



Algorithm for Polycystic Ovarian Syndrome (PCOS) in Children and Adolescents

What is PCOS?

The most common endocrinopathy in reproductive age women with exact etiology unknown.

INDICATIONS FOR PCOS SCREENING

Diagnosis is difficult as the presentation is varied with gynecologic, dermatologic and metabolic manifestations. Consider as a diagnosis of exclusion in patients with the following clinical presentations:

1. Menstrual Irregularities (amenorrhea¹, oligomenorrhea² or AUB/HMB³)
2. Hyperandrogenism (hirsutism⁴, acne, male pattern baldness)
3. Metabolic (obesity, acanthosis nigricans, diabetes)

ABSENT

PRESENT

- If BMI \geq 85th percentile OR signs of insulin resistance⁵, closely monitor for development of PCOS symptoms that indicate lab screening
- Consider lifestyle intervention⁶, may refer to Dietician or IDEAL Clinic
- Follow-up in primary care clinic every 1-2 months to track progress

SCREENING LABORATORY TESTS⁷

• ESSENTIAL TESTS

- Beta hCG
- TSH⁸
- 17-Hydroxyprogesterone
- Serum total **AND** free testosterone
- FSH
- LH
- DHEAS

**Goal is to rule out alternative diagnoses in all patients prior to making a diagnosis of PCOS.*

• ADDITIONAL TESTS

- If **ANY** irregular menses, screen prolactin

Refer to Endocrinology Department for appropriate evaluation based on lab abnormality⁹

All normal labs and absent menstrual abnormalities

- Total Testosterone >150 ng/dL
- DHEAS >600 ug/dL
- Abnormal TSH, prolactin, 17-Hydroxyprogesterone

PRESENT menstrual abnormalities lasting \geq 2 years

- Serum total testosterone > 55 ng/dL and < 150 ng/dL OR serum free testosterone > 9 pg/mL
- LH:FSH ratio of 3:1 with LH level ≈ 18 mIU/ml and FSH level ≈ 6 mIU/ml
- All other labs are NORMAL:
 - Beta hCG < 5 mIU/mL
 - Prolactin < 25 ng/mL
 - DHEAS < 600 ug/dL
 - Early morning 17-Hydroxyprogesterone < 170 ng/dL

DIAGNOSTIC PCOS

- Consider diagnosis of PCOS by 2 of 3 criteria below only after exclusion of other etiologies:
 1. Oligo and/or amenorrhea
 2. Biochemical and/or clinical signs of hyperandrogenism:
 - Total testosterone >70 ng/dL, androstenedione >245 ng/dL, DHEA-S >248 ug/dL
 - clinical: acne, hirsutism, acanthosis nigricans
 3. Polycystic ovaries
- Refer to Adolescent medicine for atypical presentation or if any support needed in diagnosis, treatment, and long-term management
- **Ultrasound is NOT indicated in initial workup**
- Screen for T2DM since PCOS patients are at high-risk regardless of BMI
- Lifestyle intervention therapy is a critical treatment for all patients with PCOS, consider referral to IDEAL Clinic if BMI > 95 th percentile
- Recommended to treat irregular menses with medium potency monophasic OCPs
- If concerned with hirsutism or intractable acne, refer to Dermatology

ABSENT menstrual abnormalities OR PRESENT menstrual abnormalities lasting < 2 years

POSSIBLE PCOS

- Closely monitor with follow-up every 3-6 months in primary care clinic as these patients are AT RISK for PCOS
- If menstrual abnormalities develop, reorder screening laboratory tests to determine source of androgen excess
- If BMI ≥ 85 th percentile, consider lifestyle intervention⁶, possible referral to Dietician or IDEAL Clinic
- Screen for T2DM regardless of BMI

