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Frequency of pulmonary hypertension in patients undergoing computed tomography chest in tertiary care hospitals

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Pulmonary Arterial Hypertension
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ABSTRACT Pulmonary arterial hypertension is a devastating disease with significant disability and mortality, and it has much higher frequency than previously thought. To determine the frequency of pulmonary hypertension in patients undergoing contrast enhanced computed tomography chest in tertiary care hospitals of Lahore. Descriptive study among 151 patients of Pulmonary Arterial Hypertension were selected with age and gender discrimination by convenient sampling, at Combined Military Hospital Lahore. Computed Tomography machine Toshiba Aquiline 64 Slice was used. This study analyzed data from 151 patients who sought medical attention for Pulmonary Arterial Hypertension (PAH) at the radiology department. The patients' ages ranged from 20 to 80 years, with an average age of 48.41 years. Out of the total patients, 93 were males (61.6%), and 58 were females (38.4%). Further examination revealed that 130 patients (86.1%) had a Dilated Inferior Vena Cava (IVC), while 138 patients (91.4%) had an Enlarged Caliber of the right Pulmonary Artery. Additionally, 95 patients (63%) had an Enlarged Pulmonary Trunk, and 50 patients (33%) were diagnosed with Filling defects. These findings provide valuable insights into the age and gender distribution and the frequency of specific indicators in patients with Pulmonary Arterial Hypertension. The study revealed a considerable frequency of pulmonary hypertension (64.2%). Study found a significant number of cases, with indicators like an enlarged pulmonary trunk (62.9%), and filling defects (33.1%). Males had more instances than females. Notably, people aged 50-65 years were most affected. This shows the importance of addressing pulmonary hypertension in CECT patients, considering gender differences, and focusing on the 50-65 age group for better diagnosis and treatment. More research is needed to understand this condition better and improve patient care.

1. INTRODUCTION

Pulmonary hypertension (PH) is a complex and potentially life-threatening condition characterized by elevated pulmonary artery pressure, leading to right ventricular strain and potential heart failure. It can result from various underlying causes, including lung diseases, heart diseases, and other systemic conditions. Early diagnosis and appropriate management are crucial for improving patient outcomes and quality of life. In this context, contrast-enhanced computed tomography (CECT) of the chest emerges as a valuable non-invasive imaging tool that aids in the assessment and diagnosis of pulmonary hypertension (Surie, S., 2104).

CECT of the chest is a widely used imaging modality that provides detailed cross-sectional images of the chest area, allowing for a comprehensive evaluation of the pulmonary vasculature, lung parenchyma, and other thoracic structures. The administration of contrast agents during the scan enhances the visibility of blood vessels, making CECT especially useful in visualizing the pulmonary arteries and detecting any abnormalities or pathological changes associated with pulmonary hypertension. The non-invasive nature of CECT reduces patient discomfort and eliminates the need for invasive procedures, such as right heart catheterization, in certain cases (Woldeamanuel et al., 2019).

The global burden of pulmonary hypertension is significant, and the disease is a major public health concern. It affects millions of individuals worldwide and imposes a substantial healthcare burden on healthcare systems. While pulmonary hypertension is prevalent across the globe, its frequency and distribution vary among regions and populations. On a global scale, pulmonary hypertension is estimated to affect around 1% of the population, making it a considerable public health burden. However, this estimate is likely to be conservative as many cases may go undiagnosed due to the subtle and nonspecific symptoms of the early stages of the disease. Moreover, the prevalence of pulmonary hypertension tends to increase with age, with individuals over the age of 65 being particularly susceptible. The burden of pulmonary hypertension is not only related to the number of affected individuals but also in-

cludes the economic impact on healthcare systems. The cost of managing pulmonary hypertension, particularly in advanced stages, can be substantial due to hospitalizations, medication, and potential surgical interventions such as lung transplantation. Therefore, understanding the global burden of pulmonary hypertension is crucial for policymakers to allocate resources effectively and implement preventive measures death (Karadogan et al., 2018).

