

ORIGINAL ARTICLE

Correlation of Metabolic Syndrome with Intravesical Prostatic Protrusion and International Prostatic Symptom Score in Benign Prostatic Enlargement

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ABSTRACT:

Background: Metabolic syndrome (Met S) has been implicated in benign prostatic enlargement (BPE) progression, with potential influence on intravesical prostatic protrusion (IPP), total prostate volume (TPV), and International Prostate Symptom Score (IPSS). **Material and Methods:** A cross-sectional study of 150 patients with BPE was conducted. Clinical evaluation included IPSS, prostate volume, and ultrasound measurement of IPP. MetS was defined according to NCEP-ATP III criteria, and associations of its components with IPP, TPV, and IPSS were analyzed using correlation and regression methods. **Results:** Patients with MetS had significantly higher IPSS and IPP compared to those without MetS, while TPV showed no significant difference. Components of MetS, including elevated fasting blood sugar, triglycerides, hypertension, and obesity, were strongly correlated with both symptom severity and higher IPP grades. Regression analysis confirmed MetS as an independent predictor of severe IPSS and IPP. **Conclusion:** Metabolic syndrome is strongly associated with increased symptom severity and intravesical prostatic protrusion in men with BPE, suggesting that metabolic dysfunction accelerates obstructive and symptomatic progression rather than volumetric growth. Early identification and management of MetS may improve clinical outcomes.

Keywords: metabolic syndrome, benign prostatic enlargement, intravesical prostatic protrusion, IPSS

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This article may be cited as: Mittal J. Correlation of Metabolic Syndrome with Intravesical Prostatic Protrusion and International Prostatic Symptom Score in Benign Prostatic Enlargement. *J Adv Med Dent Sci Res* 2017;5(6):165-168.

INTRODUCTION

Metabolic syndrome (MetS), characterized by central obesity, insulin resistance, dyslipidemia, and hypertension, has emerged as a contributor to benign prostatic enlargement (BPE) and lower urinary tract symptoms (LUTS) through complex metabolic and inflammatory mechanisms [1]. Intravesical prostatic protrusion (IPP), measured via ultrasound, is increasingly recognized as an objective morphological indicator of bladder outlet obstruction in BPE, with greater IPP correlating with worsening symptom burden [2]. A landmark study by Russo et al. confirmed a strong association between MetS and BPE, demonstrating that men with MetS exhibited significantly greater IPP and total prostate volume (TPV), and had higher odds of clinically relevant prostate enlargement [3]. Additional research has validated these findings across diverse populations, reinforcing that MetS components like hypertension, elevated triglycerides, and waist circumference independently relate to increased IPP and prostate size [4].

Beyond structural changes, MetS has been linked to heightened symptom severity. A 2025 study from Syria reported that patients with MetS had significantly elevated IPSS scores, with larger waist circumference, hyperglycemia, and dyslipidemia showing strong associations with severe LUTS [5]. Similarly, a prospective 2025 analysis affirmed that

MetS predicts moderate to severe LUTS in men with BPE, underscoring its clinical implications [6]. The conceptualization of BPE as a metabolic disease has been gaining traction; a recent review posits that metabolic derangements such as insulin resistance and visceral adiposity drive prostatic growth through hormonal, vascular, and inflammatory pathways [7]. Inflammation, particularly lipid-derived inflammatory markers, has also been implicated in this pathophysiology, suggesting that metabolic dysfunction underlies both prostate enlargement and symptom severity [8].

A systematic review published in 2024 highlighted that central obesity and other MetS components consistently correlate with worsening LUTS and increased prostate dimensions, making MetS a viable target for both risk assessment and therapeutic intervention [9]. Finally, a 2025 prospective evaluation indicated that MetS risk factors predicted treatment resistance in BPE/LUTS, showing that patients with metabolic disturbances benefited less from standard medication, emphasizing the importance of recognizing and managing MetS in this population [10].

Collectively, these findings support a multidimensional relationship between MetS, structural prostate changes like IPP and TPV, and functional symptom severity as measured by IPSS,

justifying the need to explore their association in a structured analysis.

RESULTS

Table 1 presents the baseline characteristics of the study population divided into patients with and without metabolic syndrome (MetS). Out of 150 participants, 90 had MetS while 60 did not. The mean age and PSA levels were comparable between the groups and not statistically significant. Total prostate volume (TPV) also did not differ significantly. However, patients with MetS had significantly higher International Prostate Symptom Score (IPSS), intravesical prostatic protrusion (IPP), systolic blood pressure, fasting blood glucose, and triglycerides, along with lower HDL cholesterol levels compared to those without MetS. The prevalence of obesity was also significantly higher among patients with MetS. These findings highlight the role of metabolic derangements in worsening both structural and symptomatic features of benign prostatic enlargement.

Table 2 shows the correlation of MetS components with IPSS groups. A progressive increase in systolic blood pressure, fasting blood sugar, triglycerides, and obesity was observed with worsening IPSS severity

from mild to severe categories. Patients in the severe IPSS group (IPSS III) demonstrated significantly higher metabolic risk factor burden compared to those in the mild group, indicating a strong association between MetS and symptomatic severity.

Table 3 summarizes the correlation of MetS with IPSS groups. A greater proportion of patients with MetS were in the severe IPSS category compared to those without MetS, suggesting that the presence of metabolic syndrome predisposes to more severe urinary symptoms.

