Impact of components of metabolic syndrome on the prostatic volume and lower urinary tract symptoms in a sample of patient with benign prostatic hyperplasia in Iraq

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ABSTRACT

Objective
To evaluate the association between the components of metabolic syndrome (MetS) and lower urinary tract symptoms (LUTS) due to benign prostatic hyperplasia (BPH) focusing at their effects on prostatic volume and on the severity of LUTS.

Patients & Methods
From October 2016 to January 2018, eighty patients presented with LUTS due to the BPH. LUTS were assessed using the international prostatic symptoms score (IPSS) and MetS was defined according to the National Cholesterol Education Program-Adult Treatment Panel III guidelines. Patients were randomly collected into two categories: A (48 patients) had MetS and B (32 patients) without MetS.

Results
The mean age was 64.3 years, statistically significant variation was identified between the two categories regarding the moderate and severe IPSS, S.PSA, prostatic size and post voiding residue (PVR), the P value (<0.05). The most frequent MetS components were: hypertension in 65/80 patients (81.25%), high fasting glucose in 49/80 patients (61.25%), and waist circumference elevation in 55/80 patients (68.75%). The association between MetS components, the prostatic volume and severity of LUTS had shown that all MetS components except HDL-cholesterol were significantly correlated with higher prostatic volume (P < 0.05). Also a positive statistically significant association was discovered between each component of MetS and higher IPSS, excepting HDL-cholesterol (P = 0.93) and triglyceride (P = 0.58).

Conclusion
The results of the present study confirmed that there is a significant relation between the components of metabolic syndrome, the increase in prostatic volume and the severity of LUTS/BPH.
Introduction
Benign Prostatic .Hyperplasia (BPH) is an advancing disease with a peak age of onset at 80 years, recognized by enlargement of the prostate . along with lower urinary tract symptoms (LUTS) [1, 2] which could results in chronic UTI, acute urinary retention, renal failure, incontinence of urine & the necessity for BPH related surgery [3, 4].
Metabolic syndrome is a cluster of medical conditions which include elevated triglycerides, arterial hypertension, impaired glucose metabolism, low High Density Lipoprotein (HDL) and abdominal obesity [5].
Evidences have underlined an emerging link between MetS, benign prostatic enlargement and its related lower urinary tract symptoms [6-8].
Among Mets features, insulin resistance and secondary hyperinsulinaemia have a role with an increased risk of BPH [9]. Reduced HDL and increased triglyceride levels were considerably linked to higher prostatic inflammation which is directly related to prostate enlargement [10] inducing BPH which is a main cause of bladder outlet obstruction triggering LUTS [5].
Besides age, LUTS and MetS also participate in a variety of other risk factors, such as obesity, hyperglycemia, hypertension, lack of androgen, depression, and smoking, consequently indicating that metabolic syndrome might have a major role in the pathogenesis of LUTS [11] A link between metabolic syndrome and prostate growth rate has also been found in clinical series [12, 13].
All these findings point out that the MetS-related BPH/ LUTS should be counted as potentially objective therapy in order to oppose the resulting prostate rapid growth [14].
The objective of the present study was to evaluate the effects of MetS on the prostatic volume and LUTS/BPH in a sample of Iraqi men aged >50 years.
Patients &methods
From October 2016 to January 2018, [80 patients (with an age range: 50-85 years)], presented to the urology consultation department of Al-Yarmouk Teaching Hospital/Baghdad/Iraq with LUTS due to the BPH (Prostatic volume > 30 ml was considered prostatic hyperplasia) [15].
Assessment of patients included history taking regarding general patient health and voiding status, assessed by IPSS, clinical general examination including waist circumference and digital rectal examination in all patients, laboratory investigations including CBC, urinalysis, urine culture and sensitivity, blood urea, serum creatinine, fasting blood sugar, PSA, lipid profile (S. cholesterol, triglyceride, LDL, HDL ). Transabdominal ultrasound (performed by the same operator) to measure the post void residual urine volume & prostatic size according to using the equation: Width x height x length x 0.52. Uroflowmetry to determine the maximum urine flow rate (Q max) at a voided volume of > 150 ml. Inclusion criteria included age > 50 year, Patient had both LUTS and BPH and no drugs taken for urinary symptoms.
Exclusion criteria: neurological disorders, renal insufficiency, urinary tract infection, bladder calculi, prostatic tumors, urethral stricture and previous pelvic surgery or radiotherapy.
Informed consents were obtained from all patients before enrolling in this study.
Then patients were divided into two groups; group A 48 patients with MetS and group B 32 patients without MetS.
MetS was determined in agreement with the USA National Cholesterol Education Program – Adult Treatment Panel III (NCEP-ATPIII), by the existence of three or more of the following: central obesity (waist circumference of ≥102 cm), elevated triglycerides (≥1.7 mmol/L or 150 mg/dL), elevated blood pressure (≥130/85 mmHg), or patients on
antihypertensive drugs, elevated fasting glucose (≥6.1 mmol/L or 110 mg/dL), or patients on antidiabetic drugs, reduced HDL cholesterol (<1.03 mmol/L or 40 mg/dL) [16]. The severity of LUTS was evaluated according to IPSS. The questionnaire was setup on seven questions. LUTS was classified as none/mild (0–7), moderate (8–19), or severe (20–35). Utilizing this questionnaire, symptoms were subdivided into three classes; voiding, storage and post micturition symptoms [17].

