

# Correlation of Histopathological Changes with the Manner of Death in Fatal Burns in a Tertiary Care Hospital in Northern India

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## Abstract

**Objectives:** To find the correlation of manner of death with histopathological changes in fatal burns in a tertiary care hospital in north India.

**Method:** This was a comparative study. Cases were thoroughly studied using specially designed proforma that included the demographic profile of deceased along with information gathered from relatives, police & hospital records and autopsy findings. Before taking the lung sample, proper consent was taken from the relatives after explaining the purpose of the study. After gross examination, sections were taken from different lobes of lungs.

**Results:** Tracheal congestion was found mainly in accidental deaths (49.77%), followed by suicidal deaths with 28.57% and homicidal deaths with 21.66%. This difference was found to be statistically significant ( $p < 0.001$ ). Lung Consolidation was more commonly seen in accidental and suicidal deaths (48.4%) as compared to homicidal deaths (3.19%). Various other variables were also correlated with type of burns.

**Conclusion:** This association of histopathological changes in lung tissue could help to ascertain the mode of Death, as well as can hint towards conduction of proper inquest in suspicious cases of so called suicidal deaths

**Key words:** Fatal burn, Manner of death, Histopathological changes

## Introduction

As per the definition Burn is a type of Thermal injury caused due to application of excessive dry heat to external and internal body surfaces resulting in tissue destruction<sup>1</sup>. In a developing country like India, Burns constitute a major problem with an incidence of 6-7 million, out of which 70% victims are from the

productive age group of 15-40 years, coming from the lower socio economic strata<sup>2</sup>. Not only this, Burns have another black dot to its name when it comes to dowry deaths, constituting a significant number to the medico-legal cases of the hospitals.

Accidental Burns are the most common form of Burns<sup>3</sup>. Fatal Burns as a result of residential fires account for 10% of all Accidental deaths in developed countries, with one-fourth of the deaths involving elderly people. Throughout ages Burns are considered as a common means of suicide and homicide across the globe. Apart from that, Burn injuries also tops the trauma list of the world, followed closely by Road traffic accidents, falls and interpersonal violence<sup>4</sup>.

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There is a huge list of factors leading to fire fatalities. The most frequent among them are smoke inhalation and accidental physical injuries. Examination of victims who have died from smoke inhalation usually reveals soot in the nostrils and mouth as well as burns, and coating of the larynx, trachea, and bronchi at autopsy. Soot can be detected with the naked eye 2 or 3 days after inhalation of smoke<sup>5</sup>. The extent of the burn is determined by the classic “rule of nine”: head (9% of body surface), upper extremities (each 9%), front of the trunk (18%), the back (18%), each lower extremity (18%), and the perineum (1%). Carbon monoxide inhalation is the cause of death in most of victims of house fires. In enclosed areas, in addition to carbon monoxide, hydrogen cyanide is responsible for death from smoke inhalation. Septicemia is the major cause of delayed deaths in cases of burns (45%)<sup>6</sup>.

The purpose of our research is to study the histopathological changes in fatal burns in a tertiary care hospital in north India. These histopathological changes are then linked with the manner of Burn injury i.e whether Accidental, suicidal or Homicidal.

All autopsies with history of burn injury were studied to find out the significant histopathological change in lung.

### Material and Method

This was a comparative study conducted in the

mortuary of King George Medical University of Lucknow. All autopsies with history of burn injury were studied to find out the significant histopathological change in lungs. We came across 610 cases of burns during the course of our study period of one year. However we have included only 550 cases in our study. The cases with time since death of more than 24 hours were excluded from our study because lungs undergo decomposition after 24 hour period of death. Cases with having previous history of lung diseases and anatomically distorted lungs were also excluded from the study.

All the Cases were thoroughly studied using specially designed proforma that included demographic profile of deceased, history from relatives, police & hospital records, autopsy findings. Before taking the lung sample, proper consent was taken from the relatives after explaining the purpose of the study. After gross examination sections from different lobe were taken. These sections were sent to Department of Pathology for microscopic examination through a multi-step process. Routine Hematoxylin & Eosin staining was done. The histopathological changes were studied under the electron microscope.

### Statistical Analysis

The results were taken in frequencies and percentages. Chi-square test was used for comparisons. The p-value < 0.05 was considered significant. All the analysis was carried out on SPSS 16.0 version (Chicago, Inc., USA).

## Results

### Manner of Death and Histopathological findings

Variables	Total +ve	Accidental		Homicidal		Suicidal		Statistical significance	
		No.	%	No.	%	No.	%	$\chi^2$	p
<b>Trachea</b>									
Congestion (n=550)	433	215	49.77	94	21.66	124	28.57	25.943	<0.001
Soot particle (n=548)*	39	15	38.46	17	43.59	7	17.95	20.007	<0.001
<b>Lung</b>									
Pneumonia (n=323)**	188	91	48.40	6	3.19	91	48.40	67.316	<0.001
Congestion (n=323)***	314	142	45.22	53	16.88	119	37.90	1.941	0.379
Capillary dilatation (n=323)**	147	65	44.22	48	32.65	34	23.13	51.350	<0.001

