



## An autopsy study of morphological changes of lung in burn patients with duration of hospital stay and total body surface area burned

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#### Abstract:

Many people die in India due to burn injury every year both in rural & urban areas. It is well known that many changes occur in lungs due to burn injury, which is studied in detail in this study with special reference to histopathological finding. In this study, 126 cases revealed histopathological finding in lung which varies with duration of survival. This may be helpful to conclude the cause of death even in such autopsy cases where opinion is reserved till viscera report is waiting.

**Key words:** Autopsy; Burn; Duration of survival; Histopathology; Lung

#### Introduction

In recent years, several factors like sky high ambition, undue peer-pressure, irrational craving for luxury items etc. led to an increase in the incidence of suicidal deaths in the society, and self immolations become one of the commonest method adopted for suicide. Further more pressure for dowry (most common cause for homicidal burn), inappropriate fire control system in crowdie places etc. have contributed to rise in the occurrence of burn injuries. Accidental burn sometime occurs during cooking also. So burns have become one of the most common causes of unnatural death. Lung injury is common

after burns which may be due to direct thermal damage to lower respiratory tract or development of multiorgan dysfunction depending on the time, age of the victims as well as sepsis. In India, with a population of over one billion, there are 700000 to 800000 burn admissions annually. The high incidence makes burns an endemic health hazard [1].

Death may occur immediately, few hours or few days later after burn injury. As after burn injury de-oxygenated blood entered into lung and gaseous exchange occur there are many direct and indirect

injury to lung occur, we can expect various changes in lung histopathology like alveolar edema fluid collection, alveolar fibrinoid exudates with inflammatory cell infiltration, alveolar thick hyaline membrane, interstitial edema, Interstitial inflammation, dilated & congested vessels, hyalinised vessels etc.

### Aims & Objective:

- To find out different changes in lung that of different age group of burn victims.
- To find out different changes in lung that occur in different degrees of burns (according to TBSA%)
- Association between lung changes with durations of hospital stay.

### Material & Methods

This study was carried out in the department of pathology in collaboration with department of Forensic Medicine and Toxicology, R G Kar Medical College & Hospital, Kolkata.

This was a cross sectional observational study of 1 year duration from April 2012- March 2013. In these study period 126 autopsies with history of burn injury was studied, revealed significant histopathological findings in lung. Cases were excluded are previously history of lung diseases, anatomically distorted lungs.

Cases were thoroughly studied using specially designed proforma that included-demographic profile of deceased, history from relatives, police & hospital records, autopsy findings. After gross examination sections from different lobe were taken. These sections prepared for microscopic examination through a multi-step process. Paraffin Blocks of these tissues prepared. Routine Haematoxylin & Eosin stains done.

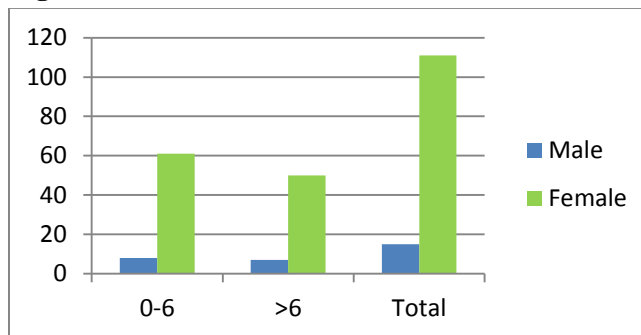
### Result

Out of 126 autopsy it was seen that after the incidence of burn injury patients death were occurred between 1-12 days. The Figure-I is showing the distribution of male and female according to duration of survival.

