

Facilitator Preparation: Facilitators should thoroughly review this module. They should also prepare or photocopy handouts to distribute during the course of the case presentation and the “Materials for Learners” packet.

Open the Discussion: Introduce the case title and the objectives of the session. Explain that this will be an interactive case discussion prompted by a series of multiple choice questions and not a lecture. Distribute Part I of the case and ask one or more of the participants to read it aloud.

Missing menses

Amenorrhea in the Adolescent

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Objectives:

- Distinguish normal versus abnormal menstrual function.
- List a differential diagnosis for both primary and secondary amenorrhea
- Formulate a diagnostic plan to workup the adolescent with amenorrhea.
- Describe the management options for PCOS

Part I:

Introduction:

A 17 year old female, Neha, come into your office for a routine check-up. She tells you that she had not had her period in 7 months.

- Menarche at age 12, irregular from onset
- Breast and pubic hair development at age 10
- Cycles became longer over the past several years from every 2-3 months to now every 4-7 months

Current History:

Neha’s last menstrual period was seven months ago lasting for about one week. She has not had any bleeding or spotting since then. This is the longest interval of time she has gone without having a period.

She reports she has been visiting a salon weekly for hair removal. She has always struggled with her weight and has noted continued increase over the past several years despite attempts at weight loss. She denies PMS symptoms. She has no significant cramping with her menses. She does not feel that acne is a problem although has occasional breakouts. Review of systems is also negative for headaches, visual changes, gastrointestinal symptoms, heat or cold intolerance, fatigue, and galactorrhea.

Past Medical History:

No previous diagnoses. Full-term infant, BW: 5 lbs 10 oz. She does not take any medications regularly.

Family History:

Only child. She reports her mother struggled to become pregnant. Father and multiple aunts and uncles have type 2 diabetes.

Following this reading, ask all participants “So what do you think about this case? What would you like to focus on during our discussion today?” List agenda items on a blackboard or flipchart. Then use the questions below to start the discussion. Remember that the key to successfully leading a small group is facilitation of the discussion rather than lecture. Draw as many participants as possible into the discussion. Allow silences while group members think about questions.

Potential Discussion Questions:

When does menarche typically occur?

- Menarche (mean age): 12.4 years
 - Racial/ethnic differences with earlier age of menarche for non-Hispanic black and Hispanic girls
- 2-3 years after the onset of secondary sexual characteristics
- More typically at Tanner IV breast development
- Only 3 in 1000 girls will experience menarche after 15.5 years

What constitutes a normal menstrual cycle in adolescents?

- Median cycle interval: 32.2 days
- Menstrual cycle interval: 21-45 days for the first 1-2 years after menarche, then 21-35 days
- Duration of flow ≤ 7 days
- 10-15 soaked tampons or pads per cycle

What defines amenorrhea?

- Primary amenorrhea
 - absence of menarche by age 15 years OR
 - absence of menarche 3 or more years after thelarche (breast development)
- Secondary amenorrhea: 3 or more months without a period

What is the differential diagnosis of amenorrhea?