This study was approved by the ethical committee of the institute (Ministry of Health/ The Arab board for health specializations in Iraq/Al-Yarmouk Teaching center, Baghdad). Statistical analysis was performed using students T-test and one way analyses of variance (ANOVA) and chi-squared, post analysis was used to test the difference in outcome between deferent groups, where appropriate, using Statistical Package for Social Sciences (SPSS), version 16 (Chicago, IL). Data were presented as mean ± standard deviation or as number and percentage. A probability (P) value of less than 0.05 was considered statistically significant.

Results
During the study period, eighty patients {forty eight (60%) with MetS and the other thirty two patients (40%) without MetS} were evaluated, their mean age was 64.3 years, focusing on the effects of MetS and its components on the severity of the LUTS and on the prostatic volume.

In the comparison of the two groups as summarized in Table 1 and Figures 1. Regarding the patients with MetS the mean age in this study was 62.5 ± 6.4 years. Mild, moderate and severe LUTS were found in 25% (12/48), 43.75% (21/48) and 31.25% (15/48) patients respectively. The mean prostatic size in this group was 60.6 ± 20 ml. While in patients without MetS the mean age was 67.2 ± 6.1 years. Eleven (34.37%) patients had mild LUTS, thirteen (40.62%) patients had moderate LUTS and eight (25%) patients had severe LUTS. The mean prostatic size in this group was 49.2 ± 15.9 ml.

Statistically significant variation was detected between the two groups regarding the moderate and severe IPSS, PSA, prostatic size and PVR, where men with MetS had significantly greater mean IPSS, more severe LUTS and higher PSA, prostatic size and PVR than those without Mets, the P value (<0.05). Conversely there was no statistically significant variance regarding the mild IPSS and Qmax.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group A: Patients with MetS</th>
<th>Group B: Patients without MetS</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>age (years)</td>
<td>62.5 ± 6.4</td>
<td>67.2 ± 6.1</td>
<td>0.02</td>
</tr>
<tr>
<td>PSA (ng/mL)</td>
<td>2.3 ± 0.6</td>
<td>1.7 ± 0.4</td>
<td>0.02</td>
</tr>
<tr>
<td>Prostatic size (ml)</td>
<td>60.6 ± 20</td>
<td>49.2 ± 15.9</td>
<td>0.02</td>
</tr>
<tr>
<td>PVR (ml)</td>
<td>44.8 ± 7.9</td>
<td>30.2 ± 6.8</td>
<td>0.01</td>
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<tr>
<td>Mild IPSS N (%)</td>
<td>12 (25.00%)</td>
<td>11 (34.37%)</td>
<td>0.34</td>
</tr>
<tr>
<td>Moderate IPSS N (%)</td>
<td>21 (43.75%)</td>
<td>13 (40.62%)</td>
<td>0.04</td>
</tr>
<tr>
<td>Severe IPSS N (%)</td>
<td>15 (31.25%)</td>
<td>8 (25.00 %)</td>
<td>0.01</td>
</tr>
<tr>
<td>Qmax (ml/s)</td>
<td>15.8 ± 3.1</td>
<td>16.9 ± 2.8</td>
<td>0.36</td>
</tr>
</tbody>
</table>

**Table 1:** Comparison of the effects of MetS on the prostatic volume and the severity of LUTS/BPH, between the two groups.

**Figure 1:** Comparison of the mean of prostatic size in patients’ with and without MetS.

The frequency of Mets components were listed in **Figure 2, Table 2.** Hypertension was found in 65/80 (81.25%), high fasting blood glucose in 49/80 (61.25%) and waist circumference elevation in 55/80 (68.75%) patients. These three components were the most often recorded criteria of metabolic syndrome.

**Figure 2:** The frequency of components of metabolic syndrome
Table 2: The frequency of components of MetS.

The association between metabolic syndrome components, the prostatic size and the severity of LUTS/BPH was shown in Table 3 and 4. All MetS components except HDL-cholesterol were significantly correlated with higher prostatic volume ($P < 0.05$). Also a positive statistically significant association was identified between each component of MetS and higher IPSS, except for HDL-cholesterol ($P = 0.93$) and triglyceride ($P = 0.58$).

