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The relationship of blood pressure with urine protein examination in fisherman of Batu Karas Village, Cijulang, Pangandaran, West Java

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ABSTRACT

Background: Hypertension is an increase in persistent blood pressure with systolic 140 mmHg and diastolic ≥ 90 mmHg. In Indonesia, hypertension ranks the 6th largest non-infectious disease, with a prevalence of 25.8%. Uncontrolled hypertension results in target organ damage, causing strokes, heart attacks, retinopathy, or kidney disorders. The presence of protein in urine can be a marker of kidney abnormality. This study evaluates the relationship between blood pressure and urine protein examination in fishermen of Batu Karas Village, Cijulang, Pangandaran, West Java.

Methods: The descriptive-analytic cross-sectional study was conducted using a total sampling of 97 Batu Karas fishermen. Samples were examined their blood pressure and urine dipstick at the social service event of Faculty of Medicine and Health, University of Muhammadiyah Jakarta, in August 2016. Univariate analysis and gamma relationship tests were done using SPSS version 21 for Windows.

Results: In the fishermen with normal blood pressure, we found 29 samples with 1+ protein urine, two samples were 2+, and 11 were negative. In the pre-hypertensive group, 27 were 1+, and 15 were negative. In the stage I hypertension group, three were 1+, and four were negative. In the stage II hypertension group, three were 1+, and three were negative. We also found a significant correlation between blood pressure and urine protein examination results (p=0.048).

Conclusion: There was a significant relationship between blood pressure and urine protein examination results in fishermen in Batukaras, Cijulang, Pangandaran, West Java.

Keywords: blood pressure, dipstick, hypertension, kidney disorders, protein urine

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INTRODUCTION

According to the Joint National Committee (JNC) VII, hypertension is a state of systolic pressure ≥140 mmHg and diastolic blood pressure ≥90 mmHg.[1] According to the World Health Organization (WHO), the adult population with hypertension in 2012 was 40%.[1,2] In the Southeast Asia region, the average percentage of hypertension patients, was 37%, and the prevalence of hypertension in Indonesia is about 25.8%. West Java is the fourth province with biggest hypertensive patients in Indonesia with prevalence about 29.4%, with case distribution dominantly in Garut regency (9.7%), Sukabumi district (9.5%), Bogor regency (6.8%), and Pangandaran district (3%).[2,3]

Based on etiology, hypertension is divided into primary and secondary hypertension. Primary hypertension is mostly found in 90% of incidences, and genetic factor is considered to be one of the causes.[2,4,5] Secondary hypertension is caused by unhealthy lifestyles such as smoking, hypercholesterolemia, obesity, alcohol consumption, drugs, and the consequences of other diseases associated with hormonal disorders, heart disease, kidney disorders, diabetes mellitus, and vascular disease.[6] The course of hypertension depends on the number and severity of risk factors that can be modified or not. Factors that cannot be modified include genetics, age, sex, and ethnicity. While the other modifiable factors are included as stress, obesity, and nutrition.[7] One of the unhealthy lifestyle that contributed to high blood pressure is the high salt intake. High salt intake will induce the hyperactivity of the sympathetic nervous system and the renin-angiotensin system and an increase in electrolytes resulting in high blood pressure.[5] The population that prone to this unhealthy lifestyle is the fisherman and coastal community because they mostly do salt production.[6]

Complications in hypertension often occur due to inadequate monitoring and therapy. One of the most common complications is kidney failure. Hypertension is the second cause of kidney failure after diabetes mellitus.[4] Regular monitoring of blood pressure, and kidney function can prevent kidney failure complications. Kidney function abnormalities able to be assessed by performing a urinalysis examination. The urinalysis consists of dipstick and sediment examination. Dipstick examination

assessed the presence of protein, glucose, ketones, faint blood, bilirubin, urobilinogen, nitrite, and leukocyte esterase. At the same time, urine sediment examination assesses the presence of erythrocytes, leukocytes, epithelium, crystals, cylinders, and bacteria. In patients with kidney failure, the urinalysis result will show proteinuria. This study aims to evaluate the urinalysis result of fishermen in Batu Karas and the relationship between blood pressure and the urine protein examination result.[5,6]