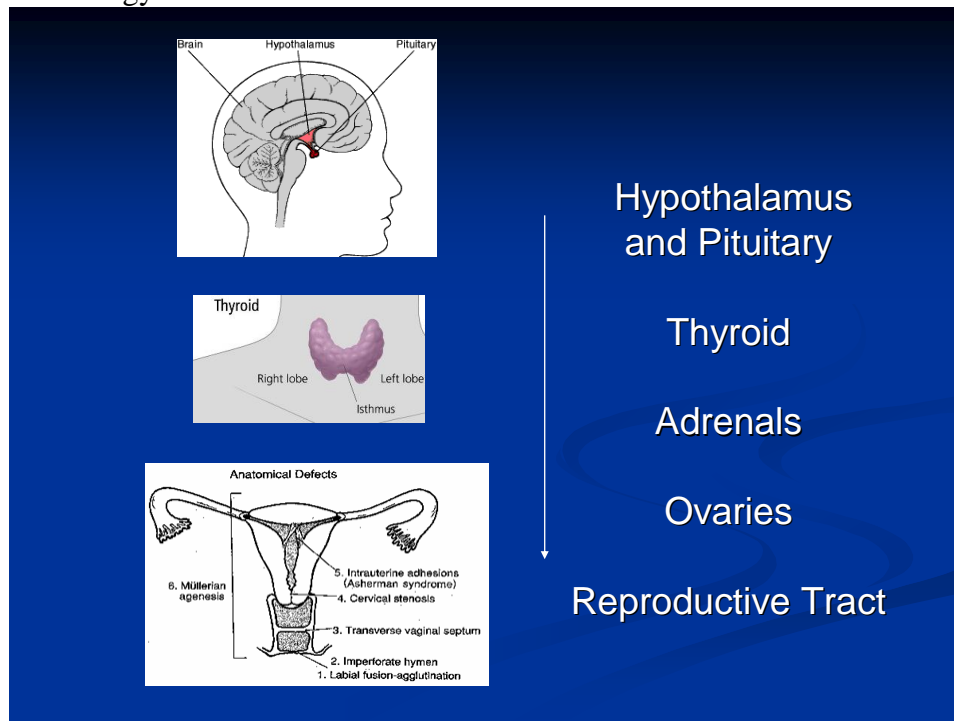
Ask learners to refer to Figure 1 in their packet.

Problems can occur along the hypothalamic-pituitary-ovarian (HPO) axis (see figure 1); in those with primary amenorrhea, genital anomalies must also be ruled out. The differential diagnosis for amenorrhea includes the following:

- Hypothalamus: chronic disease, familial delay, stress, eating disorders, overexercise, Kallmann syndrome, drugs (e.g. risperidone), tumor, irradiation

- Pituitary gland: tumor, hemochromatosis, infarction, irradiation
- Thyroid: Hyper- or hypothyroidism
- Adrenals: Cushing's disease, CAH, Addison disease, tumor
- Ovaries: Primary ovarian insufficiency (autoimmune, idiopathic, FMR1 premutation, ataxia telangectasia, gonadal dysgenesis, irradiation, galactosemia); 17 hydroxylase deficiency; polycystic ovary syndrome
- Reproductive tract: pregnancy, MRKH (46XX karyotype with functional ovaries but agenesis of reproductive tract), 46XY AIS, transverse septum, imperforate hymen

Figure 1: Etiology of Amenorrhea



What other information would you like to gather?

- Sexual activity
- Disordered eating behaviors (restriction, bingeing, purging, diet pill/diuretic/laxative use)
- Exercise history
- Growth charts
- Physical exam findings

Should you talk to this teenager alone?

- Teens need to be seen alone, even if only briefly to ask sensitive questions. Explaining this to the parent is important.
- Confidentiality must be protected for teens unless a clinician identifies a serious risk.

- An adolescent girl should be offered the choice of having her mother (or female guardian) in or out of the room during the examination and the option of having a chaperone.

Distribute Part II of the case (including growth charts) and have participant(s) read it aloud.

Part II:

Next Steps:

Psychosocial History:

Neha has been sexually active with one male partner in the past but is not in a current relationship. No history of pregnancy or STI. Last intercourse was over a year ago. She denies alcohol, tobacco, or drug use. She admits she is bothered by her weight and feels “fat.” She has tried dieting but says that “it doesn’t work.” She does not skip meals nor restrict her diet; she denies diet pill, diuretic, and laxative use. She also denies history of bingeing and purging. No extraordinary stressors with family, friends or school. She does not engage in any sports or regular exercise but considers herself active.

Physical Exam:

Ht 64 in, 163 cm (50%) weight is 180 lbs, 82 kg (>95 %). BMI = 30.9 kg/m² (95%)
Heart rate is 72.

No thyromegaly. Lungs clear bilaterally. Heart RRR s1 s2. Breasts are Tanner V without galactorrhea. Her abdomen is soft, NT, ND, no masses on palpation. Her pubic hair is Tanner V and external genitalia are normal. No clitoromegaly (<3 mm width). Vaginal mucosa is pink, moist. A bimanual vaginal/abdominal exam reveals a firm, small uterus and normal ovaries bilaterally. Skin darkened, thickened over neck. Moderate papular acne on face and back. Dark thick hair on chin, sideburns, back, lower abdomen

Growth charts available

Figures 2 & 3

Distribute and ask learners to review Figures 2 & 3.

