Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v31i3.5084

PREVALENCE AND ASSOCIATION OF BENIGN PROSTATIC HYPERPLASIA AND METABOLIC SYNDROME: FINDINGS FROM A CROSS-SECTIONAL STUDY

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Abstract

Background: It is known that the main reason for discomfort of the lower part of the urinary tract in males 40 years of age and older is benign prostatic hyperplasia or BPH. Although sex steroids affect BPH, there's increasing interest in investigating the link between metabolic syndrome and urinary symptoms. Research results, however, differ; some point to a strong beneficial relationship, while others show no meaningful correlation.

Objectives: The purpose of this investigation is to identify the prevalence of metabolic syndrome in individuals with BPH and investigate any possible connections between metabolic syndrome and symptoms associated with BPH.

Methodology: Participants in this observational cross-sectional study included people 40 years of age and older with benign prostatic hyperplasia. A questionnaire-based interview was conducted to gather data from patients visiting the urology clinic at Lady Reading Hospital, Peshawar between Jan 2023 and Oct 2023. Symptoms of urination were evaluated using the "International Prostate Symptom Score" (IPSS), and metabolic syndrome was defined according to the guidelines provided by the "US National Cholesterol Education Program Adult Treatment Panel" '(NCEP ATPIII)'.

Results: In our cross-sectional study involving 800 individuals, we found a median age of 60 years among participants, with a majority falling within the 51-70 age group. The median Body Mass Index (BMI) was 30, and over half of the participants had a BMI between 25 and 30. Smoking prevalence was 56.25%, and the median International Prostate Symptom Score (IPSS) was 21,

indicating a predominantly severe level of symptoms. A majority (62.5%) had elevated blood pressure or was on antihypertensive treatment, while 40% had fasting blood glucose levels ≥ '110 mg/dl' or were on 'drug treatment' for raised 'glucose'. Notably, 40% of participants had metabolic syndrome, and 60% had elevated triglycerides. The median prostate volume was 50 ml.

Conclusion: Our study sheds light on the demographic and clinical characteristics of individuals with 'benign prostatic hyperplasia' (BPH) and 'metabolic syndrome', highlighting the frequency of both conditions and their potential associations. We observed substantial connections between lower urinary tract symptoms (LUTS) intensity and the metabolic syndrome as well as various clinical parameters such as age, BMI, smoking status, and prostate volume. These findings underscore the importance of comprehensive assessment and treatment strategies for BPH patients, particularly those with concurrent metabolic syndrome, to optimize clinical outcomes and improve quality of life. More studies are warranted to elucidate the functions responsible for driving these associations and to explore targeted interventions for this patient population.

Keywords: 'benign prostatic hyperplasia', 'BPH', 'metabolic syndrome', 'lower urinary tract symptoms', 'LUTS', 'prevalence', 'association'.

Introduction

Prostatic hyperplasia, sometimes referred to as benign prostatic hyperplasia (BPH), is a common disorder that primarily affects males 40 years of age and older and is characterized by the non-cancerous growth of the prostate gland. This illness frequently results in lower urinary tract symptoms (LUTS), such as inadequate bladder emptying, nocturia, urgency, and frequency of urination. [1]. BPH can significantly impair quality of life and may progress to complications such as acute urinary retention and urinary tract infections if left untreated. Metabolic syndrome is a cluster of metabolic abnormalities that collectively increase the risk of cardiovascular disease, type II diabetes, and other adverse health outcomes [2]. The diagnostic criteria for metabolic syndrome typically include 'central obesity', 'elevated blood pressure', 'dyslipidemia' (elevated 'triglycerides' and/or 'reduced high-density lipoprotein cholesterol'), and 'insulin resistance' or 'impaired glucose tolerance' [3].

