

## Incidental lung pathologies in medicolegal autopsies: a study

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### Abstract

**Introduction:** Autopsy may reveal some natural diseases, the presence of which may trigger questions like association of the disease with trauma, work, crime etc., and its relative contribution towards death. The present study was taken up to study the presence of lung pathologies in medicolegal autopsies so as to find out the role of the co-morbidities of the lung in the cause of death.

**Materials and Method:** Across-sectional study was carried out in the mortuary of the Forensic Medicine department in collaboration with the Pathology department of a tertiary care teaching institute in northeast India from October 2014 to September 2016. A detailed history and hospital records, if available, were recorded and the autopsy findings of the cases were noted. After gross examination of the lungs, samples of the cut sections were collected and examined for any pathology. The findings were recorded and statistically analysed.

**Results:** The commonest lung pathology observed was pulmonary oedema (62.91%) followed by intraalveolar and interstitial haemorrhage (20.89%), pneumonia (10.56%), fibrosis (7.98%), etc. No cases of pulmonary tuberculosis were found as the primary cause of death in the present study except as co-morbidities in 1.87% of the cases. Pulmonary pathology like pneumonia and focal pneumonitis were present as contributing factors in the cause of death in 5.43% and 0.5% of the cases.

**Conclusion:** In medicolegal autopsies, most of the cases are with unknown history of past illness. Gross and histopathological study of the lungs in the medicolegal autopsies may reveal natural diseases and their role as a contributory factor in such deaths.

**Keywords:** Autopsy, Lung pathologies, Co-morbidity, Cause of death.

### Introduction

An autopsy also known as a post-mortem examination, is a highly specialized surgical procedure that consists of a thorough examination of a corpse to determine the cause and manner of death and to evaluate any disease or injury that may be present.<sup>(1)</sup> Autopsy may reveal some natural diseases, the presence of which may trigger questions like association of the disease with trauma, work, crime, etc., and its relative contribution towards death.<sup>(2)</sup> One of the most important vital organs in the human body is the lungs. In medicolegal autopsies, depending on the cause of death, the lungs may be found in various conditions viz. a collapsed lung as in traumatic pneumo and/or haemo-thorax, or a non-collapsed lung as in pulmonary embolism, or an inflated type of lung as in emphysema or oedema from various causes.<sup>(3)</sup> On the other hand, the lungs are involved in various kinds of inflammatory, neoplastic and other lesions, but they are secondarily involved in almost all forms of terminal diseases and some degree of pulmonary oedema, atelectasis or bronchopneumonia is virtually observed in every case.<sup>(4)</sup>

Some of the important pathological conditions of the lung which may be observed on gross examination during autopsy include: - pneumonic consolidations, caseous lesions and cavitation's of tuberculosis or Ranke complexes formed by progressive fibrosis and calcification of these lesions, emphysema, pulmonary oedema, lung cancer, abscess, infarcts, etc.

Further, several studies have shown that many tuberculosis cases were diagnosed only at autopsy. Tuberculosis may have a variety of appearances; the Ghon complex is a solitary caseous lesion, usually in the upper lobe or upper part of the lower lobes; Ranke complexes develop when the lesions resolve and undergo progressive fibrosis and calcification. Secondary tuberculosis may have multiple caseous lesions, cavities, empyema, military dissemination, or bronchopneumonia; erosion into a vessel may cause massive hemorrhage.

In medicolegal autopsies, majority of the cases brought for autopsy are of unknown medical history. On the other hand, associated co-morbidities of lung may increase the risk of fatality in a trauma case. Hence, the present study was taken up to study the presence of lung pathologies in medicolegal autopsies so as to find out the role of the co-morbidities of the lung in the cause of death.

