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Exploring Histological Diversity: An Analysis of Post-Mortem Lung Tissues Across a Spectrum of Respiratory Pathologies

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ABSTRACT
Autopsies determine death identification, causality, temporal elements, and chronological connection. Autopsies show primary and secondary lung lesions. This research examined the histological features of post-mortem lung tissue samples to investigate a broad range of lung diseases. The study was conducted at the Mysore Medical College and Research Institute Department of Pathology autopsy unit. A total of 80 lung autopsy specimens were collected from December 1, 2014-May 31, 2016. The specimens underwent paraffin sectioning, followed by Haematoxylin and Eosin staining. Macroscopic and microscopic examinations were conducted to comprehensively explore the histological characteristics. Among the 80 cases that were examined, it was observed that 3 cases had normal results. The age range of the patients varied from 13 years-85 years. The most common histology finding in surviving individuals was pulmonary Edema (27.5%). This was followed by 22.5% emphysema, 12.5% interstitial pneumonitis, 11.25% pneumonia, 10% cardiovascular congestion lung, 8.75% intra alveolar haemorrhage, 2.5% Tuberculosis and 1.25% aspergillosis. The prevalence of pulmonary Edema, emphysema and various inflammatory conditions highlights the significance of histological analysis in advancing our understanding of respiratory pathologies.

INTRODUCTION

The lungs are the organs most often impacted on a global scale and the manifestation of lung disease exhibits a diverse and intricate range of presentations. Clinicians often encounter difficulties in the process of diagnosis, despite the use of contemporary and sophisticated diagnostic techniques[1]. A significant proportion of the global population experiences avoidable chronic respiratory illnesses. Sathawane and Swami[2] implicated Lung parenchyma in several disorders characterized by inflammation, fibrosis, or granulomatous responses[2]. The clinical and radiological symptoms associated with lung disorders lack specificity, necessitating timely pathological investigations and diagnosis[3]. These measures are crucial for enhancing patient survival, preventing the fast advancement of the disease and minimizing the need for invasive operations[3].

The rapid advancement of medical knowledge and technology has resulted in a decrease in the amount of time available for comprehensive diagnostic and invasive treatments. The histological characteristics of well-documented lung illnesses in their early stages continue to provide a challenge due to the limited feasibility of obtaining biopsy samples[4]. Therefore, the histological investigation of lung autopsy has significant importance in the identification and diagnosis of respiratory-related causes of death. Furthermore, it enhances our understanding of lung pathophysiology. The primary purpose of a medico-legal autopsy is to ascertain the cause of death. In addition to determining clinicopathological distinctions, autopsies play a crucial role in advancing our comprehension of established illnesses and provide a valuable avenue for investigating the pathophysiology of emerging diseases[5].

Numerous pathological disorders affecting lung parenchyma might exhibit associations with inflammation, fibrosis, or granulomatous responses[6]. The clinical history, laboratory tests and radiographic results provide supporting data, but a quick pathology diagnosis is necessary to confirm the illness and determine its prognosis[3]. This measure serves to mitigate the need for the patient to undergo further operations of a more invasive kind. Hence, it is essential to ascertain the primary factors contributing to mortality in order to facilitate the implementation of cost-effective preventative measures against the progression of pulmonary ailments. Furthermore, it is desirable to minimise the need for an intrusive medical intervention, such as a lung biopsy[4].

The histological characteristics of well-documented lung illnesses in their early stages continue to be enigmatic due to the limited feasibility of obtaining biopsy samples[8]. Therefore, the use of histological analysis in lung autopsies proves to be very valuable in the identification and diagnosis of respiratory-related causes of death. Furthermore, it contributes to our understanding of lung pathophysiology. The primary purpose of a medico-legal autopsy is to ascertain the cause of death. Hence, the practise of conducting an autopsy has significant value as it enables the comprehensive assessment of internal organs subsequent to an individual's demise. This meticulous examination serves the purpose of assessing the presence of sickness or damage, as well as ascertaining the underlying cause and method of death[9].