Figure 2: Height and Weight Chart

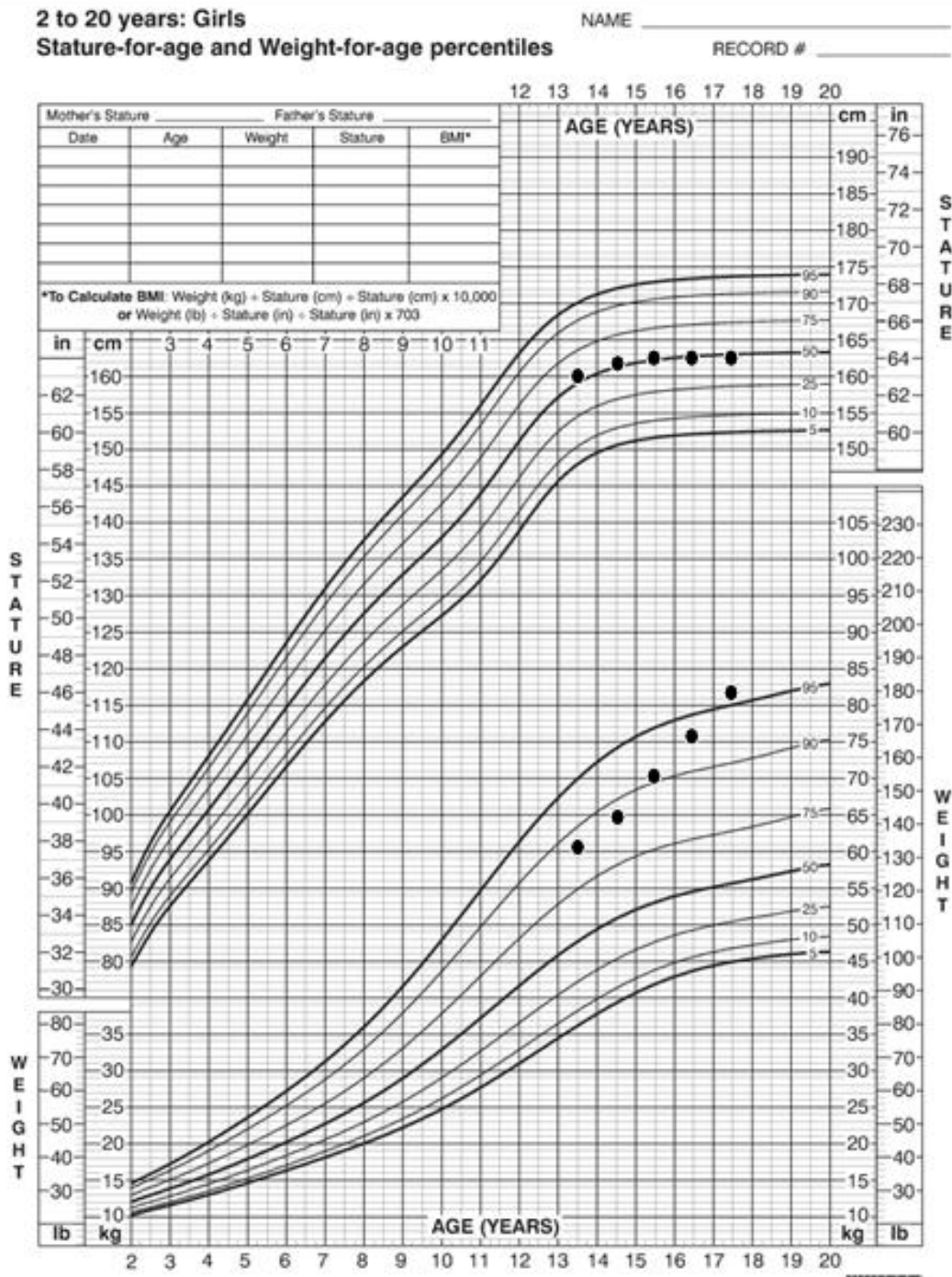
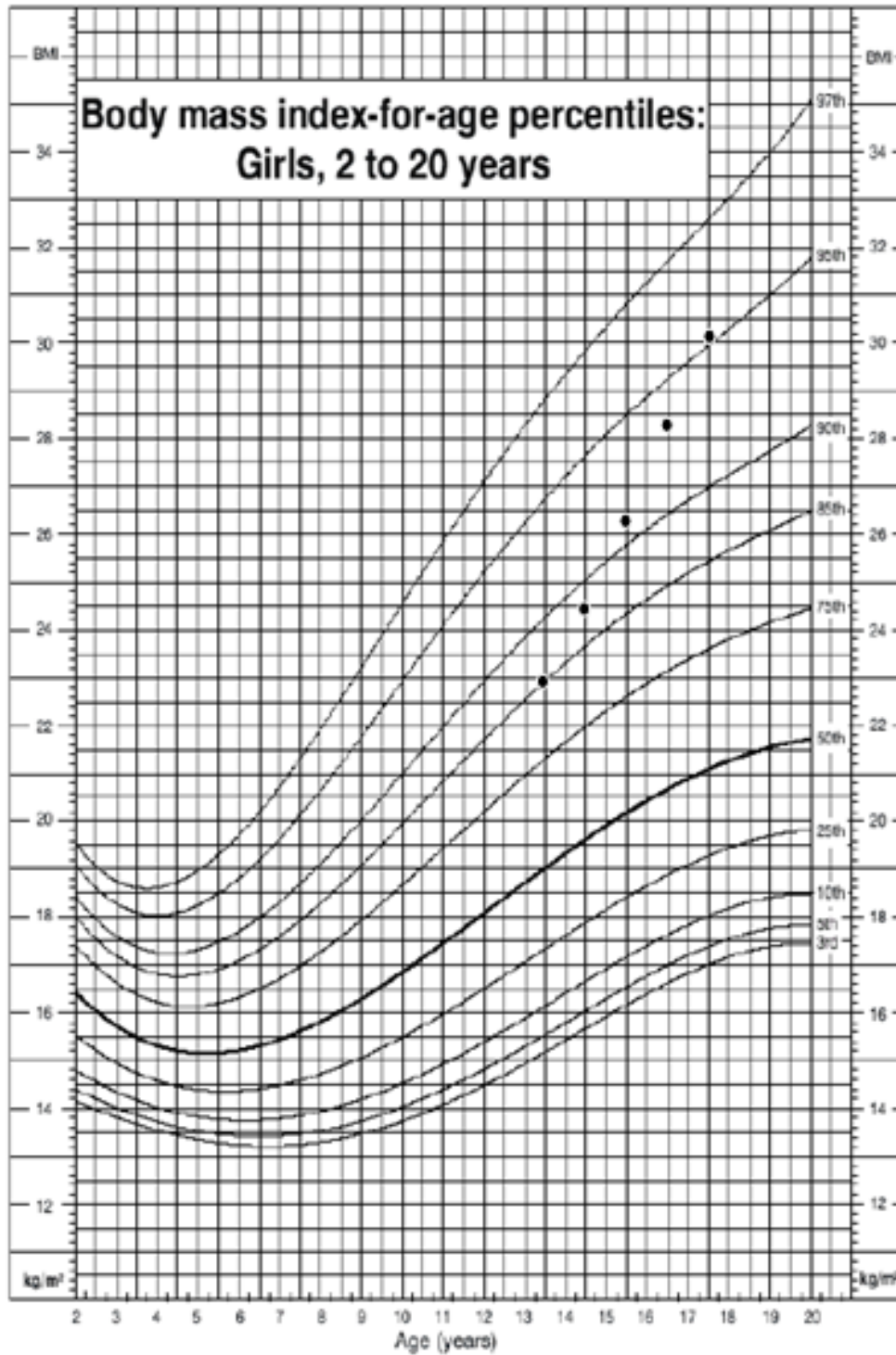


Figure #3: BMI chart



Pause and begin next set of discussion questions.