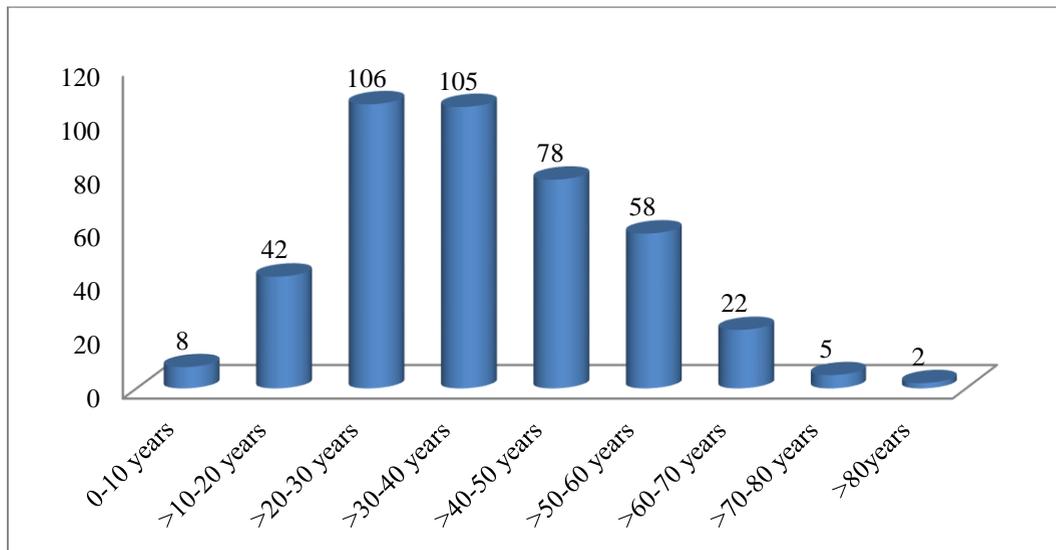
### Materials and Method

A cross-sectional study was carried out in the mortuary of Forensic Medicine Department in collaboration with the Pathology Department of a tertiary care teaching Institute in northeast India from October 2014 to September 2016 after obtaining approval from the Institutional Ethics Committee of the Institute. All the cases brought for medicolegal autopsy regardless of the cause of death were included; however, decomposed bodies were excluded from the study. A

detailed history and hospital records, if available, were recorded and the autopsy findings of the cases were noted. After gross examination of the lungs, samples of the cut sections were collected and examined for any pathology. The findings were recorded and analysed using descriptive statistics to find out the mean, percentage and frequencies, and chi-square test.

## Results

In our study, most of the deceased were from the 3<sup>rd</sup> decade 106 (24.9%) followed by 4<sup>th</sup> decade (24.9%) and 5<sup>th</sup> decade (18.3%). The age of the deceased in the present study ranged from 1-90 years with a mean age of  $36.78 \pm 0.73$  years (Fig. 1).



**Fig. 1: Showing age wise distribution of study population**

It was observed that pulmonary lesions mainly consisted of pulmonary oedema (62.91%), intraalveolar and interstitial haemorrhage (20.89%), pneumonia (10.56%) and fibrosis (7.98%) as shown in Table 1. Tuberculosis was observed in only 1.78% of the cases. No other lung lesions like chronic venous congestion of lung (CVC lung), lung carcinoma, lung abscess etc., were observed in the present study.

