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Analysis of the Relationship between Pulmonary Hypertension and Tuberculosis Patients at RS Ibnu Sina Makassar January - June 2023

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A B S T R A C T
Pulmonary hypertension (PAH), seen in 20%-40% of chronic respiratory diseases, is linked to the severity of these conditions. Tuberculosis, a bacterial infection causing lung damage and impaired function, can contribute to this increased blood pressure in the pulmonary arteries, complicating patient outcomes by worsening both conditions. This study used an analytical observational method with a cross-sectional approach, measuring independent and dependent variables simultaneously at a single point in time. It focused on analyzing the relationship between pulmonary hypertension and pulmonary tuberculosis in patients. The study found that most respondents were aged 51-70 years, with no significant link between age or gender and hypertension (P-values=0.091 and 0.655, respectively). Light smoking was significantly associated with hypertension (P-value=0.001), while nutritional status was not (P-value=0.332). Significant relationships were found between blood pressure (P-value=0.002) and spirometry results (P-value=0.000) with hypertension. Thus, blood pressure, smoking habits, and spirometry results were key factors influencing pulmonary hypertension in the 60 patients studied. There is a significant relationship between Pulmonary Hypertension and Tuberculosis patients at Ibnu Sina Hospital, Makassar, January - June 2023.

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INTRODUCTION

Among the various types of tuberculosis (TB), pulmonary TB is the most frequently encountered and can cause permanent damage to the lung parenchyma, bronchi, and lymph nodes, resulting in a condition known as tuberculous destructive lung (TDL). Treatment success in pulmonary TB has been primarily defined by mycobacteriological response, often overlooking the chronic disabilities faced by survivors. Despite effective treatment, over 50% of pulmonary TB patients experience significant permanent lung damage. This damage can be obstructive or restrictive, resulting in gas exchange abnormalities and the development of pulmonary hypertension (Marjani et al. 2024).

Pulmonary tuberculosis (TB) is one of the five major causes of pulmonary hypertension. Pulmonary TB, a widespread disease globally, can lead to parenchymal lung tissue destruction and affect vascular structures, thereby causing pulmonary hypertension (PH). PH is defined as a condition where the mean pulmonary artery pressure exceeds 20 mmHg.(Nowroozpoor et al. 2019)

Pulmonary hypertension (PH) is a hemodynamic condition that can complicate lung diseases, including tuberculosis (TB). It is relatively common among active TB patients, and some data indicate that up to 47% of TB survivors who experience dyspnea after treatment might develop PH. PH is linked to a poor prognosis and can lead to decreased functional capacity, diminished quality of life, and right ventricular dysfunction and heart failure. Risk factors for PH in individuals with TB-related lung damage include age, dyspnea, D-dimer levels, PaCO2, the number of destroyed lobes, bronchiectasis, and chronic pleurisy. Due to diagnostic challenges, PH remains under-researched, and many TB survivors may not be identified as being at risk. Early diagnosis and treatment of TB, along with prompt intervention for PH, are essential (Louw et al. 2023).

Research by (Parekh et al. 2020) found that out of 728 pulmonary TB patients, 104 had pulmonary hypertension. Among them, 27% were newly diagnosed TB cases, while 73% had a history of previous TB treatment. Another study by (Obaidy 2018) involving 50 PH patients with a history of TB treatment showed that 92% had an mPAP < 40 mmHg, and all patients had normal findings on electrocardiogram without evidence of pulmonary P waves.

Based on Riskesdas 2018 data, the prevalence of pulmonary TB in South Sulawesi was reported as 33,693 cases. This descriptive observational study aims to analyze the relationship between pulmonary hypertension and pulmonary tuberculosis patients at Ibnu Sina Hospital in Makassar in 2023.