In this study we found a marked female predominance (88.09%) over male, which is also statistically significant. Maximum age in this study was 64 years, minimum age was 8 years; the mean age being 27.98 years. Majority of cases (47.06%) were in the age group of 21-30 years, followed by 11-20 years age group. Two autopsy cases were

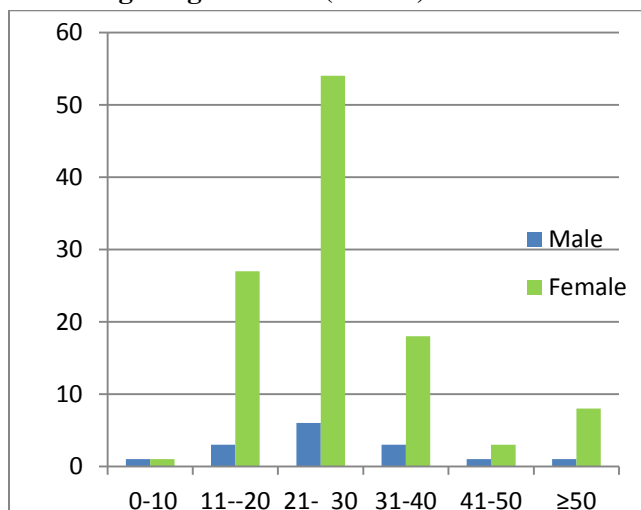
found to be in the 1<sup>st</sup> decade in this series. Six out of fifteen male cases in this study were of 21-30 years age.

**Figure 1:**



Considering various demographic changes, it was found total 69 (46.75%) cases among 126 subjects died within 6 days. There were 8 male subjects and 61 were female. Total 57 subjects (42.23%) were died after 6 days of burn incidence (7 cases were male and 50 cases were female). In this study, male subjects survival time mean value is 7.686 and in females 6.859. So mean survival rate in male subjects are more than female subjects.

**Figure 2: is showing distribution of cases according to age and sex (n= 126)**

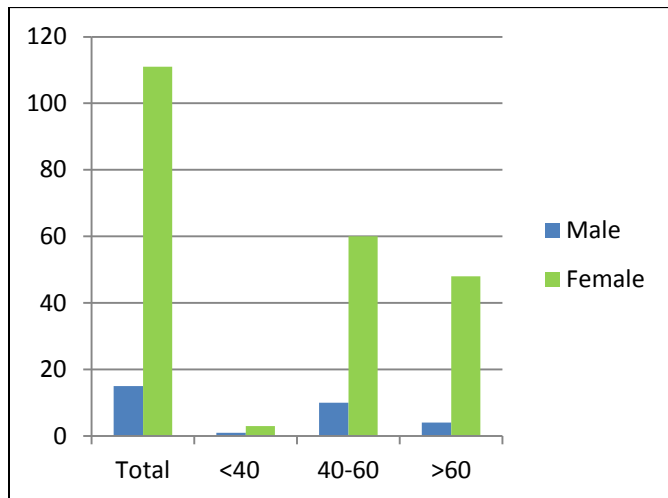


Here it was observed that the majority of the cases 70 (55.56%) had 40-60% TBSA burn. Whereas cases (52 cases) 41.26% had burn of >60% TBSA and only (4 cases) 3.17% had <40% of TBSA burn.

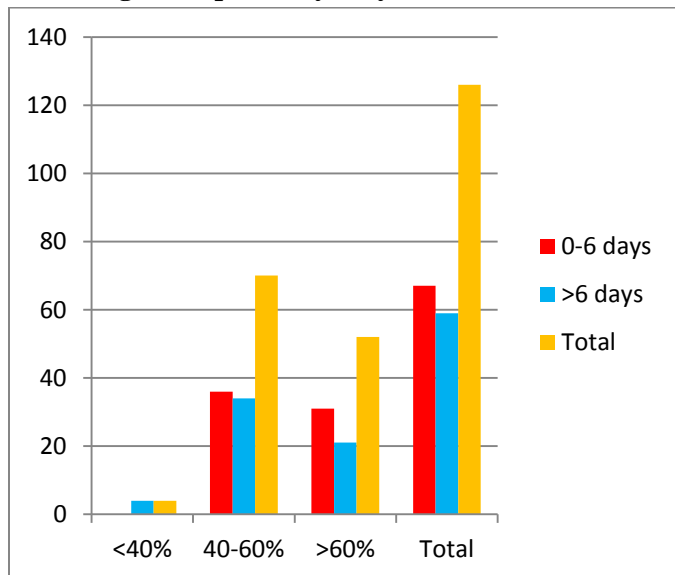
It shows among the four patients with <40% burn all survived more than six days. Patients who had 40-60% burn, almost equal number of cases both less than and more than six days with slight predominance of the former (28.56% vs 26.98%). Among the cases that had >60% burn, majority of

cases survived less than six days. So, from the figure it appears that patients that had more %TBSA burn had a tendency to survive for lesser duration.

