



AN AUTOPSY BASED TWO YEAR PROSPECTIVE STUDY OF HISTOPATHOLOGICAL LESIONS OF LUNGS

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ABSTRACT

Introduction: The lungs are affected by a wide range of infectious, inflammatory, occupational, and neoplastic disorders. Thousands of individuals worldwide suffer from many of these avoidable and treatable pulmonary diseases. Additionally, the lungs play a secondary role in numerous fatal illnesses of the body. Despite advances in clinical, radiological, and other diagnostic modalities, including available invasive procedures, it is still not always possible to accurately diagnose underlying pathological processes. In these situations, autopsy-based histomorphological examination of the lungs serves as a useful tool for understanding pathophysiology and disease progression from the perspectives of pathologists and researchers. **Aims and Objective:** To study the various changes in lungs, submitted for autopsy, involved in different pathological conditions and to understand their diagnostic, preventive, curative importance as well as application in research activity. **Material and Method:** This prospective study includes a gross and histopathological evaluation of 220 autopsied lungs (Pieces and occasionally Whole) that were received at the pathology department of RNT Medical College in Udaipur over a two-year period (January 22–December 23). A total of 202 specimens were investigated after 18 of the 220 lung specimens were autolyzed and removed from the study. After the specimens were fixed in 10% formalin, they were processed according to protocol, paraffin sectioning was done followed by Hematoxyline and Eosin (H and E) staining was applied, with the use of specific stains as needed. Data from police inquiries, autopsy reports, and received clinical histories have been correlated with our microscopic and gross results. **Results:** 202 lung specimens ranging in age from 0 to 75 years were examined in detail, both grossly and microscopically. Of them, 88 instances (43.56%) impacted the age group of 31 to 45 years, followed by 16 to 30 years. Compared to women (46,22.72%), men were significantly more affected (156,77.22%). According to chronological sequence, the most frequent lesions were congestion and pulmonary edema (47.52%), followed by pneumonia (14.35%), emphysema (8.41%), tuberculosis (6.93%) and Congestion, pulmonary edema including intra-alveolar hemorrhages (5.44%) seen. In addition, cases of numerous other diseases, such as ARDS, chronic bronchitis, lung abscess, aspiration pneumonitis, and pulmonary thromboembolism, are found upon gross and microscopic examination. Additionally, there are two cases of primary malignancy, one each of squamous cell carcinoma and adenocarcinoma, and one case of metastasis in varying proportions. Despite excessive attempts, we were unable to identify any pathology in 15 tissues (7.42%). **Conclusions:** The results of this study show that, despite major advancements in current diagnostic pathology, infectious and inflammatory lesions remain the most frequently encountered entities and cause a considerable amount of morbidity and mortality. Therefore, the importance of autopsies has not diminished; they are still crucial for learning and evaluating the disease processes as well as a supplemental tool for identifying and evaluating respiratory disorders.

KEYWORDS : Autopsy, Emphysema, Tuberculosis, Congestion, Pulmonary edema, Pneumonia

INTRODUCTION

In the current era of industrialization, urbanization, alarming pollution, indulgent smoking, bad eating habits, and compromised immune systems, humans are extremely susceptible to a wide range of illnesses and disease processes. As the most prevalent cause of mortality for males, lung cancer is a dreaded malignancy that often results from a multitude of viral, inflammatory, occupational, and chemical threats, to which the lungs become overly sensitive and susceptible. The development of COPD is a notable instance, where occupational risks have a substantial influence. Studies have shown that the global burden of COPD is significantly influenced by occupational exposures. Occupational COPD, which damages the lungs and airways and causes chronic inflammation, is frequently the result of years of exposure to hazardous substances (1).

COVID was a recent example that had a significant effect on lung health. Pneumonia and, in the worst situations, acute respiratory distress syndrome, or ARDS, were pulmonary problems brought on by Covid-19. Another potential COVID-19 consequence that might have a long-lasting negative impact on the lungs and other organs is sepsis (2).

