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Dr. Rama D Sathawane
Postgraduate Student,
Department of Pathology,
SRTR Government Medical College, Ambajogai,
Maharashtra, India

Dr. Sunil Y Swami
Associate Professor,
Department of Pathology,
SRTR Government Medical College, Ambajogai,
Maharashtra, India

Corresponding Author:
Dr. Sunil Y Swami
Associate Professor,
Department of Pathology,
SRTR Government Medical College, Ambajogai,
Maharashtra, India

Histopathology of pulmonary lesions in autopsy cases

Dr. Rama D Sathawane and Dr. Sunil Y Swami

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Abstract
Introduction: Autopsies are carried out to establish the identity, cause of death, time of death and antemortem or postmortem nature of death. A wide variety of pathological conditions involve the lungs.
Aim: To study the prevalence and pattern of lung lesions in autopsy cases, confirmed by histopathological examination.
Material and Methods: This is an observational study carried out in the pathology department at tertiary care center. Lung tissues from autopsy cases were preserved in 10% formalin, processed and examined microscopically. A total of 500 cases were studied during a 4 year's period from 2017 to 2020.
Results: Among the 507 autopsy cases studied, lung specimen from 7 [1.38%] cases were autolyzed hence excluded from the present study. Out of 500 study cases, 70 cases [13.8%] showed unremarkable histopathology. Wide spectrum of microscopic findings was seen in the rest [84.81%] of the cases.
Conclusion: Autopsy remains vital and important complimentary tool in identifying and understanding pulmonary lesions. Histopathological study of lungs at autopsy may reveal various lesions and their relative inputs toward death.

Keywords: pulmonary, autopsy, histopathology, lung

Introduction
Autopsy is important not only to determine the state of lungs at death but also to study the morphology of various diseases [1]. Studies have documented 20-30% of sudden deaths being attributed to underlying pulmonary pathology [2]. As a result, histopathological examination of lung autopsy is of great value not only to diagnose the respiratory cause of death if any but also because it enriches our knowledge about lung histology in health and disease [3].
The aim of this study was to present the pulmonary histopathological alterations identified in autopsies of patients as well as to throw a light on principle cause of death due to pulmonary involvement [4]. This study also describes the prevalence and pattern of lung diseases in medicolegal autopsies, confirmed by histopathological examination.

Materials and Methods
This is an observational study of 500 autopsy cases carried out on lung tissue received to the department of pathology, tertiary care center for histological examination for a 4 year's period. [2017-2020]. The case selection was based on inclusion and exclusion criteria. All lung specimens from autopsy cases were included in this study while autolyzed lung specimens were excluded. Ethical clearance was not taken because of medicolegal nature of the cases.
Lung specimens received were preserved in 10% formalin. They were examined grossly for abnormalities on gross and cut sections and representative sections were processed as per laboratory standard operating protocol. Histological sections were stained with hematoxylin and eosin stains. Special stains were done as when required for confirmation of the diagnosis. Pulmonary lesions were studied histologically and relative frequency amongst various lesions with clinicopathological correlation was obtained.

Results
During the period of January 2017 to December 2020, lung specimens from a total of 507 autopsy cases [Table: 1] were received to our department of pathology at tertiary care center, out of which 7 autopsy cases [1.38%] were excluded from our study as the specimens from

them were autolyzed, 70 [13.8%] cases showed unremarkable gross and microscopic histology while 430 [84.81%] cases showed significant pathological microscopic findings in their lung specimens.

Table 1: Distribution of findings in the lung tissue received for histopathological examination

Overall state of lungs	No. of cases	Percentage (%)
Autolyzed	07	1.38
Normal histology	70	13.80
Pathological findings	430	84.81
Total	507	100

Table 2: Number of lung tissues received for histopathological examination

Total cases studied	Right lungs	Left lungs
500	500	448

Out of 500 cases studied, the number of specimens received from right lungs were 500 while that from left lungs were 448. [Table: 2]