Studying the link between 'LUTS' and 'metabolic syndrome' holds significant clinical relevance for several reasons. First, both conditions share common risk factors such as age, obesity, and physical inactivity, suggesting potential underlying pathophysiological mechanisms linking them together [4]. Second, understanding this association may help clinicians identify patients at higher risk for metabolic syndrome among those presenting with LUTS, leading to early intervention and preventive strategies. Third, elucidating the relationship between LUTS and metabolic syndrome could contribute to the development of more comprehensive treatment approaches targeting both conditions simultaneously, thereby improving overall patient outcomes and reducing healthcare burden. Prostatic hyperplasia, also known as benign prostatic hyperplasia (BPH), is a non-cancerous enlargement of the prostate gland, which surrounds the urethra and is located just below the bladder in men. As men age, the prostate gland tends to increase in size, leading to BPH. This enlargement can cause compression of the urethra, leading to a variety of urinary symptoms.

BPH is highly prevalent, especially among men aged 40 years and older. The prevalence of BPH increases with age, affecting approximately 50% of men in their 50s and up to 90% of men in their 80s [5]. As life expectancy increases globally, the burden of BPH is expected to rise, making it a significant public health concern. The symptoms of BPH are primarily related to urinary dysfunction and can significantly impact the quality of life of affected individuals [6]. Moreover, untreated BPH can lead to complications such as urinary tract infections, bladder stones, bladder dysfunction, and renal impairment. 'Metabolic syndrome' encompasses a constellation of 'metabolic abnormalities' that collectively heighten the risk of 'cardiovascular disease', 'type 2

diabetes', and other adverse health outcomes [7]. Diagnosis is based on specific criteria, with the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATPIII) offering widely utilized guidelines [8]. These criteria serve as vital markers for identifying individuals at heightened risk, facilitating early intervention and management strategies to mitigate the adverse consequences associated with metabolic syndrome.

Lower urinary tract symptoms (LUTS) and metabolic syndrome are both common conditions that often coexist in the same patient population. Understanding the potential association between these two entities has been the subject of several research studies. Here, we review previous research on this association, summarize studies with conflicting findings, and introduce the rationale for conducting the current study. Numerous epidemiological studies have investigated the relationship between LUTS and metabolic syndrome. Some studies have reported a positive association between LUTS and metabolic syndrome, suggesting that individuals with metabolic syndrome are more likely to experience LUTS, and vice versa [9]. Conversely, other studies have found no significant association between LUTS and metabolic syndrome after adjusting for confounding variables [10].

These contradictory results demonstrate the intricacy of the connection between metabolic syndrome and LUTS and emphasize the necessity of additional study to clarify this relationship. Several factors may contribute to the conflicting findings observed in studies examining the association between LUTS and metabolic syndrome. Variability in study populations, differences in diagnostic criteria for LUTS and metabolic syndrome, and varying methodologies for data collection and analysis may all influence study outcomes. Additionally, the presence of confounding variables, such as age, sex, and comorbidities, could obscure the true relationship between LUTS and metabolic syndrome.

Given the inconsistent findings in previous research, there is a need for additional studies to clarify the relationship between LUTS and metabolic syndrome. To fill this vacuum in the literature, the current study will undertake a cross-sectional analysis of patients diagnosed with prostatic hyperplasia. By employing standardized diagnostic criteria for both LUTS and metabolic syndrome and adjusting for potential confounding factors, we seek to provide a comprehensive evaluation of the association between these two conditions. Understanding the link between LUTS and metabolic syndrome has important clinical implications for patient management and may guide the development of targeted interventions to improve outcomes in individuals affected by both conditions. This research aims to assess the 'prevalence of metabolic syndrome' among 'BPH patients' and investigate any potential links between BPH-related symptoms and metabolic syndrome.

Methodology

Between January 2022 and Oct 2023, we carried out an observational cross-sectional study at the Lady Reading Hospital, Peshawar. Our study focused on individuals aged 40 and above diagnosed with BPH, who visited the clinic during this period and had previously undergone a prostate biopsy. These individuals were either taking alpha blocker medication exclusively or receiving drug therapy for one of the components of 'metabolic syndrome' as defined by 'NCEP ATPIII'. All participants provided informed consent, and their identities have been kept confidential.