Potential discussion questions:

What are the significant exam findings?

- Patient is obese
- Vaginal tissues appear well estrogenized. Non-estrogenized vaginal tissues appear thin and reddened.
- Signs of androgen excess: acne, hirsutism

How does the clinician determine if hair growth is excessive?

- Hirsutism refers to the presence of terminal hair (>0.5 cm long, coarse, pigmented) in a male distribution pattern (face, back, chest, abdomen).
- The degree of hirsutism can be influenced by genetic and racial/ethnic factors as well as hormonal factors such as androgen secretion and sensitivity to hormone levels.
- The Ferriman-Gallwey system can be used to objectively assess hair growth. Clinicians score hair growth on a scale of 1 to 4 on multiple areas of the body (**Ask learners to refer to Figure 4 in their packet**); a score ≥ 6 indicates hirsutism.

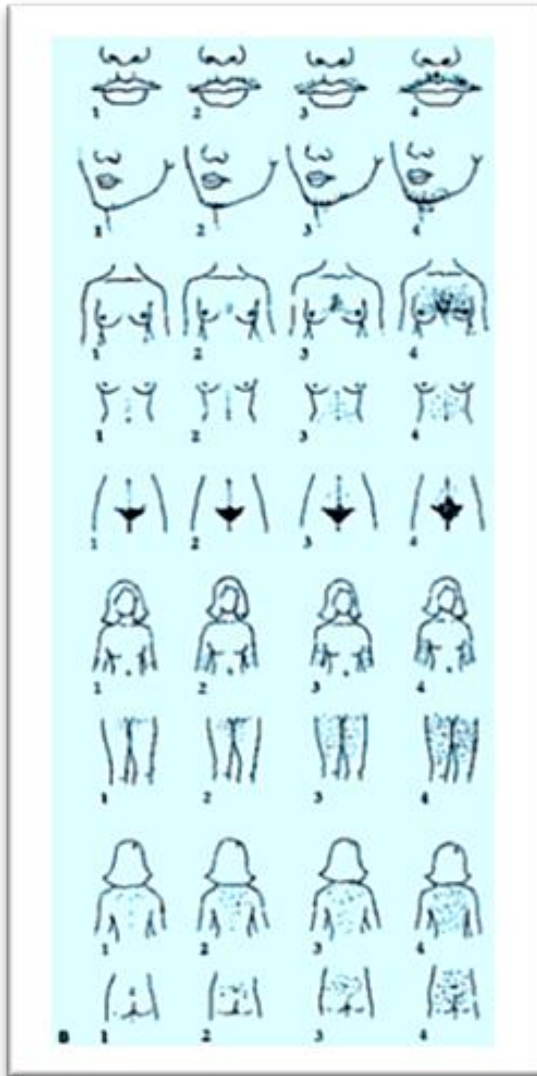


Figure 4: Assessing hirsutism

(With permission from S.J. Emans and M.R. Laufer, *Emans, Laufer, Goldstein's Pediatric and Adolescent Gynecology*, 6th ed. Lippincott, Williams & Wilkins; Wolters Kluwer, 2012)

What workup would you consider for a patient with amenorrhea? What tests would be the most important in our patient()?*

- Serum or urine HCG test to exclude pregnancy.*
- FSH level to determine central problems versus ovarian insufficiency.* In our patient, normal breast development and estrogenized vaginal tissues imply that the ovaries are making estrogen.
 - High FSH (>30 mIU/ml) indicates hypergonadotropic hyponadism in primary ovarian insufficiency (POI). A single high FSH should be repeated in 2-4 weeks along with an estradiol level (usually <50 pg/ml) before making diagnosis of POI.

