Metabolic syndrome in females with polycystic ovary syndrome and International Diabetes Federation criteria

Sudhindra M. Bhattacharya¹²

¹Sri Aurobinda Seva Kendra, Kolkata, and ²Vivekananda Institute of Medical Sciences, Kolkata, India

Abstract

Aim: To find out the incidence of metabolic syndrome (MS) in females with polycystic ovary syndrome (PCOS) and to assess the metabolic risk factors as per the definition of International Diabetes Federation.

Methods: One hundred and seventeen females (39 adolescents and 78 adults) diagnosed with PCOS underwent assessments clinically and by appropriate laboratory tests for the evidence of MS, as per the criteria laid down by International Diabetes Federation.

Results: MS was diagnosed in 54 cases (46.2%), of which 43.6% were adolescents and 47.4% were adults (difference not statistically significant). MS in females with PCOS had significantly higher body mass index compared to those who did not have MS, irrespective of age. Abnormalities in both the lipids were more common than fasting glucose abnormalities.

Conclusion: MS was found in 46.2% of females with PCOS, with both adolescents and adults being similarly affected. Dyslipidaemia is more common than impaired fasting glucose and finding one risk factor should prompt the clinician to search for other risk factors. All females with PCOS should undergo periodic screening for MS.

Key words: International Diabetes Federation criteria, metabolic syndrome, polycystic ovary syndrome.

Introduction

The term metabolic syndrome (MS) is widely used in clinical practice and research, consisting of multiple interrelated risk factors of metabolic origin, arising due to underlying insulin resistance (IR), which appear to directly promote the development of atherosclerotic cardiovascular disease (CVD), of which some risk factors tend to cluster in predisposed patients.

Females with polycystic ovary syndrome (PCOS) are at increased risk of dyslipidaemia,¹ diabetes mellitus/ impaired glucose tolerance² due to the underlying IR and are therefore at risk of having MS as well.

There are multiple definitions of MS. The International Diabetes Federation (IDF) (http://www.idf.org) has proposed a new definition addressing both clinical and research needs, providing an accessible diagnostic tool suitable for worldwide use.

Since IR can have its metabolic effects in both adolescents and adults, the aim of this study was to find out the incidence of MS in females with PCOS (adolescents and adults), as per IDF criteria, and to assess the role of dyslipidaemia and fasting glucose abnormalities as risk factors in females with MS.

The IDF criteria of MS is new and there are scant studies utilizing this definition. Therefore, the author acknowledges that there has been debate about the usefulness of the MS as a diagnostic tool. The aim of the study is not to discuss the utility of the syndrome but rather to help facilitate comparison of results across studies.
Materials and Methods

The present study was done at Sri Aurobinda Seva Kendra (SASK), Kolkata, India. One hundred and seventeen females (39 adolescents with minimum gynecologic age three years and 78 adults), presenting to the author’s clinic at SASK between July 2004 and June 2006 with the complaints of oligomenorrhea (< / = six menses per year), with or without clinical evidences of hyperandrogenism (hirsutism/acne), were recruited and underwent detail hormonal evaluations for the diagnosis of PCOS according to the Rotterdam 2003 criteria.  

Secondary causes of hyperandrogenism like 21-hydroxylase deficiency, Cushing’s syndrome, hypothyroidism, hyperprolactinaemia, and androgen-secreting tumors were excluded by appropriate clinical and/or laboratory tests. Apart from the hormonal tests as per the Rotterdam 2003 criteria above, all females underwent ultrasonographic examination of the lower abdomen to note the status of the ovaries.

Exclusion criteria

Females with evidence of the following factors were excluded from the study:

1. Women more than 40 years of age with irregular periods.
2. Girls with gynecologic age less than three years.
3. Females with hypothyroidism/hyperprolactinaemia.
5. Female who had used oral pills in the preceding three months.

During clinical examination, body mass index (BMI) (kg/M²) was calculated in each case from height and weight measurements. Height was recorded to the nearest 0.5 cm and weight was taken on a platform type (bathroom scale) machine, the accuracy of which was checked each time before weighing. The weight was recorded in kg with the female wearing minimal garments.

As per the IDF criteria, the first criterion to be fulfilled is that the waist circumference (WC) should be above 80 cm (cut-off value for south Asian woman). WC was measured as the minimum value between the iliac crest and the lateral costal margin, using a 1-cm wide measuring tape.

Every female diagnosed with PCOS underwent fasting plasma glucose (FPG) estimation. Plasma high-density lipoprotein-cholesterol (HDL-C) and triglyceride (TG) levels were measured after 12-h overnight fasting. Plasma glucose was measured by the glucose oxidase-peroxidase method. HDL-C was measured by direct enzymatic method using surfactant and TG was measured by the enzymatic colorimetric method using glycerol phosphate dehydrogenase.