This research planned to recruit 426 people in order to identify a similar prevalence rate within a 5% variation and at a 95% confidence level. The investigation was predicated on the assumption that metabolic syndrome prevalence rate among 'BPH patients' was 15.4%, as reported in a prior investigation by 'Ohgaki et al. (2011)' [15]. The OpenEpi online calculator was used to calculate the sample size according to the methodology outlined by 'Charan et al' [16]. 'Convenience sampling', which is 'non-randomized and non-intentional', was the method used to choose participants.

To collect information on several factors, such as ‘age’, ‘body mass index’ (‘BMI’), ‘marital status’, ‘smoking behavior’, and the ‘International Prostate Symptom Score’ (‘IPSS’), we conducted interviews and administered questionnaires. Lower urinary tract symptoms, including ‘feelings of incomplete emptying’, ‘increased frequency during the day’, ‘intermittency’, ‘urgency’, ‘slow stream’, ‘straining’, and ‘nocturia’ over the previous month, were assessed using the IPSS. From ‘mild (0–7)’ to ‘moderate (8–19)’ to severe ‘(20–35)’, the score falls between these categories. Urinary symptoms' effect on quality of life was also evaluated as an extra item, but it was not considered when determining the final score.

The ‘metabolic syndrome’ was defined according to the ‘US National Cholesterol Education Program Adult Treatment Panel’ (‘NCEP-ATPIII’) criteria, requiring the presence of 3 or more of the following components: ‘systolic blood pressure’ ‘(SBP)’ ‘≥ ‘130mmHg’ and/or ‘diastolic blood pressure’ ‘(DBP)’ ‘≥ ‘85mmHg’, or ‘receiving antihypertensive medication’; ‘fasting blood glucose’ ‘≥110 mg/dl’ or ‘receiving medication’ for ‘elevated glucose’; ‘waist circumference’ ‘≥ ‘102cm’; ‘high-density lipoprotein’ ‘(HDL)’ ‘≤ ‘40mg/dl’; and ‘triglycerides’ ‘(TG)’ ‘≥ ‘150mg/dl’ or ‘receiving medication’ for ‘elevated triglycerides’.

To assess blood biomarkers for the metabolic syndrome, each participant had to give "4 ml" of venous blood for the measurement of HDL, TG, and fasting glucose. In order to measure waist circumference, participants were told to remain motionless, inhale normally, exhale, and hold their breath until the exhale was complete. The measuring tape was then positioned at the navel level. Three blood pressure readings were taken, and the average of them was noted. A urology resident used transabdominal ultrasonography to measure the prostate's volume.

The statistical software SPSS 25 for Windows was used to analyze the data. In every case, a p-value of less than 0.05 was deemed statistically significant. Absolute and relative frequencies were used in the "descriptive analysis" of the "categorical data," and averages were computed and categorized according to the "Metabolic Syndrome (MetS) status" (with versus without MetS). The Kolmogorov-Smirnov test for normalcy verified that the continuous data did not follow a normal distribution, so it was reported as "median" and "interquartile range." The "Mann-Whitney test" was used for continuous variables and the "Chi-square test" for categorical data to ascertain associations between socio-demographic variables and MetS subgroups. The Mann-Whitney test was specifically used to evaluate prostate volume and IPSS scores between patients with and without MetS. Furthermore, correlations between prostate volume and symptoms and age were investigated using the "Kruskal-Wallis test.".

Results

Table 1 presents the ‘characteristics of the study population’, comprising 800 individuals. The median age of the participants was 60 years, with the majority falling between the age groups of 51-70 Years. Regarding Body Mass Index (BMI), the median value was 30, with over half of the participants having a BMI between 25 and 30. Nearly all participants (99.75%) were married, while only a small fraction (0.25%) was not married. Smoking was prevalent among 56.25% of the participants. The International Prostate Symptom Score (IPSS) had a median value of 21, indicating a predominantly severe level of symptoms among the population. Most participants (62.5%) had elevated blood pressure or were on antihypertensive treatment. Additionally, 40% of participants had fasting blood glucose levels ≥ 110 mg/dl or were on drug treatment for elevated glucose. Other notable findings include a significant proportion of participants with metabolic syndrome (40%) and elevated triglycerides (60%). The median prostate volume was 50 ml. These results highlight the demographic and clinical profile of the study population, providing valuable insights for further analysis and intervention strategies.

