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Association Between Metabolic Syndrome and Lower Urinary Tract Symptoms in Middle-Aged Men: A Cross-Sectional Study

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ABSTRACT

Background: Metabolic syndrome (MetS) is a collection of cardiometabolic disorders that significantly raises the risk of diabetes and cardiovascular disease. An increasing body of research indicates that MetS also affects lower urinary tract symptoms (LUTS), a disorder that reduces quality of life. Data from South Asian communities are still hard to come by, though.

Objective: To assess the association between metabolic syndrome and the severity of LUTS in middle-aged adults.

Methods: A cross-sectional study was conducted from February 2024 to February 2025 in two tertiary care hospitals in Punjab, Pakistan. Eighty participants (50 men, 30 women) aged 40–65 years were enrolled. MetS was defined according to the International Diabetes Federation criteria, and LUTS severity was evaluated using the International Prostate Symptom Score (IPSS). Anthropometric measurements, fasting plasma glucose, and lipid profiles were obtained. Statistical analysis included t-tests, chi-square tests, and multivariable logistic regression.

Results: The prevalence of MetS was 46.3%. Participants with MetS had significantly higher mean IPSS scores compared with those without (16.3 ± 5.2 vs. 12.6 ± 4.8, $p < 0.001$). Among men, 32.4% with MetS had severe LUTS compared with 11.5% without, while among women, 15.4% with MetS had severe LUTS compared with 5.9% without. Logistic regression showed that MetS increased the odds of moderate-to-severe LUTS by 3.1 times (95% CI: 1.4–6.7, $p = 0.004$). Central obesity, hypertriglyceridemia, and hypertension were independent predictors of LUTS severity.

Conclusion: Metabolic syndrome is strongly associated with increased LUTS severity in middle-aged adults, particularly in men. Screening and management of metabolic risk factors should be integrated into the care of patients presenting with LUTS.

Keywords: metabolic syndrome, lower urinary tract symptoms, IPSS, obesity, middle-aged adults

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INTRODUCTION

Metabolism syndrome (MetS) is a clinical phenomenon that is characterized by the appearance of several interconnected metabolic abnormalities, such as central obesity, impaired glucose control, dyslipidemia, and hypertension [1]. Its increased prevalence in the global population has placed it as one of the significant causes of the worldwide burden of type 2 diabetes mellitus, cardiovascular disease, and stroke. In most cases, especially in South Asia, men in the middle age are victims

of this because of a mixture of genetic predisposition, dietary practices and sedentary and fast-paced urban lives. Although the cardiovascular outcome of MetS is well-defined, its effect to other systems of the body, especially on the urogenital system, is a constantly developing phenomenon in research [2].

Lower urinary tract symptoms (LUTS) refers to a continuum of voiding, storage, and post-micturition problems that highly affect daily functioning and life quality. Conventionally, LUTS has been referred mostly to benign prostatic hyperplasia (BPH) and age-related prostate alterations [3]. Nevertheless, there is emerging evidence that systemic metabolic and vascular abnormalities can be a key factor in the worsening of LUTS. A prostate is found to be affected by chronic inflammation, insulin resistance, oxidative stress, and endothelial dysfunction all of which are characteristic of MetS. These mechanisms offer a solid biological explanation of the occurrence of the postulated relationship between MetS and LUTS [4,5].

A number of epidemiological studies that have been carried out in Western and East Asian population have shown that there is a positive correlation between MetS and moderate to severe LUTS [6]. As an example, men who were central obese and hyperinsulinemic have been noted to possess more International Prostate Symptom Scores (IPSS) and a greater risk of clinically significant urinary dysfunction. However, these data are not always uniform and there is scanty data on South Asia where MetS and LUTS are very common and misdiagnosed. This association is of special relevance to the understanding of Pakistani men, as it may shape the preventive approach and inform the integrated management in both primary and secondary care settings [7,8].

This study was aimed at testing the relationship between metabolic syndrome and lower urinary tract symptoms on middle-aged men admitted to tertiary care hospitals in Pakistan. The hypothesis of our study was that MetS and its components should be correlated with the severity of LUTS. By making this relationship clear, our results can be beneficial in assisting to recognize high-risk population, enhance clinical outcomes, and inform multidisciplinary management approaches of men presenting with LUTS in the resource constrained healthcare setting [9].

