CORRELATION OF BLOOD PRESSURE WITH PULMONARY FUNCTION OF ELDERLY PEOPLE WITH HYPERTENSION IN EAST PURWOKERTO SUB-DISTRICT

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Abstract. Hypertension is included in the list of non-communicable diseases with the first highest prevalence in the elderly. Not only does it affect the increased risk of cardiovascular disease, but hypertension also influences reducing lung performance in sufferers. Researchers are interested in seeing the correlation between blood pressure and lung function in elderly people with hypertension. This research is a cross-sectional study. The study subjects were 31 people, collected using the purposive sampling method. The criteria for research subjects were uncontrolled hypertension patients aged ⩾ 45 years, who did not have respiratory system disorders and were willing to become research subjects by signing an Informed Consent. A blood pressure examination was performed by auscultation method using a stethoscope and mercury sphygmomanometer. Pulmonary function was measured using a spirometer to see the value of FVC and FEV 1. Data analysis used the Pearson correlation test with Spearman's alternative test. Significance level at $p<0.05$. A total of 19 people (61.3%) have normal lung function which can be seen in the FVC and FEV1 values. The results of the correlation analysis test of blood pressure with lung function parameters in elderly patients with hypertension showed no correlation between blood pressure and lung function as indicated by $p>0.05$. However, there was a negative correlation between blood pressure and lung function FVC ($r = -0.317$ for systolic blood pressure; $r = -0.323$ for diastolic blood pressure) and FEV1 ($r = -0.273$ for systolic blood pressure; $r = -0.242$ for diastolic blood pressure). The higher the blood pressure, both systolic and diastolic, the lower the lung function of both FVC and FEV1. There is no correlation between blood pressure and lung function of elderly people with hypertension in East Purwokerto District. There is a tendency of negative correlation between blood pressure and lung function. The higher the blood pressure, the lower the lung function.

Keywords: systolic blood pressure; diastolic blood pressure; pulmonary function; hypertension; elderly

1. Introduction

Hypertension is a non-communicable disease that is included in the cardiovascular disease group. According to the World Health Organization [1], hypertension is a global problem where the prevalence of hypertension in the world has reached 22% of the total world population. Southeast Asia ranks third in hypertension prevalence after Africa and the Eastern Mediterranean at 25%. Nationally, according to RISKESDAS data in 2018, there is an increasing trend in the prevalence of hypertension in Indonesia compared to RIKESDAS data

in 2007 with a prevalence rate of 34.11% which increased from 2013 which was 25.8% [2]. Central Java Province ranks fourth with a rate of 37.57% while Banyumas alone has a prevalence rate of 38.90%. Based on age group, the highest prevalence of hypertension is in the >75 years age group with 69.5% followed by the 65-74 years age group with 63 [2], [3].

Hypertension is included in the list of non-communicable diseases with the first highest prevalence in the elderly group (age ⩾ 60 years), namely 32.5%, and the second position in the elderly group (age 45-59 years), namely 21.20%. On the other hand, Indonesia is included in the group of countries that are expected to experience an increasing trend in the number of elderly people. According to the Central Statistics Agency (BPS), Indonesia is expected to experience an increase in the number of people aged 60 years and over to reach 31 million people in 2022 [2].

Hypertension is often referred to as the silent killer because of the morbidity and mortality it causes. Not only does it affect the increased risk of cardiovascular disease, but hypertension also influences reducing lung performance in sufferers. This is in line with the research of Yadav et al.[4], that the value of all pulmonary function test parameters in the hypertensive population is lower than in the normal population. The pattern of decline in lung function is mostly in the form of obstruction disorders (74% of the hypertensive population. The remaining 13% showed restriction abnormalities, and another 13% had normal results. The hypothesized mechanisms leading to decreased pulmonary function test scores in hypertensive patients are left ventricular dysfunction and the use of antihypertensive beta-blockers. Although other studies have shown no difference in pulmonary function test values between hypertensive patients and controls. Pulmonary functions measured are Forced vital capacity (FVC) and Forced expiratory volume in 1 second (FEV1). FVC refers to the maximum amount of air that can be exhaled after taking the deepest breath possible, while FEV1 is the maximum amount of air that can be exhaled after taking the deepest breath possible. By knowing the FVC and FEV1 values, lung function can be determined.

Another study also showed a decrease in pulmonary function test values in hypertensive populations without beta-blockers with the most abnormal pattern being restriction (34.4%), lower than controls (1.6%) [5]. Therefore, researchers are interested in seeing the correlation between blood pressure and lung function (FVC and FEV1) in elderly people with hypertension.

2. Methods

This research is a cross-sectional study. The study subjects were 31 people, collected using the purposive sampling method. The criteria for research subjects were uncontrolled hypertension patients aged ⩾ 45 years, who did not have respiratory system disorders such as asthma, COPD, or tuberculosis and were willing to become research subjects by signing an Informed Consent. Blood pressure examination was performed by auscultation method using a stethoscope and mercury sphygmomanometer. Pulmonary function was measured using spirometry. The research was conducted at the Physiology Laboratory of the Faculty of Medicine, Unsoed from August to September 2023. Data analysis used the Pearson correlation test with the Spearman alternative test. The level of significance at $p<0.05$. The study has received Ethical Approval from the Medical Research Ethics Commission of the Faculty of Medicine, Jenderal Soedirman University (Ref: 118/KEPK/PE/VIII/2023).

3. Results

A total of 31 elderly research subjects with uncontrolled hypertension were measured for blood pressure and pulmonary function parameters (FVC, FEV1, and FEV1/FVC) as shown in Table 1 below.