The lungs have a role in a wide range of inflammatory, neoplastic and other pathological conditions. Additionally, they are affected as a secondary site in almost all types of terminal illnesses[10-16]. The study of lungs during autopsies provides significant insights into different phases of fibrosis, including initial patchy fibrosis and honeycombing lesions, as well as their distribution and evolution throughout the pulmonary system[17]. Anisha *et al.,* examined autopsy lung histopathology for lung lesions from individuals with diverse causes of death and their direct or indirect contributions. Acute respiratory failure is a significant contributor to mortality in individuals presenting with a diverse range of underlying primary conditions[18]. In contemporary times, the issue of air pollution and the presence of various environmental inhalants, chemicals, and harmful compounds have led to the exacerbation of bronchitis and pulmonary edema, making them difficult to manage[19-25]. Furthermore, the lungs are often affected in almost all types of terminal diseases, resulting in the presence of pulmonary edema, atelectasis, or bronchopneumonia to some extent in practically every patient nearing death. The primary aim of this study was to analyse the histological characteristics of postmortem lung tissue samples, with the purpose of investigating the wide spectrum of lung illnesses[26].

MATERIALS AND METHODS

The current study was carried out as a non-interventional, descriptive research endeavour. The present research received approval from the Ethical Committee of Mysore Medical College and Research Institute. The current investigation was carried out on lung specimens obtained from normal autopsies received at the department of pathology, namely the Autopsy division, of Mysore Medical College and Research Institute. The objective was to determine the prevalence of different pulmonary lesions seen during autopsies. The research was performed over a span of 18 months, commencing on December 1, 2014 and concluding on May 31, 2016.

Inclusion Criteria: The participants in this study were chosen from a pool of medico-legal autopsies, irrespective to age, sex, or cause of death.

Exclusion Criteria: The inclusion criteria of the research did not include autolyzed lung specimens and incomplete autopsies. Autopsy specimens of the lungs that exhibited only congestion and edema were also eliminated from the investigation.

Data Collection Procedure: Request forms were used to acquire detailed case histories. The Forensic Medicine Department of Mysore Medical College and Research Institute sent lung samples for histopathological investigation after autopsies. After that, the lungs were preserved in 10% formalin, their weight and dimensions were measured and a macroscopic examination was performed to assess colour, volume, texture, scarring, fibrosis, bullae, consolidation, nodules, infarction, secretions, edoema, congestion, granuloma/abscess formation and bronchi and pleura condition. No matter the presence of abnormalities, many lung tissue slices were microscopically analysed. After standard processing and paraffin wax embedding, 4-micrometer slices were made. These sections were stained with H and E, a typical staining method, then mounted on slides for inspection. Different stains were utilised to highlight tissue characteristics or disease states during analysis. All observations and discoveries were thoroughly recorded.

RESULTS AND DISCUSSIONS

Between December 1, 2014 and May 31, 2016, a sample size of 80 lung specimens obtained from autopsy subjects at the Department of Forensic Medicine, Mysore Medical College and Research Institute, Mysore, were subsequently transferred to the Department of Pathology, Mysore Medical College and Research Institute, Mysore.

Age and Sex Cross Tabulation: Table 1 is a cross-tabulation displaying the distribution of individuals across various age groups and their respective genders. It provides a count of males and females within each age category, indicating, for example, that in the 11-20 age group, there are four males and four females, totalling eight individuals. Additionally, the table offers the percentages of males and females within each age group, such as 7.8% for males and 13.8% for females in the 11-20 age group, collectively representing 10% of the entire dataset. The Total row at the bottom summarizes the overall counts, revealing 51 males, 29 females and a total of 80 individuals across all age groups. It confirms the balanced distribution of 100% within each gender category, making this cross-tabulation a valuable reference for comprehending the demographic composition of the studied population or sample. (Table 1)

Age wise Distribution of Different Histopathological Patterns of Lung Lesions: In pulmonary edema equal incidence was seen in both males and females. In all other lesions incidence was higher in males compared to females. Table 2 (Fig 1) presents the distribution of different histopathological patterns of lung lesions across various age groups. It reveals the number of cases with specific lung lesion patterns in each age category. For example, in the 21-30 age group, there are six cases of pulmonary edema, three cases of emphysema, two cases of CVC (cardiovascular congestion) and four cases of interstitial pneumonitis. Notably, the table illustrates variations in the prevalence of these lung lesions across different age groups, providing valuable insights into the relationship between age and specific histopathological patterns within the lung, which can be instrumental for medical research and diagnostic purposes. (Fig 1) (Table 2)

Histopathological Patterns of Lung Lesions in Males and Females: Table 3 displays the distribution of histopathological patterns of lung lesions categorized by gender (males and females) and provides the overall total and percentage distribution. It shows that pulmonary edema is observed in 11 males and 11 females, making up 27.5% of the total cases. Emphysema is more prevalent in males, with 13 cases compared to 5 in females, accounting for 22.5% of the total. Other patterns, such as interstitial pneumonitis and pneumonia, also show variations between genders. In summary, the table provides a comprehensive overview of the distribution of lung lesion patterns in males and females, with the percentage breakdown indicating the relative prevalence of each pattern within the total dataset. (Table 3)

