ABSTRACT

Aim To determine justifiability of oral glucose tolerance test (OGTT) in non diabetic patients with metabolic syndrome (MetS).

Methods It was included 398 patients attended to Outpatient Clinics of Sisli Efthal Training and Research Hospital. Eligible patients were assigned as patients with MetS according to International Diabetes Federation (IDF) criteria.

Results After OGTT, there were 7 (2%) diabetic patients, 119 (30%) patients had impaired glucose tolerance (IGT) and 272 (68%) were normal. Height, weight, waist circumference, fasting glycemia, high density cholesterol were not different between IGT and non IGT group.

Conclusion OGTT is necessary in MetS non diabetic situation for detection early prediabetic patients.

Key words: glucose tolerance test, metabolic syndrome
INTRODUCTION

The Metabolic Syndrome (MetS) was first described in 1998 by Reaven as ‘‘syndrome X’’ and termed a multi – metabolic syndrome or insulin resistance (1) since major organizations released the definition of the MetS. Prediabetes, identified by impaired fasting glucose (IFG) and/or impaired glucose tolerance (IGT), may predict future development of diabetes mellitus (DM). MetS, a clustering of abnormalities thought to be related to one or both - insulin resistance and increased central adiposity (2). A proinflammatory state probably contributes to the syndrome (3). The increased risk for type 2 diabetes and cardiovascular disease demands therapeutic attention in the MetS patients (4). Although MetS is a well known risk factor for type 2 DM, it seems that it is a separate entity independent from prediabetes and type 2 DM (5). The identification of IGT, at which stage intervention strategies are often initiated, requires a 2-hour OGTT. Because such test may not be easily applied in community settings, the use of routinely measured clinical variables to detect individuals at high risk of diabetes would offer a practical alternative.

The purpose of the present study was to investigate the association between MetS and the development of glucose tolerance status in a retrospective study of a defined Turkish population.

PATIENTS AND METHODS

A total of 416 patients who consulted with MetS, 50,32±10.21 years old attending MetS and hypertension outpatient clinics of Sisli Etfal Hospital, Turkey, were studied retrospectively between January 2007 and February 2009. Data of patients files have been completed and recorded in May 2010. All analyses have been done based on patients’ documentations. Our hospital reflects Turkish population by welcoming people all around the country. It is located in the centre of metropolis of Istanbul and has a great position for patients who have hypertension. Exclusion criteria for this study were a prior diagnosis or treatment of diabetes, being pregnant or breastfeeding, taking glucocorticoids, having liver or renal disease. Eighteen patients had not been taken into the study because all of them had been using medication for hypertension. Eligible patients were assigned as patients with MetS according to the International Diabetes Federation (IDF) criteria and divided as patients having IGT or normoglycemic after OGTT.

Glucose and triglyceride levels were measured by enzymatic methods and HDL cholesterol was measured by direct method. In subjects having fasting glucose <100 mg/dL, the 2003 American Diabetes Association definitions of IGT (2-h glucose ≥ 140mg/dL and < 200 mg/dL) were used (6). The IDF definition required elevated waist circumference plus two of the other four following components: elevated waist circumference (94 cm in male and 80 cm in female), hypertriglyceridemia (≥ 150 mg/dL), low high density cholesterol level (<40 mg/dL in male and <50 mg/dL in female), high blood pressure (systolic blood pressure more than 130 mmHg and/or diastolic blood pressure 85 mmHg and/or pharmacological treatment), and elevated fasting glucose (100 mg/dL and/or pharmacological treatment). Statistical significance was defined as a p<0.05.

RESULTS

Baseline characteristics of the study population (MetS group), females and males, are presented in Table 1.