- Low to normal levels of FSH indicate hypogonadotropic hypogonadism (CNS dysfunction)
- Increased LH:FSH ratio (2.5:1 to 3:1) is often found in adolescents with PCOS, but can also be seen in stress.
- Thyroid function (TSH and/or free T4)*: Both hypo- and hyperthyroidism can cause amenorrhea
- Prolactin level to rule out prolactin-secreting pituitary tumors.* Elevated levels can also be found in those taking drugs that interfere with dopamine secretion from the hypothalamus (e.g antipsychotics)
- Testosterone (free and total), DHEAS, and 17OH-progesterone in the adolescent with amenorrhea and signs of androgen excess to evaluate for PCOS, tumors, and late-onset CAH.* 17-OHP levels should be a first morning laboratory draw ideally between 7-8 AM.
- Other tests that may be helpful include
 - CBC, ESR, chemistry panel, LFTs, and celiac screen if concern regarding chronic illness
 - Late night salivary cortisol or 24 hour urinary cortisol are first line evaluation if concern for Cushing's; a low-dose dexamethasone suppression test may be needed for diagnosis.
 - In adolescents with primary amenorrhea, genital anomalies must be considered. Clinicians should assess patency and length of vaginal canal. If concern for anomalies, pelvic ultrasonography or pelvic MRI are important to better define uterine structure. Of note, in the non-estrogenized patient, it may be difficult for radiologist to visualize uterus and thus may be reported as absent.
- Adolescents who have ever been sexually active should be evaluated with tests for *Neisseria gonorrhoeae* and *Chlamydia trachomatis* (nucleic acid amplification tests, or NAATs, using vaginal, cervical, or urine samples) as part of preventive care.*

Distribute Lab results and have participants evaluate for abnormalities.

Laboratory results:

urine pregnancy test: negative

FSH: 5.4 IU/L

LH: 15.2 IU/L

TSH: 1.3 uU/ml (normal: 0.7-5.7)

Prolactin: 14.6 ng/ml (normal < 26)

Testosterone (free): 9.7 pg/mL (normal: 1.1-6.3)

Testosterone (total): 65 ng/dL (normal for Tanner V female: 10-55)

DHEAS: 286 mcg/dl (45-380)

17OHP (7-8 AM draw): 91 ng/dL (normal <200)

NAAT (aptima): negative for gc/chlamydia

What is your diagnosis?

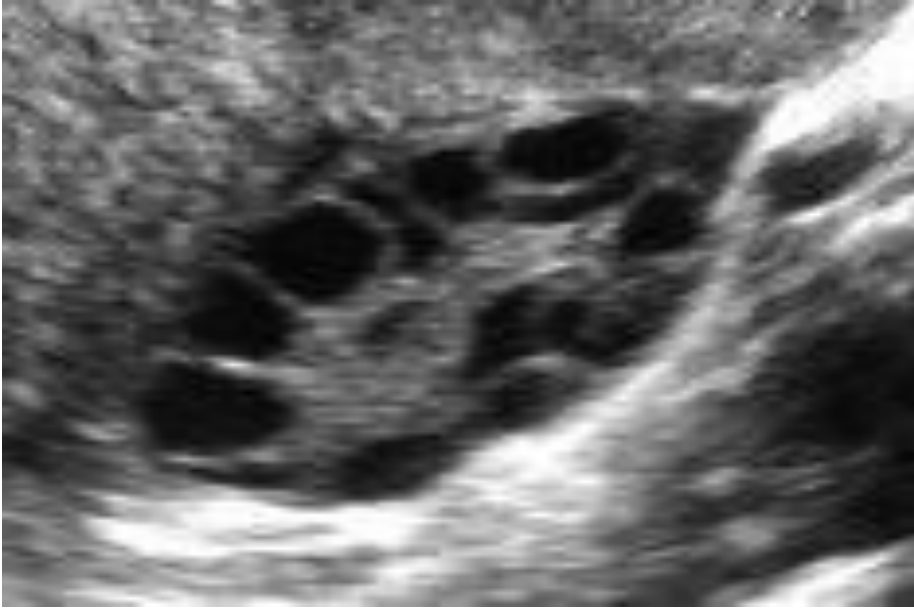
- History, exam, and laboratory results are consistent with polycystic ovary syndrome (PCOS).
- The definition of PCOS has evolved over the years with no less than three sets of proposed criteria for diagnosis.
 - In 1990, a National Institutes of Health Consensus defined PCOS as a combination of hyperandrogenism, menstrual dysfunction, and exclusion of other etiologies such as last-onset CAH.
 - The 2003 Rotterdam Consensus workshop expanded the definition to include any 2 out of 3 criteria with exclusion of other medical conditions: (1) oligomenorrhea and/or anovulation, (2) clinical or biochemical signs of hyperandrogenism, (3) polycystic ovaries by transvaginal ultrasound.
 - The 2006 Androgen Excess Society narrowed the definition to exclude women who did not have androgen excess. Their criteria include hyperandrogenism and ovarian dysfunction (oligo-anovulation and/or polycystic ovarian morphology on ultrasound), and exclusion of other disorders.
- The other prominent endocrine component involves insulin resistance; PCOS patients, in addition to androgen excess, often have accompanying hyperinsulinemia. Insulin not only affects glucose metabolism, but may also lead to increased circulating androgen levels by stimulating ovarian androgen secretion.