Table 3: Age wise distribution of 500 autopsy cases in the present study

Age group (Years)	Male	Female	Total
0-9	33	27	60
10-19	23	25	48
20-29	48	48	96
30-39	64	34	98
40-49	50	13	63
50-59	58	19	77
60-69	30	12	42
>70	11	5	16
Total	317	183	500

Out of 500 cases studied, 317 of the cases were males and 183 cases were females accounting to a male: female ratio of 1.7: 1. The highest cases received were in the age group of 20 to 40 years and the least cases being from age group over 70 years. [Table: 3]

On microscopy [Table 4], the majority of cases had pulmonary edema [Fig.1: A, B] in 72.4% of right and 71.4% of left lungs followed by pulmonary congestion [Fig. 1: C] in 68% of right and 70.3% of left lungs, pneumonia in 18.8% of right and 15.8% of left lungs, pulmonary hemorrhages [Fig.1: D] in 14% of right and 11.6% of left lungs.

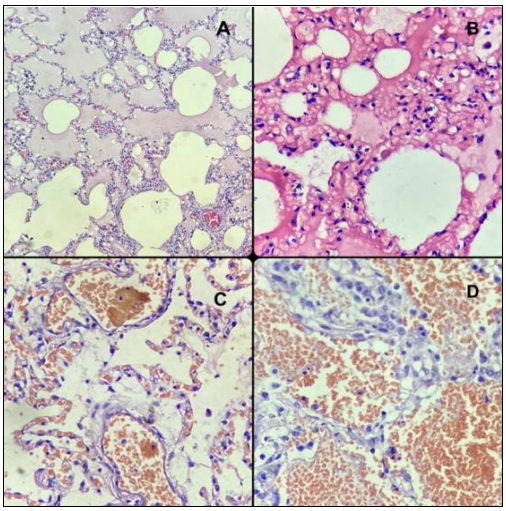

Fig 1: Pulmonary edema [A, B]: Showing edematous fluid in the alveoli [A] and in the interstitial spaces of lung [B]; Pulmonary congestion [C]: Showing congested blood vessels and capillaries, Pulmonary hemorrhage [D]: Showing hemorrhages in the alveoli. [H&E: 40X]

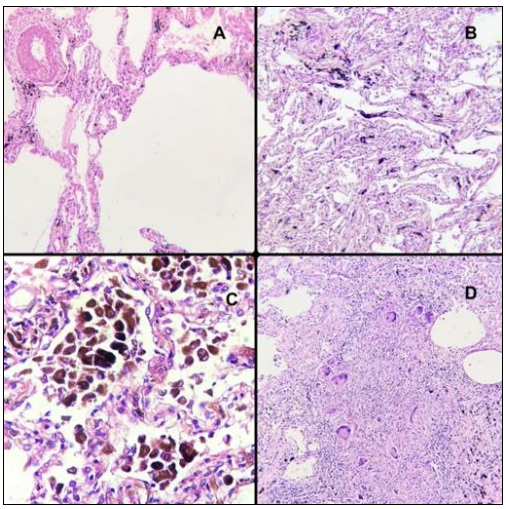

Fig 2: Emphysema [A]: Showing dilatation of the alveoli. Atelectasis [B]: Showing collapsed alveoli. CVC [C]: Showing plenty of hemosiderin laden macrophages in the alveoli with congested capillaries in the interstitium. [H&E: 40X] Granuloma [D]: Showing non caseating granuloma with plenty of langhans giant cells, epithelioid cells, lymphocytes and surrounding fibrosis [H&E: 10X]

Emphysematous changes [Fig. 2: A] were observed in 8% of right and 6.7% of left lungs while atelectasis [Fig. 2: B] was seen in 2.8% of right and 2.9% of left lungs. CVC (Chronic venous congestion) [Fig. 2: C] and granuloma formations [Fig. 2: D] were observed each in 1.4% of right lungs and 1.5% and 0.9% of left lungs respectively. All granulomas were subjected to fitefaraco staining to demonstrate acid fast bacilli and to confirm tuberculosis.