THEORETICAL REVIEW

Pulmonary hypertension is a hemodynamic disorder characterized by elevated pulmonary arterial pressure, diagnosed when the mean pulmonary arterial pressure (mPAP) is ≥25 mmHg, assessed via right heart catheterization. In advanced stages of the disease, patients often experience weight loss and cardiac cachexia. Malnutrition in PAH may arise from several factors, including reduced food intake as the disease progresses, intestinal edema and malabsorption due to venous congestion and low cardiac output, and the effects of diuretics and PAH-specific medications like prostacyclin on bowel function and renal clearance. Additionally, chronic illness often leads to anorexia. While

malnutrition is well-documented in end-stage PAH, there is limited understanding of the nutritional status of patients who are stable on treatment. Although deficiencies in iron and vitamin D are known in PAH, a comprehensive assessment of vitamin and mineral levels, as well as overall nutritional intake, is still lacking (Kwant et al. 2022).

The prevalence of pulmonary hypertension has been reported as 97 cases per million, with a male-to-female ratio of 1:8. The standardized mortality rate from pulmonary hypertension in the United States ranges from 4.5 to 12.3 per 100,000 population. Globally, the true incidence of pulmonary hypertension remains unknown, with an estimated prevalence around 1% of the global population. Annual incidence rates in the UK range from 6.1 to 7.6 cases per million people. Pulmonary hypertension is reported in 20%-40% of chronic respiratory diseases and correlates with the severity of underlying conditions.(Alzayer and Al Nasser 2021; Chordia 2021)

METHODOLOGY

This study is analytical observational research with a cross-sectional study approach, emphasizing the simultaneous collection of data on independent and dependent variables at a single time point. Data were gathered from secondary sources to analyze the relationship between pulmonary hypertension and pulmonary tuberculosis patients. This method enables researchers to explore the association between these two conditions at a specific point in time without directly intervening with the study subjects.

RESULTS

This study utilized secondary data from the medical records of pulmonary TB patients in 2023. The sample size met the inclusion and exclusion criteria. During the study period, 60 new cases of pulmonary tuberculosis were identified. Doppler echocardiography revealed that 10 patients (16.67%) had a systolic pulmonary arterial pressure exceeding 35 mm Hg. Right heart catheterization was not performed.

Recorded data of all new cases of pulmonary tuberculosis from Ibnu Sina hospital registry from January until June 2023. Demographic, characteristics and other variables were entered in SPSS (version 11.5) software

Respondent Profile

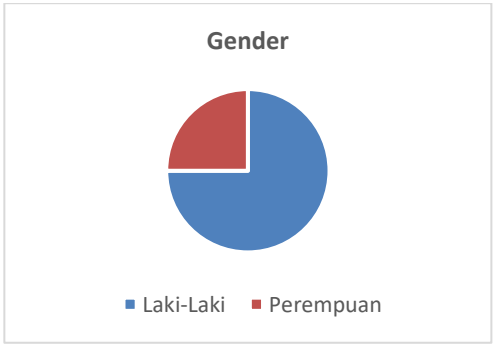
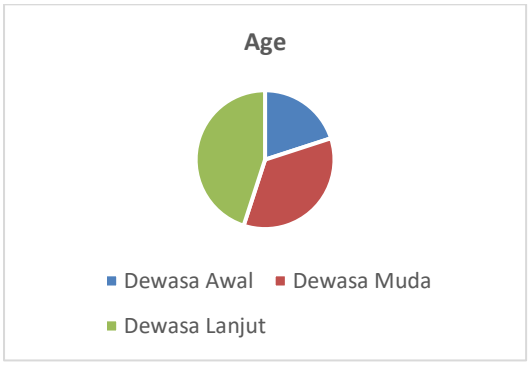
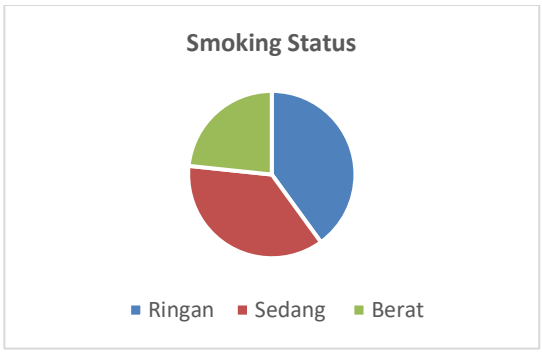


