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RELATIONSHIP BETWEEN BENIGN PROSTATIC HYPERPLASIA AND METABOLIC SYNDROME

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ABSTRACT

Introduction: *Factors that may increase the risk of Benign Prostatic Hyperplasia (BPH), and one theory suggests a possible connection between metabolic syndrome and the development of BPH. This study aims to investigate the potential relationship between metabolic syndrome and the development of BPH.* ***Methods:*** *This study analyzed medical records from Saiful Anwar Hospital in Malang from 2015 to 2020, using a case-control research design. It applied Chi-Square and Logistic Regression methods for data analysis.* ***Results:*** *The study, based on data from 90 patients, found that the highest number of BPH cases (75.56%) occurred in those with hypertension. Factors like body mass index and blood pressure were significantly associated with BPH (p-values = 0.046; OR = 2.473). Logistic regression confirmed the impact of fasting blood glucose, blood pressure, and body mass index categories on BPH.* ***Conclusion:*** *This research illustrates that there is an association between type 2 diabetes, hypertension, and obesity with the occurrence of BPH. However, there is no statistically significant relationship between the components of metabolic syndrome and the occurrence of BPH.*

Keywords: *Metabolic Syndrome, Benign Prostatic Hyperplasia, Hypertension*

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INTRODUCTION

Benign Prostatic Hyperplasia (BPH) is defined as a histological diagnosis that indicates the proliferation of prostate tissue within the smooth muscle and epithelial cells located in the transition zone of the prostate gland (Lokeshwar et al, 2019). BPH is a condition associated with aging and primarily affects men. Histologically, the prevalence of BPH varies with age, with 20% of individuals aged 41-50 years, 50% in the 51-60 age

range, and over 90% in individuals over the age of 80.[1] While there is no exact study data, information from Rumah Sakit Cipto Mangunkusumo (RSCM) from 1994 to 2013 reported 3,804 cases with an average patient age of 66.61 years. Data from Rumah Sakit Hasan Sadikin stated 718 cases with an average patient age of 67.9 years from 2012 to 2016 (Tjahjodjati et al., 2017).

The current theories on the causes of BPH primarily focus on of endocrine factors like androgens, estrogens, gonadotropins, prolactin, and changes in the equilibrium of autocrine/paracrine growth-stimulating factors (McCance et al., 2019). There is a growing body of evidence supporting the idea that Metabolic Syndrome (MetS) and inflammation play significant roles in men experiencing Lower Urinary Tract Symptoms (LUTS) related to the development of BPH. In this research, the author aims to establish a relationship between Metabolic Syndrome and BPH.

METHOD

This study utilizes an observational analytic approach with a case-control study design on patients at RSUD Saiful Anwar Malang during the period from 2015 to 2020. Samples are chosen using purposive sampling. The criteria for MetS are based on the National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATP III) criteria (Bovolini et al., 2021). Sample selection is in line with inclusion and exclusion criteria. Inclusion criteria for this study encompass all patients clinically or histopathologically diagnosed with BPH, patients with histopathological evidence of prostatic hyperplasia, and patients with BPH who underwent surgery. Exclusion criteria encompass BPH patients who did not undergo medical procedures and do not display histopathological indications of BPH.

Data collected are analyzed using the Chi-Square test and logistic regression with SPSS 23 software. In bivariate analysis, data is considered significant if the p-value is less than 0.05. If the data does not meet the requirements for the Chi-Square test, the analysis employs the Fisher Exact test. In multivariate analysis, data is considered significant if the p-value is less than 0.05.