Table 4: Distribution of microscopic feature in the right and left lung tissues received for histopathological examination

Sr. No.	Microscopic features	Right lung	Right lung (%)	Left lung	Left lung (%)
1.	Pulmonary oedema	362	72.4	320	71.4
2.	Pulmonary congestion	340	68.0	315	70.3
3.	Pneumonia	94	18.8	71	15.8
4.	Normal histology	70	14.0	71	15.8
5.	Pulmonary hemorrhage	70	14.0	52	11.6
6.	Emphysematous changes	40	8.0	30	6.7
7.	Atelectasis	14	2.8	13	2.9
8.	Chronic venous congestion	07	1.4	07	1.5
9.	Granuloma formation	07	1.4	04	0.9
10.	Diffuse alveolar damage	06	1.2	04	0.9
11.	Bronchiolitis	04	0.8	03	0.7
12.	Smokers Lung	04	0.8	02	0.4
13.	Bronchitis	03	0.6	03	0.7
14.	Vasculitis	03	0.6	03	0.7
15.	Interstitial fibrosis	02	0.4	02	0.4
16.	Congenital malformations	02	0.4	02	0.4
17.	Pleuritis	02	0.4	02	0.4
18.	Thrombus formation.	02	0.4	00	0.0
19.	Tuberculosis	01	0.2	01	0.2
20.	Hypertensive changes in vessels.	01	0.2	01	0.2
21.	Carcinoma	01	0.2	01	0.2
22.	Extramedullary hematopoiesis	01	0.2	01	0.2

Out of 8 granulomas observed in right and 5 in left lung specimens, 1 case showed caseating granulomas with acid fast bacilli positivity by fitefaraco staining in both the lungs and was categorized this as case of tuberculosis. [Fig. 3: A, B]

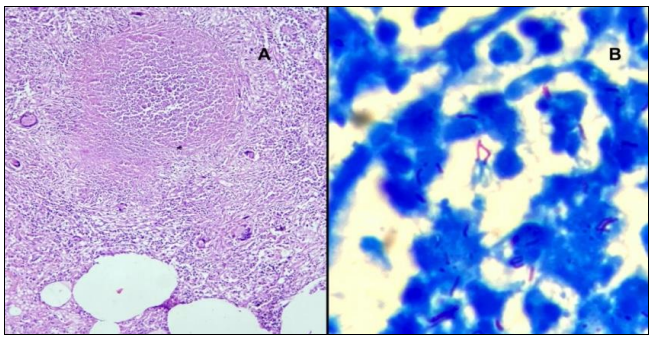

Fig 3: Tuberculosis [A]: Showing caseating granuloma with central caseation surrounded by epithelioid cells, many langhans giant cells, lymphocytes and fibrosis. [H&E: 40X] [B]: showing positive for acid fast bacilli. [Fitefaraco: 100X]

Diffuse alveolar damage was seen in 6 right lung specimens and 4 left lung specimens followed by bronchiolitis and smoker's lung in 4 right lung specimens each and 3 and 2 left lung specimens respectively.

Bronchitis and vasculitis were observed in both the lungs in 3 cases while interstitial fibrosis, pleuritis and congenital malformations were observed in both sided lung specimens in 2 cases each.

Congenital malformations were in the form of pulmonary lymphangiectasis [Fig.4: A], observed in 1-month female child while second case was of broncho-vascular malformations with pneumonia [Fig.4: B] seen in the 4-month male child.

Hypertensive changes in the form of arteriolosclerosis, extramedullary hematopoiesis and secondaries [Fig. 5] were observed in one case each in both lungs. Thrombus formation [Fig. 6: D] was seen in 2 cases in right lungs.

