INTRODUCTION

Metabolic syndrome, which is becoming increasingly common worldwide, is defined as the combination of all metabolic risk factors such as abdominal obesity that starts with insulin resistance, glucose intolerance or diabetes mellitus, dyslipidemia, hypertension, and systemic disorders such as coronary artery disease, and it has high morbidity and mortality rates with cardiometabolic complications (1). Despite significant advances in treatment approaches, atherosclerotic cardiovascular diseases remain the most common cause of death worldwide.
This pioneering status of cardiovascular diseases parallels the increasing epidemic of obesity and type 2 diabetes mellitus, the most common endocrine disease worldwide. The most important etiological factor that brings this trio together is the metabolic syndrome, which now affects so many regions in the world that it can be called a pandemic. This prevalent worldwide syndrome that cannot be diagnosed with a single parameter can lead to critical consequences with high morbidity and mortality when the diagnosis is delayed.

Metabolic syndrome can be mentioned as a result of specific anthropometric measurements, laboratory results, and clinical evaluation, starting with the syndrome being thought of first. In addition to the metabolic syndrome’s first defined diagnostic criteria, which was published in 1998, various diagnostic criteria are defined by many organizations worldwide, and new parameters that are thought to be helpful in diagnosis are being studied (2). Most of the parameters investigated in patients with metabolic syndrome remained at the level of scientific studies. They could not take their place among the diagnostic criteria, and they were not used in daily clinical use due to the fact that scientific competence could not be achieved, and they were not financially cost-effective.

Uric acid and high-sensitivity C-reactive protein (HSCRP) are two parameters that have been reported in the literature to be associated with metabolic syndrome and its components such as hypertension, hyperglycemia, obesity, and dyslipidemia.

Chronic inflammation is the main factor in the development and progression of atherosclerosis and cardiovascular diseases. Many inflammatory markers have been studied in this regard; the most critical acute phase response marker associated with cardiovascular disease risk in different populations is CRP. Studies in the literature show that a high CRP level is one of the critical risk factors for developing chronic diseases with increasing prevalence, such as diabetes or hypertension (3,4). Upon the demonstration of the effectiveness of CRP in predicting subclinical inflammation, the HSCRP test, which can measure CRP levels at lower concentrations, and which is determined by high-sensitivity methods, was developed (5).

Obesity, the main component of metabolic syndrome, is associated with systemic inflammation originating from adipose tissue. That cytokines such as tumor necrosis factor-alpha and IL-6, which are released in large amounts from adipose tissue, trigger chronic subclinical inflammation by stimulating CRP production from the liver, which is thought to be the underlying mechanism of high HSCRP levels in obese individuals (6).

Elevated uric acid is thought to be an essential risk factor for developing cardiovascular events related to oxidative stress and endothelial dysfunction (7). It has been observed that insulin resistance underlying the metabolic syndrome is inversely related to renal uric acid clearance, and as a result, there is a decrease in renal excretion of uric acid in patients with hyperinsulinemia (8,9).

Although uric acid and HSCRP measurements are strongly associated with metabolic syndrome and its components, they are not included in the diagnostic criteria for metabolic syndrome defined by different organizations and in the recently published review of these definitions. In this study, we aimed to evaluate the usability of measurement of serum uric acid levels and HSCRP values, which can also be studied in our hospital laboratory, in clinical practice, in the prediction of metabolic syndrome, which can lead to serious outcomes in terms of mortality and morbidity when the diagnosis is delayed.

**MATERIAL AND METHODS**

The study included 95 patients with metabolic syndrome who applied to the Internal Medicine outpatient clinic of SBU Ankara Training and Research Hospital for any reason within nine months after the ethics committee's approval. Ethics committee approval was obtained from Ankara Training and Research Hospital, Education, Planning and Coordination Ethical Board (2012/02).

The diagnosis of metabolic syndrome was made according to the criteria of NCEP ATP III (The National Cholesterol Education Program's Adult Treatment Panel III report), which is the most accepted definition in practice due to its ease of application (10). The diagnosis is delayed. That cytokines such as tumor necrosis factor-alpha and IL-6, which are released in large amounts from adipose tissue, trigger chronic subclinical inflammation by stimulating CRP production from the liver, which is thought to be the underlying mechanism of high HSCRP levels in obese individuals (6).

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The study was carried out with a total of 174 cases, including 95 patients with metabolic syndrome and 79 healthy patients. Of the patients in the metabolic syndrome group, 58.9% (56) were female, 41.1% (39) were male; 57% (45) of the control group were female, and 43% (34) were male, and the mean age of the study population was 51.25±11.60 years (Table 1). The mean body mass index of all subjects included in the study was 27.79±6.05, and the mean waist circumference was 96.24±16.05. Mean waist circumference and body mass indexes of patients.
with metabolic syndrome were statistically significantly higher than the control group (p<0.01). Fasting glucose, triglyceride, LDL, HbA1c, fasting insulin level, and insulin resistance were significantly higher in the metabolic syndrome group compared to the control group (p<0.01). There was no significant difference between serum creatinine levels of both groups (p:0.960). HDL levels of patients with metabolic syndrome were found to be lower than the control group (p<0.01) (Table 2).