Table 1. Baseline characteristics of the study population

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>IGT (n=95)</th>
<th>non IGT (n=183)</th>
<th>p</th>
<th>IGT (n=24)</th>
<th>non IGT (n=89)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>52.35±10.31</td>
<td>50.02±10.26</td>
<td>0.134</td>
<td>56.52±13.94</td>
<td>50.36±11.71</td>
<td>0.598</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>156.89±6.43</td>
<td>155.63±6.69</td>
<td>0.064</td>
<td>158.17±6.90</td>
<td>155.62±6.95</td>
<td>0.105</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>82.44±16.31</td>
<td>79.17±13.99</td>
<td>0.092</td>
<td>83.23±21.09</td>
<td>79.40±13.33</td>
<td>0.639</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>98.07±10.97</td>
<td>95.45±10.61</td>
<td>0.102</td>
<td>102.88±13.41</td>
<td>100.78±10.39</td>
<td>0.883</td>
</tr>
<tr>
<td>Body mass index (kg/m2)</td>
<td>33.48±6.32</td>
<td>32.72±5.59</td>
<td>0.402</td>
<td>33.20±7.82</td>
<td>32.77±4.98</td>
<td>0.891</td>
</tr>
<tr>
<td>Weight/height ratio</td>
<td>0.63±0.07</td>
<td>0.62±0.07</td>
<td>0.725</td>
<td>0.63±0.07</td>
<td>0.62±0.07</td>
<td>0.725</td>
</tr>
<tr>
<td>Systolic blood pressure (mmHg)</td>
<td>143.65±18.80</td>
<td>143.35±22.49</td>
<td>0.503</td>
<td>143.65±18.80</td>
<td>143.35±22.49</td>
<td>0.503</td>
</tr>
<tr>
<td>Diastolic blood pressure (mmHg)</td>
<td>89.01±12.20</td>
<td>87.41±10.92</td>
<td>0.259</td>
<td>90.52±8.80</td>
<td>86.37±12.15</td>
<td>0.057</td>
</tr>
<tr>
<td>Hypertension period (years)</td>
<td>7.12±7.37</td>
<td>5.70±6.68</td>
<td>0.233</td>
<td>4.41±3.96</td>
<td>3.88±3.90</td>
<td>0.175</td>
</tr>
<tr>
<td>Triglyceride level (mg/dL)</td>
<td>182.74±100.74</td>
<td>154.64±99.63</td>
<td>0.008</td>
<td>196.88±96.75</td>
<td>193.17±53.48</td>
<td>0.013</td>
</tr>
<tr>
<td>High density cholesterol (mg/dL)</td>
<td>49.50±11.87</td>
<td>50.89±13.99</td>
<td>0.662</td>
<td>46.82±12.36</td>
<td>42.82±9.02</td>
<td>0.189</td>
</tr>
<tr>
<td>Fasting glucose level (mg/dL)</td>
<td>93.36±5.72</td>
<td>92.94±5.09</td>
<td>0.385</td>
<td>93.36±5.72</td>
<td>92.94±5.09</td>
<td>0.385</td>
</tr>
<tr>
<td>2-h glucose level (mg/dL)</td>
<td>160.93±16.76</td>
<td>101.27±20.87</td>
<td>0.001</td>
<td>162.70±13.98</td>
<td>98.26±24.81</td>
<td>0.001</td>
</tr>
</tbody>
</table>

IGT, impaired glucose tolerance; nonIGT, non impaired glucose tolerance
According to 2-h OGTT, 7 (2%) patients were diabetics (four female, three male), 119 (30%) had IGT and 272 (68%) were euglycemic. Among females, 95 (33%) had IGT, 183 (66%) had not IGT. Among males, 24 (21%) had IGT and 89 (77%) did not have IGT (Table 2).

In MetS group 282 (70%) were female and 116 (30%) were male. The number of patients with IGT were higher in females than in males (p=0.001). Age, height, weight, waist circumference, body mass index, blood pressure, high density cholesterol, fasting glucose, were not different between IGT and non IGT group in females and males (p>0.05). Triglyceride was different in females and males between IGT and non IGT group.