The IDF criteria for the diagnosis of MS adopted in the present study is:

1. WC =/>80 cm (cut-off value for south Asian woman).
2. Any two of the following additional features should be present:
   (a) TG =/>150 mg% (1.7 mmol/Liter).
   (b) HDL-C < 50 mg% (1.3 mmol/Liter).
   (c) Systolic Blood Pressure > 130 mm of Hg.
   (d) Diastolic Blood Pressure > 85 mm of Hg.
   (e) FPG =/>100 mg% (5.6 mmol/Liter).

The Ethics committee of SASK approved the study and all females agreed to the investigation protocol. For adolescent girls, a parent gave consent to the study.

Results

Table 1 shows the clinical characteristics of the 117 females (39 adolescents and 78 adults) of which all females had WC =/>80 cm. MS was diagnosed in

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Whole group</th>
<th></th>
<th>Adolescent group</th>
<th></th>
<th>Adult group</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With MS</td>
<td>Without MS</td>
<td>With MS</td>
<td>Without MS</td>
<td>With MS</td>
<td>Without MS</td>
</tr>
<tr>
<td>Number of cases (%)</td>
<td>54 (46.2)‡</td>
<td>63 (53.8)</td>
<td>17 (43.6)‡</td>
<td>22</td>
<td>37 (47.4)‡</td>
<td>41</td>
</tr>
<tr>
<td>Age (SD) (Years)</td>
<td>22.8 (5.2)</td>
<td>21.8 (4.3)</td>
<td>16.5 (1.5)</td>
<td>17.2 (1.8)</td>
<td>25.7 (3.5)</td>
<td>24.3 (2.9)</td>
</tr>
<tr>
<td>BMI (SD) (KG/M²)</td>
<td>29.5 (3.6)</td>
<td>25 (4.1)</td>
<td>29.3 (3.8)‡</td>
<td>23.9 (3.2)§</td>
<td>29.5 (3.5)§</td>
<td>25.6 (4.4)§</td>
</tr>
</tbody>
</table>

†Not statistically significant. ‡Statistically significant (P = 0.0004). §Statistically significant (P = 0.0004). All females had WC ≥ 80 cm irrespective of age, as per IDF criteria. MS, metabolic syndrome; SD, standard deviation.
46.2% of cases (54/117) with 43.6% in adolescents (17/39) and 47.4% in adults (37/78). BMI of females with MS were more than those without MS in both the whole group and in the two subgroups (adolescents and adults). No statistically significant difference in the incidence of MS between adolescents and adults was found.

Table 2 shows the distribution of MS cases across age-groups in the adult subgroup only. More than 85% of the cases were less than 30 years of age.

Table 3 shows the abnormalities in the metabolic factors (lipid abnormalities and FPG abnormality and elevated blood pressure (BP) as per IDF criteria in the two subgroups. There was one woman in the adult subgroup that did not have lipid abnormalities but had elevated (BP) and high FPG level. Lipid abnormalities were found in only 36 cases in the adult subgroup. This table shows that dyslipidaemia and elevated BP (sy- tolic and/or diastolic) is more common than FPG abnormalities in both the adolescents and adults groups.

Table 4 shows the distribution of the additional features as mentioned in the IDF criteria. There are five additional features out of which two should be present to diagnose MS in addition to the WC cut-off value of 80 cm. None of the adolescents showed all five additional features but in adults, all five features were found in 3 cases (81%). Any three of these features were found in 9 cases (52.9%) of adolescents and at least two features were in 18 cases (48.6%) of adults.

**Discussion**

MS is a constellation of three main abnormalities (impaired FPG, dyslipidaemia, and hypertension) which relate to a state of IR, and has been known for several decades. The same pathogenic mechanism is also found in females with PCOS and females with PCOS can have features of MS also.

The definition of MS laid down by the IDF is new and the clinical criteria proposed by IDF are similar to those of NCEP-ATP III (National Cholesterol Education Program Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults [abbreviated to Adult treatment Panel -ATP III]) with
identical thresholds for TG and HDL-C levels, BP and FPG. The IDF criteria difference in its inclusion of WC thresholds, which are adjusted for different ethnic groups.

The present study shows that the overall incidence of MS according to IDF criteria is 46.2% (43.6% in adolescents and 47.4% in adults, difference not statistically significant).

In comparison, Apridonidze et al.\textsuperscript{4} reported an incidence of MS of 46% (by modified ATP III) in 106 mostly obese women over a 3-year period. Dokras et al.\textsuperscript{5} (by NCEP-ATP III) reported an incidence of 47.3% in adult females with PCOS. Hahn et al.\textsuperscript{6} in a study on German females using IDF criteria found MS in 33.8% of PCOS females and 7.3% in the control group. They found the prevalence rate increased with obesity and increased age.