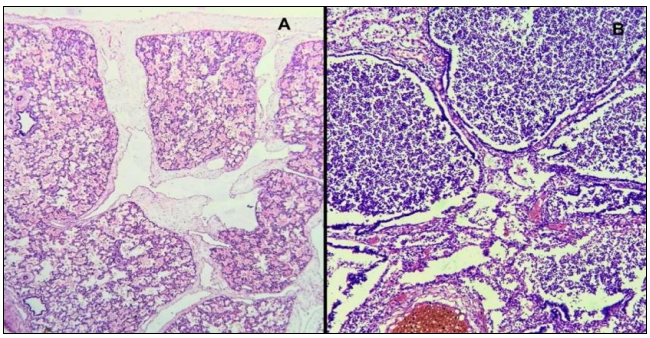

Fig 4: Pulmonary lymphangiectasis [A]: Showing increased number of dilated lymphatic channels in the lobular septa of the lungs [H&E: 5X] Broncho-vascular malformations with pneumonia [B]: Showing multiple dilated bronchioles lined by columnar epithelium and plenty of inflammatory cells in the lumen. Interstitium also shows increased number of blood vessels. [H&E: 10X]

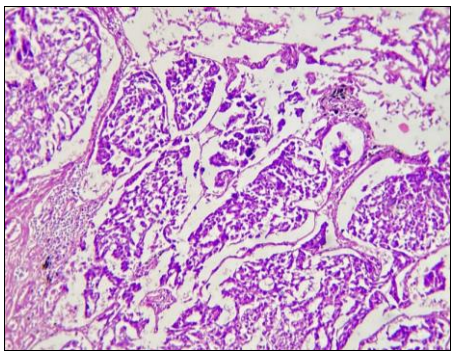

Fig 5: Malignancy: Showing metastatic deposits of atypical epithelial cells in the alveolar lumen. [H&E: 40X]

Table 5: Age wise distribution of pneumonias

Type of pneumonia	Age in years							
	0-9	10-19	20-29	30-39	40-49	50-59	> 60	Total
Interstitial Pneumonia	09	03	08	12	05	08	10	55 [58.5%]
Lobar Pneumonia	05	02	02	02	05	03	04	23 [24.5%]
Bronchopneumonia	02	02	01	01	01	01	05	13 [13.8%]
Aspiration Pneumonia	02	01	0	01	0	0	0	03 [1.2%]
Total	18	08	11	16	11	12	19	94 [100%]

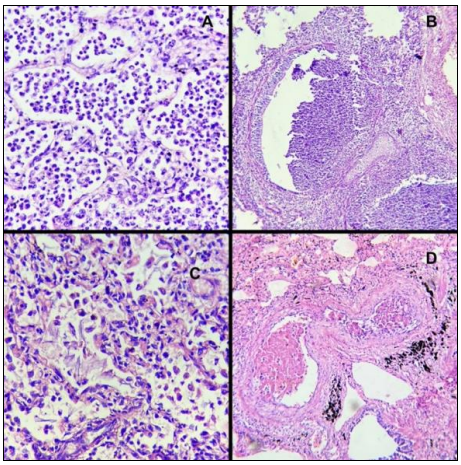

Fig 6: Lobar pneumonia [A]: Showing alveoli filled with plenty of acute inflammatory cells. Bronchopneumonia [B]: Showing bronchi lined with columnar cells with infiltration of acute inflammatory cells in the wall as well as in the lumen. Aspiration pneumonia [C]: Showing aspirated material in the alveolar spaces with inflammatory infiltrate in the interstitium. Thrombus [D]: Shows pink hyaline fibrin thrombus attached to the arterial wall of the vessels of the lung. [H&E: 40X]

Out of 94 cases of pneumonias, interstitial pneumonia was observed in majority of cases i.e., 55 [58.5%] cases while lobar pneumonia [Fig. 6: A] accounted for 23 [24.5%] cases followed by bronchopneumonia [Fig. 6: B] in 13 [13.8] cases and aspiration pneumonia [Fig.6: C] in 3 [1.2%] cases. Overall, pneumonias were observed in extremes of age as observed in the present study. Interstitial pneumonia was observed predominantly in the age group of more than 60 years followed by pediatric age group of 0-9 years. Aspiration pneumonias were observed predominantly in the age group of 0-9 years.