All of these stories have one thing in common: the lungs are impacted by a variety of pathophysiological events, including

diseases of other systems, including the cardiovascular system, and it is never easy to detect and treat these conditions in a timely manner due to their complicated and complex processes. Although there has been significant progress in clinical, radiographic, and other advanced and invasive diagnostic methods, outcomes are not always favorable. If identified early on and treated effectively, many pathological illnesses are avoidable and treatable. Thus, autopsies of the lungs both gross and microscopic offer excellent platforms for education, comprehension of the chronology of etiopathogenesis, research endeavors, and the enhancement of knowledge regarding lung pathology. This will enable us to prevent, treat, and considerably lessen the burden of human illness. The studies have documented 20–30 % of sudden deaths being attributed to underlying pulmonary pathology (3). To better understand various frequent or infrequent lung lesions and their proper application, we conducted a study on autopsied lungs in this context.

MATERIALS AND METHODS

Over the course of two years, from January 2021 to December 2023, a prospective study was carried out in the pathology department at RNT Medical College in Udaipur, Rajasthan. During this time, 220 medicolegal autopsies involving lobes, portions of lobes, or even entire lungs were obtained from forensic medicine. We included 202 autopsied lung specimens

in our analysis, regardless of gender, age, or religion, because 18 of the 220 were autolyzed and thus eliminated from the study.

The specimens were fixed in 10% formalin. Following examination for consistency, color, texture, areas of consolidation, infarction, edema, cavity, growth area, abscess, congestion, bullae, and area of hemorrhage, two tissue sections of the pathological area of 3-5 mm thickness from each piece were cut, standard tissue processing procedures were followed, and paraffin embedding was completed. Routine Hemotoxylin and Eosin stains were applied to tissue slices. using DPX, the stained pieces were mounted using cover slip. Additionally, specific stains were utilized as needed. The slides were made and examined under a light microscope while being correlating to the patient's medical history, any relevant investigations, and any police records if available.

Statistical Analysis

The results of the study were statistically analyzed using the Statistical Package for the Social Sciences (SPSS) version 20 (IBM Corp. SPSS statistics, in Armonk NY) for windows. Data were expressed as mean $\pm$ standard deviation and range for quantitative variables, numbers, and percentage. To assess differences in variables the Chi square test was used. A p value of < 0.05 was taken as being of significance for all statistical tests.

RESULTS

Over the course of two years, from January 2021 to December 2023, 202 autopsied lung specimens were included in the current investigation. These are the outcomes of this activity following a thorough gross and microscopic evaluation of the specimens. The results are only briefly described here, and relevant tables have been created. Three cases had maximum ages of 75 years, and one case had a minimum age of 1.5 months. Male predominance was seen when evaluating the data; 156 cases (77.22%) of males were observed, compared to 46 cases (22.72%) of females (Table 1). If we look at the age distribution of the cases, we find that the majority were between the ages of 31 and 45 (88 cases, 43.56%), followed by the 16 to 30 age range (63 cases, 31.18%), and the age group with the fewest cases, 0 to 15 (11 cases, 5.44%) (Table 2).

When several pathological lesions of the lungs were analyzed, congestion with pulmonary edema was shown to be the most common lesion in 96 instances (47.52%); however, when intra-alveolar hemorrhage is included, the number of cases decreases to 11 (5.44%) only. Pneumonia, which includes lobar, broncho, and interstitial pneumonia, was the second most frequent lesion and was found in 29 instances (14.35%), 2 of which were younger of 3 and 6.5 months (Figure 1,4). Despite significant progress in treatment approaches, this remained a significant cause of death. This study found that in the current age of pollution, there were 17 cases of emphysema (8.41%) and 4 cases of chronic bronchitis (1.98%) (Figure 2). Even with significant treatment advancements, there are still 14 instances of tuberculosis (6.93%) reported, including 2 cases of miliary tuberculosis (Figure 6).

Examining the lung specimens revealed a variety of pathological abnormalities, including ARDS, lung abscess, aspiration pneumonitis, pulmonary thrombo-embolism, bronchiolitis, two cases of primary malignancy, and one case of colorectal adenocarcinoma metastases (Figure 3,5). In 15 cases (7.42%) even after a thorough investigation, no pathological abnormalities were found (Table 3). The age-wise distribution of lesions was also calculated and presented in this study (Table 4).