Table 1. Demographic and Clinical Characteristics of the Patients

<table>
<thead>
<tr>
<th>Date</th>
<th>Metabolic Syndrome (n=95) Mean ±SD</th>
<th>Control Group (n=79) Mean ±SD</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>53.87±10.43</td>
<td>50.10±12.20</td>
<td>0.961</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>31.56±5.44</td>
<td>23.25±2.69</td>
<td>0.001**</td>
</tr>
<tr>
<td>Waist Circumference</td>
<td>106.12±13.55</td>
<td>84.35±9.38</td>
<td>0.001**</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>56 (%58.9)</td>
<td>45 (%57.0)</td>
<td>0.792</td>
</tr>
<tr>
<td>Male</td>
<td>39 (%41.1)</td>
<td>34 (%43.0)</td>
<td></td>
</tr>
</tbody>
</table>

*Student-t Test, **p<0.01, BMI: Body Mass Index

Table 2. Evaluation of Laboratory Results According to Metabolic Syndrome

<table>
<thead>
<tr>
<th>Date</th>
<th>Metabolic Syndrome (n=95) Mean ±SD</th>
<th>Control Group (n=79) Mean ±SD</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting Glucose</td>
<td>128.84±56.15</td>
<td>89.01±7.52</td>
<td>0.001**</td>
</tr>
<tr>
<td>Creatinine</td>
<td>0.90±0.18</td>
<td>0.90±0.18</td>
<td>0.960</td>
</tr>
<tr>
<td>HDL</td>
<td>48.09±10.60</td>
<td>55.78±10.37</td>
<td>0.001**</td>
</tr>
<tr>
<td>LDL</td>
<td>133.56±35.93</td>
<td>114.69±29.56</td>
<td>0.001**</td>
</tr>
<tr>
<td>Triglyceride</td>
<td>184.21±85.90</td>
<td>105.89±30.14</td>
<td>0.001**</td>
</tr>
<tr>
<td>HbA1c</td>
<td>6.98±1.98</td>
<td>5.60±0.53</td>
<td>0.001**</td>
</tr>
<tr>
<td>HSCRP</td>
<td>4.73±3.54 (3.70)</td>
<td>3.20±3.21 (1.90)</td>
<td>0.001**</td>
</tr>
<tr>
<td>Fasting Insulin</td>
<td>10.24±6.83 (8.90)</td>
<td>7.40±5.33 (6.00)</td>
<td>0.001**</td>
</tr>
<tr>
<td>Uric Acid</td>
<td>5.22±1.39</td>
<td>4.35±1.11</td>
<td>0.001**</td>
</tr>
<tr>
<td>IR</td>
<td>3.34±3.72 (2.51)</td>
<td>1.67±1.26 (1.30)</td>
<td>0.001**</td>
</tr>
</tbody>
</table>

*Student-t Test, aMann-Whitney U Test, **p<0.01, HDL: High Density Lipoprotein, HSCRP: High-Sensitivity C-Reactive Protein, LDL: Low Density Lipoprotein, IR: Insulin Resistance

The mean uric acid value (5.22±1.39 mg/dl) of the metabolic syndrome group was statistically significantly higher than the uric acid mean value (4.35±1.11 mg/dl) of the control group (p<0.01). With the ROC curve, the cut-off value for uric acid in detecting the incidence of metabolic syndrome was found to be 5.45 mg/dl (specificity 89.9%; sensitivity 51.6%) (Figure 1). Its positive predictive value was 86%, and its negative predictive value was 60.7%. In addition, a statistically significant relationship was found between uric acid levels and metabolic syndrome components such as hyperglycemia, hypertension, dyslipidemia, and abdominal obesity.
In a large-series study with 7399 cases, the relationship between hyperuricemia in patients with metabolic syndrome was investigated, and it was reported that the ROC curve for serum uric acid value in the prediction of metabolic syndrome was found to be 6.3 mg/dl in men and 4.9 mg/dl in women (13). In most laboratories, 7 mg/dl is taken as the upper limit of uric acid. In our study results, that similar to Zhang et al. study, the uric acid cut-off value was determined as 5.45 mg/dl in the prediction of metabolic syndrome, which shows that in association with serum uric acid levels and metabolic syndrome, in addition to overt hyperuricemia, uric acid levels at the upper limit of normal may also be significant.

HSCRP is an acute phase reactant, which has been supported by studies in which high levels are associated with an increased risk of cardiovascular disease and that it is found at higher levels in patients with metabolic syndrome compared to healthy adults (14). In a large series study comparing 3285 patients with metabolic syndrome with 3999 healthy individuals, it was reported that the increase in HSCRP level is an independent risk factor in showing the risk of cardiovascular diseases such as coronary artery disease and ischemic stroke. As the number of metabolic syndrome components increases, HSCRP levels increase in correlation with the number of components (15).

In our study, according to the correlation analysis between waist circumference measurements and body mass index and HSCRP values, it was determined that there was a positive correlation between body mass index and waist circumference measurements and HSCRP levels.

**CONCLUSION**

In conclusion; in our study to evaluate the relationship of uric acid and HSCRP levels with the metabolic syndrome and its components, and its usability in predicting metabolic syndrome in daily practice, serum uric acid and HSCRP levels were found to be significantly higher in the metabolic syndrome patient group compared to the control group. In this study, we demonstrated that this syndrome, which is very common today, can lead to various outcomes in terms of mortality and morbidity; when the early diagnosis is delayed, it constitutes an important part of health expenditures. We believe that predicting it with laboratory parameters that can be easily used in daily practice will prevent complications that may develop.
Conflict of interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical approval
Ethics committee approval was obtained from Ankara Training and Research Hospital, Education, Planning and Coordination Ethical Board (2012/02).

REFERENCES