**Table 1: Showing distribution of pulmonary lesions in study population**

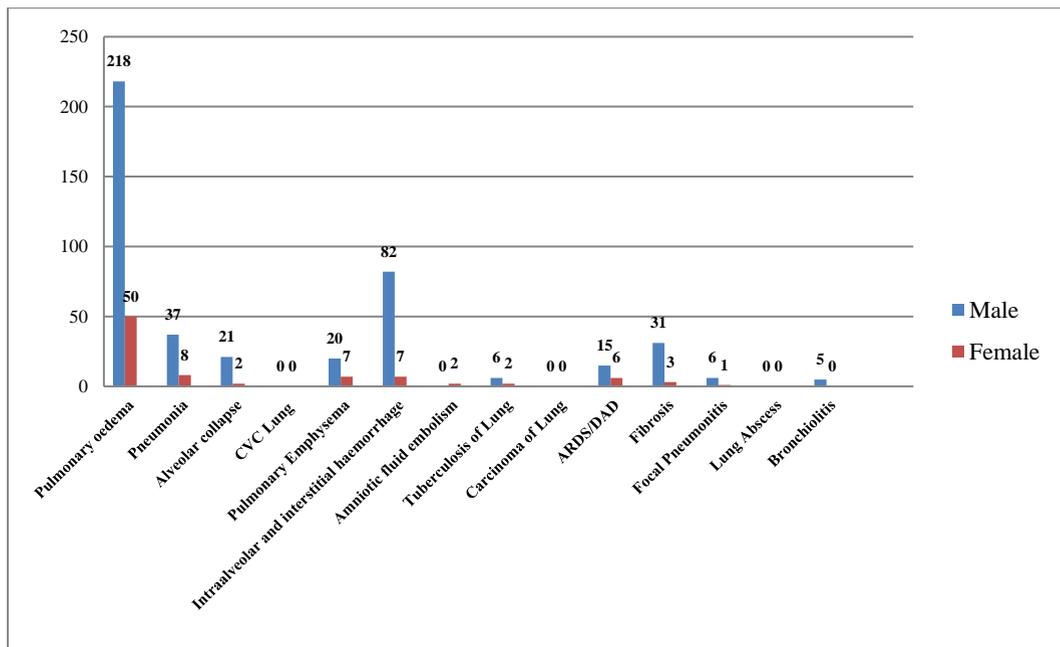
Type of lesions	No. of cases	Percentage (%)
Pulmonary oedema	268	62.91
Pneumonia	45	10.56
Alveolar collapse	23	5.39
Pulmonary Emphysema	27	6.33
Intraalveolar and interstitial haemorrhage (IIH)	89	20.89
Amniotic fluid embolism	02	0.47
Tuberculosis of Lung	08	1.87
Acute Respiratory Distress Syndrome (ARDS)/ Diffuse Alveolar Damage (DAD)	21	4.92
Fibrosis	34	7.98
Focal Pneumonitis	07	1.64
Bronchiolitis	05	1.17

It is observed from Table 2 that maximum number of cases with pulmonary oedema was observed in the age group of 20 to 40 years. The four most commonly observed lung pathologies i.e. pulmonary oedema, intraalveolar and interstitial haemorrhage, pneumonia, fibrosis were maximum in the 20-40 years age groups compared to other age group ( $p < 0.05$ ).

**Table 2: Age (years) wise distribution of lung lesions**

Type of lesion	0-10 yrs	>10-20 yrs	>20-30 yrs	>30-40 yrs	>40-50 yrs	>50-60 yrs	>60-70 yrs	>70-80 yrs	>80 yrs	Total
<b>Pulmonary oedema</b>	04 (1.50%)	29 (10.64%)	58 (21.64%)	78 (29.11%)	49 (18.28%)	36 (13.43%)	10 (3.73%)	03 (1.12%)	01 (0.37%)	268
<b>Pneumonia</b>	1 (2%)	4 (9%)	5 (11%)	17 (38%)	12 (27%)	6 (13%)	00	00	00	45
<b>Alveolar collapse</b>	00	03 (13.04%)	10 (43.48%)	04 (17.39%)	02 (8.7%)	03 (13.04%)	00	00	01 (4.35%)	23
<b>Pulmonary emphysema</b>	01 (3.35%)	03 (11%)	05 (18%)	12 (44%)	02 (7%)	04 (14%)	1 (3.35%)	00	00	27
<b>Intraalveolar and interstitial haemorrhage</b>	02 (2%)	05 (6%)	25 (28%)	19 (21%)	15 (17%)	13 (15%)	08 (9%)	02 (2%)	00	89
<b>Amniotic fluid embolism</b>	00	01 (50%)	00	01 (50%)	00	00	00	00	00	02
<b>Tuberculosis of lung</b>	00	00	06 (75%)	00	00	00	02 (25%)	00	00	08
<b>ARDS/DAD</b>	00	02 (9.33%)	02 (9.33%)	06 (29%)	04 (19%)	05 (24%)	02 (9.33%)	00	00	21
<b>Fibrosis</b>	01 (3%)	02 (6%)	05 (15%)	09 (26%)	09 (26%)	03 (9%)	04 (12%)	00	01 (3%)	34
<b>Focal pneumonitis</b>	01 (14.33%)	00	00	04 (57%)	01 (14.33%)	01 (14.33%)	00	00	00	07
<b>Bronchiolitis</b>	00	00	03 (60%)	00	01 (20%)	01 (20%)	00	00	00	05