Table1: Sex Wise Distribution Of Cases

Gender	Number of cases	Percentage%
Male	156	77.22
Female	46	22.77

Table2: Age Wise Distribution Of Cases

Age groups	Number of cases, (202)	Percentage%
0-15	11	5.44
16-30	63	31.18
31-45	88	43.56
46-60	27	13.63
61-75	13	6.43

Table3: Distribution Of Spectrum Of Lesions

Lesions	Number of cases, (202)	Percentage %
Congestion and pulmonary edema	96	47.52
Pneumonia	29	14.35
- Lobar pneumonia	17	8.41
- Broncho pneumonia	8	3.96
- Interstitial pneumonia	4	1.98
Emphysema	17	8.41
Tuberculosis	14	6.93
Congestion + pulmo. edema + hemorrhage	11	5.44
Acute respiratory distress syndrome	5	2.47
Chronic bronchitis	4	1.98
Lung abscess	3	1.48
Aspiration pneumonitis	2	0.99
Pulmonary thrombo-embolism	2	0.99
Bronchiolitis	1	0.49
Primary malignant lesion	2	0.99
Secondary metastasis	1	0.49
Normal (Unremarkable)	15	7.42

Table4: Age Wise Distribution Of Lesions

Lesions and no. of cases	0-15 years	16-30 years	31-45 years	46-60 years	61-75 years
Congestion and pulmonary edema (96)	4 (4.16%)	30 (31.25%)	46 (47.91%)	10 (10.41%)	6 (6.25%)
Pneumonia (29)	3 (10.34%)	7 (24.13%)	8 (27.58%)	9 (31.03%)	2 (6.89%)
Emphysema (17)	0 (0%)	3 (17.64%)	11 (64.70%)	2 (11.76%)	1 (5.88%)
Tuberculosis (14)	0 (0%)	5 (35.71%)	8 (57.14%)	1 (7.14%)	0 (0%)
Congestion, pulmo. edema and hemorrhage (11)	1 (9.09%)	3 (27.27%)	6 (54.54%)	1 (9.09%)	0 (0%)
Acute respiratory distress syndrome (5)	0 (0%)	2 (40%)	2 (40%)	1 (20%)	0 (0%)
Chronic bronchitis (4)	0 (0%)	1 (25%)	1 (25%)	0 (0%)	2 (50%)
Lung abscess (3)	0 (0%)	0 (0%)	2 (66.66%)	0 (0%)	1 (33.33%)
Aspiration pneumonitis (2)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)
Pulmonary thrombo-embolism (2)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	1 (50%)
Bronchiolitis (1)	1 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Primary malignant lesion (2)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
Secondary metastasis (1)	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)
Normal (Un-remarkable) (15)	2 (13.33%)	9 (60%)	4 (26.66%)	0 (0%)	0 (0%)



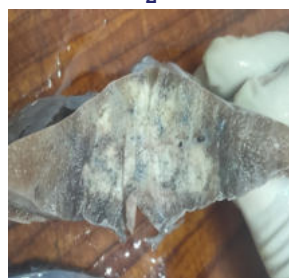
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Gross Findings, Fig.1: Lobar pneumonia (Stage of congestion and red hepatization). Fig.2: Emphysema, lung are hyperinflated, and small, thin-walled subpleural blebs (<1cm in diameter) are present. Fig.3: Lung abscess, with central cavitation lined by suppurative material and a shaggy necrotic wall. Fig.4: Lobar pneumonia (Stage of grey hepatization).

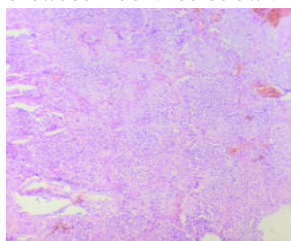


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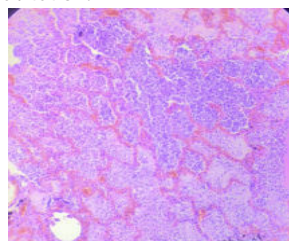


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Gross Findings, Fig.5: Lung carcinoma, large mass in the hilar region, with areas of pale necrosis and the lung parenchyma infiltration. Fig.6: Tuberculosis, lung shows extensive involvement of the bronchial tree and parenchyma by pale foci of caseous (cheesy appearing) necrosis and upper lobe shows confluent necrosis with cavitation.