Asia is home to a diverse population with varying risk factors for pulmonary hypertension. Some of the common risk factors in Asia include tobacco smoking, exposure to biomass smoke during cooking, and high-altitude living. The prevalence of these risk factors contributes to the higher frequency of pulmonary hypertension in the region. Additionally, the rapid urbanization and industrialization in many Asian countries have led to changes in lifestyle and environmental factors, further influencing the disease's occurrence.

Numerous studies have investigated the frequency of pulmonary hypertension in different Asian countries. These studies have reported varying prevalence rates, with estimates ranging from 15 to 50 cases per million individuals. The wide range of prevalence reflects the heterogeneity of the disease, the diversity of risk factors, and variations in diagnostic practices across different regions in Asia (Galiè et al., 2019).

In Pakistan, the prevalence of pulmonary hypertension is also a matter of clinical interest, considering the diverse population and unique environmental factors. Research on the frequency of pulmonary hypertension in Pakistan is essential for understanding the local burden of the disease and tailoring healthcare strategies accordingly. Moreover, studying the prevalence of pulmonary hypertension in patients undergoing CECT of the chest at tertiary care hospitals in Lahore can provide valuable insights into the disease's occurrence in a specific urban setting (Vachiéry et al., 2018).

The primary objective of this study is to investigate the frequency of pulmonary hypertension in patients undergoing CECT of the chest at tertiary care hospitals in Lahore, Pakistan. By analyzing a large dataset of CECT reports, we aim to determine the prevalence of pulmonary hypertension in this specific population and explore any potential associations with demographic factors, risk factors, and other clinical parameters. Descriptive statistics will be used to summarize the demographic and clinical characteristics of the study population. The frequency of pulmonary hypertension cases detected through CECT will be calculated, along with confidence intervals. Associations between pulmonary hypertension prevalence and age, gender, smoking history, and other relevant factors will be explored using appropriate statistical tests (Nathan et al., 2019).

This study's findings will provide valuable insights into the frequency of pulmonary hypertension in patients undergoing CECT of the chest at tertiary care hospitals in Lahore. The data can help clinicians and policymakers understand the local burden of the disease and devise strategies for early detection and management. Additionally, the study may identify specific risk factors associated with pulmonary hypertension, enabling targeted preventive measures and interventions in at-risk populations (Bansal et al., 2017).

1.1 Patients

A descriptive study was conducted at Radiology Department of Combined Military Hospital of Lahore. The sample size was 151 patients in which 93 were males and 38 females. All the patients who visited the radiology department for Chest Computed Tomography (CT) scans was examined in duration of 7 months.

1.2 Instruments and Materials

Siemens- 64 slices Multidetector Computed Tomography

1.3 Contrast Enhanced Computed Tomography Chest

a. Patient lied supine on couch and raised arms over the head for CT examination.

b. Kvp 120 and mAs modulation were adjusted

c. Collimation was from clavicle to the diaphragm.

d. Iodinated contrast was used. Contrast was given intravenously.

e. Breath hold technique was described to the patient.

f. All the examination was well explained to the patient.

1.4 Statistics

In the data analysis procedure, SPSS version 27 was used to analyze the obtained results

2. RESULTS & DISCUSSION

2.1 Results

This study analyzed data from 151 patients who sought medical attention for Pulmonary Arterial Hypertension (PAH) at the radiology department. The patients' ages ranged from 20 to 80 years, with an average age of 48.41 years. Out of the total patients, 93 were males (61.6%), and 58 were females (38.4%). Further examination revealed that 130 patients (86.1%) had a Dilated Inferior Vena Cava (IVC), while 138 patients (91.4%) had an Enlarged Caliber of the right Pulmonary Artery. Additionally, 95 patients (63%) had an Enlarged Pulmonary Trunk, and 50 patients (33%) were diagnosed with Filling defects. These findings provide valuable insights into the age and gender distribution and the frequency of specific indicators in patients with Pulmonary Arterial Hypertension.

Among the female participants, 53.4% were found to have an enlarged pulmonary trunk, while 31.0% exhibited a filling defect. Additionally, a striking 87.9% of females demonstrated a dilated inferior vena cava (IVC). Moving on to the male participants, an even higher percentage, 68.8%, displayed an enlarged pulmonary trunk, and 34.4% showed evidence of a filling defect. Similarly, a significant 84.9% of males exhibited a dilated IVC.