METHOD

This study was a descriptive-analytic cross-sectional study. The study was conducted at the Faculty of Medicine and Health, the University of Muhammadiyah Jakarta, in October-November 2017. The sample was obtained from social service and research events in Batu Karas Village, Cijulang, Pangandaran, West Java. The inclusion criteria were all fisherman in Batu Karas Village that attended the social service event. The exclusion criteria were the patients who had not completed characteristics and vital signs data, urinalysis and dipstick examination results, and patients who refused to participate in the study. From total sampling, we obtained 97 patients. Blood pressure was examined using a standard sphygmomanometer and recorded in the form in mmHg. To evaluate the kidney function, urinalysis and protein dipstick were done. Urinalysis was conducted in the Faculty of Medicine and Health, University of Muhammadiyah Jakarta laboratory. Univariate analysis and bivariate analysis were done. The independent variable was blood pressure, and the dependent variable was protein urine examination results using a dipstick. Gamma correlation test was used to find the relationship between blood pressure and urine dipstick examination were done using SPSS version 21 for windows with levels of confidence interval 95% and significant p-value ≤ 0,05.

RESULTS

Subject Characteristics

Characteristics of the samples, including age, weight, height, education level, income, and years of working. Most of the samples were in 36-45 years old (39.2%) with a mean age of 44.3 years old, with the youngest age was 18 years and the oldest was 75 years. The level of education in most subjects was elementary, and the highest education was high school. The sample monthly income ranged from Rp.100,000.00 to Rp.5,000,000.00, with an average of Rp.1,371,134.00. For most subjects, the working period was more than ten years, with an average working period of 23.2 years. Most of the samples

Table 2 Urinalysis results

Urinalysis Results	n (%)
Hemoglobin (gr/dl)	
13.0 – 18.0	55 (56.7%)
11.0 – 12.9	37 (38.1%)
8.0 – 10.9	5 (5.2%)
<8.0	0 (0.0%)
Hematocrit (%)	
40 – 54	37 (38.1%)
<40	60 (61.9%)
>54	0 (0.0%)
Protein urine (mg/dl)	
Negative	33 (34.0%)
Trace	0 (0.0%)
1+ = 30	62 (63.9%)
2+ = 100	2 (2.1%)
3+ = 300	0 (0%)
4+ = ≥2000	0 (0%)
Glucose level (mg/dl)	
Negative	92 (94.8%)
Trace = 100	0 (0%)
1+ = 250	1 (1.0%)
2+ = 500	0 (0.0%)
3+ = 1000	1 (1.0%)
4+ = ≥2000	3 (3.1%)
Ketone (mg/dl)	
Negative	62 (63.9%)
Trace = 5	35 (36.1)
Small = 15	0 (0.0%)
Moderate = 40	0 (0.0%)
Large = 80	0 (0.0%)
Large = 160	0 (0.0%)
Erythrocytes	
Negative	91 (93.8%)
Trace	3 (3.1%)
1+ = Small	3 (3.1%)
2+ = Moderate	0 (0.0%)
3+ = Large	0 (0.0%)
Leukocytes	
Negative	78 (80.4%)
Trace	0 (0.0%)
1+ = Small	14 (14.4%)
2+ = Moderate	5 (5.2%)
3+ = Large	0 (0%)
Bilirubin	
Negative	97 (100%)
1+ = Small	0 (0.0%)
2+ = Moderate	0 (0.0%)
3+ = Large	0 (0.0%)

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Table 4 Relationship between blood pressure and urinalysis protein results

Blood Pressure Category	Protein urine - (N=33)	1+ (N=62)	2+ (N=2)	Total	P
Normal	11	29	2	42	0.048
Pre-hypertension	15	27	0	42	
Hypertension Stage I	4	3	0	7	
Hypertension Stage II	3	3	0	6	

have normal BMI (69.1%) with mean of body weight and height were 61.45 kg and 161.8 cm, respectively. For blood pressure, 42 (43.3%) samples categorized normal, 42 (43.3%) samples pre-hypertension, 7 (7.2%) samples had stage I hypertension, and 6 (6.2%) had stage II hypertension, with the lowest blood pressure was 80/50 mmHg, and the highest blood pressure was 170/100 mmHg.