Distribution of History of Smoking: Table 4 presents the distribution of a history of smoking among a total of 80 cases. It shows that 33 cases (41.2%) have a present history of smoking, while 27 cases (33.8%) do not have a history of smoking. Additionally, for 20

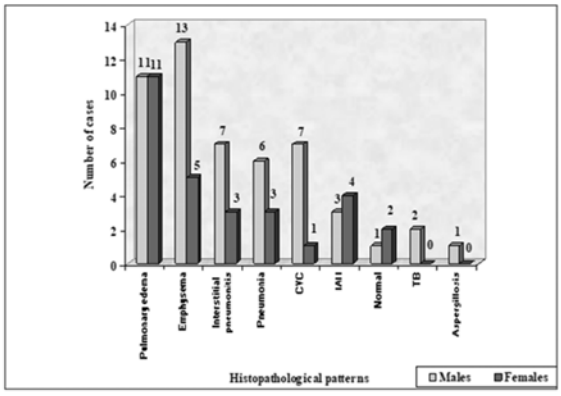

Fig. 1: Age stratified distribution of distinct histopathological patterns

Table 1: Age and sex cross tabulation

Age group (Years)		Sex		
		Males	Females	Total
11-20	Count	4	4	8
	% within sex	7.8	13.8	10.0%
21-30	Count	8	10	18
	% within sex	15.7	24.1%	22.5%
31-40	Count	9	4	16
	% within sex	17.6	13.8%	20.0%
41-50	Count	9	2	13
	% within sex	17.6	6.9%	16.2%
51-60	Count	13	2	15
	% within sex	25.5	6.9%	18.8%
61-70	Count	4	2	6
	% within sex	7.8	6.9%	7.5%
71-80	Count	2	0	2
	% within sex	3.9%	0.0%	2.5%
81-90	Count	2	0	2
	% within sex	3.9%	0.0%	2.5%
Total	Count	51	29	80
	% within sex	100.0%	100.0%	100.0%

Table 2: Age wise distribution of different histopathological patterns of lung lesions

Histopathological patterns	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90
Pulmonary edema	4	6	1	6	2	1	1	1
Emphysema	0	3	7	2	3	2	0	1
CVC	0	2	3	0	2	1	0	0
Interstitial pneumonitis	0	4	1	2	1	1	1	0
Intra alveolar hemorrhage	2	2	2	0	1	0	0	0
TB	0	0	0	1	1	0	0	0
Pneumonia	0	0	2	2	4	0	0	0
Aspergillosis	0	0	0	0	1	0	0	0
Normal	2	1	0	0	0	0	0	0

Table 3: Histopathological patterns of lung lesions in males and females

Histopathological patterns	Male	Female	Total	Percentage
Pulmonary edema	11	11	22	27.5
Emphysema	13	5	18	22.5
Interstitial pneumonitis	7	3	10	12.5
Pneumonia	6	3	9	11.25
CVC	7	1	8	10
IAH	3	4	7	8.75
Normal	1	2	5	3.75
Normal	2	0	2	2.5
Aspergillosis	1	0	1	1.25
Total	-	-	80	100

Table 4: Distribution of history of smoking

History of smoking	Number of cases	Percentage (%)
Present	33	41.2
Absent	27	33.8
Not available	20	25
Total	80	100

cases (25%), the smoking history is not available. This table offers a clear breakdown of the prevalence of smoking history within the studied population, indicating that a significant portion has a present history of smoking, while a smaller proportion has no history of smoking and in some cases, the information is not available. (Table 4)

The findings of this research indicated that among the 80 instances examined, men accounted for 63.8% of the cases, while females accounted for 36.3%. The male to female ratio was calculated to be 1.76:1, which is consistent with the ratio reported in a previous study conducted by Chauhan[27]. In their study, males included 71.64% of the cases, while females comprised 28.36% of the cases. These results are also consistent with research conducted by Akhilesh Pathak and Mangal[28]. The age distribution of different histological patterns showed a higher prevalence in the 21-30 years age range, with 18 cases, which is consistent with the findings of Hanmante *et al,* who reported 27 instances[29].