As shown in Fig. 2, the four most commonly observed lung pathology in the present study were pulmonary oedema, intraalveolar and interstitial haemorrhage, pneumonia, fibrosis were most commonly observed in males compared to females (p <0.05).



**Fig. 2: Showing sex wise distribution of lung lesions in study population**

It is evident from Table 3 that pulmonary tuberculosis was observed in 8 cases in the study population with concomitant lung lesions i.e. pulmonary oedema, pneumonia, alveolar collapse, diffuse alveolar damage and intraalveolar and interstitial haemorrhage. Among the lung lesions, pulmonary oedema was the most common finding with tuberculous lesions in the study population.

**Table 3: Showing pulmonary tuberculosis**

Concomitant Pathology	No of Cases (TB cases)
Tuberculosis with pulmonary oedema	05 (8)
Tuberculosis with Pneumonia	01 (8)
Tuberculosis with alveolar collapse	01 (8)
Tuberculosis with diffuse alveolar damage (DAD)	01 (8)

Tuberculosis with intraalveolar and interstitial haemorrhage	01 (8)
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Various causes of death in medicolegal autopsies are shown in Table 4, and the commonest cause of death observed was shock and haemorrhage in 45.53% of the cases followed by head injury cases in 22.77%. Deaths due to natural diseases viz. heart problems i.e. coronary insufficiency, cardiomyopathies and other conditions like septicaemia, liver diseases, amniotic fluid embolism, etc. accounted for 10.56% of the cases.

Pulmonary oedema was observed in 40.20% of the haemorrhagic shock cases and 68.04% of the head injury cases. Interstitial haemorrhage was observed in 33.50%, pneumonia in 3.09% of the cases. Interestingly, in the present study, one of the most commonly observed lung pathologies in the traumatic conditions is pulmonary oedema.

**Table 4: Showing cause of death in the study population**

Cause of death	TB	Pneumonia	PE	AC	IIH	Fibrosis	Bronchiolitis	DAD	PLE	FP
Haemorrhagic shock (A) (43)	1	3	19	2	17	3	1	3	3	0
Haemorrhagic shock (B) (151)	1	3	59	8	48	8	2	6	4	3
VAD (36)	1	1	28	1	5	2	0	0	6	0
Burn Shock (3)	0	0	2	0	1	0	0	1	0	0
Head injury (97)	1	4	66	7	14	7	1	8	9	0
Electrocution (7)	0	0	4	0	1	1	0	0	0	1
Poisoning (6)	0	5	5	1	0	0	0	0	0	0
Natural death(45)	2	17	39	1	0	9	0	3	1	2
Unknown cause(61)	2	12	46	3	3	4	1	0	4	1

**Haemorrhagic shock (A)** = Haemorrhagic shock resulting from firearm and bomb blast; **Haemorrhagic shock (B)** = Haemorrhagic shock resulting from blunt trauma like RTA, earthquake, fall from height, blunt force injury etc.; **PE** = Pulmonary oedema; **VAD** = Violent asphyxial death; **DAD** = Diffuse alveolar damage; **AC** = Alveolar collapse; **IIH** = Intraalveolar and interstitial haemorrhage **PLE** = Pulmonary emphysema; **FP** = Focal pneumonitis.