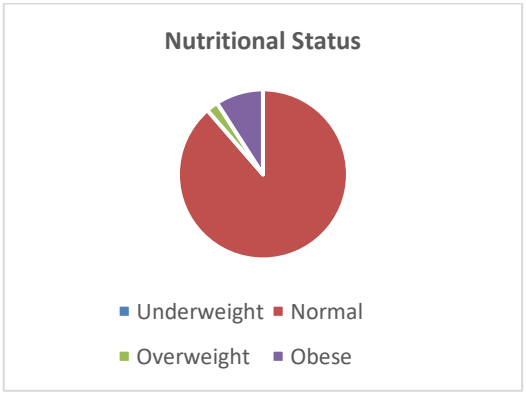
Figure 1. shows out of 60 respondents, 75% were male and 25% were female. It can be concluded that the majority of respondents are male.



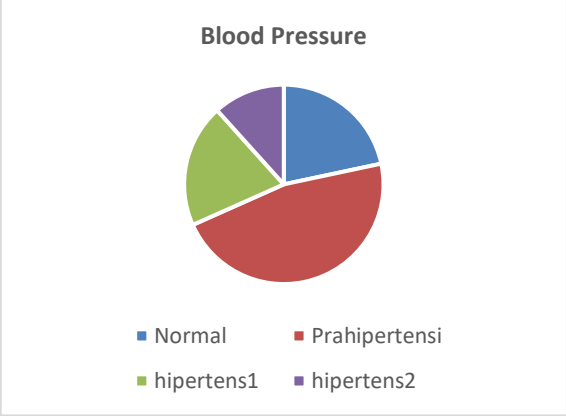
Based on figure 2. out of 60 respondents, 45% are categorized as late adults, 35% as young adults, and 20% as early adults.



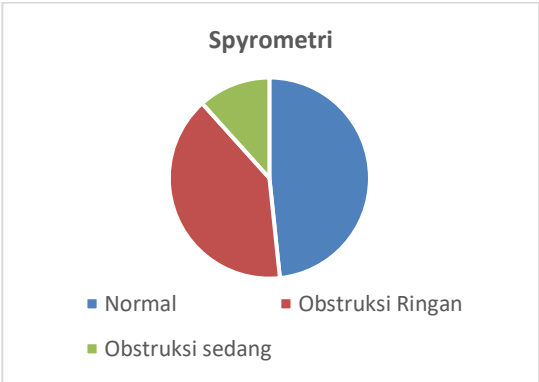
Based on figure 3, out of 60 respondents, 40% are light smokers, 36.6% are moderate smokers, and 23.4% are heavy smokers.



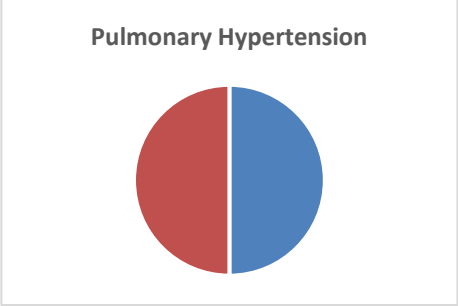
Based on the information provided, 65% of the respondents are categorized as Normal, 26.7% are Underweight, 1.6% are Overweight, and 6.7% are Obese.



Based on Figure 5, out of 60 respondents, 22% are categorized as Normal, 47% as Prehypertensive, 20% as Hypertension Stage 1, and 12% as Hypertension Stage 2.



Based on Figure 6, out of 60 respondents, 48.3% have a normal status, 40% have mild obstruction status, and 11.7% have moderate obstruction status.



