An adolescent with polycystic ovary syndrome

Marja Ojaniemi and Michel Pugeat
Department of Pediatrics, Biocenter Oulu, University of Oulu, Oulu, Finland and 1Department of Endocrinology, East Pole of Lyon Hospitals, and INSERM Unit 0322, Lyon, France
(Correspondence should be addressed to M Ojaniemi; Email: marja.ojaniemi@oulu.fi)

Abstract
Polycystic ovary syndrome (PCOS) is a common clinical condition that manifests during adolescence with menstrual irregularities, acne, and hirsutism. As these symptoms are frequently observed in healthy teenagers, it can be difficult to recognize PCOS. Establishment of hyperandrogenism, polycystic ovaries, and identifying a metabolic disorder are required for the management of PCOS in a teenager. The underlying defects in PCOS are still unclear; however, insulin resistance and the metabolic syndrome are common in both obese and non-obese PCOS patients, so that the evaluation of glucose tolerance is recommended. More than 50% of PCOS patients are overweight or obese, and will benefit from an increase in physical activity and weight loss. Metformin is a treatment option that requires further investigation before being recommended on a long-term basis.

Introduction
Polycystic ovary syndrome (PCOS) in a teenager is characterized by irregular menstrual cycles, generally less than six menses per year, and by clinical or biochemical features of hyperandrogenism. More than 50% of PCOS patients have the metabolic syndrome, including obesity, insulin resistance, and dyslipidemia (1). Although PCOS is a common disorder, the diagnosis may be overlooked during adolescence, as irregular menses with anovulatory cycles, obesity, and acne are frequent in adolescent women. According to the androgen overexposure hypothesis, PCOS may have its origin already in fetal life, but becomes clinically manifest during adolescence with maturation of the hypothalamic–pituitary–ovarian axis (2). The incidence of PCOS among adolescents is estimated to be between 11 and 26% (3) and about 50% are overweight. The pathophysiology of PCOS is still uncertain, although there is evidence that both genetic and environmental factors may play a role, resulting in ovarian hyperandrogenism and impaired insulin sensitivity (4–8). As the underlying defects for PCOS are unclear, the management of PCOS in teenage girls is symptomatic. Weight control and physical activity reduce hyperandrogenism and improve insulin sensitivity (9). Metformin has been shown in several studies to improve insulin sensitivity, lower androgen levels, and to induce menstrual cyclicity in adults (10, 11). However, there are limited data regarding the use of metformin in the treatment of adolescents with PCOS and impaired glucose tolerance (6, 9, 12–15).

Here, we report a case of an adolescent girl with PCOS, who has been treated with metformin for 4.5 years.

Case report

Patient
In September 2001, a 15.5-year-old girl presented for evaluation of obesity and amenorrhea.

The patient was the third child in the family. Her parents were of normal weight, and they both had hypertension, hypercholesterolemia, and impaired glucose tolerance. Her mother had gestational diabetes mellitus during her pregnancies. Two female siblings were healthy and of normal weight.

The patient started a marked weight gain from 8 years of age. Over the next 7 years, her weight increased from the 10th to 70th centile by the time of presentation. Her height SDS remained consistent at K0.5 S.D. Menarche occurred at the age of 14, but she soon thereafter she developed secondary amenorrhea.

Assessment
The patient was obese; her height was 160.8 cm (−0.5 s.d.); weight 83.0 kg (71 centile), body mass index (BMI) 32.1 kg/m², waist circumference 85 cm, and blood pressure 135/84. Her pubertal stage was Tanner B4.
the ovaries on a recent ultrasound scan.

Table 1 Baseline serum gonadotropin, testosterone, estradiol, and 17-OH progesterone levels.

<table>
<thead>
<tr>
<th>Serum</th>
<th>Reference range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Follicle-stimulating hormone (U/l)</td>
<td>5.9</td>
</tr>
<tr>
<td>Luteinizing hormone (U/l)</td>
<td>11.0</td>
</tr>
<tr>
<td>Testosterone (nmol/l)</td>
<td>4.3</td>
</tr>
<tr>
<td>Estradiol (nmol/l)</td>
<td>0.18</td>
</tr>
<tr>
<td>17-OH progesterone (nmol/l)</td>
<td>2.8</td>
</tr>
</tbody>
</table>

