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Correlation Between Stress Level and Albumin Creatinine Ratio (ACR) among Hypertensive Patients

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ABSTRACT

Background: Chronic hypertension can impact on decreased kidney function. Hypertension, accompanied by stress, increases the risk of kidney failure. The risk of damaged kidney function in hypertensive patients can be seen from the albumin creatinine ratio. This study aims to determine the correlation between stress level and albumin creatinine ratio among hypertensive patients in the Baros District Work Area. **Methods**: This quantitative research employed cross sectional study design with technique of sample selection was total sampling with a sample size of 46 people. The instruments used were a stress level questionnaire and an observational sheet to record blood pressure, and albumin creatinine ratio, which was measured by Rapid Test Complete Urine Test Strips. **Results**: The results showed that 52.4% of respondents with a mild stress level were at risk of experiencing chronic kidney failure. From the results of statistical tests, it was found that there was a significant correlation between stress levels and albumin creatinine ratio (p value = 0.002), where higher stress level, can impact to higher albumin creatinine ratio (correlation coefficient 0.406). Conclusions: controlling stress levels in hypertensive patients can be done to help reduce the risk of kidney failure.

***Keywords**: Hypertension, Stress, Albumin Creatinine Ratio*

1. INTRODUCTION

Hypertension is defined as blood pressure above 140/90 mmHg as measured by three measurements or above 125/80 mmHg on 24-hour blood pressure monitoring. Increased blood pressure that occurs continuously can damage blood vessels and organs and increase mortality. Blood pressure is determined by cardiac output, systemic vascular resistance, and circulating volume. The key determinant of systemic vascular resistance is arteriolar vasoconstriction and the determinant of circulating volume is renal handling of sodium.

Chronic hypertension can cause damage to the kidneys. High blood pressure can cause kidney blood vessel damage. In the walls of the interlobularis arteries, the muscles are replaced by sclerotic tissue. The walls of afferent arterioles are hyalinized due to lipids and subintimal glycoproteins that are released from the plasma. Damage to these resistant vessels exposes the glomerular capillary endothelium to destructive hypertension. This decreases blood flow and glomerular filtration, and promotes proteinuria. Exudated inflammatory protein from plasma that occurs results in glomerular sclerosis or ischemic atrophy so that the filtration process is further disturbed and ultimately causes renal failure [1].

According to the United States Renal Data System Report, hypertension is the most common cause of chronic renal failure, accounting for nearly 80,000 patients in 2016. The incidence of chronic renal failure associated with hypertension has nearly eightfold increased since 2010, suggesting that hypertension should be considered equal its importance with diabetes in the kidney disease epidemic. Epidemiological studies show that the risk for chronic renal failure increases gradually when the systolic blood pressure increases more than 120 or 130 mmHg and the greatest risk is for subjects with sustained systolic blood pressure greater than 200 mmHg. The risk of death is also related to the severity of microvascular changes in the brain, heart, and retina as a result of hypertension, with survival rates being only 0 to 20% at 5 years [2]. Thus untreated hypertension results in renal insufficiency which leads to renal failure.

Kidney failure is a condition of kidney damage manifested by structural or functional abnormalities of the kidneys, with a decrease in the Glomerular Filtration Rate (GFR) accompanied by abnormalities in the results of laboratory tests of blood, urine or imaging and irreversible tests where the body's ability to fail to maintain metabolism and balance of fluids and electrolytes and resulting in uremia (retention of urea and other nitrogenous wastes in the blood) [3].

The incidence of chronic kidney failure in Indonesia in 2013 was 2.0% per million and in 2018 it increased to 3.8% per kilo (Basic Health Research (Riskesdas)), 2018. In addition, in Serang District, in 2016 there were as many as 9,766 hypertensive patients with potential for kidney failure. Based on a preliminary study at the Baros District Health Center, the highest disease experienced by the local community is hypertension. This proves that this disease is increasing due to several previous comorbidities including hypertension which is the most common case in Indonesia [4].

According to research by Gray, Sidaway-Lee, White, Thorne, & Evans, (2018) and Rifkin et al (2010), the majority (50 to 70%) of patients with kidney failure have hypertension, 25% have albuminuria, 50 to 65% have decreased clearance of inulin, 70 to 80% had decreased renal plasma flow, and 95% had histological evidence of chronic renal injury. The role of specialist nurses (advanced practice nurse) is as a clinician, educator, advocator, counselor, administrator and researcher. Apart from clinicians, the role of nurses in patients with hypertension is as a researcher and advocate. Nurses should try to detect the relationship between stress and the albumin to creatinine ratio as a risk factor for kidney failure in hypertensive patients who experience stress. That way, nurses can determine the right preventive measures for hypertensive patients with stress so as not to experience kidney failure.