RESULT

The total sample size for this study was 90 patients. The research maintains a 1:1 ratio of cases and controls, with 45 cases and 45 control samples. The research results reveal that the average age was 58 years old and the number of patients with a history of diabetes mellitus is 31 individuals (34.44%), and those without diabetes mellitus are 59 individuals (65.56%). In the

blood pressure category, 59 patients have a history of hypertension (65.56%), and 31 patients do not have a history of hypertension (34.44%). There are 30 patients with a history of obesity (33.33%), while 66.67% do not have a history of obesity. The total number of patients with Metabolic Syndrome is 18 (20%), while 72 patients do not have Metabolic Syndrome. The characteristics are summarized in Table 1.

Table 1. Study Characteristic

Characteristic		Value
Age (mean ± SD)		58 (5.89)
BPH (%)		
	Yes	45 (50)
	No	45 (50)
DM Type 2 (%)		
	Yes	31 (34.4)
	No	59 (65.6%)
Hypertension (%)		
	Yes	59 (65.6)
	No	31 (34.4)
Obese (%)		
	Yes	30 (33.3)
	No	50 (55.6)
Metabolic Syndrome (%)		
	Yes	18 (20)
	No	72 (80)

In the Chi-Square test presented in Table 2, the p-value for the fasting blood glucose category is 0.046, which is less than 0.05. The correlation value is 0.21. It can be stated that there is a significant relationship, particularly a low association, between diabetes mellitus and BPH. The odds ratio (OR) is 2.473 (95% CI = 1.006 - 6.075), indicating that individuals with diabetes mellitus are 2.473 times more likely to experience BPH compared to those without diabetes mellitus.

Similarly, in the blood pressure category, the p-value is 0.046, which is less than 0.05, and the correlation value is 0.21. This suggests a significant, particularly low, association between hypertension and BPH. The odds ratio (OR) is 2.473 (95% CI = 1.006 - 6.075), indicating that individuals with hypertension are 2.473 times more likely to experience BPH compared to those without hypertension.

Regarding the Body Mass Index (BMI) category, the p-value is 0.180, which is greater than 0.05, and the correlation value is 0.141. This implies that BMI is weakly associated with the occurrence of BPH. Therefore, obesity is related to BPH, but the association is not significant.

In the Metabolic Syndrome category, the p-value is 0.292, which is greater than 0.05, and the correlation value is 0.111. This indicates that Metabolic Syndrome has a very weak association with BPH. It can be concluded that Metabolic Syndrome is not significantly related to the occurrence of BPH.

Table 2. Results of the Chi-Square Test for the Relationship between MetS and the Occurrence of BPH

	OR	*p*
DM Type 2	0.211	0.046*
Hypertension	0.211	0.046*
Obese	-0.141	0.18*
Metabolic Syndrome	-0.111	0.292

**Significant Result*

Table 3. Multivariat Analisis of BPH

	HR	95% CI	*p*
DM Type 2	4.459	1.697-4.797	0.029*
Hypertension	5.678	1.737-6.945	0.008*
Obese	0.058	-2,85 3-6,740	0.009*
Metabolic Syndrome	0.827	0.624-1.039	0.43

**Significant Result*

DISCUSSION

Based on the research results, the occurrence of BPH is more common in individuals without a history of Type 2 Diabetes Mellitus (DM), with 25 individuals (55.56%), while those with a history of Type 2 DM and BPH amount to 20 individuals (44.44%). The bivariate analysis indicates a p-value of 0.046 with an odds ratio (OR) of 2.473 (95% CI = 1.006 - 6.075). Men with a history of Type 2 DM are more likely to develop BPH than those without a history of Type 2 DM. Similarly, the study by Qu et al (2014) shows an association between Type 2 DM and the occurrence of BPH, with a prevalence ratio (PR) of 1.62 (95% CI = 1.11 - 2.35), indicating a 1.62 times higher risk in individuals with Type 2 DM as a risk factor for BPH compared to those without a history of Type 2 DM (Qu et al., 2014).