Snehalatha et al.\textsuperscript{7} had reported that the normal BMI for healthy urban Indians should be less than 23 kg/m\textsuperscript{2}. In the present study, the average BMI in the two subgroups is above this cut-off value. Those with MS had much higher BMI compared to those without MS (statistically significant in both the groups, \(P = 0.0004\)). Thus, obesity in PCOS can significantly influence the likelihood of having MS. Aijan et al.\textsuperscript{8} using IDF criteria found MS in 39% of healthy South Asians. They found ethnic differences in non-traditional cardiovascular risk factors in the presence of MS. Choi et al.\textsuperscript{9} in a study on Korean population found higher prevalence of MS (by IDF criteria) in those with high BMI. Since adolescence is the most important habit forming phase of one’s life, it remains to be seen in further studies, and longitudinal follow up of PCOS in adolescent girls without MS, whether controlling BMI by lifestyle changes and dietary modifications can help prevent development of MS in adulthood before they reach the fourth decade of life.

The present study shows that in adults with PCOS, MS is more common (>85% cases) in women less than 30 years. Dokras et al.\textsuperscript{5} also found that women less than 30 years of age with PCOS were more at risk of having MS. This underscores the importance of early and regular screening for MS in young females with PCOS.

Abnormalities in both the lipids, HDL-C and TG together, are more common in adolescents (64.7%) and adults (47.2%) than single lipid abnormalities. But Dokras et al.\textsuperscript{5} found low HDL-C in 63.7% and elevated TG in 46.8% of adult females. Ethnic differences may be the cause of this.

Despite known associations between PCOS and glucose intolerance,\textsuperscript{2} the present study shows that abnormalities in both HDL-C and TG together are more common than FPG in both adolescents and adults (Table 3). Dokras et al.\textsuperscript{5} also found the same result in their study of mainly white females. The common presence of lipid abnormalities over FPG abnormality emphasizes the greater importance of screening for dyslipidaemia, rather than FPG alone, in females with PCOS. The present study shows that adolescents and adults are equally at risk of having dyslipidaemia, elevated BP and elevated FPG level.

Among the additional features as per IDF criteria, none of the adolescents showed all five features. The majority of adolescents (52.9%) showed the presence of any three features whereas 48.6% of adults showed any two of the five additional features. But there is no significant difference between adolescents and adults as shown in Table 4, showing that identification of one of the risk variables in a female should prompt the clinician to search for others.

The present study also has limitations. No control group has been studied and it is a clinic-based study. There is also an inadequate number of published data from the Indian subcontinent using the IDF criteria, so comparison of the present study’s data to other research from this country is not possible.

\textbf{Table 4} Distribution of the five additional features of the International Diabetes Federation criteria

<table>
<thead>
<tr>
<th>Number of features</th>
<th>Adolescents</th>
<th>Adults</th>
<th>Observed Z-value</th>
<th>Null Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>All five features</td>
<td>0 – 3</td>
<td>3</td>
<td>8.1 –</td>
<td>–</td>
</tr>
<tr>
<td>Any four features</td>
<td>2†</td>
<td>6†</td>
<td>16.2 –</td>
<td>A</td>
</tr>
<tr>
<td>Any three features</td>
<td>9‡</td>
<td>10‡</td>
<td>27.0 –</td>
<td>A</td>
</tr>
<tr>
<td>Any two features</td>
<td>6§</td>
<td>18§</td>
<td>48.6 –</td>
<td>A</td>
</tr>
</tbody>
</table>

\(†\) Not statistically significant. \(‡\) Statistically significant \((P = 0.0004)\). \(§\) Statistically significant \((P = 0.0004)\). A, null hypothesis accepted (tabled value of standard Z- table at 5% level of significance – 1.96 (double tail)); n, number.
Summary and Conclusion

MS is found in 46.2% of females with PCOS with similar incidences in adolescents and adults as per IDF criteria. Females with MS have significantly higher BMI compared to those without MS.

The present study highlights the need for comprehensive screening and educational programmes for females with PCOS of all ages. Lipid abnormalities are more common than FPG abnormality in females with PCOS with MS and finding one risk factor should prompt the clinician to search for other risk factors. Though there are no guidelines for the best screening test or frequency with which to screen these females after the initial evaluation, the present study suggests that obese females with PCOS should be screened at frequent intervals.

Acknowledgments

The author is extremely grateful to Mr S. M. Bhattacharjee M.Sc (ex-lecturer, Department of Mathematics, Jaipuria College, Kolkata) for carrying out the statistical analysis and inferences.

References