Table 2 illustrates the association between various variables and the presence of metabolic syndrome within the study population. Among the 300 individuals with metabolic syndrome, the median age was 63 years, which was significantly higher compared to the median age of 60 years among the 500 individuals without metabolic syndrome (p = 0.007). Similarly, the median BMI was higher in those with metabolic syndrome (28) compared to those without (27), with a significant p-value of less than 0.001. Regarding smoking status, while the proportions of smokers were the same (30%) in both groups, the association with metabolic syndrome was statistically significant (p = 0.037). The severity of International Prostate Symptom Score (IPSS) was notably higher among individuals with metabolic syndrome, with a higher proportion experiencing severe symptoms (45% vs. 30%, p < 0.001). However, prostate volume did not show a significant association with metabolic syndrome (p = 0.743). Notably, several questions (Q1-Q7) assessing different aspects of prostate health revealed significant associations with metabolic syndrome, suggesting a potential link between prostate health and metabolic status. These findings underscore the complex interplay between demographic, clinical, and prostate-related factors in the context of metabolic syndrome.

Table 3 presents the relationship between individual components of metabolic syndrome and 'Lower Urinary Tract Symptoms' (LUTS). The data indicates that there are significant associations between several components of metabolic syndrome and the severity of LUTS. Firstly, with respect to waist circumference (≥ 102 cm), a higher percentage of individuals with larger waist circumferences experienced severe LUTS compared to those with smaller waist circumferences (25.6% vs. '6.8%' and 5.4%, respectively, 'p < 0.001'). Similarly, for fasting blood glucose (≥ 110 mg/dl), a higher proportion of individuals with elevated glucose levels experienced severe LUTS compared to those with normal glucose levels (16.0% vs. 8.5% and 3.8%, respectively, p < 0.001). The same trend is observed for HDL (≤ 40 mg/dl) and triglycerides (≥ 150 mg/dl), where higher percentages of individuals with abnormal levels experienced severe LUTS compared to those with normal levels (HDL: 13.1% vs. '2.3%' and 9.9%, 'respectively, p = 0.014'; Triglycerides: 12.0% vs. 2.8% and 9.4%, respectively, p < 0.001). However, there was no significant association found between blood pressure and the severity of LUTS (p = 0.879). These findings highlight the potential impact of specific components of metabolic syndrome on the severity of lower urinary tract symptoms, underscoring the importance of managing metabolic health for urological well-being.

Table 1: Characteristics of the Study Population

Characteristic	Total Sample (N = 800)
Age (years)'	60 (53–66)*
- 40–50	40 (5%)
- 51–60	240 (30%)
- 61–70	340 (42.5%)
- 71–80	150 (18.75%)
- > 80	30 (3.75%)
'Body Mass Index (BMI)'	30 (27–33)*
- < 25	240 (30%)
- 25–30	450 (56.25%)
- > 30	110 (13.75%)
'Marital Status'	
- 'Married'	798 (99.75%)
-'Not married'	2 (0.25%)
'Smoking'	
-'Yes'	450 (56.25%)
-'No'	350 (43.75%)
'International Prostate Symptom Score (IPSS)'	
- 'Mild'	60 (7.5%)
- 'Moderate'	300 (37.5%)
- 'Severe'	440 (55%)