Discussion

In the present study of 500 autopsy cases, terminal changes in the lung due to extrapulmonary cause of death like pulmonary edema, congestion and intra alveolar hemorrhages, all falling under acute lung injury, accounted for maximum number of cases forming the bulk of pulmonary pathology. These observations are in agreement with those of Rupali RK *et al.* [2017] [4] who reported 58% [743 cases] and Chauhan *et al.* [2015] [5] who reported 54.32% cases of terminal changes in the lungs which included interstitial edema, congestion and changes due to cardiovascular diseases. These observations in the present study also correlates with the study done by Bora Ozdemir *et al.* [2012] [6] who found intra alveolar hemorrhage and pulmonary edema together accounting for 71% of the cases, Alexandre de MS *et al.* [2008] [7] whose study revealed intra alveolar edema, pulmonary congestion and diffuse alveolar damage in 77.7% of the cases and Bal *et al.* [2008] [8] who reported 59.3% cases of terminal events in the lung like pulmonary edema and acute respiratory distress syndrome.

Male preponderance was seen in terminal changes in lung in our study similar to other studies as stated above [5, 6].

In the present study, second most common lesion observed was pneumonia which was observed in 94 right lung tissues and 71 left lung tissues. This finding was comparable to the study done by Bal *et al.* [8], Niazi *et al.* [9], Fang *et al.* [10] and Chauhan *et al.* [5] who found 18%, 17.88%, 15% and 14.62% cases of pneumonia at autopsy in their studies respectively. The most common age group affected in our study was above 60 years of age similar to findings of Chauhan *et al* [5] who found maximum number of pneumonia cases in 6th and 7th decade of life. In the present study, we found interstitial pneumonia as most common type in 55 cases [58.5%] followed by lobar pneumonia in 23 cases [24.5%] and bronchopneumonia in 13 cases [13.8%] as comparable to study done by Rupali RK *et al.* [4] who found these types of pneumonia in 42.56%, 28.92% and 27.68% cases respectively.

Emphysematous changes were observed in 40 [8%] in right and 30 [6.7%] in left lungs in our case series. Chauhan *et al.* [5] in their study have noted the percentage of emphysematous cases to be 8.2% in males and 7.76% in females.

Atelectasis was seen in 2.8% [14] of right and 2.9% [13] of left lungs in our study. Saara Neeha *et al*., reported atelectasis accounting for 29.3% (54) of cases in their autopsy study of foetal deaths at tertiary care centre [11].

CVC and granuloma formations were observed each in 1.4% of right lungs and 1.5% and 0.9% of left lungs respectively. One case of tuberculosis was confirmed by AFB positivity in our study. Kurawar *et al*., observed tuberculous granulomas in 32 [2.53%] cases out of 1263 cases studied [12].

A few differential diagnoses must be thought of during reporting of pulmonary granulomas. Non neoplastic granulomatous diseases like Wegener's granulomatosis and Churg-Strauss syndrome on histopathology shows necrotizing granulomas with features of vasculitis. Many infectious granulomatous lesions may also mimic tuberculosis. Fungal infections especially histoplasma show necrosis similar to tuberculosis. The Zeihl Neilson stain strongly identifies the tuberculous bacilli. AFB positivity on histopathological specimens also depends on bacillary load [1].

Diffuse alveolar damage was seen in 6 [1.2%] right lung specimens and 4 [0.9%] left lung specimens in our study. Thej Jagadish Mothakapalli *et al*., observed DAD in 13.6% of right lungs and 13.5% of left lungs [13]. The lower rate of DAD in the present study could be due to fact that most of the cases did not die of acute respiratory failure.

In the rest of cases, we found normal histology in 70 [14%] in right lungs and 71 [15.8%] in left lung specimens. Bronchitis and vasculitis were observed in both the lungs in 3 cases while interstitial fibrosis, pleuritis and congenital malformations were observed in both sided lung specimens

in 2 cases each. Thrombus formation was seen in 2 cases in right lungs. Hypertensive changes in the form of arteriolosclerosis, extramedullary hematopoiesis and secondaries were observed in one case each in both lungs.

Summary and Conclusion

The present study documents the histopathological spectrum of lung lesions seen in autopsies. Though the pulmonary diseases are commonly encountered clinically, study of lung tissue not only gives us an insight into histology of various stages of different diseases and lesions as seen in this present study but also helps in final cause of death. This study also highlights various lesions in lungs which were either incidental or direct cause of death.

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