**Cont... Manner of Death and Histopathological findings**

Alveolar and interstitial edema (n=323)**	82	45	54.88	9	10.98	28	34.15	5.165	0.076
Alveolar and interstitial hemorrhage (n=323)**	237	114	48.10	14	5.91	109	45.99	86.024	<0.001
Alveolar wall disruption (n=323)**	75	31	41.33	37	49.33	7	9.33	78.632	<0.001
Inflammatory cells (n=323)**	115	63	54.78	9	7.83	43	37.39	12.946	0.002
Hyaline membrane (n=323)**	24	7	29.17	0	0.00	17	70.83	13.677	0.001
Fibrin strands (n=323)**	24	7	29.17	0	0.00	17	70.83	13.677	0.001

\*Autolyzed excluded, \*\*Autolyzed and not done excluded

Tracheal congestion was found in higher proportion of cases in whom manner of death was Accidental (49.77%) as compared to Suicidal (28.57%) and Homicidal (21.66%) and this difference was found to be statistically significant ( $p < 0.001$ ).

Tracheal soot particles were found in statistically significantly higher proportion of cases in where manner of death was Homicidal (43.59%) or accidental (38.46%) as compared to suicidal (17.95%).

Consolidation in lungs was found in statistically significantly higher proportion of cases in whom manner of death was Accidental or Suicidal (48.40% each) as compared to Homicidal (3.19%).

Lung congestion was found in higher proportion of cases in whom manner of death was Accidental (45.22%) or Suicidal (37.90%) as compared to Homicidal (32.65%), but difference was not found to be statistically significant.

Capillary dilatation in lung was seen in significantly higher proportion of cases in whom manner of death was Accidental (44.22%) or Homicidal (32.65% each) as compared to Suicidal (23.13%).

Alveolar and interstitial edema in lung was statistically found in significantly higher proportion of cases in whom manner of death was Accidental (54.88%) or Suicidal (34.15%) as compared to Homicidal (10.98%).

Alveolar and interstitial hemorrhage in lung was statistically found in significantly higher proportion of

cases in whom manner of death was Accidental (48.10%) or Suicidal (45.99%) as compared to Homicidal (5.91%).

Alveolar wall disruption in lung was found in statistically significantly higher proportion of cases in whom manner of death was Homicidal (49.33%) or Accidental (41.33%) as compared to Suicidal (9.33%).

Inflammatory cells of lung was statistically found in significantly higher proportion of cases in whom manner of death was Accidental (54.78%) or Suicidal (37.39%) as compared to Homicidal (7.83%).

Hyaline membrane and Fibrin stands in lung was found to be affected in statistically significantly higher proportion of cases in whom manner of death was Suicidal (70.83%) as compared to Accidental (29.17%) or Homicidal (0.00%).

## Discussion

Burn injuries have been occurring throughout the world since ancient times making the Human race pay the price for mishandling the precious fire element of nature. Burns cause a variety of medical and psychological problems along with inflicting severe economic and social burden on the victims' families and ultimately the society in both the developed and developing countries. 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 (1984), Ragheb et al (1984), Lari (2000) and Kachare et al (2005)<sup>7,8,9,10</sup>.

In the present study, all the histopathological findings were significantly associated with type of burns. In our study, most of the burns cases were accidental. Chawla et al (2011) & Jagannath HS et al (2011) studied majority of cases due to accidental burns<sup>11, 12</sup>. In the study by Bhanvadia et al (2017), majority of gross findings of lungs showed heavy, firm, congestion followed by congestion & frothy fluid on cut surface & consolidation, which is in accordance with other studies<sup>13</sup>.

Bhanvadia et al (2017) found that majority of histopathological features showed diffuse alveolar damage followed by interstitial pneumonitis, diffuse interstitial edema, bronchopneumonia and pulmonary edema<sup>13</sup>. Rare findings like focal atelectasis, areas of emphysema, necrotizing bronchiolitis were also seen. Toor et al (1990) observed diffuse alveolar damage in 16 (48.48%) patients, acute bronchopneumonia in seven (21.21%) patients, and necrotizing inflammation in seven (21.21%) patients, which is accordance with other study<sup>14</sup>.

Argamaso (1967) showed changes of pulmonary edema in majority of cases (70.00%) followed by pneumonitis and abscess formations in 26.66% of cases<sup>15</sup>. Hasleton et al (1983) noted congestion of alveolar walls, interstitial and intra alveolar edema and intra alveolar hemorrhage in first 48 hours<sup>16</sup>. Pneumonia and septicemia were common findings after 48 hours. Intravascular microthrombi denoting disseminated intravascular coagulation along with above changes were also noted after 48 hours. Chopra and Sabherwal (1988) have proved that the examination of myocardium after acridine orange stain, under fluorescent light is more sensitive than autofluorescence for detecting ischemia<sup>17</sup>.

### Conclusion

Our study has tried to associate the histopathological findings in burn cases with the manner of death. This has got great relevance medicolegally in suspicious cases of Burns. This association of histopathological changes in lung tissue could help to ascertain the mode of Death, as well as can hint towards conduction of proper inquest in suspicious cases of so called suicidal deaths. Besides India being a so called hub for the dowry deaths, the culprits mainly try to portray the homicidal burns as accidental or suicidal burns. Therefore a further enhancement of laboratory techniques for histopathological study of lung tissue in fatal burns may turn out to be an essential tool

of forensic importance for our legal system.

**Conflict of Interest:** None

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**Ethical Clearance:** Taken

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