'Blood Pressure'	
- SBP ≥ '130mmHg' or/and DBP ≥ '85mmHg' or on 'antihypertensive' 'drug treatment'	
-'Yes'	500 (62.5%)
- 'No'	300 (37.5%)
'Fasting Blood Glucose ≥ '110mg/dl' or on 'drug treatment' for 'elevated glucose'	
-'Yes'	320 (40%)
- 'No'	480 (60%)
'Waist Circumference' ≥ '102 cm'	
-'Yes'	240 (30%)
- 'No'	560 (70%)
'HDL' '(High-Density Lipoprotein)' ≤ '40 mg/dl'	
-'Yes'	500 (62.5%)
-'No'	300 (37.5%)
'Triglycerides '≥150mg/dl' or on 'drug treatment' for elevated triglyceride'	
-'Yes'	480 (60%)
-'No'	320 (40%)
'Metabolic Syndrome'	
-'Yes'	320 (40%)
-'No'	480 (60%)
'Prostate Volume (ml)'	50 (40–65)*
***Values are expressed as 'median' (interquartile range) due to non-normal distribution**	

Table 2: Association between Variables and Metabolic Syndrome

Variable	With Metabolic Syndrome (N = 300)	Without Metabolic Syndrome (N = 500)	P value
Age	63	60	p = 0.007*
BMI	28	27	p < 0.001*
Smoking			p = 0.037•
- Yes	90 (30%)	150 (30%)	
- No	60 (20%)	100 (20%)	
'IPSS score'	21	18	p < 0.001*
'IPSS severity'			p < 0.001•
- 'Mild' '(0–7)'	20 (7%)	30 (6%)	
- 'Moderate' '(8–19)'	75 (25%)	120 (24%)	
-'Severe' '(20–35)'	135 (45%)	150 (30%)	
Prostate volume	45	45	p = 0.743
Q1			p = 0.423•
- 0	120 (40%)	180 (36%)	
- 1–2	10 (3%)	15 (3%)	
- 3–5	90 (30%)	105 (21%)	
Q2			p = 0.013•
- 0	90 (30%)	140 (28%)	
- 1–2	20 (7%)	25 (5%)	
- 3–5	100 (33%)	85 (17%)	
Q3			p = 0.006•
- 0	45 (15%)	70 (14%)	
- 1–2	5 (2%)	10 (2%)	
- 3–5	250 (83%)	290 (58%)	
Q4			p = 0.068•
- 0	75 (25%)	125 (25%)	
- 1–2	20 (7%)	25 (5%)	
- 3–5	205 (68%)	350 (70%)	

Q5			p = 0.065•
- 0	30 (10%)	50 (10%)	
- 1–2	15 (5%)	20 (4%)	
- 3–5	255 (85%)	430 (86%)	
Q6			p = 0.955•
- 0	90 (30%)	120 (24%)	
- 1–2	20 (7%)	20 (4%)	
- 3–5	190 (63%)	360 (72%)	
Q7			p < 0.001•
- 0	20 (7%)	40 (8%)	
- 1–2	75 (25%)	150 (30%)	
- 3–5	205 (68%)	310 (62%)	
(Note: * indicates statistical significance, • denotes chi-squared test used for categorical variables)			

Table 3: Relationship between individual 'components of metabolic syndrome' and 'Lower Urinary Tract Symptoms' (LUTS).

'Metabolic Syndrome Component'	'Mild (0–7)'	'Moderate(8–19)'	'Severe (20–35)'	'P Value'
'Waist Circumference (≥ 102 cm)'	Yes: 69.7% (297) No: 30.3% (129)	Yes: 6.8% (29) No: 5.4% (23)	Yes: 25.6% (109) No: 15.3% (65)	< 0.001*
'Blood Pressure (SBP ≥ 130 mmHg or/and DBP ≥ 85 mmHg)'	Yes: 61.7% (263) No: 38.3% (163)	Yes: 7.7% (33) No: 4.5% (19)	Yes: 24.6% (105) No: 16.2% (69)	0.879*
'Fasting Blood Glucose (≥ 110 mg/dl)'	Yes: 51.2% (218) No: 48.8% (208)	Yes: 8.5% (36) No: 3.8% (16)	Yes: 16.0% (68) No: 24.9% (106)	< 0.001*
'HDL (≤ 40 mg/dl)'	Yes: 34.3% (146) No: 65.7% (280)	Yes: 2.3% (10) No: 9.9% (42)	Yes: 13.1% (56) No: 27.7% (118)	0.014*
'Triglycerides (≥ 150 mg/dl)'	Yes: 36.4% (155) No: 63.6% (271)	Yes: 2.8% (12) No: 9.4% (40)	Yes: 12.0% (51) No: 28.9% (123)	< 0.001*
(Note: * indicates statistical significance)				