Another research has shown the distribution of cases based on age and sex, revealing that the occurrences were greater in males compared to females throughout the third and fourth decades of life. This finding aligns with previous studies conducted by Gupta BD and Jani CB, as well as Jani[30]. The leading cause of mortality was road traffic accidents (RTA), accounting for 30% of cases, followed by asphyxia (17.5%), poisoning (11.3%), drowning (7.5%), septicaemia (6.3%), snake bite, myocardial infarction (MI) and renal failure (RF) each with a prevalence of 4%. Multiple organ failure (MOF) accounted for 3.78% of cases. In 3.75% of instances, the cause of death

remained unidentified, whereas 1.25% of cases were attributed to both postpartum hemorrhage (PPH) and sudden death. There was no observed association between the causes of mortality and lung illnesses, which aligns with the findings of Selvam[26].

In the current investigation, three instances exhibited histological results that were within the normal range. This observation aligns with a previous study conducted by Hanmante *et al.,* where out of a total of 10 cases, 8.3% of the cases did not display any pulmonary lesions[29]. The histological pattern that occurred most often in the study was pulmonary edema, accounting for 22 cases or 27.5% of the total sample. An equal number of instances, namely 11 cases, were seen in both men and females. The findings of this investigation were consistent with those reported by Hanmanth *et al.* (21.7%) in a sample of 26 patients[29]. The research conducted by Soeiro[30] also reported similar results. Emphysema emerged as the second most prevalent histologic pattern, accounting for 22.5% of the observed patients[31].

Research has resemblance to Niazi's work titled Morphological study of pulmonary embolism in autopsy cases, whereby a prevalence of emphysema was seen in 30.89% of cases. A statistically significant increase ($p<0.005$) in the prevalence of emphysema (77.5%) was seen among those who smoke[35]. This study demonstrated the causal relationship between smoking and the development of emphysema[32]. In a similar vein, research done by Latif *et al.* discovered the presence of emphysema in 43% of the patients examined. Additionally, Tariq's study identified emphysema in 40% (324 out of 810) of the cases investigated[34]. The research observed a higher prevalence of cases in men, which aligns with the data reported by Tariq[34].

This finding is consistent with the study conducted by Fang[33] which reported a prevalence of 15% (95 out of 635 cases), as well as the study conducted by Chauhan[26], which reported a prevalence of 14.62% (49 out of 335 cases). Notably, the highest number of pneumonia cases occurred within the age group of 51 to 60 years. In the research conducted by Chauhan[26], it was shown that pneumonia accounted for 14.62% (49 out of 335) of the total cases. A total of seven patients (8.75%) exhibited evidence of intra-alveolar haemorrhage. The majority of individuals in the sample were under the age of 40, including six instances[27].

Hanmante *et al.* identified 7 instances (5.8%) and Soeiro *et al.* found 10.4% intra alveolar haemorrhage. In our analysis, we detected 2 instances (2.5%) of TB, 1 of which was a known case and died from respiratory failure. Hanmante[25] detected 2 TB cases (1.75%). Soeiro[30] 21 3.6% instances and Hjortn *et al.* (1995).1% (1/100)[31]. Military TB accounts for 19% of all cases, according to Sanefugi *et al.* We reported one male aspergillosis case with 1.25% (1/80). Some individuals with bronchial tree damage and cavitatory/cystic parenchymal illness develop aspergilloma[33].

Microscopically interwined septate hyphae and conidiophores were PAS-positive. Only 1 of 41 pulmonary aspergillomas studied by Shah R *et al.* over 15 years in surgical and autopsy materials was unexpectedly found histologically at autopsy[37]. The usefulness of autopsy as a critical component for studying and evaluating the illness process remains unchanged, despite the advancements in diagnostic technologies. The use of autopsy serves as a significant method for the identification and comprehension of lung diseases, contributing to the assessment of their outcomes and providing valuable insights for their prevention. In addition, the implementation of educational counselling and regular medical examinations might contribute to the mitigation of lung disease prevalence within society[38].

CONCLUSION

Autopsy is the best way to determine cause of death, especially in areas with inadequate diagnostic testing. This autopsy research shows that incidental discoveries in autopsies may not cause mortality but provide important epidemiological information. Autopsy remains a valuable tool for diagnosing and studying respiratory disorders, despite improvements in diagnostic technologies. Histopathological results of autopsy-removed lung tissue are shown in this research. Lung tissue autopsy specimens most often showed pulmonary edema. Though pulmonary disorders are widespread clinically, lung tissue examination provides insight into histology of various phases of diseases and lesions, as observed in this study and helps determine mortality cause.

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