It states that 50% of the respondents have (+) Pulmonary Hypertension and 50% of the respondents have (-) Pulmonary Hypertension.

Relationship of Variables with the Incidence of Pulmonary Hypertension

The study predominantly involved respondents aged over 60 years. Statistical analysis showed a non-significant relationship (p = 0.091) between age and hypertension. Most respondents were aged 51-70 years, with no significant association found between gender and hypertension (p = 0.655). Active smoking showed a significant association with hypertension (p = 0.001). Nutritional status did not significantly correlate with hypertension (p = 0.332). Prehypertension was prevalent among respondents, showing a significant relationship with

hypertension (p = 0.002). Normal spirometry status was significantly associated with hypertension (p = 0.000).

DISCUSSION

Based on the data analysis from the study, it can be concluded that the age of the respondents does not significantly affect the occurrence of pulmonary hypertension. This is evidenced by a p-value of 0.091, which is greater than 0.05, indicating no significance. This finding contrasts with (Chen, Hung, and Chiang 2022), which found a higher prevalence of pulmonary hypertension among elderly patients compared to younger ones. However, PAH is being increasingly diagnosed in the elderly, leading to new clinical considerations that were previously overlooked. In older adults, the diagnosis of PAH may often be delayed because it can be masked by chronic comorbid conditions, such as coronary artery disease or other causes of dyspnea. Although survival rates and clinical outcomes have improved, elderly patients still experience notably lower survival rates compared to younger populations (Rothbard et al. 2020).

Similarly, the gender of the respondents was found to have no significant influence on the occurrence of pulmonary hypertension, with a p-value of 0.655, also greater than 0.05. In contrast, (Sidqoh 2020) reported a higher incidence of pulmonary hypertension among female respondents. This research indicates that the majority of patients were male. Female sex is a well-established risk factor for pulmonary arterial hypertension (PAH); however, males with PAH often experience worse survival outcomes. This discrepancy is known as the "sex paradox" or "sex puzzle" in PAH. Several explanations for the poorer survival in males have been suggested, including more severe hemodynamics, less pulmonary vascular remodeling, increased immune dysregulation, less aggressive treatment, and varying responses to therapy (DesJardin et al. 2024).

The smoking status of the respondents showed a significant association with pulmonary hypertension (p-value = 0.001), contrasting with study from (Umbas and Numansyah 2019), smoking is one modifiable factor; the relationship between smoking and hypertension involves nicotine, which causes an increase in blood pressure. Nicotine in cigarettes is absorbed by small blood vessels in the lungs and then circulated through the bloodstream to the brain. The brain responds to nicotine by signaling the adrenal glands to release epinephrine. A study by (van Heerden et al. 2024) in a systemic review explains that the way cigarette smoking toxins penetrate the epithelial barrier and impact both pulmonary and systemic blood vessels is frequently highlighted as a mechanism by which smoking leads to cardiovascular disease, stroke, and other systemic conditions. The processes of dynamic vasoconstriction and vasodilation are driven by the contraction and relaxation of smooth muscle and mesenchymal cells in the blood vessels, which, similar to other muscle cells, are regulated by the opening and closing of various ion channels.

Nutritional status (p-value = 0.332) was found not to significantly influence the occurrence of pulmonary hypertension in the respondents. In this study, nutrition was found to be insignificant due to several factors, such as the adequate fulfillment of daily nutritional needs in patients. However, the study

conducted by (Luo et al. 2022), it was found that patients with pulmonary hypertension often experience nutritional deficiencies, including iron and vitamin D deficiency. In addition, some patients also suffer from deficiencies in vitamin B12, vitamin K1, and selenium. Significantly, these nutritional changes are more common in PAH patients compared to the general population, and there is substantial evidence suggesting that they may initiate or worsen the progression of the disease. High-dose diuretics are commonly used in pulmonary arterial hypertension (PAH) to prevent fluid retention, but long-term use of furosemide can lead to thiamine deficiency, which is crucial for energy and carbohydrate metabolism. The impact of thiamine and proton pump inhibitor (PPI)-related vitamin deficiencies on PAH is unknown. A recent study found that long-term use of PPIs and other medications, like vitamin K antagonists, leads to hypomagnesemia, which is associated with cardiovascular issues. However, its relevance to PAH has not been investigated. Symptoms of hypomagnesemia include muscle cramps, palpitations, and cardiovascular disease (Kwant, Ruiter, and Noordegraaf 2019).