**Figure 3:** is showing distribution of cases according to Total Body Surface Area (%TBSA) burned and sex (n= 126)



**Figure 4:** is showing distribution of cases according to hospital stay (days) and %TBSA

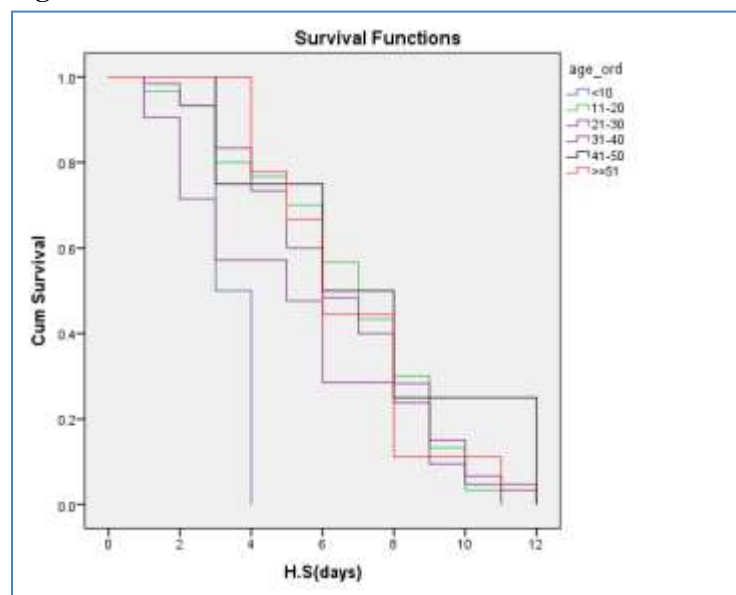


**Figure V:** This is a figure of survival distributions for the different level of age . According to Chi-square test. Log rank Mantle - Cox value is 6.557.This study is seen statistically significant (P value 0.256).

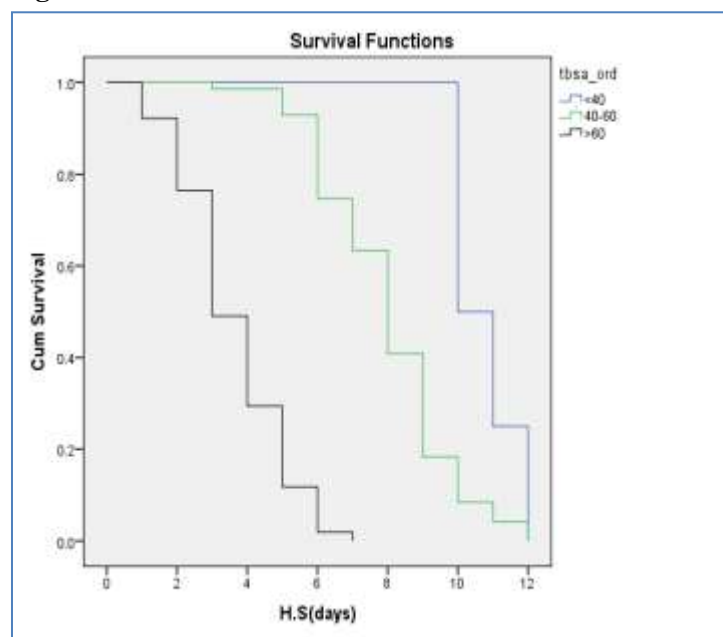
The present study revealed almost normal gross findings in lungs with mild focal congestion were obvious in some cases. Some specimens show outer surface patchy, whitish area and cut surface show consolidated area, though we had excluded the

cases with gross anatomical distortion for better histopathological evaluation.