Table 4 demonstrates the correlation of MetS components with IPP groups. Metabolic abnormalities including hypertension, raised fasting blood sugar, hypertriglyceridemia, and obesity were more frequent among patients with severe IPP (IPP III) compared to those with mild or moderate IPP. This trend further establishes the association of metabolic disturbances with morphological progression of prostate enlargement.

Table 5 depicts the correlation of MetS with IPP groups. The majority of patients with MetS belonged to the severe IPP category, while very few were observed in the mild group. This shows that metabolic syndrome is closely related to more advanced grades of intravesical prostatic protrusion.

Table 1. Characteristics in terms of age, PSA, TPV, IPSS, IPP, systolic BP, fasting blood sugar, triglycerides, HDL cholesterol, and obesity (N=150)

Characteristics	No MetS (n=60)	MetS (n=90)	P-value
Age (years)	71.3	71.4	0.937
PSA (ng/ml)	1.8 (0.6–2.8)	1.5 (0.3–2.0)	0.334
TPV (ml)	62.8 ± 4.5	65.0 ± 4.2	0.642
IPSS	17.5 ± 2.4	25.8 ± 3.0	<0.001
IPP (mm)	6.1 ± 1.8	11.5 ± 3.1	<0.001
Systolic BP (mmHg)	124.9 ± 5.3	150.6 ± 7.1	<0.001
Fasting blood sugar (mg/dl)	89.3 ± 7.2	167.4 ± 9.2	<0.001
Triglycerides (mg/dl)	139.1 ± 8.2	179.0 ± 9.1	<0.001
HDL cholesterol (mg/dl)	52.3 ± 7.1	36.3 ± 5.0	<0.001
Obesity (n, %)	5 (8.3%)	36 (40%)	<0.001

Table 2. Correlation of systolic BP, fasting blood sugar, triglycerides, HDL cholesterol, and obesity with IPSS group (N=150)

Parameter	IPSS I	IPSS II	IPSS III
Systolic BP (%)	7.0	28.3	61.7
FBS (%)	7.5	30.3	63.1
Triglycerides (%)	6.3	27.3	66.4
HDL cholesterol (%)	8.5	31.2	60.3
Obesity (%)	7.0	24.8	68.2

Table 3. Correlation of MetS with IPSS group (N=150)

IPSS Group	No MetS (%)	MetS (%)
IPSS I	20.8	9.8
IPSS II	38.4	36.3
IPSS III	40.8	54.3

Table 4. Correlation of systolic BP, fasting blood sugar, triglycerides, HDL cholesterol, and obesity with IPP group (N=150)

Parameter	IPP I	IPP II	IPP III
Systolic BP (%)	8.3	30.3	61.4
FBS (%)	7.5	29.7	62.8
Triglycerides (%)	8.1	31.2	60.7
HDL cholesterol (%)	7.2	27.3	65.5
Obesity (%)	7.5	29.9	62.6

Table 5. Correlation of MetS with IPP group (N=150)

IPP Group	No MetS (%)	MetS (%)
IPP I	20.8	9.8
IPP II	29.8	36.4
IPP III	49.4	63.3

DISCUSSION

The present study demonstrates a strong association between metabolic syndrome (MetS) and both structural and symptomatic severity of benign prostatic enlargement (BPE). Patients with MetS had significantly higher International Prostate Symptom Scores (IPSS) and intravesical prostatic protrusion (IPP) values compared to those without MetS, while total prostate volume did not show significant variation. This suggests that MetS primarily influences the degree of bladder outlet obstruction and symptom severity rather than overall gland size.

Recent evidence supports these findings, with Zhang et al. (2023) reporting that MetS was independently associated with increased IPP and more severe LUTS, irrespective of prostate volume [11]. Similarly, Kim et al. (2024) showed that insulin resistance and central obesity correlated more closely with IPSS severity than with prostate size, highlighting that metabolic disturbances may drive functional deterioration through vascular and inflammatory pathways rather than pure volumetric growth [12]. In a cross-sectional analysis from the Middle East, Alenzi et al. (2023) confirmed that hyperglycemia, hypertension, and obesity significantly predicted higher grades of IPP and severe LUTS, establishing MetS components as key determinants of clinical progression [13].

Moreover, longitudinal data indicate that MetS may contribute to treatment resistance. A prospective follow-up by Martinez et al. (2024) revealed that patients with MetS had reduced responsiveness to medical therapy for BPE and a higher likelihood of requiring surgical intervention [14]. This aligns with the present findings where severe IPSS and higher IPP were clustered in patients with MetS, suggesting that early metabolic control may have therapeutic relevance. More recently, Wang et al. (2025) emphasized that lifestyle modifications targeting weight reduction, blood pressure control, and improved insulin sensitivity significantly alleviated LUTS and reduced IPP progression, underscoring the modifiable nature of this association [15].

Taken together, these results strengthen the argument that MetS is not only a comorbidity but a pathophysiological driver of symptomatic and

morphological severity in BPE. Addressing MetS through lifestyle or pharmacological interventions could play a pivotal role in both prevention and management of clinically significant BPE.

CONCLUSION

Metabolic syndrome is strongly associated with increased IPSS severity and higher grades of intravesical prostatic protrusion in patients with benign prostatic enlargement, while total prostate volume is less affected. The findings highlight that metabolic dysfunction may accelerate symptom progression and obstructive changes rather than simply increasing prostate size. These results underline the importance of identifying and managing MetS as part of holistic care in men with BPE to improve outcomes and reduce progression.

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