## Discussion

In medicolegal autopsies, most of the cases are brought for examination without any known history. Histopathological examination in medicolegal autopsy is done to establish the cause of death if any morbid anatomical change in tissue is observed. But many incidental findings have been highlighted on histopathological examinations which have been proven to be great learning tools for the pathologists as well as the forensic expert. Histopathological examination is important for accumulation of mortality statistics which are essential for public health and health service planning.<sup>(5)</sup>

In the present study, the commonest pulmonary lesions encountered were pulmonary oedema (62.91%) followed by intraalveolar and interstitial haemorrhage, pneumonia, fibrosis, pulmonary emphysema. Pulmonary oedema was observed by workers like Todovic et al<sup>(5)</sup> in 87.3%, Pathak and Mangal<sup>(6)</sup> in 33% of the cases. Hanmante et al<sup>(7)</sup> and Selvam et al<sup>(8)</sup> also observed pulmonary oedema in 21.7% and 31.5% of the cases. The incidence of pulmonary oedema was high with history of traumatic conditions. In these trauma cases where the cause of death was shock and haemorrhage, pulmonary oedema was observed in 40.21% (78/194) of cases which correlate with the study findings of Wardle TD.<sup>(9)</sup> It was the frequent non-specific autopsy finding which was associated with all type of cause of death.

Intraalveolar and interstitial haemorrhages were seen in 20.89% of the cases in our study while Soeiro et al<sup>(10)</sup> observed it in 10.4% cases. Hanmante et al<sup>(7)</sup> observed alveolar haemorrhages in 5.8% of cases in their study population. Intraalveolar and interstitial haemorrhage also have significant and powerful association between traumatic conditions in the study population as it was observed in blast injury 50%, intracranial haemorrhage (ICH) 14.21%, injuries to the vital organs 43.66%, shock and haemorrhage 30.08% cases.

The infective condition like pneumonia constituted third most common histopathological pattern and accounted for 10.56% (45/426) of the total cases which was consistent with the studies by Nichols et al<sup>(11)</sup> (12%), Chauhan et al<sup>(12)</sup> (14.62%), and Fang et al<sup>(13)</sup> (18%). However, Hanmante et al<sup>(7)</sup> observed pneumonia in 39%, Soeiro et al<sup>(10)</sup> 33.9% and Udayashankar et al<sup>(14)</sup> in 41.18% of the study population which is in contrast to the findings of other study. On the other hand, fibrosis was seen in 7.98% of the cases in the present study, whereas Bal et al<sup>(15)</sup> observed fibrosis in 0.66% of cases and Udayashankar et al<sup>(14)</sup> found only one case in their study population.

Pulmonary emphysema was seen in 28 cases (6.52%) in the present study which is consistent with study by Hanmante et al<sup>(7)</sup> 6.07% and Chauhan et al<sup>(12)</sup> 7.76% of cases in their respective study. Udayashankar et al<sup>(14)</sup> found pulmonary emphysema in 11.76% (2/17), Todorovic et al<sup>(5)</sup> observed 80.95% of cases. Tariq et

al<sup>(16)</sup> reported that it was the commonest histopathological pattern seen in his study, accounting for 40% (324/810) cases. Emphysema was predominantly seen in male in our study which is fairly correlated with the findings of Tariq et al<sup>(16)</sup> as it is mainly seen in male patients. This appears to be due to smoking and alcohol habits which are common in males as compared to females in the Indian scenario.

In the present study acute respiratory distress syndrome (ARDS) /diffuse alveolar damage (DAD) were observed in 4.92% (21/426) cases while a study by Sachdev and Pandit<sup>(17)</sup> revealed acute respiratory distress syndrome (ARDS)/ diffuse alveolar damage (DAD) in 3.15% cases. In a study by Soeiro et al,<sup>(10)</sup> the pulmonary histopathology showed diffuse alveolar damage in 40.7% (780/1917) of the cases. There were 71.43% (15/21) male and 28.57% (6/21) female cases and all were in adult age group at the present study which is similar to the findings of Urer et al<sup>(18)</sup> where 83.33% (55/66) men with 16.67% (11/66) were women. But few other workers have observed diffuse alveolar damage in 11.76% (2/17)<sup>(14)</sup> and 1.33% of cases.<sup>(15)</sup>