Characteristic of Urinalysis Results

Data from urinalysis were included in hematology assessment, urine chemistry, macroscopic, and microscopic examination. The respondent's average hemoglobin level was 13.1 mg/dl, the lowest was 10.0 mg/dl, and the highest was 16.0 mg/dl. Hematocrit averages were less than the normal category (38.61%), with the lowest was 29%, and the highest was 47%. The patient's macroscopic urine was mostly yellowish (found in 54 subjects), and the rest was yellow. Clear urine was found in 81 subjects, and the rest was cloudy. The subjects' mean urine specific gravity was 1,020, with the lowest specific gravity was 1,005, and the highest was 1,030. The average urine pH was normal (pH 6.0), with the lowest was 5.0, and the highest was 9.0. Proteinuria was found positive in 63,9% of total subjects, and only 33 subjects were negative.

Reversely, in glucose examination, only five subjects showed positive glucose; the remaining 92 were negative. The urine ketones results showed that 62 subjects were negative, and the rest were in the trace category. On erythrocyte results, 91 of the total subjects were negative, and only three subjects showed positive. The rest was in the trace category. On the leukocyte examination, 78 subjects were negative, and 19 subjects were positive. Bilirubin and urobilinogen examination showed a normal result in all subjects. No nitrite was found in all subjects as well.

In most of the samples, the epithelium was found in 92 subjects (94.8%), 64 subjects with 0-1 cell epithelium, 19 subjects with 1-2 cells, seven subjects with 2-3 cells, and only one subject with as many findings 3-4 cells and 4-5 cells. No cylinders were found in all urine samples. Erythrocytes were found in 17 samples, and two of them were found in 5-6 erythrocytes in their urine.

Bacteria were found in 10 samples. On sediment examination, oxalate crystals were mostly positive (71.1%), and only 28 subjects were negative. On examination of monohydrate oxalate crystals, only two urine were positive. In tyrosine crystals, examination showed varied results, 77 were negative, 17 were 1+, and only three subjects were found in category 2+. In the cystine crystals examination, only one subject was positive in category 2+; thus, uric acid examination showed only four urine were observed positively contains crystals.

As shown in Table 3 below, samples in the normal blood pressure group were 42 samples, with most samples have 1+ protein urine result. In pre-hypertension group also have 42 samples, with most of them also have 1+ protein urine result. In stage 1 hypertension and stage 2 hypertension group, there were seven and six samples, respectively. We found a significant relationship between blood pressure and protein urine (p-value=0.048) from the correlative analysis.

DISCUSSION

Hypertension is defined as systolic blood pressure ≥140 mmHg and diastolic blood pressure ≥ 90 mmHg.[1] Based on recommendations of the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7), the classification of BP for adults aged 18 years or older has been as follows: 1) Normal: Systolic lower than 120 mm Hg, diastolic lower than 80 mmHg; 2) Pre-hypertension: Systolic 120-139 mm Hg, diastolic 80-89 mmHg; 3) Stage 1: Systolic 140-159 mm Hg, diastolic 90-99 mm Hg; and 4) Stage 2: Systolic 160 mm Hg or greater, diastolic 100 mm Hg or greater.[1,7]