Table 3: Prostatic size and its association with the components of MetS

Table 4: The association between metabolic syndrome components, the prostatic size and the severity of LUTS/BPH.
<table>
<thead>
<tr>
<th>&lt;130/85</th>
<th>69.23</th>
<th>23.08</th>
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<tr>
<td>HDL cholesterol (mg/dl)</td>
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<tr>
<td>≤ 40</td>
<td>62.50</td>
<td>25.00</td>
<td>12.50</td>
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<tr>
<td>&gt; 40</td>
<td>65.91</td>
<td>20.45</td>
<td>13.64</td>
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<tr>
<td>Serum triglyceride (mg/dl)</td>
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<td></td>
<td></td>
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<tr>
<td>≥ 150</td>
<td>36.84</td>
<td>47.37</td>
<td>15.79</td>
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<tr>
<td>&lt; 150</td>
<td>51.22</td>
<td>36.59</td>
<td>12.20</td>
</tr>
<tr>
<td>Fasting blood sugar (mg/dl)</td>
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<tr>
<td>≥ 110</td>
<td>33.33</td>
<td>56.41</td>
<td>10.20</td>
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<tr>
<td>&lt; 110</td>
<td>66.67</td>
<td>23.81</td>
<td>9.52</td>
</tr>
</tbody>
</table>

Table 4: The association between the components of MetS and the severity of LUTS/BPH.

Discussion
This study was designed to investigate the association between the components of metabolic syndrome (MetS) and the severity of lower urinary tract symptoms due to BPH and its effect on the prostatic volume.

In this study mean (±SD) age was 62.5±6.4 years in group A and 67.2±6.1 years in Group B and the variance was statistically significant (P = 0.02). This result was consistent with the reports of some investigators (Ford et al [18] and Parsons et al [19]) but it differed from that of Isa et al [20]. It might be due to aging in addition to the effects of MetS components on the earlier progression of prostatic volume and on the earlier LUTS in our patients.

As evident in our study, Hypertension was found in 65/80 (81.25%), high fasting blood glucose in 49/80 (61.25%) and waist circumference elevation in 55/80 (68.75%) patients. These three components were the most often recorded criteria of metabolic syndrome. Many other studies observed similar findings Hammarsten et al [21], Parsons et al [22].

In the present study, there was a positive correlation between elevating fasting blood glucose (P = 0.005), hypertension (P = 0.004), central obesity (waist circumference) (P = 0.018), elevating triglyceride (P = 0.02) and the higher prostatic volume and negative correlation with HDL-cholesterol (P = 0.65). These results were in agreement with many studies; Ozden et al [12], Parsons and colleagues [22]. Hammarsten and colleagues [23] and Dahle et al [24] who demonstrated a positive relation between prostatic enlargement and MetS. However, Gupta et al [25] did not confirm an association between MetS and BPH.

The precise pathophysiology correlating LUTS and BPH to metabolic syndrome is still unclear. Many mechanisms were put in to explain this association; including insulin resistance with resulting hyperinsulinemia lead to increment in insulin growth factor favoring prostate growth and enlargement [21] and chronic prostatic inflammation inducing BPH development [10].

In this study, positive correlation between elevating fasting blood glucose (P = 0.036), hypertension (P = 0.022), central obesity (waist circumference) (P = 0.003) and higher I-PSS score was identified and negative correlation with HDL-cholesterol (P = 0.93) and triglyceride (P = 0.58). Several studies noticed comparable findings like De Nunzio et al, Hammarsten & Peeker, Kirby et al, Pan et al, and Yang et al [26-30].

The pathophysiological hypothesis to explain the correlations between metabolic syn-
drome and lower urinary tract symptoms include the effect of hyperglycemia on parasympathetic nerves in the pelvic ganglion, inducing apoptosis leading to an oversupply of sympathetic activity compared to parasympathetic. In addition, hypertension has a role in increasing sympathetic tone and function of α1-adrenoreceptor. This increase in sympathetic tone may lead to increased bladder neck obstruction and reduced bladder contractility power, resulting in increased lower urinary tract symptoms as demonstrated in our study.

However, this association between metabolic syndrome and lower urinary tract symptoms was not supported by a study made by Gao et al. who found that no significance was detected in the severity of LUTS in men with MetS as compared to those without MetS. Nevertheless, it is difficult to compare their study with ours as their objects were the whole man population, regardless of BPH existence and their patients were younger (mean age was 39 versus 64.3 of the present study).

Conclusion
The results of the present study confirmed that there is a significant relationship between the components of metabolic syndrome, increment in prostatic volume and the severity of LUTS/BPH. Considering Mets as a group of variable factors and preventing such factors through dietary modification and practicing physical activity may play an important role in the prevention and management of LUTS/BPH.

Authors’ contributions
1. A. Z. Khudhur: literature search, concept and research design, writing the manuscripts
2. AAD. H. Al-Dabbagh: concept and research design, data analysis and interpretation, editing manuscripts, supervising the edited manuscripts

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Conflict of interest
None

Funding
None

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