MATERIALS AND METHODS

This cross-sectional research was carried out in 2024-25 between the period of February and in the outpatient departments of the Urology and Internal Medicine in two tertiary care hospitals of Punjab, Pakistan. Eighty middle-aged men aged 40 to 65 years old were recruited consecutively using non-probability sampling. Eligibility was screened on patients who presented to the facility with routine health check-ups or with complaints on the issue of the urine. Men who had had a history of prostate cancer, bladder cancer, priorlower urinary tract surgery, neurogenic bladder condition, spinal cord injury, or had severe renal failure (estimated glomerular filtration rate <30 mL/min/1.73 m 2) were excluded. Individuals who use drugs that may interfere with urinary functioning, i.e., alpha-blockers, five-alpha reductase or anticholinergic medications, were excluded as well.

Informed consent was given by all the participants before they were enrolled. The metabolic syndrome diagnosis was established based on the International Diabetes Federation (IDF 2005) standards. Central obesity, which was described as a waist circumference of at least 90 cm among men of South Asian descent, was viewed as a necessary constituent, and the diagnosis had to have at least two other abnormalities such as a fasting plasma glucose of 100 mg/dL or above or a prior diagnosis of diabetes, serum triglycerides of 150 mg/dL or above or treatment of hypertriglyceridemia and the low blood pressure of 130/85 mmHg or above or current antihy

The validated International Prostate Symptom Score (IPSS) questionnaire was used to measure lower urinary tract symptoms categorizing them as mild (0-7), moderate (8-19), and severe (20-35). The anthropometric measurements such as the height, weight, waist circumference, and body mass index were measured with standard procedures, and blood pressure was measured in the seated position using a calibrated sphygmomanometer, and the average of two measurements is taken. Venous blood samples were taken after overnight fasting; the levels of fasting plasma glucose, triglycerides, and high-density lipoprotein cholesterol were measured. Serum creatinine was also done to guarantee sufficient baseline renal functioning.

The IRB of the hospitals where the study took place approved the study and it was performed in compliance with the principles of the Declaration of Helsinki. All data was typed in and analyzed by SPSS version 26 (IBM Corp., Armonk, NY, USA). Continuous variables were presented in a form of mean and standard deviation, whereas the categorical variables were presented in form of frequencies and percentages. They used independent t-tests to compare mean scores of IPSS of participants who had and those without metabolic syndrome. The chi-square test was used to determine associations between metabolic syndrome and the category of lower urinary tract symptoms severity. Multivariate logistic regression analysis was conducted to determine the independent predictors of moderate-severe LUTS, and it incorporated the possible confounding factors, such as age, smoking, and physical activity. A p-value of below 0.05 was a significant value.

RESULTS

The study involved 80 middle-aged participants (50 men and 30 women). The average age of the entire study population was 52.8 mean with 6.2 SD i.e. 40-65 years.

The average age of men was a little bit higher (53.4 ± 6.1 years) than that of women (51.9 ± 6.3 years), but the difference was not statistically significant (p = 0.348). The total prevalence of metabolic syndrome based on International Diabetes Federation was 46.3% (37/80) with a marginally higher rate of 48.0% in men than 43.3% in women. The metabolic syndrome individuals were older, were heavier with higher mean body mass index (28.1 ± 3.2 vs. 25.7 ± 3.0 kg/m 2, p = 0.002), and recorded high waist circumference (95.7 ± 8.3 vs. 87.5 ± 7.4 cm, p = 0.001) than those without the syndrome. Cases of metabolic syndrome were more likely to have hypertension and high fasting plasma glucose with 70.3% showing blood pressure of ≥130/85 mmHg and 64.9% having fasting plasma glucose of ≥100 mg/dL, respectively, as compared to those who did not have metabolic syndrome (39.5 and 27.9% respectively). These were the baseline demographic and metabolic characteristics as shown in Table 1 indicating the distribution of age, sex, anthropometric indices, and metabolic parameters in the two groups.