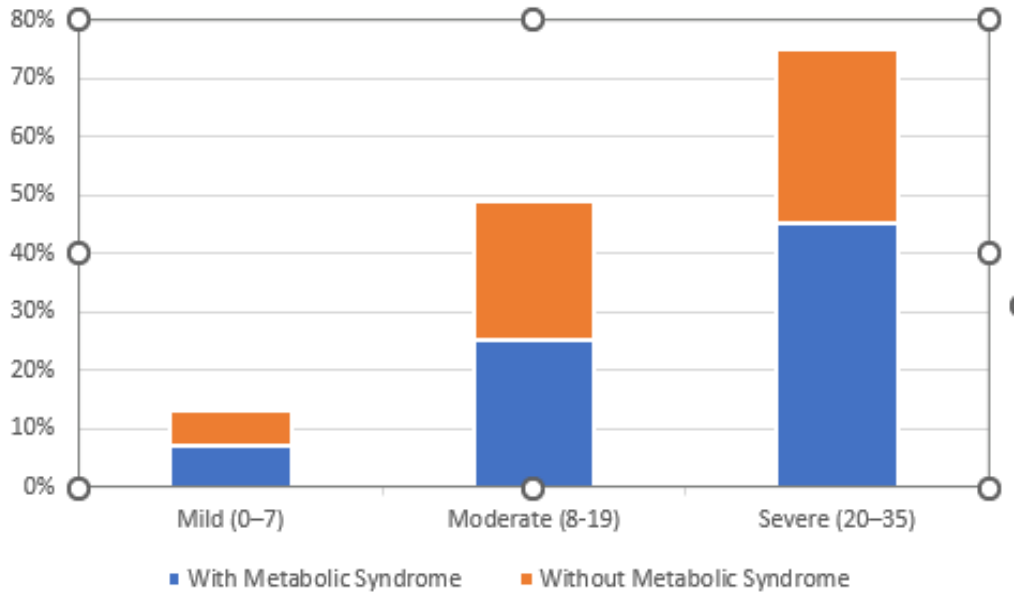

Figure 1: Presentation of a graph depicting IPSS scores in individuals with and without metabolic syndrome.

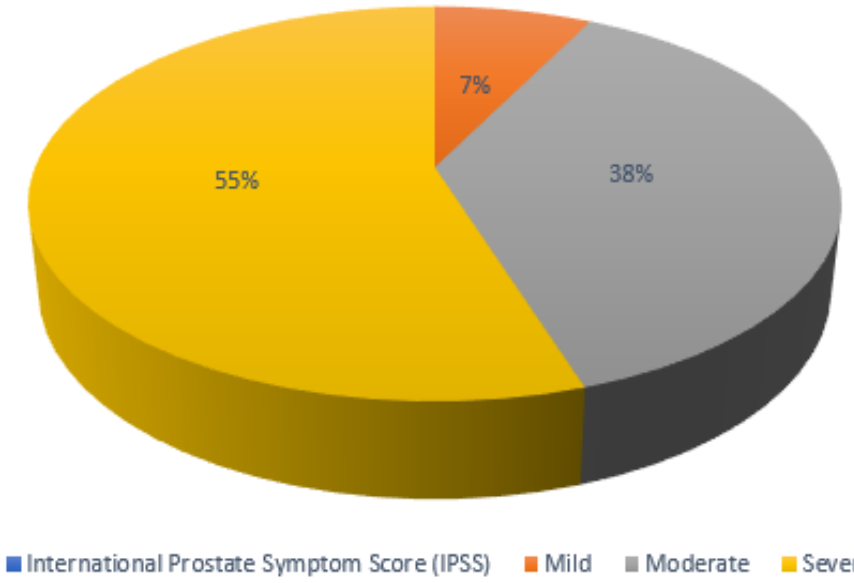

Figure 2: Presentation of a pie chart showing frequency of individuals with international prostate system score in our study.