Table 1. Characteristics of Research Subjects

Variables	n	Mean ± SD	Median	Min - Maks	95% CI
Age (year)	31	62,42±7,2	63	45 - 81	59,78 – 65,10
Sistolic blood pressure (mmHg)	31	156,32±17,48	160	114 – 184	149,91 – 162,73
Diastolic blood pressure (mmHg)	31	87,78±16,56	80	68 – 130	81,70 – 93,85
FVC	31	0,79±0,19	0,84	0,49 – 1,21	0,72 – 0,87
FEV1	31	0,87±0,26	0,87	0,42 – 1,46	0,77 – 0,96
FEV1/FVC	31	0,81±0,12	0,83	0,57 – 1,00	0,77 – 0,86

Table 1. presents data on the characteristics of the research subjects. The subjects were aged between 45 and 81 years, with a mean of 62.42±7.2 years. From the aspect of blood pressure, the subjects had a mean systolic blood pressure of 156.32±17.48 mmHg and a mean diastolic blood pressure of 87.78±16.56 mmHg. While from the parameters of lung function, the mean FVC was 0.79 ± 0.19, the mean FEV1 was 0.87 ± 0.26 and the mean was 0.81 ± 0.12. After the Shapiro-Wilk normality test, it was found that all variables were normally distributed ($p>0.05$), except for the diastolic blood pressure variable ($p=0.06$).

The results of the pulmonary function examination of the study subjects can be seen in Table 2 below. A total of 19 people (61.3%) has normal lung function which can be seen in the FVC and FEV1 values. As for the FEV1/FVC value, 22 subjects (71%) had normal values.

Table 2. Distribution of Pulmonary Function Parameters of the Study Subjects

Pulmonary function parameters	n	Percentage
FVC		
Normal	19	61,3
Abnormal	12	38,7
FEV1		
Normal	19	61,3
Abnormal	12	38,7
FEV1/FVC		
Normal	22	71
Abnormal	9	29
Jumlah	31	100

The bivariate test of the correlation of systolic blood pressure with pulmonary function parameters uses the Pearson correlation test because the parametric test requirements are met (normally distributed data). The bivariate test of the correlation of systolic blood pressure with lung function parameters uses the Spearman correlation test because the parametric test requirements are not met (data is not normally distributed). The results of the bivariate test analysis can be seen in Table 3 below.

Table 3. Correlation of Blood Pressure with Pulmonary Function Parameters

Variabels	Mean ± SD	*p-value*	r
Systolic Blood Pressure	156,32±17,48		
FVC	0,79±0,19	0,083	-0,317
FEV1	0,87±0,26	0,137	-0,273
FEV1/FVC	0,81±0,12	0,630	0,090
Diastolic Blood Pressure	87,78±16,56		
FVC	0,79±0,19	0,077	-0,323
FEV1	0,87±0,26	0,189	-0,242
FEV1/FVC	0,81±0,12	0,380	0,163

The results of the correlation analysis test of blood pressure with lung function parameters in elderly patients with hypertension showed no correlation between blood pressure and lung function as indicated by $p>0.05$. However, there is a tendency of negative correlation between blood pressure and lung function FVC ($r = -0.317$ for systolic blood pressure; $r = -0.323$ for diastolic blood pressure) and FEV1 ($r = -0.273$ for systolic blood pressure; $r = -0.242$ for diastolic blood pressure). The higher the blood pressure, both systolic and diastolic, the lower the lung function of both FVC and FEV1.

4. Discussion

The results showed there was no correlation between blood pressure and lung function of elderly people with hypertension in East Purwokerto District. However, there is a negative correlation between blood pressure and lung function. The higher the blood pressure, the lower the lung function. In hypertensive patients, there is a decrease in baroreceptor sensitivity resulting in baroreflex dysfunction. The cardiovascular system and the respiratory system have adjacent anatomical structures, both in the control center in the brain, as well as in the periphery related to baroreceptors and chemoreceptors. This cardiorespiratory unit relationship is explained by the interaction between neurons in the cardiovascular and respiratory centers in the medulla oblongata. While in the periphery, baroreflex dysfunction will affect the rate of respiration and the effectiveness of respiratory muscles which will ultimately affect the volume and capacity of lung function [6],[7],[8].

Previous research in a population study with 1640 healthy subjects aged 18 - 80 years also showed similar results [9]. In that study, in general, the correlation was only found in diastolic blood pressure with lung function, while systolic blood pressure was not significantly correlated with lung function. The results in the population aged 30-35 years obtained similar results to this study, namely there was no correlation between blood pressure both systolic and diastolic with pulmonary function both FVC and FEV1. However, there are consistent results that are also similar to the results of this study, namely the tendency of a negative correlation between

blood pressure and lung function, namely the higher the blood pressure, the lower the lung function. Esa [9] mentioned that the correlation between blood pressure and lung function is still likely to be influenced by age given the difference in results between the population of 18 - 80 years and the population of 30 - 35 years. The older the age, the weaker the correlation between blood pressure and lung function. This supports that there is no correlation between blood pressure and lung function in this study because the study was conducted in the elderly population aged > 45 years.

The results of the study underline the importance of being able to control blood pressure in people with hypertension because it will also affect lung function. The higher the blood pressure of hypertensive patients, the more likely it will cause disturbances in other body systems, in this case, the respiratory system.

5. Conclusion

There is no correlation between blood pressure and lung function of elderly people with hypertension in East Purwokerto District. There is a tendency of negative correlation between blood pressure and lung function. The higher the blood pressure, the lower the lung function.

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