Tuberculosis (TB) of Lung was seen in 1.87% (8/426) cases in our study which is similar with Theegarten et al<sup>(19)</sup> 1.39%, Sangma et al<sup>(20)</sup> 1.68%, Kaur et al<sup>(21)</sup> 1.6%, Pavic et al<sup>(22)</sup> 1.8%. The incidence of pulmonary tuberculosis noted in 6 of the 8 cases were between 20-30 years age group, 2 were between 60-70 age group; males are more prone for infection as compared to females which is almost similar to the studies of Theegarten et al,<sup>(19)</sup> Pavic et al<sup>(22)</sup> and Sangma MM et al.<sup>(20)</sup> In several studies, it was observed that many cases of TB were diagnosed at autopsy. In a study by Andrion et al<sup>(23)</sup> and Lum and Koelmeyer,<sup>(24)</sup> it was found that the frequency of active TB was 1.9% and that 70% of those cases were diagnosed only at autopsy. In our study, 1.87% of the cases had TB and these cases were diagnosed only during autopsy. Social stigma often discourages people from seeking treatment and, thus, undiagnosed TB cases form a substantial proportion of cases reported in autopsy studies.<sup>(25)</sup> This also indicates that there are people who do not seek medical attention.

Focal pneumonitis observed in 1.64% (7/426) cases of medicolegal autopsies in the present study. Selvam et al<sup>8</sup> observed pneumonitis in 13% of cases and bronchiolitis was seen in 1.17% (5/426) of the cases in present study and incidence mostly in traumatic causes of death like in intracranial haemorrhage 1.03% (1/97), injuries to the vital organs 2.82% (2/97) and shock and haemorrhage 1.76% (2/97) cases.

Pulmonary oedema was observed in 40.20% of the haemorrhagic shock cases and 68.04% of the head injury cases. This can be explained by the fact that most of the cases underwent treatment in hospitals after sustaining trauma, and the infusion of intravenous fluid to supplement the blood loss in these cases could have resulted in pulmonary oedema up to some extent. Intraalveolar and interstitial haemorrhage was observed

in 33.50% of the deaths due to haemorrhagic shock and 40.43% of the deaths due to head injury. Pulmonary pathology like pneumonia and focal pneumonitis were present as contributing factor in the cause of death in 5.43% and 0.5% of cases. According to Reddy,<sup>(26)</sup> in medicolegal practice, about 10 to 15% of the sudden deaths are due to respiratory diseases which include pneumonia, rupture of blood vessels in pulmonary tuberculosis with cavitation, bronchial asthma, acute oedema of the lungs, lung abscess, lung collapse, pulmonary embolism, infarction, etc. In the present study, pulmonary pathology was the cause of death in 5.45% of cases. Bal et al<sup>(15)</sup> found lung diseases to be the cause of death in 61.43% hospital deaths. Respiratory failure as the immediate cause of death in 38% of cases was observed by Nichols et al,<sup>(11)</sup> and Kaur et al<sup>(21)</sup> observed involvement of respiratory system and pneumonia as the cause of death in 4.8% of cases, which is similar to the findings of the present study. Sangma et al<sup>(20)</sup> found pulmonary TB was the primary cause of death in 22.97%, however, no cases of pulmonary TB was found as the primary cause of death in the present study except as co-morbidities in 1.87% (8/426) of cases.

## Conclusion

In medicolegal autopsies, most of the cases are with unknown history of past illness. Moreover, in some cases with non fatal injuries, natural diseases may be the actual cause of death, which may have been precipitated by the assault. Gross and histopathological study of the lungs in the medicolegal autopsies may reveal natural diseases and their role in such deaths. Pulmonary oedema was a common finding in our study; even though the co-morbid conditions of the lung were not directly responsible for the deaths, they could have contributed to these deaths up to some extent.

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