**Figure 5:**



**Figure 6:**



**Figure VI:** This is a figure of equality of survival distributions for the different levels of TBSA order. According to Chi-square test Log Rank (Mantle-Cox) value is 124.494 and it is statistically significant.

**Fig 7: Surface ulcerated, patchy with pus filled specimen of lung**



**Fig 8: Specimen of congested lung**

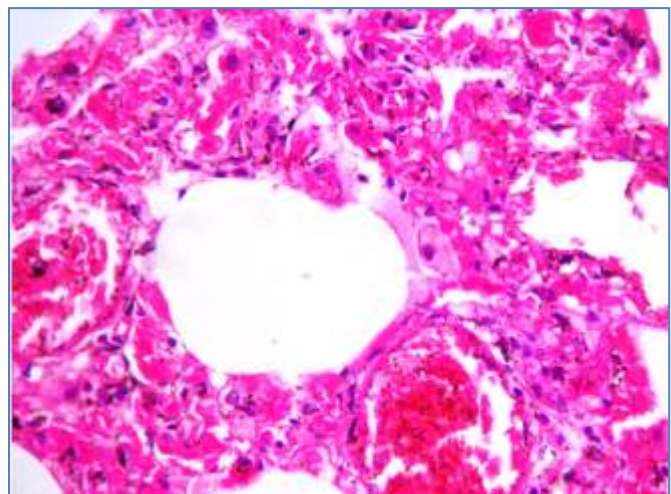


Considering the different histopathological changes, we get the findings which are given below.

**Table I:**

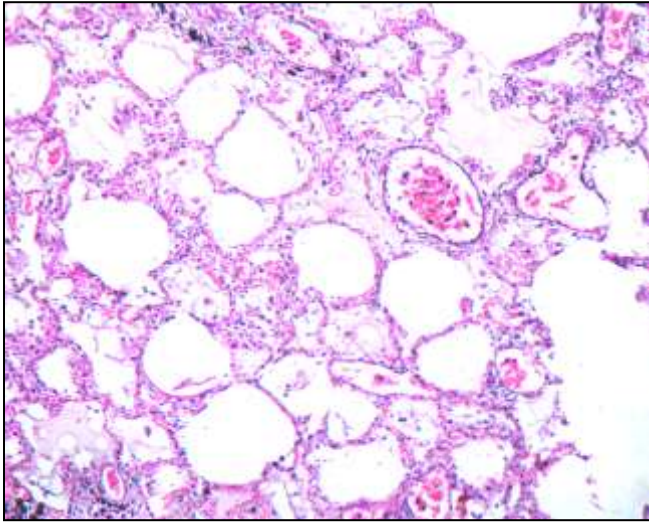
Parameters	Present (%)
Alveolar edema fluid	20 (15.87)
Alveolar fibrin strands	42 (33.33)
Alveolar hyaline membrane	20 (15.87)
Widened septa	60 (47.61)
Interstitial edema	20 (15.87)
Dense fibrin	4 (3.17)
Dilated blood vessel	60 (47.61)
Compressed blood vessel	4 (3.17)
Cyst macrophage	4 (3.17)
Neutrophil and RBCs	Mild- 59 (46.80) Severe- 41 (32.60)
Total	n = 126