In terms of specific pulmonary artery characteristics, among the females, 79.3% were found to have an enlarged caliber of the left pulmonary artery, and 91.4% showed an enlarged caliber of the right pulmonary artery. When it came to the final diagnosis of Pulmonary Hypertension based on the CT scan results, 55.2% of females received a positive diagnosis. Among the males, 84.9% exhibited an enlarged caliber of the left pulmonary artery, and an equal 91.4% displayed an enlarged caliber of the right pulmonary

Table 1. Descriptive Statistics

Variables	Frequencies	Percentage
Gender		
F	58	38.4
M	93	61.6
Dilated IVC		
No	21	13.9
Yes	130	86.1
Enlarged Caliber of right PA		
No	13	8.6
Yes	138	91.4
Enlarged Caliber of left PA		
No	26	17.2
Yes	125	82.8
Enlarged pulmonary trunk		
No	56	37.1
Yes	95	62.9
Filling defect		
No	101	66.9
Yes	50	33.1
Final diagnosis on CT Pulmonary Hypertension		
No	54	35.8
Yes	97	64.2

Table 2. Gender Wise Comparison of CT Findings in Patients with Portal Hypertension

Gender	Enlarged Pulmonary Trunk	Filling Defect	Dilated IVC
F	31 (53.4%)	18 (31.0%)	51(87.9%)
M	64 (68.8%)	32 (34.4%)	79 (84.9%)
Gender	**Enlarged Caliber of Left PA**	**Enlarged Caliber of Right PA**	**Final Diagnosis on CT Pulmonary Hypertension**
F	46(79.3%)	53(91.4%)	32 (55.2%)
M	79 (84.9%)	85(91.4%)	65 (69.9%)

artery. In terms of the final diagnosis on CT for Pulmonary Hypertension, a higher percentage, 69.9%, of males were positively diagnosed.

The study assessed a total of 151 participants, categorized into three distinct age groups: 20-40, 41-60, and 61-80 years old. Notably, the prevalence of an enlarged pulmonary trunk varied across these groups, with 27.4% in the youngest, 45.3% in the middle, and 27.4% in the oldest age group. The p-value for this observation was 0.060, indicating a borderline significant difference.

Similarly, the frequency of an enlarged caliber of the right pulmonary artery (PA) displayed a notable pattern across the age groups. Among those aged 20-40, 30.4% exhibited this characteristic, while in the 41-60 age group, it increased to 46.4%, and in the 61-80 age group, it decreased to 23.2%. The p-value associated with this trend was 0.176, suggesting no significant difference.

In terms of a dilated inferior vena cava (IVC), the prevalence also demonstrated a trend across age groups. Participants in the 20-40 age group exhibited this feature in 32.3% of cases, which decreased to 44.6% in the 41-60 age group, and further reduced to 23.1% in the 61-80 age group. However, the p-value of 0.643 indicated no significant difference in this characteristic across the age groups.

A similar pattern was observed for an enlarged caliber of the left pulmonary artery (PA). Among those aged 20-40, 29.6% had this feature, increasing to 46.4% in the 41-60 age group, and decreasing to 24% in the 61-80 age group. The p-value for this observation was 0.180, suggesting no significant difference across age groups.

Regarding the presence of a filling defect, the percentages were 32% in the 20-40 age group, 42% in the 41-60 age group, and 26% in the 61-80 age group. The p-value associated with this characteristic was 0.665, indicating no significant difference across the age groups.

Finally, in terms of the final diagnosis of Pulmonary Hypertension based on CT scan results, 26.8% of participants in the 20-40 age group received a positive diagnosis, compared to 45.4% in the 41-60 age group and 27.8% in the 61-80 age group. The p-value of 0.029 suggests a statistically significant difference in the prevalence of Pulmonary Hypertension across these age groups.