#	Subject Superscript	Description															
1	Amenorrhea classification	<ul style="list-style-type: none"> • Primary amenorrhea: the absence of menarche by 15 years old or by 3 years post onset of breast development or by bone age of 15 years old if early pubertal onset. • Secondary amenorrhea: absence of menses for more than 3 months in girls or women who previously had regular menstrual cycles, or 6 months in girls or women who had irregular menses. 															
2	Oligomenorrhea classification	<table border="1"> <thead> <tr> <th>Postmenarcheal Year #</th> <th>Cycle length</th> <th>Period per year</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>> 90 days</td> <td>< 4 period per year</td> </tr> <tr> <td>2</td> <td>> 65 days</td> <td>< 6 period per year</td> </tr> <tr> <td>3</td> <td>> 45 days</td> <td>< 8 period per year</td> </tr> <tr> <td>4 to menopause</td> <td>> 38 days</td> <td>< 9 period per year</td> </tr> </tbody> </table>	Postmenarcheal Year #	Cycle length	Period per year	1	> 90 days	< 4 period per year	2	> 65 days	< 6 period per year	3	> 45 days	< 8 period per year	4 to menopause	> 38 days	< 9 period per year
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3	Abnormal Uterine Bleeding or Heavy Menstrual Bleeding classification	<ul style="list-style-type: none"> • More frequent than every 19 days in postmenarcheal Y1 and every 21 days thereafter • Prolonged bleeding lasting more than 7 days • Patient (subjectively) describes heavy period as "bleeding that soaks pads and/or tampons" such that quality of life is disrupted 															
4	Ferriman-Gallwey hirsutism scoring	The Ferriman-Gallwey hirsutism scoring system entails using visual scoring tools in 9 androgen sensitive areas of the body with 0 = absent hair growth and 4 = extensive hair growth. A score of 8 or higher constitutes hirsutism. However, this does not factor ethnic/racial differences. More research needs to be conducted to create a scoring system that standardizes hirsutism classifications according to ethnic/racial differences.															
5	Signs of insulin resistance	<ul style="list-style-type: none"> • Acanthosis Nigricans/Skin Tags • Hypertension • Dyslipidemia (high TC, high TGs, high non-HDL, high LDL and low HDL) 															
6	Lifestyle interventions	<ul style="list-style-type: none"> • Nutrition: Create tailored dietary prescription with monthly follow-up to support patients in having a healthy balanced diet - a range of balanced dietary approaches are recommended with no one specific diet showing benefit over another • Exercise: <ul style="list-style-type: none"> - Aerobic exercise 1-hr daily (walk, run, team sports, bike, hike, etc.) - Strength exercise 3X per week <ul style="list-style-type: none"> * Body weight exercises such as push-ups, planks, sit-ups and squats are recommended for children and adolescents * Resistance band, light free weight and light weight machine exercises are recommended in adolescents with proper training • Behavior: <2 hours of non-academic screen time is recommended • Weight loss: If BMI ≥ 85th percentile modest weight loss of 5-10% is recommended as this has been shown to improve menstrual regularity and ovulation in some studies (though currently based on small scale studies) 															
7	Differential diagnosis for amenorrhea/irregular menses and/or hyperandrogenism **except for pregnancy, if above cut off values refer to endocrinology	<ul style="list-style-type: none"> • Beta hCG > 25 mIU/ml --> pregnant • Elevated FSH --> primary hypogonadism • Low LH --> secondary hypogonadism • Prolactin > 25 ng/mL --> prolactinoma • DHEAS > 600 ug/dL --> virilizing ovarian tumor or virilizing adrenal tumor • Early morning 17-Hydroxyprogesterone > 170 ng/dL --> non-classical CAH or virilizing tumor • Serum total testosterone > 150 ng/dL --> ovarian stromal hyperthecosis or tumor • If acromegaloid features present AND elevated IGF-1 --> acromegaly <p>If all other labs are normal with clinical features</p> <ul style="list-style-type: none"> - Consider Cushing's syndrome in patients with rapid weight gain, hypertension, elevated glucose, and wide violaceous striae - refer to endocrine for work up - Consider obtaining chronic disease panel (CRP, CBC, ESR, CMP) as chronic disease state may affect ovulation 															

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8	TSH lab interpretation	Mildly elevated TSH (5-10) is common in patients who have overweight or obesity diagnosis, and is reversible with weight management and does not warrant referral. Repeat testing is recommended and if TSH values rising then refer to endocrinology. T4 testing should not be run unless there is an abnormal TSH or there is clinical concern for central hypothyroidism (pituitary or hypothalamic dysfunction)
9	Serum total/ free testosterone lab interpretation	Serum free testosterone is more sensitive for detecting hyperandrogenemia than serum total testosterone.

Citations:

- Children's National Hospital Endocrinology Department
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- Depart of Obstetrics and Gynecology, University of Pennsylvania, Buggs et al., *Endocrinol Metab Clin North Am*, DOI: 10.1016/j.ecl.2005.04.005
- Hatch et al., *Am J Obstet Gynecol*, DOI: 10.1016/0002-9378(81)90746-8
- FIGO Menstrual Disorders Committee, Munro et al., *Int J Gynaecol Obstet*, DOI: <https://doi.org/10.1002/ijgo.12666>
- The University of Chicago Pritzker School of Medicine, Rosenfield, *Pediatrics*, DOI: 10.1542/peds.2015-1430
- International PCOS Network, Teede et al., *Fertil Steril*, DOI: 10.1016/j.fertnstert.2018.05.004
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