**Fig 9: Alveolar edema fluid and interstitial edema, picture of diffuse alveolar damage**

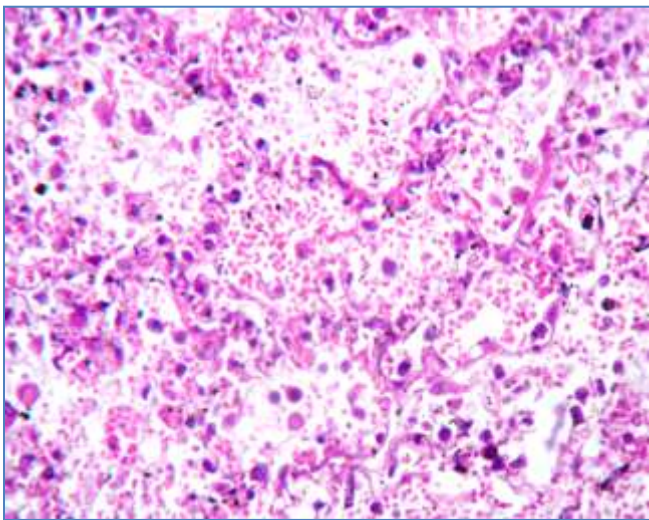




**Fig 10: Widened septa, dilated blood vessel, few polymorphs and RBCs, picture of congestion**



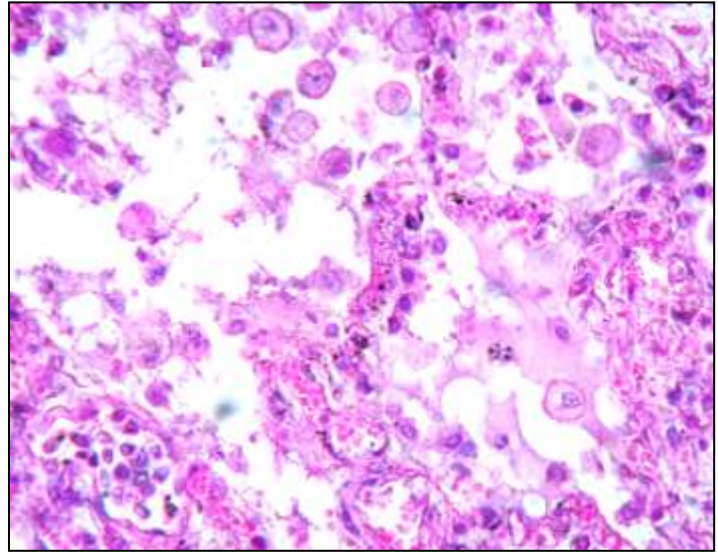
**Fig 7: Alveolar fibrin strands, Neutrophil and RBCs, picture of red hepatization of pneumonia**



From the previous tables of histopathological finding we came to the conclusion that four spectrum of disease were present. They were-

- Diffuse alveolar damage (DAD)  
20 cases (15.87%)
- Congestion  
60 cases (47.61%)
- Red hepatization of pneumonia (RHOP)  
42 cases (33.33%)
- Grey hepatization of pneumonia (GHOP)  
04 cases (3.17%)

**Fig 8: Dense fibrin, compressed blood vessel and Cyst macrophages, picture of grey hepatization of pneumonia**



## Discussion

This is well known that burn injuries are endemic in our country and they pose a major public health problem and as lung is one of the major and earliest involved organs, burn related lung changes have always been a point of interest. Earlier studies in this regard have shown, commonly leading to diffuse alveolar damage or pneumonia. Some of the studies show mild interstitial cell infiltration. But as of now lung changes in burn has not been properly corroborated with %TBSA, the age of the subject and their duration of hospital stay.

In the present study the age of the patients ranged from 8 years to 64 years and the mean age being 27.98 years. Majority of cases (47.06%) were in the age group of 21-30 years, followed by 11-20 years age group. The females (88.09%) outnumbered males in all age groups and the male-female ratio being 1:7.4. This high prevalence of female subjects, with maximum of cases belonging to child bearing age groups may be due to socio-economic causes. These findings are corroborated with the different series of Indian studies like Batra A K [2]. (n=942) where 71.9% belonged to the young age group of 21-40 years. Khajuria B, Sharma R, Verma [1]. (n=113) also observed that 85.84% cases were in the reproductive (15-45 years) age group.

In the present study we found maximum number of the cases (55.55%) had 40-60% TBSA burn and 41.26% had burn of >60% TBSA and only 3.17% had <40% TBSA burned. In the study

Daniela et al. [3] the TBSA burnt also ranged from 20% to 95%. Subhramanyam M et al [4] observed the extent of the burns ranged from 3 to 100% TBSA in their study. Illiopolou E et al [5] found the total burn surface area ranged between 20% to 95% and 26 patients (65%) had major burns (41-95% TBSA) in their study.