2. METHODS

The research design was a cross sectional study. Factors that are predicted to affect the incidence of kidney failure in hypertensive patients are demographic factors, proteinuria, microalbuminuria, urine creatinine, salt consumption patterns, blood pressure, and individual stress levels. The population in this study were all hypertensive patients in the working area of the Baros Health Center. After conducting a preliminary study and direct research into the Baros sub-district, Serang, Banten, a population of 46 people with hypertension was obtained, where according to the information from the Posyandu and Posbindu Health cadres, many hypertensive patients have died from last year to the present. Therefore, the sampling technique in this study is total sampling. Total sampling is a sampling technique where the number of samples is the same as the population (Sugiyono, 2007). The number of samples in this study were 46 people. The research instrument was an online questionnaire and observation sheet. The online questionnaire contains identification of patient data related to age, salt consumption patterns, and individual stress levels. To measure the level of stress, the DASS 14 questionnaire was used which was valid and reliable with a value of r> 0.3 and Cronbach alpha 0.9483. The observation sheet was used to record the blood pressure and albumin to creatinine ratio. Blood pressure is measured using a clinically tested tensimeter, the Microlife tensimeter. Albumin to creatinine ratio was measured by comparing the value of albumin and urine creatinine as measured using *Rapid Test Complete Urine Test Strips*.

3. RESULTS

Demographic Data and Characteristics of Respondents
Based on the results of the study, demographic data and respondent characteristics in this study, it was found that the mean age of the respondents was 53.8 years (SD 11.09) with the lowest age of 34 years and the highest is 78 years, most of the respondents had an abnormal or abnormal salt consumption pattern. high (more than 2400 mg or more than 1 teaspoon) as many as 32 people (69.6%) and most respondents also had normal stress levels, namely 23 people (50%) and 11 respondents (52.4%)) with a light level of stress. The characteristics of respondents based on blood pressure and albumin to creatinine ratio can be seen in Table 1.

Table 1. Characteristics of Respondents Based on Blood Pressure and Albumin Creatinine Ratio (N=46)

No.	Variable	Mean ± SD	Min	Maks
1	Blood pressure			
	1. Sistolic BP	151,22 ± 22,39	110	195
	2. Diastolic BP	89,28 ± 13,82	60	122
2	Albumin Creatinin Ratio (ACR)	24,86 ± 20,25	6,82	88,89

Table 1 shows that the mean systolic blood pressure of respondents was 151.22 mmHg (SD 22.39) and diastolic blood pressure 89.28 mmHg (SD 13.82) with an average Albumin Creatinine Ratio (ACR) of 24.86 mg / g (SD 20.25).

Analysis of the Relationship between Stress and Albumin Creatinine Ratio in Hypertension Patients
The results of the analysis of the relationship between stress and the albumin creatinine ratio (ACR) in hypertensive patients are as follows:

Table 2. Analysis of the Relationship between Stress and Albumin Creatinine Ratio

No.	Variable	N	R^2	P value
1	Stress level	46	0,406	0,002

Table 2 shows that there is a significant relationship between stress levels and the albumin to creatinine ratio (p value = 0.002) with an R value of 0.406, which means that there is a moderate or strong relationship between stress levels and albumin to creatinine levels.

4. DISCUSSIONS

Hypertension develops with an increase in oxidative metabolism and renal hypoxia leading to chronic renal failure, which is characterized by a nocturnal decrease of 10 to 20%. This is controlled by several factors including diurnal variations in autonomic function, salt excretion and the Renin Angiotensin Aldosterone (RAA) system [7]. Chronic hypertension can cause damage to the kidneys.

High blood pressure can cause damage to the blood vessels, which can lead to kidney failure. From the results of the study, most of the respondents who suffer from hypertension, have a pattern of salt consumption that is not normal or high (more than 2400 mg or more than 1 teaspoon) as many as 32 people (69.6%). High salt consumption patterns result in increased salt and water retention in the body which results in an increase in plasma volume and an increase in cardiac output. The increase in cardiac output that occurs can lead to an increase in blood pressure, and if it occurs for a long time, it will result in kidney failure [1], [8].