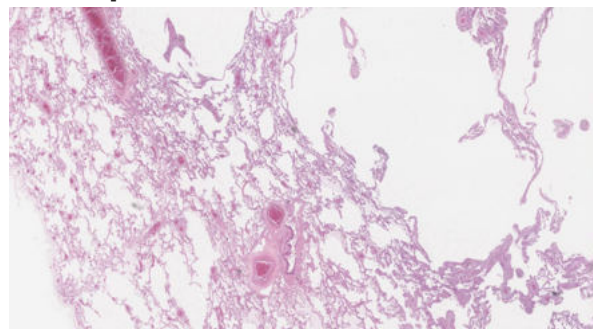


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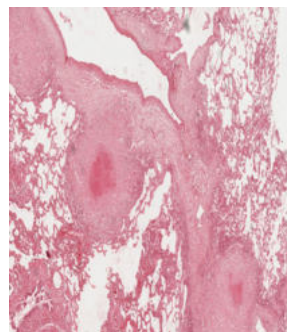


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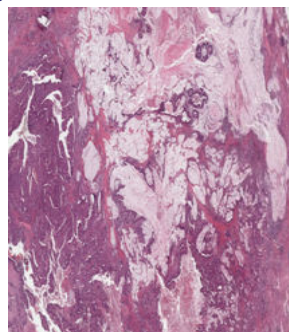
Microscopic Findings, Fig.7: Lobar pneumonia, stage of grey hepatization. Fig.8: Lobar pneumonia, stage of congestion and red hepatization.



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Microscopic Findings, Fig.9: Features of Emphysema, Fig.10: Tuberculosis, multiple caseating granulomas seen, Fig.11: Lung metastasis from colorectal carcinoma.

DISCUSSIONS

People may experience numerous infectious, inflammatory, and neoplastic lesions throughout their lives as a result of illnesses affecting many different body organs, but the lung is one of the most commonly affected tissues due to worrying environmental pollution, occupational hazards, and frequent and direct exposure to pathogenic organisms, many of which are easily avoidable and treatable. Clinical, laboratory, and radiographic evidence frequently may not strongly imply a particular pathology. Too often, the proper diagnosis and treatment are delayed. While certain diagnostic approaches can stop the illness process from progressing further, this isn't always feasible in developing nations because of a lack of resources and inadequate health infrastructure.

Because the lung is located in the intrathoracic region, invasive procedures like FNAC or biopsy are never easy to do. There are therefore many gaps in the accurate and timely diagnostic approach to lung pathology, but despite all of these shortcomings, medicolegal autopsies of the lungs provide us with a wonderful opportunity to learn about the pathophysiology of various lung disease processes, expand our knowledge, and effectively apply research findings so that we may successfully treat and prevent the progression of disease. For this reason, lung autopsy was crucial.

In the current study, 43.56% (88) of the cases and lesions were observed in the age group of 31 to 45 years. The majority of cases were found in 30-39 year olds, according to studies by Kurawar RR and Vasaikar MS, Patel CB et al, and Sumaya et al (4-6). In contrast, Chauhan G et al and Amin NS et al report that the most of cases are found in 50-60 year olds (7-8).

In this study, we found a preponderance of men (156 males, or 77.22%) compared to 46 females (22.77%). These results were similar to those of studies conducted by Kurawar RR and Vasaikar MS (4), Patel CB et al. (5), Sumaya et al. (6), and Gunja RS et al. (9). In our investigation, pulmonary edema

and congestion accounted for the majority of pathological findings (96,47.52%). Cardiovascular causes were the most frequent reasons. These results were similar to those of research conducted by Chauhan G et al (7), Khare P et al (3), Gunja RS et al (9), Sumaya et al (6), and Garg P et al (10).

To this day, infectious and inflammatory diseases remain a major cause of death and morbidity in underdeveloped nations. Pneumonia (29, 14.35%), which is defined as acute inflammation of the lung parenchyma and is typically brought on by bacteria and other microorganisms (virus and fungus), was the second most frequent finding in the current study (Figure 7,8). Traditionally classified into lobar and bronchopneumonia based on gross morphology. The most frequent bacteria that cause community-acquired pneumonia is *Streptococcus pneumoniae*, while hospital-acquired pneumonia and ventilator-associated pneumonia are also frequently caused by Gram-negative bacteria and *Staphylococcus aureus*. Pneumonia was reported to be the second most prevalent result by Chauhan G et al. (7), Amin NS et al. (11), Gunja RS et al. (9), and Kaur B et al. (12), similar to our findings.