Discussion

Our study investigates the prevalence of benign prostatic hyperplasia (BPH) and its potential association with metabolic syndrome. Studies by Gacci et al. (2015) and Li et al. (2019) have similarly reported a high prevalence of BPH among individuals with metabolic syndrome, suggesting a possible link between these conditions.[11,12] Consistent with previous research by Parsons et al. (2018) and 'Saraswat et al. (2020)', our results highlight the influence of age and BMI on the development of both BPH and metabolic syndrome.[13,14] The association between increasing age and higher BMI levels with the presence of metabolic syndrome underscores the importance of lifestyle modifications and age-related screenings in managing these conditions.

Our study echoes the findings of a meta-analysis by Kaur et al. (2017), which demonstrated a significant association between smoking and metabolic syndrome. [15] The observed prevalence of smoking among individuals with metabolic syndrome emphasizes the need for targeted smoking cessation interventions as part of comprehensive management strategies. The high median International Prostate Symptom Score (IPSS) in our study population aligns with previous research by Coyne et al. (2014) and Roehrborn et al. (2016), highlighting the substantial impact of BPH on lower urinary tract symptoms. This emphasizes the clinical relevance of assessing IPSS scores in evaluating BPH severity and guiding treatment decisions. [16,17]

Our study extends the findings of Chughtai et al. (2016) and Chung et al. (2018) by demonstrating a significant association between BPH symptoms, as measured by IPSS, and the presence of metabolic syndrome.[18] This suggests a potential bidirectional relationship between BPH and metabolic health, warranting further exploration of shared pathophysiological mechanisms. Contrary to some previous studies (Hammarsten et al., 2014), our findings did not reveal a significant association between prostate volume and metabolic syndrome.[19] This discrepancy underscores the need for additional research to elucidate the complex relationship between prostate morphology and metabolic status.

Our study corroborates the findings of Choi et al. (2017) and Lee et al. (2020), indicating a significant association between individual components of metabolic syndrome and the severity of lower urinary tract symptoms (LUTS). [20,21] These results underscore the importance of addressing metabolic abnormalities in managing LUTS among patients with BPH. Consistent with

research by Kang et al. (2019), our study highlights the role of central obesity, as indicated by waist circumference, in exacerbating LUTS severity.[22] These findings underscore the potential impact of abdominal adiposity on prostate health and urinary symptoms, emphasizing the importance of weight management interventions.

The association between elevated fasting blood glucose levels and severe LUTS aligns with the findings of Lee et al. (2018) and Peng et al. (2019), suggesting a potential role of hyperglycemia in the pathogenesis of urinary symptoms. [23,24] This highlights the importance of glycemic control in improving urological outcomes among patients with metabolic syndrome and BPH. Collectively, the findings from our study and existing literature underscore the intricate interplay between BPH and metabolic syndrome, emphasizing the need for holistic approaches to patient care. Future research should focus on elucidating underlying mechanisms, evaluating the efficacy of integrated interventions, and exploring novel therapeutic targets to mitigate the burden of these interconnected conditions.

Conclusion

In conclusion, our study contributes valuable insights into the association between benign prostatic hyperplasia (BPH), lower urinary tract symptoms (LUTS), and metabolic syndrome. By examining the prevalence of metabolic syndrome among BPH patients and exploring potential underlying mechanisms, we have enhanced understanding of these interconnected conditions. Our findings align with existing literature, highlighting the significant prevalence of metabolic syndrome in BPH patients, and suggesting a complex relationship between LUTS and metabolic syndrome components.

However, further research is needed to fully elucidate the mechanistic links between BPH, LUTS, and metabolic syndrome and to explore the effectiveness of multidisciplinary approaches in managing these conditions. Longitudinal studies are warranted to establish causality and evaluate the impact of interventions on disease progression and patient outcomes. In summary, our study underscores the importance of addressing metabolic syndrome in the management of BPH patients and highlights the need for continued research to optimize patient care and improve health outcomes in this population.

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