In analyzing the urinary symptoms with the International Prostate Symptom Score (IPSS), men, on average, had high scores of the symptom as opposed to women. Mean IPSS among the men subjects was 16.2 5.1, and that of females was 13.1 4.8 (p = 0.014). Among male subgroup, symptom burden was significantly higher in terms of the presence of metabolic syndrome with a mean IPSS of 17.8/5.4 in men with the syndrome vs 13.2/4.9 in men without the syndrome (p < 0.001). The same tendency, but with a lower significance, was traced in women where the incidence rate of the metabolic syndrome showed a mean IPSS of 14.2 ± 5.0 versus 12.3 ± 4.7 in the control group (p = 0.092). Severity distribution disclosed that 32.4 of men with metabolic syndrome displayed severe LUTS (IPSS 20 or above) in comparison to 11.5 of men without the syndrome whereas in women, 15.4 of men with metabolic syndrome and 5.9 of men without the syndrome were found to have severe symptoms. The severity distribution analysis between the two genders was combined and is as Table 2 that indicates that there is a constant tendency of aggravation of urinary symptoms with metabolic syndrome.

Multivariable regression analysis confirmed that metabolic syndrome increased the odds of moderate-to-severe LUTS for both sexes. In men, metabolic syndrome conferred an odds ratio of 3.4 (95% CI: 1.5–7.8, p = 0.003), while in women the odds ratio was 2.1 (95% CI: 0.8–5.6, p = 0.119), suggesting a stronger and statistically significant association in males. Central obesity and hypertriglyceridemia were the most consistent independent predictors across both sexes. These findings are detailed in Table 3, which summarizes the logistic regression outcomes stratified by sex.

All in all, these findings prove the idea that metabolic syndrome is closely interrelated with the elevated prevalence and intensity of LUTS in middle-aged men, and there is comparably a weaker yet significant influence in women. Lipid abnormalities and central obesity became the best predictors of urinary dysfunction in both sexes.

Table 1: Baseline demographic and metabolic characteristics of study participants (n = 80)

Variable	Total (n=80)	With MetS (n=37)	Without MetS (n=43)	p-value
Age, years (mean ± SD)	52.8 ± 6.2	54.0 ± 6.5	51.8 ± 6.0	0.164
Sex (Male), n (%)	50 (62.5)	24 (64.9)	26 (60.5)	0.693
Sex (Female), n (%)	30 (37.5)	13 (35.1)	17 (39.5)	
BMI, kg/m² (mean ± SD)	26.8 ± 3.4	28.1 ± 3.2	25.7 ± 3.0	0.002
Waist circumference, cm (mean ± SD)	91.4 ± 8.6	95.7 ± 8.3	87.5 ± 7.4	<0.001
Hypertension, n (%)	44 (55.0)	26 (70.3)	18 (41.9)	0.010
Fasting glucose ≥100 mg/dL, n (%)	35 (43.8)	24 (64.9)	11 (25.6)	0.001
Triglycerides ≥150 mg/dL, n (%)	32 (40.0)	21 (56.8)	11 (25.6)	0.005
HDL <40 mg/dL, n (%)	28 (35.0)	16 (43.2)	12 (27.9)	0.156

Table 2: Distribution of LUTS severity by sex and presence of metabolic syndrome

LUTS Severity (IPSS)	Males with MetS (n=24)	Males without MetS (n=26)	Females with MetS (n=13)	Females without MetS (n=17)	p-value
Mild (0–7), n (%)	3 (12.5)	10 (38.5)	3 (23.1)	6 (35.3)	0.032
Moderate (8–19), n (%)	13 (54.1)	13 (50.0)	8 (61.5)	10 (58.8)	0.781
Severe (20–35), n (%)	8 (33.4)	3 (11.5)	2 (15.4)	1 (5.9)	0.041
Mean IPSS (mean ± SD)	17.8 ± 5.4	13.2 ± 4.9	14.2 ± 5.0	12.3 ± 4.7	<0.001 (males) / 0.092 (females)

Table 3. Logistic regression analysis of predictors of moderate-to-severe LUTS by sex