Blood pressure showing a significant relationship with pulmonary hypertension ($p = 0.002$). Pulmonary hypertension (PH) is a rare condition characterized by elevated blood pressure in the lungs, particularly in the pulmonary arteries. A specific type of PH, known as pulmonary arterial hypertension (PAH), involves the narrowing, blockage, or destruction of blood vessels in the lungs. This impedes blood flow and raises the pressure in the pulmonary arteries, forcing the heart to work harder to circulate blood through the lungs. This increased workload can harm the heart and lead to systemic issues. If left untreated, PH can result in right-sided heart failure and may be fatal (Rosenkranz et al. 2020). The term pulmonary arterial hypertension (PAH) refers to a specific group of patients with pre-capillary hypertension, characterized by an end-expiratory pulmonary artery wedge pressure of less than 15 mmHg and a pulmonary vascular resistance greater than 3 Woods units. This discussion will concentrate on idiopathic pulmonary arterial hypertension (IPAH), which occurs sporadically without a family history, and emphasize the importance of the interprofessional team in managing the condition (Duan et al. 2023).

Finally, spirometry results were significantly associated with pulmonary hypertension (p-value = 0.000), indicating its relevance in assessing this condition among respondents. A study by (Mallikarjuna Reddy and Rajesh Reddy 2020) shows a strong correlation was observed between dyspnea (shortness of breath) and pulmonary hypertension, as measured by the percentage predictive value. Spirometry proved to be highly effective in diagnosing and staging chronic obstructive pulmonary disease (COPD). Spirometry can aid in identifying obstructive airway disorders and may also be used to assess pulmonary hypertension (PH). In patients with pulmonary arterial hypertension (PAH), spirometry typically appears normal or reveals mild obstructive or restrictive patterns, or a combination of both. Occasionally, spirometry may indicate a restrictive pattern linked with echocardiographic signs of PH. Additionally, spirometry can detect reduced lung volumes and a decreased diffusing capacity of the lungs for carbon monoxide (DLCO), which may suggest interstitial lung

disease. In PAH, DLCO is often lower than normal, and a DLCO below 45% of the predicted value may indicate PAH (Anand et al. 2023).

CONCLUSION AND RECOMMENDATION

Based on research at RS Ibnu Sina Makassar from January to June, it was found that age (51-70 years), gender (predominantly male), and smoking status (light smokers) were prevalent among respondents. Statistical analyses showed age (p-value = 0.091) and gender (p-value = 0.655) had no significant correlation with pulmonary hypertension. However, smoking status (p-value = 0.001) and spirometry results (p-value = 0.000) significantly correlated with hypertension. Nutritional status and prehypertensive blood pressure showed no significant correlation. Overall, the study identified smoking, spirometry results, and blood pressure as key factors influencing pulmonary hypertension in tuberculosis patients.

This study's cross-sectional design limits its ability to establish causality and relies on secondary data, which may be incomplete or inaccurate. The sample size of 60 patients may not represent the broader population, and confounding variables like comorbidities or medication use were not considered. Future research should use a longitudinal approach with a larger, more diverse sample for more comprehensive insights.

FURTHER STUDY

It should come as no surprise that the researcher found several errors in language, writing, and presentation style when creating this article, considering their own little experience and proficiency. As a result, the researcher expects insightful critiques and suggestions from many sources to guarantee the job is perfect.

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