Discussion

The Rotterdam 2004 Consensus Workshop (16) proposed that PCOS is a syndrome of ovarian dysfunction, and recommended that two of the following criteria should be present to establish a diagnosis: chronic oligo- or anovulation for more than 6 months, clinical and/or biochemical evidence of hyperandrogenism, and polycystic ovaries on ultrasound. Other disorders that mimic the PCOS phenotype should be excluded. The criteria for PCOS were fulfilled in this patient. She was amenorrhoic and had clinical and biochemical signs of hyperandrogenemia and polycystic ovaries on ultrasound. Gonadotropin and estradiol levels were normal, thus excluding primary ovarian failure or hypo- or hypergonadotropic hypogonadism. Hyperprolactinemia and late-onset congenital adrenal hyperplasia were excluded because of normal prolactin and 17-OH progesterone levels. Furthermore, there was no evidence of hypercortisolism and thyroid disease. PCOS is generally underdiagnosed during adolescence. While clinical and metabolic features are similar to those in adults, it can be difficult to distinguish the young PCOS woman from features seen in a normal adolescent. PCOS has been detected in 95% of adolescents with irregular menses (17). Many are treated with the oral contraceptive pill, which may mask the condition until pregnancy is attempted (2). Clinicians should note that abnormal menses, such as cycles shorter than 21 days or longer than 35 days, are often associated with PCOS.

The spectrum of PCOS phenotype is wide: this includes women with no evidence of clinical and biochemical hyperandrogenism despite dysfunctional polycystic ovaries. Our patient had mild symptoms of hyperandrogenemia and the serum testosterone level was elevated (18). Testosterone is the principal circulating androgen in women, produced from ovarian and adrenal precursors (mainly androstenedione and dehydroepiandrosterone), metabolized in peripheral tissues. Some adolescent PCOS patients may have normal androgen levels (19) with moderate hirsutism compared to adults with PCOS (20). Measurement of total testosterone using a reliable immunoassay is recommended to establish hyperandrogenemia. Androgen-secreting tumors are rare in adolescents but need to be excluded. A marked increase in serum testosterone (8.7 nmol/l, two to three times the upper normal range), with a normal DHEA-sulfate (DHEAS) level, is highly suggestive of an androgen-secreting ovarian tumor. When DHEAS is also increased (> 16.3 μmol/l), this suggests an adrenal androgen-secreting tumor.

Insulin resistance plays an important role in PCOS physiopathology. During puberty, insulin sensitivity is
decreased, causing increased secretion of insulin (3). A study of obese adolescent girls with clinical features of PCOS showed increased secretion of insulin and reduced insulin sensitivity in comparison with weight-matched controls (21). Before treatment, our patient had severe hyperinsulinemia and impaired glucose tolerance, but lifestyle changes and metformin therapy ameliorated these abnormalities. A study of massively obese PCOS patients reported a high prevalence of impaired glucose tolerance and type 2 diabetes mellitus in first degree relatives, suggesting a genetic component to impaired glucose metabolism in PCOS patients (22). Interestingly, the parents of our patient had the metabolic syndrome despite being normal weight. The increased risk of metabolic impairment suggests screening in first degree relatives of patients with PCOS is warranted.

Learning points

1. PCOS is common in adolescents and should be considered in an adolescent with irregular menses and excess weight.
2. The metabolic syndrome is a common feature of PCOS. Testing for glucose intolerance and dyslipidemia is required, particularly in the presence of obesity.
3. Lifestyle changes are the first-line intervention in young women with PCOS, who are overweight.
4. Management of the PCOS adolescent with metformin is beneficial and well tolerated, but the longer term effects are not yet established.

Table 2 Oral glucose tolerance test (OGTT) and lipid profiles before and after therapy.

<table>
<thead>
<tr>
<th></th>
<th>Pre-treatment</th>
<th>Post-treatment (6 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OGTT (h)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Glucose (mmol/l)</td>
<td>6.1</td>
<td>10.2</td>
</tr>
<tr>
<td>Insulin (mU/l)</td>
<td>37.0</td>
<td>113.6</td>
</tr>
</tbody>
</table>

Lipid profile

<table>
<thead>
<tr>
<th></th>
<th>Pre-treatment</th>
<th>Post-treatment (6 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total-Ch (mmol/l)</td>
<td>6.2</td>
<td>6.1</td>
</tr>
<tr>
<td>HDL-Ch (mmol/l)</td>
<td>0.93</td>
<td>1.06</td>
</tr>
<tr>
<td>LDL-Ch (mmol/l)</td>
<td>3.7</td>
<td>4.0</td>
</tr>
<tr>
<td>TG (mmol/l)</td>
<td>4.65</td>
<td>2.44</td>
</tr>
</tbody>
</table>

Total-Ch, total cholesterol; HDL-Ch, high density lipoprotein cholesterol; LDL-Ch, low density lipoprotein cholesterol; TG, triglycerides.

Figure 1 Polycystic appearance of the patient's right (left panel) and left (right panel) ovaries by ultrasonographic examination. Note the increased stroma in the left ovary. Ovarian volumes: right 16.0 ml, left 6.8 ml.
References


10. Morin-Papunen LC, Koivunen RM, Ruokonen A & Martikainen HK. Metformin therapy improves the menstrual pattern with minimal endocrine and metabolic effects in women with polycystic ovary syndrome. *Fertility and Sterility* 1998 **69** 691–696.


Received 19 June 2006
Accepted 31 July 2006