Because of the worrying rise in smoking rates and environmental contaminants, COPD is currently the third most common cause of death worldwide (13). Emphysema is characterized by aberrant air space enlargement distal to the terminal bronchioles, little to no fibrosis, and loss of the alveolar septa (Figure 9). Many pulmonary functions are impacted by emphysema, which often results in long-term respiratory problems. In this study, 17 instances (8.41%) had emphysema, with men making up the majority of those affected. Similar to our investigation, studies by Kare P et al (3) and Chauhan G et al (7) reported that the percentage of emphysematous cases was 8.2% and 7.76%, respectively.

An estimated 10.0 million individuals worldwide contracted tuberculosis (TB) in 2019, with an estimated 1.2 million TB-related fatalities among HIV-negative individuals and an additional 208,000 deaths among individuals living with HIV. Of all TB patients, adults made up 88% and children under the age of 15 made up 12% (14). Common risk factors include immunosuppression, such as HIV/AIDS, chronic immunosuppressive medication, inborn immunodeficiency, and occupational exposure to pneumoconiosis (silicosis) in mining and construction (15).

Mycobacterium-induced pulmonary disorders result in considerable morbidity and mortality for human health, and HIV infection greatly raises the risk of tuberculosis (16). The diagnosis of tuberculosis is made using a combination of clinical symptoms, radiologic and laboratory findings, and exposure history; however, because of societal stigma, this is not always an easy process. The majority of the 14 (6.93%) tuberculosis patients in our study were males in the 31–45 age range. In the study by Kurawar et al. (4), out of 1263 cases examined, 32 (2.53%) had tuberculosis; of these, 22 (1.74%) cases were male. The age group with the highest frequency of tuberculosis cases was 40–49 years old. In the study by Shetty A. and C. Vijaya (17), 3.3% of cases were seen and the age group with the highest percentage of cases was 31–45 years old (Figure 10).

ARDS, also known as diffuse alveolar damage, is characterized by damage to the alveolar lining and endothelial cells, pulmonary edema, the creation of hyaline membranes, and later proliferative alterations involving the lining cells of the alveoli and bronchi, as well as the interstitial cells. While DAD is the characteristic appearance of ARDS, the clinical condition of ARDS is not the same as the pathologic diagnosis of DAD and presents with a wide range of symptoms that complicate the diagnosis. Infectious pathology and sepsis were the two main causes of ARDS in the

five cases of ARDS that we observed in our investigation.

In the course of our investigation, we also came across a variety of cases in varying proportions, including lung abscesses, aspiration pneumonia, two cases of pulmonary thrombo-embolism brought on by deep vein thrombosis and a car accident each, two cases of primary squamous cell carcinoma and adenocarcinoma each, and one case of metastasis from colorectal adenocarcinoma (Figure 11). Although there were no pathological abnormalities found in 15 instances (7.42%) after a thorough and detailed examination, our results were similar to those of studies conducted by Shweta et al. (18), Kour B et al. (12), and Hanmante RD et al. (19).

CONCLUSION

Lung is frequently engaged in a variety of disease processes, especially inflammatory and infectious ones. Even though there are numerous diagnostic techniques, precise diagnosis isn't always achievable due to the intricate pathophysiology of numerous conditions. Thus, lung autopsies add to our understanding and provide a means of better comprehending disease processes. The results of this investigation indicated that emphysema, TB, and pneumonia were the most prevalent conditions. Males experienced lung lesions at a higher rate than females. The different pathological abnormalities in the lungs that were either accidental or could have been a direct cause of death or illness are highlighted in this study. There are certain shortcomings as well as room for development. The fact that many times only a portion of the organ or lobe was obtained, was a study constraint. Having the entire organ would allow for more accurate histopathological reporting. Autolyzed specimen, insufficient information and clinical history obscures the reason of death and diagnosis.

Conflict of Interest -The authors declare that there are no conflicts of interest in this paper.

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