Uncontrolled hypertension could affect our vascular system and result in target organ damage, both in macrovascular and microvascular. One of the macrovascular complications is kidney failure. Kidney failure is marked by the presence of protein or proteinuria. Proteinuria is defined as

the presence of protein higher than the normal limit, which is about 150mg/24 hours in adults and 140mg/m^3 in children.[8] In a normal condition, protein should be present in urine in a little amount about less than 10 mg/dl. In this study, we found a significant relationship between blood pressure with protein urine. Continually high blood pressure could induce barotrauma in the blood vessel and cytokine activation that lead to blood vessel defects in the long term. In a normal condition, increasing systolic blood pressure could be prevented from entering the renal microcirculation by autoregulation mechanism. The autoregulation mechanism was done by vasoconstriction of the pre-glomerular blood vessel. Thus renal blood flow and hydrostatic pressure can be maintained. But the increase of systolic blood pressure exceeds a certain threshold can cause damage, although the autoregulation mechanism is still functioning.[9,10]

Proteinuria can be measure by urine analysis examination. One of the simplest and cheapest methods is by protein urine dipstick test. The protein urine dipstick test was done by using a dipstick made with a color-sensitive pad. Once the urine sample was ready, the health care provider will soak the dipstick and the color change on the dipstick protein level in the urine. The grade of proteinuria is negative (less than 10 mg per dL), trace (10 to 20 mg per dL), 1+ (30 mg per dL), 2+ (100 mg per dL), 3+ (300 mg per dL) or 4+ (1,000 mg per dL). Protein urine dipstick test has sensitivity, specificity, negative predictive value, and a fairly good positive predictive value if an albumin-to-creatinine ratio ≥300 mg / g was used as the reference value, but the sensitivity decreases when the albumin-creatinine ratio is ≥30 mg/g is used as a reference. Protein urine dipstick test can be used for filtering if the reference value of the albumin-to-creatinine ratio is ≥ 300mg/g.[8-10]

Hypertension and proteinuria occur in most patients with chronic kidney disease and are risk factors for faster progression of kidney disease.[9,11] The high blood pressure condition causes the damage of the renal blood vessels. The continuously high blood pressure will cause gradual deterioration of the vessel structures that form the filtration system. The vessel structure's damage will cause changes in the glomerulus filtration system, failure of protein reabsorption in tubules, and protein filtration that exceeds the tubules' reabsorption capacity. All of those mechanisms will lead to kidney damage and causing proteinuria. Findings of this study in accordance in several studies, such as the study by Agarwal et al., that suggest patients with 3+ or greater proteinuria should trigger not only the appropriate evaluation of proteinuria but also have mean arterial pressures targeted to less than 92 mm Hg.[9] The degree of proteinuria is correlated with systolic and diastolic blood pressure without impact from glomerular filtration rate. This is consistent with our findings that found there is a relationship between high blood pressure with proteinuria as well as other parameters.[10,11]

There are several limitations of this study; the first is the urine sample collection process. The collected urine must be from the midstream, we have informed the sample regarding the condition, but we can't control the sample's compliance. The second is the blood pressure measurement that is done just in one examination. In diagnosing hypertension, blood pressure measurement should be done at least two times at different times.[1] We also do not control the confounding variables, and we do not include women in our study subject.

CONCLUSION

This study found that 42 patients (43.4%) had normal and pre-hypertensive blood pressure, and 13 patients had hypertension (13.4%). The urinalysis data found 62 patients with positive protein results. The analysis test results found a significant relationship between blood pressure and the results of urine protein examination in fishermen in Batu Karas Village, Cijulang, Pangandaran, West Java. Researchers suggest conducting research in populations with more varied degrees of hypertension.

CONFLICT OF INTEREST

The authors declare that there is no competing interest regarding the manuscript.

ETHICAL CONSIDERATION

This research was conducted based on the ethical conduct of research from the Ethics Committee of the Medical and Health Faculty, Muhammadiyah University Jakarta, Indonesia.

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AUTHOR CONTRIBUTION

All of the authors equally contributed to the study from the conceptual framework, data gathering, and data analysis until interpreting the study results on publication.

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