**DISCUSSION**

In this study we would like to share our experiences about the relationship between the MetS and OGTT. The results of this study have shown in MetS subjects non diabetics IGT was significantly frequent among normoglycemic patients, and in terms of MetS ratio, females formed 33%, males 21% of the total amount. This is explained by worsening of metabolic parameters rapidly after menopause in females. Of course, long term follow-ups allowing evaluating the rate of prediabetes or type 2 diabetes developments in these patients would better clarify the issue. A number of studies have shown an association between MetS and increased risk of diabetes and cardiovascular disease (7). Interestingly, fasting glucose values did not show significant difference within IGT and non IGT groups in this study. Also other metabolic parameters in both groups, except triglyceride, did not show any significant difference. So we can conclude that triglyceride level is more important than other parameters in terms of pre-diabetes. Therefore, it is monitored that OGTT test is important to clarify diabetes potential for patients with MetS. The Diabetes Prevention Program randomized trial showed that intensive lifestyle intervention and metformin therapy can reduce the incidence of MetS and also the prevalence of MetS at follow-up (8). Other randomized controlled trials have confirmed that lifestyle intervention can reduce the prevalence of MetS (9). Therefore, implementing intervention strategies for individuals with the syndrome may be a practical solution to prevent, or least to delay the onset of diabetes. However, impaired glucose tolerance is determined by means of a 2-hour OGTT, which is often not accessible or easy to perform in community settings. Although MetS at baseline had low sensitivity and low positive predictive value for detecting future diabetes, it had high specificity and high negative value for correctly identifying disease-free individuals at follow-up (10). Observations were reported in the Strong Heart Study, that the risk of diabetes was higher among those with metabolic syndrome than among those without the syndrome (11). In the present study, about 30% of patients with MetS had IGT and higher comparing the prevalence of IGT in Turkey (6.7%) by international standards (12). On the other hand, the presence of IGT in about 30% of normoglycemic patients suggests that IGT is an important component of MetS. In particular, it is largely unknown what proportions of participants with IGT have the MetS and whether this varies by ethnicity, age, and sex. Clearly, because an elevated blood glucose level is a common criterion for all definitions, a close association is to be expected. This association may be even stronger in the subgroup of people with both IGT and impaired fasting glucose. In the AusDiab study while the MetS is an effective predictor of incident diabetes, the MetS was no better at predicting diabetes than a single blood glucose measurement (13). In a study the MetS affected approximately half of the participants in the diabetes prevention program at baseline (14). Diamantopoulos et al. (15) demonstrate that MetS and prediabetes have an overlapping pattern. Another study suggests the addition of abnormal 2-hour plasma glucose as a criterion for the MetS, when fasting glucose is normal (16). MetS is an important public health problem and its prevalence is increasing in the world and analyses of clinical trial documents lower a risk of new-onset diabetes with use of hypertensive treatment (17). Some classes of antihypertensive, notably calcium channel blockers, angiotensin-converting enzyme inhibitors and angiotensin II receptor blockers, have been shown to reduce the incidence of new-onset diabetes in patients with metabolic syndrome (18). The prospective studies show that the MetS, regardless of how it is defined, is a significant pre-
predictor of incident diabetes in many different populations, including Native Americans, U.S Hispanics, Mexicans, Turks, Chinese, and Europeans (19). In our study the percentage of IGT is higher than DM. We can propose that prevention or delay of the onset of type 2 DM is possible in diabetics by changes in lifestyle or by pharmacotherapy. MetS is not a diagnostic tool; however, the syndrome and its components may be used to communicate increased risk of diabetes. Finally, it acknowledges that this syndrome is effective in predicting future diabetes but questions its predictive value beyond glucose intolerance. The present study is not a population-based prevalence study and cannot be generalized for population. The other inconvenience of this study is that OGTT were realized under the treatment of hypertension. On the other hand, rate of female patients was high and the number of non MetS patient group was less.

In conclusion, the present analysis clearly demonstrates that MetS is a significant risk factor for developing diabetes. Our data support that OGTT is necessary in MetS non diabetic situation for detection of early prediabetic patients and eventually to begin treatment as soon as possible.

FUNDING
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TRANSPARENCY DECLARATIONS
Competing interests: none to declare.

REFERENCES