In this study, most respondents had normal stress levels, namely 23 people (50%) and 11 respondents (52.4%) with mild stress levels. The increase in stress hormones such as adrenaline, thyroxine, and cortisol has a significant effect on the balance function of the body. This hormone acts simultaneously with the sympathetic nervous system, which affects the increase in pulse rate and blood pressure. Continuously increasing blood pressure to renal afferent arterioles, will cause damage to blood vessels in the kidneys which in turn will interfere with the filtration function of the kidneys. From the results of the study, the mean ACR value was 24.86 mg / g (SD 20.25). ACR is more accurate to determine minimal protein leakage from the kidneys. If the ACR value is ≥ 3 mg / mmol or ≥ 30 mg / g, the patient can be diagnosed with CKD regardless of eGFR [9].

In this study, the mean age of the respondents was 53.8 years (SD 11.09) with the lowest age being 34 years and the highest being 78 years. In line with other studies [10], patients suffering from hypertension were in the age range 49-65 years with a proportion of 6.0%. With increasing age, kidney function decreases in filtration due to a physiological decrease in the number of nephrons which is marked by a decrease in the glomerular filtration rate. The results of the Baltimore Longitudinal Study of Aging (BLSA) showed that with age, there was a decrease in the mean creatinine clearance by 0.75 ml / min / year in people without kidney disease or other comorbid diseases. The presence of comorbid factors further accelerates the decrease in creatinine clearance [11]. When viewed from the results of the study, the mean systolic blood pressure of respondents was 151.22 mmHg (SD 22.39) and diastolic blood pressure 89.28 mmHg (SD 13.82). According to the 2018 American Heart Association (AHA), people with increased systolic blood pressure between 140-180 mmHg are categorized as stage 2 hypertension, while diastolic blood pressure between 80-89 mmHg is categorized as stage 1 hypertension. afferent arteriolar pressure in the kidney which further causes vasoconstriction of glomerular afferent arterioles [12], [13].

Analysis of the relationship between stress levels and the albumin to creatinine ratio showed that as many as 11 respondents (52.4%) with mild stress levels were at risk for chronic kidney failure. From the analysis, it was found that there was a relationship between stress levels and the risk of chronic kidney failure (p value = 0.012). Based on previous research, there is also a positive association between the level of protein excretion and stress as seen from an increase in the hospital anxiety and depression scale (HADS) score. The stress experienced by the caregiver results in increased glomerular permeability, which leads to increased protein excretion. Other studies have also shown that stress can lead to increased proteinuria [14], [15].

Stress is part of modern life, the stress conditions experienced have increased during the COVID 19 pandemic. Stress during the COVID 19 pandemic can be caused by fear of contamination, economic hardship, COVID xenophobia, health checks related to COVID and symptoms of traumatic stress due to COVID. The stress caused by the COVID pandemic experienced by hypertensive patients can result in a decline in the patient's health condition. Stress stimulates the release of the hormones adrenaline, cortisol, and noradrenaline by the adrenal cortex. The hormone that is produced will trigger the heart to pump blood faster around the body, causing an increase in blood pressure. Increased blood pressure causes barotrauma stimulation of the capillaries in the glomerulus, barotrauma that occurs continuously increases the potential for scarring on the capillaries that leads to glomerulosclerosis. This condition will cause glomerular hypoxia, resulting in an increase in vasoactive substances that cause vasoconstriction. The onset of scar also aggravates the occurrence of hypoxia which triggers kidney damage [12], [16].

Urinary protein excretion may increase during stress leading to an incorrect diagnosis of nephropathy in the disease. There was a significant relationship between HADS score and protein ratio with a value of r = 0.854 [15]. Stress can increase the production of TNF alpha and proinflammatory cytokines which cause increased glomerular permeability. Under normal conditions, large molecular proteins are not found in urine, however, during stressful conditions, large molecular proteins enter the filtration process through the podocyte gaps in the glomerulus and result in loss of selectivity in the filtration function. Damaged podocyte clefts can lead to further kidney damage [15].

5. CONCLUSION

The average of age respondents who had hypertension was 53.8 years (SD 11.09) with the lowest age of 34 years and the highest was 78 years, most of the respondents had an abnormal or high salt consumption pattern (more than 2400 mg or more than 1 teaspoon) as many as 32 people (69.6%) and most of the respondents also had normal stress levels, namely 23 people (50%) and 11 respondents (52.4%) with mild stress levels. Analysis of the relationship between stress levels and the albumin to creatinine ratio showed that as many as 11 respondents (52.4%) with mild stress levels were at risk for chronic kidney failure. From the analysis, it was found that there was a relationship between stress levels and the risk of chronic kidney failure (p value = 0.012).

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