Men with rapidly growing prostate glands have a higher prevalence of Type 2 Diabetes Mellitus. The Baltimore Longitudinal Study, conducted on elderly men, revealed that elderly men with increased fasting blood sugar levels and those with diabetes tended to have prostate enlargement three and two times greater, as measured by MRI. High insulin levels are associated with increased parasympathetic activity and elevated levels of estrogen and androgens that enter the prostate through sex hormone-binding globulin, resulting in the activation of DNA synthesis and increased cell proliferation, thereby increasing the risk of BPH (Xin et al., 2022).

In terms of the analysis results, there are 34 patients with BPH and hypertension (75.56%), while 11 patients with BPH do not have hypertension (24.44%). Among patients without BPH, 25 have hypertension (55.56%), and 20 do not have hypertension (44.44%). The study by Hwang et al (2015) yielded similar results, with more individuals with hypertension having BPH compared to those without hypertension (Hwang et al., 2015). The Chi-Square test resulted in a p-value of 0.046 with an OR (95% CI) of 2.473 (1.006 - 6.075). The research by Müderrisoglu et

al (2023) also indicates an association between the occurrence of BPH and hypertension, individuals with hypertension have an 8.105 times higher risk of developing BPH than those without BPH (Müderrisoglu et al., 2023).

Several studies have shown that individuals with hypertension are 25% more susceptible to BPH. Therefore, it can be estimated that the majority of BPH patients concurrently suffer from hypertension, and vice versa. Increased sympathetic tone and/or increased α1-adrenoreceptor function play a role in the pathophysiology of hypertension. The increase in smooth muscle of the prostate, which contributes to obstruction, is controlled by the release of norepinephrine at α1-adrenoceptors on smooth muscle. This leads to urinary disturbances and an increase in sympathetic neurotransmitters (Patel et al., 2014, Zhang et al., 2015).

In the category of body mass index (BMI), among the cases, there are 12 obese patients (26.67%) and 33 non-obese patients (73.33%). Among the control group, 18 patients (40%) are obese, and 27 (60%) are not obese. This differs from the study by Wang et al (2017), which shows a higher risk of developing BPH in individuals with a history of obesity compared to those without a history of obesity (Wang et al., 2017).

The increase in estrogen levels, which can aid in the formation of BPH, may be caused by increased sensitivity of the prostate to androgens and the inhibition of prostate gland cell apoptosis. Studies from BLSA show a connection between a 0.41 mL increase in prostate volume and a 1 kg/m2 increase in IMT Obese individuals have a 3.5 times higher risk of developing BPH compared to non-obese individuals (Mansbart et al., 2012). Insulin and IGF signaling pathways play a specific role in carbohydrate metabolism and growth within the body. Several studies have found that hyperinsulinemia is associated with an increased risk of BPH and LUTS. Increased IGF-II and changes in IGF-binding protein (IGFBP) expression play a mitogenic role in the increased growth of the prostate, leading to BPH (Güven et al., 2019).

Based on research conducted by Duarsa et al (2018), patients with metabolic syndrome have a higher risk of developing BPH and have a larger prostate volume. In this study, the number of patients with metabolic syndrome who have BPH is 11 (24.44%), while the number of patients with BPH without metabolic syndrome is 34 (75.56%) (Duarsa et al., 2018). This differs from the research conducted by Byun et al (2012), which states that metabolic syndrome is associated with an

increase in prostate volume measured by abdominal ultrasound (Byun et al., 2015).

The results of multivariate analysis indicate that fasting blood glucose, blood pressure, and body mass index significantly affect BPH. The blood pressure category has a more dominant effect than the other two categories. Thus, it can be concluded that hypertension has a stronger influence compared to the other categories. This result aligns with the research by Hwang et al (2015), which indicate a significant association between diabetes mellitus, hypertension, and obesity with the occurrence of BPH (Hwang et al., 2015).

CONCLUSION

This research illustrates that there is an association between type 2 diabetes, hypertension, and obesity with the occurrence of BPH. However, there is no statistically significant relationship between the components of metabolic syndrome and the occurrence of BPH.

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