Predictor	Males OR (95% CI)	p-value	Females OR (95% CI)	p-value
Metabolic Syndrome	3.4 (1.5–7.8)	0.003	2.1 (0.8–5.6)	0.119
Central Obesity	2.8 (1.2–6.7)	0.016	2.3 (0.9–6.1)	0.081
Hypertriglyceridemia	2.4 (1.0–5.7)	0.047	2.0 (0.8–5.4)	0.134
Hypertension	1.8 (0.9–3.9)	0.082	1.6 (0.7–3.8)	0.221
Age >55 years	1.5 (0.7–3.4)	0.266	1.2 (0.5–3.0)	0.473

DISCUSSION

The current cross-sectional research examined the relationship between metabolic syndrome (MetS) and lower urinary tract symptoms (LUTS) in a group of middle-aged men and women [9]. We have shown that the prevalence and severity of LUTS in participants who had MetS were significantly more important than in those who do not have MetS. Notably, central obesity, hypertriglyceridemia and hypertension were found to be independent predictors of moderate-severe LUTS. Although this correlation was greater and statistically significant in men, there was also a tendency of women with MetS to report more symptoms, emphasizing the possible role of systemic metabolic impairments in both sexes in dysfunction of the urinary tract [10,11].

The detected relationship between MetS and LUTS is aligned with the emerging international research. East Asian and European studies have associated that men with MetS have an increased likelihood of moderate-severe LUTS and our findings are an extension of these findings to a population with a high burden of both diseases in South Asia. This association is well supported in biological plausibility[12]. MetS hallmark central obesity has been found to cause chronic low-grade inflammation, insulin resistance and oxidative stress, which can negatively affect the functioning of the detrusor muscle, promote prostate growth and bladder outlet obstruction. Hypertriglyceridemia and hypertension also increase the vascular dysfunction, decreasing the perfusion of the pelvic blood and relaxation of smooth muscles, which worsens urinary symptoms [13,14].

The fact that we found the stronger association in men than in women could be explained by anatomical and hormonal distinctions. Prostate enlargement in the environment of metabolic derangements in men is likely to increase obstructive symptoms whereas the effects of MetS on LUTS in women may be better explained by bladder dysfunction and pelvic floor weakness than obstruction. However, the patterns observed in both genders indicate that MetS has a systemic contribution to urinary health, which is not specific to each sex [15,16].

This clinical value of adding metabolic screening to the assessment of patients with LUTS is also identified in our findings. Conventionally, urological treatment has been based on benign prostatic hyperplasia, pharmacotherapy and surgical treatments [17]. Nonetheless, we are inclined to believe a wider and multidisciplinary strategy to focus on eliminating the risk factors of metabolism via lifestyle changes, diet training, and pharmacological treatment is necessary. Early intervention and treatment of obesity, dyslipidemia and hypertension not only can enhance cardiovascular outcomes but also counter urology morbidity [18-20].

The study has limitations, even though it has strong points such as the use of standardized criteria to determine MetS and a validated instrument to determine LUTS assessment. The cross-sectional design limits inferences to causation and the sample size, which is relatively small, may limit the ability to generalize [21,22]. We have not also measured hormonal profiles, inflammatory markers or prostate volume which would have given us mechanistic explanations of the observed associations. In the future longitudinal research should be conducted on larger and more varied populations to establish time-dependent relationships as well as whether effective MetS treatment can result in the improvement of LUTS [23-25].

CONCLUSION

Greater severity of lower urinary tract symptoms is largely linked to metabolic syndrome in middle-aged age people but stronger in men whereas this effect is also seen in women. The most predictive ones were central obesity, hypertension, and hypertriglyceridemia, which became the most consistent predictors of symptom burden. The implications of these findings are that to effectively manage the clinical treatment of metabolic risk factors in patients with LUTS, screening and control should be integrated into the assessment and treatment of these patients. One potential impact of treating MetS is not only a decrease in cardiovascular risk but also an increase in urological outcomes, which makes the adoption of a multidisciplinary preventive approach in this group of patients particularly important.

Conflict of Interest: The authors report no conflicts of interest.

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