2.2 Discussion

The present study aimed to investigate the frequency of pulmonary hypertension in patients undergoing contrast enhanced computed tomography (CECT) in tertiary care hospitals of Lahore. The analysis of the obtained results revealed important insights into the frequency of pulmonary hypertension and its association with various factors, particularly gender. In this study, the frequency of pulmonary hypertension was assessed based on several indicators, including the presence of an enlarged pulmonary trunk, filling defect, final diagnosis on CT pulmonary hypertension, dilated inferior vena cava (IVC), and enlarged caliber of the left and right pulmonary arteries. The results showed that out of the total 151 patients, a considerable proportion exhibited signs of pulmonary hypertension across these indicators. Specifically, a significant number of patients had an enlarged pulmonary trunk (62.9%), filling defect (33.1%), final diagnosis of CT pulmonary hypertension (64.2%), dilated IVC (86.1%), enlarged caliber of the left pulmonary artery (82.8%), and enlarged caliber of the right pulmonary artery (91.4%). These findings indicate a noteworthy presence of pulmonary hypertension among the studied patient population. Comparing these results with previous studies, the frequency of pulmonary hypertension observed in our study aligns with existing literature.

These gender differences in the frequency of pulmonary hypertension are consistent with previous research Overall there was a male preponderance (64%) in this study. Similar results (54%) were shown in a study conducted by Bansal et al. and almost equal male: female ratio was observed (49.1% males) in an another study by Mehrotra et al. The male: female ratio in this study was 1.8: 1. This may be due to smoking in men, and it is an important predisposing factor for COPD which is one of the important causes of PH (Bansal et al., 2017).

Table 3. Computed Tomography Findings in Different Age Groups

	Age Groups			
Variable	20-40	41-60	61-80	P-Value
Enlarged pulmonary trunk	26 (27.4%)	43 (45.3%)	26 (27.4%)	.060
Enlarged Caliber of right PA	42 (30.4%)	64 (46.4%)	32 (23.2%)	.176
Dilated IVC	42 (32.3%)	58 (44.6%)	30 (23.1%)	.643
Enlarged Caliber of left PA	37 (29.6%)	58 (46.4%)	30 (24%)	.180
Filling defect	16 (32%)	21 (42%)	13 (26%)	.665
Final diagnosis on CT pulmonary Hypertension	26 (26.8%)	44 (45.4%)	27 (27.8%)	.029

This is similar to findings from the Registry to Evaluate Early and Long-Term Pulmonary Arterial Hypertension Disease Management (REVEAL) registry on pulmonary arterial hypertension in the USA, where hypertension was a frequent comorbidity. Similarly, a cross-sectional survey in Tanzania recently highlighted the fact that women had 50% lower odds of hypertension compared with men. (REVEAL 2010) Since then, the age of IPAH patients has increased considerably, at least in Western countries. In Germany, the mean age of patients newly diagnosed with IPAH in 2014 was 65 years. In a recent Swedish registry, the mean age at diagnosis was 69 years (Radegran et al., 2016).

Naturally, older patients have a higher mortality risk in general, but it has already been shown that older patients (>65 years) diagnosed with IPAH have a significantly higher mortality risk than younger patients (18–65 years), even when adjusted for their respective statistical life expectancies (Hoeper et al., 2013). Another study shows the same results where males was more effected, out of a total of 57 patients diagnosed with pulmonary hypertension, 51% were males of whom 22% came from an altitude greater than 2,500 metres above sea level. The age group were predominantly from 1 -3 years (Pumacayo Cárdenas et al., 2019).

In summary, our study provides valuable insights into the frequency of pulmonary hypertension in patients undergoing CECT in tertiary care hospitals of Lahore. The findings underscore the clinical significance of pulmonary hypertension in this patient population. Additionally, the gender differences observed in the frequency of pulmonary hypertension highlight the importance of considering gender-specific approaches in diagnosis and treatment. These results contribute to the growing body of literature on pulmonary hypertension and may inform healthcare professionals in developing targeted management strategies for patients with this condition.

3. CONCLUSION

The study revealed a considerable frequency of pulmonary hypertension (64.2%). Study found a significant number of cases, with indicators like an enlarged pulmonary trunk (62.9%), and filling defects (33.1%). Males had more instances than females. Notably, people aged 50-65 years were most affected. This shows the importance of addressing pulmonary hypertension in CECT patients, considering gender differences, and focusing on the 50-65 age group for better diagnosis and treatment. More research is needed to understand this condition better and improve patient care.

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