We divided the patients dying within six days and dying after six days in our study, as the mean duration of hospital was six days with minimal survival of one day to maximum of 12 days. In 67 cases out of 126 subjects (53.17%) duration of hospital stay was less than or equals to six days and rest survived more than six days. In the study of Daniela et al [3] nine patients died within 1-2 days, 10 patients died after 5 days, seven patients died within 10 days, eight patients died between 11-40 days and a number of five patients died after 41 days since the accident. Phillip L R et al [6] investigated the variables associated with increased mortality in burn patients and three risk factors for death were identified- age greater than 60 years, non-superficial burns covering over 40% TBSA and inhalational injury.

In our study the patients, who had >60% burn, majority of cases survived less than six days. Khajuria B, Sharma R, Verma [1] also found the same finding.

The present study revealed almost normal gross findings in lungs with mild focal congestion were obvious in some cases. Some specimens show outer surface patchy, whitish area and cut surface show consolidated area, though we had excluded the cases with gross anatomical distortion for better histopathological evaluation. F. Daniel Foley, Capt., MC, John A. Moncrife, Col., MC, Arthur D. Mashon, JR [3] also observed lobar pneumonia or bronchopneumonia in 69 patients at autopsy and was considered a major cause of death in 37 patients.

In this study, we found 20 subjects (15.87%) among 126 subjects were suffering from diffuse alveolar damage. The patients who had >60% of burn and died 0-6 days, demonstrated lung changes of diffuse alveolar damage. The number of cases according to ages are 1 case in < 10 years, 4 in 11-20 years, 6 cases in 21-30 years, 8 cases in 31-40 years and 1 case in 41-50 years age. F. Daniel Foley, Capt MC, John A. Moncrife, Col., MC, Arthur D. Mashon, JR [3] and A. Taran, N. Baciu, V. Rafulea, and A. German [7] and co-workers found almost equal result.

In our study we have found 60(47.61%) cases with histopathological features of lung congestion, red hepatization of pneumonia is found in 42 cases and Grey hepatization of pneumonia is found in 4 cases among 126 subjects. Pham TN, Kramer CB, Klein MB [8] observed older adults with burns are at risk for worse outcomes because of factors related to age, co morbidities and response to treatment. In 9 elderly patients of our study showed pneumonic changes. These findings are supported by study of Huzar TF et al. Cross JM [9] and De La Cal Miguel A.; Cerda Enrique, Garcia [10] with F. Daniel Foley, Capt. MC, John A. Moncrife, Col., MC, Arthur D. Mashon, JR., [3] it was found that 47.15% subjects had lung congestion where death occur in early post burn period.

### Conclusion

- This study includes 126 autopsy cases of death due to burn, of which majority were females (111 cases).
- The age of the subjects ranged from 8 years to 64 years and the maximum numbers of cases between 21-30 years (47.06%).
- Predominance of females was observed in deaths due to burn.
- Duration of hospital stay was more in patients with less than 40% TBSA burn, possibly because in higher percentage of burn the survival was lesser.
- The maximum changes were observed in the alveoli as dilated and congested vessel, widened septa due to edema, edema fluid within alveoli, polymorphs and RBCs in alveoli, leading to lung congestion and pulmonary edema. So this is a leading cause of death in burn.
- In the alveoli we observed diffuse alveolar damage and hyaline membrane formation in 15.87% cases. These diffuse alveolar damage type changes were seen those cases who had >60% TBSA burned and a lesser duration of survival.
- Features of red hepatization of pneumonia and grey hepatization of pneumonia in total 46 cases and most of the cases the %TBSA burned were <60%. So pneumonia is one of the important cause of death in burn injury and percentage of TBSA burned had significant effect on all these alveolar changes.

### Conflict of Interest Statement

It is certified that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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