonized by bacteria within a few days, with sparse Gram-positive organisms in the first week and dense Gram-negative organisms

thereafter.¹¹

Most episodes of septicemia occur between 6 and 10 days after the burn. Wound infection by specific organisms such as *Streptococcus pyogenes* or *Pseudomonas aeruginosa* or heavy colonization of a burn wound predispose to invasive sepsis with organisms invading living tissue adjacent to the wound.¹⁸

Conclusion

The commonest cause of death revealed at autopsy was septicemia (45.00%), followed by hypovolemic shock (30.00%); while most frequent clinical cause of death was multiple organ failure in 61% and burn shock (neurogenic/hypovolemic shock) in 24% cases. Lungs revealed congestion and alveolar edema in 48% cases, liver showed sinusoidal congestion in 39 % cases, kidneys showed hydropic degeneration of tubules in 62 % cases; which were the most common histopathological changes observed. *Pseudomonas aeruginosa* was the commonest isolate 61% in blood and 47% in pus culture.

Similar findings have been observed by Harish D et al (2013)⁵ and Khandare SV and Pawale DA (2014)⁷ who reported septicemia as cause of death at autopsy in majority of cases; while Kallinen O, Maisniemi K. et al (2012)⁶ found Multiple organ failure as commonest clinical cause of death.

Shinde AB and Keoliya AN (2013)¹⁷ reported pulmonary edema, observed sinusoidal congestion in liver, found acute tubular necrosis and cloudy degeneration in kidneys; as commonest histopathological changes, which supports the findings of present study. Similarly, Rajbahak S et al (2014) found *Pseudomonas aeruginosa* accounting for the highest percentage (45.6%) of the burn wound flora.

Major causes of death found were septicemia, bronchopneumonia and hypovolemic shock. So, there is need of strict and 100% implementation of aseptic measures in burn wards following the guidelines given by WHO. Government should ascertain the supply of sufficient and appropriate drugs specially antibiotics to the all hospitals without interruption.

Study of gross and histopathological findings in visceral organs in autopsy of burn cases, as well as microbiological analysis of blood and pus in cases of spot death/brought dead and other burn cases, may help in planning an efficient treatment protocol for burn cases in future.

Conflict of Interest : None

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Ethical Clearance: The study protocol was approved by the Institutional Ethics Committee of Gandhi Medical College, Bhopal.

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