Are there additional tests you would order now that you have made a diagnosis of PCOS?

- Additional testing is important to evaluate for metabolic abnormalities associated with PCOS including insulin resistance and/or impaired glucose tolerance, and dyslipidemia. Although recommendations vary across professional groups, multiple societies recommend evaluating for impaired glucose tolerance (IGT) in all women with a BMI > 30 kg/m² or if there are risk factors present in those with BMI <30 kg/m² (personal history of gestational diabetes, family history of type 2 diabetes). The most sensitive test for is an oral glucose tolerance test following the American Diabetes Association protocol but HgA1c may be more practical. Fasting lipid profiles and liver function tests are also recommended.
- Imaging studies may be useful prior to diagnosis if concern for androgen-producing tumor, unable to complete pelvic exam, or require additional diagnostic criteria. Transvaginal ultrasound may show classic “string of pearls” appearance (Figure 5). Criteria for polycystic ovaries include at least 12 follicles (2-9 mm) or volume of at least one ovary of >10 cc. While transvaginal US gives more details, transabdominal US performed with state of the art technology generally yields quality images and is used for most adolescent exams.

Distribute US image

Figure 5: Polycystic ovaries



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How would you manage this patient's amenorrhea?

Ask learners to refer to Table 1 in their packet.

Management depends on the etiology of the amenorrhea; in our patient, we have made the diagnosis of PCOS. The goals of therapy in treating adolescents with PCOS should address both short term issues such as lessening acne and hirsutism, managing weight, and regulating menses as well as long term issues including risk reduction for diabetes, cardiovascular disease, endometrial hyperplasia, and infertility. Multiple classes of treatments are used including:

- **Lifestyle changes:** Initial goals should focus on weight loss to improve insulin sensitivity in those who are overweight or obese (studies have shown between 38-88% of women with PCOS fall into these categories). As little as a 5-7% decrease in body weight has been shown to decrease testosterone levels and lead to resumption of menses.
- **Hormones:** Combination estrogen/progestin pills (COCs) are considered first line therapy. The pills suppress the HPO axis thereby decreasing androgen production, and increases sex hormone binding globulin concentrations resulting in decrease levels of free (or bioavailable) androgens. If patient cannot tolerate or there is a contraindication to using COCs, options include cyclic oral medroxyprogesterone, norethindrone acetate, or prometrium to induce regular withdrawal bleeds.
- **Insulin-sensitizing agents:** Metformin (1500-2000 mg daily) suppresses hepatic gluconeogenesis and increase peripheral insulin sensitivity. Although the effect on weight loss and hirsutism has been variable, metformin has been shown to decrease free testosterone levels and results in resumption of menses in 68-96% of patients. Side effects are primarily GI related; treatment is often started at 500 mg daily with food and tapered up to final dosing.

- Anti-androgens: Spironolactone is the most widely used option (50-200 mg daily) for significant hirsutism. It blocks androgen binding at the androgen receptor site and inhibiting 5 α reductase, the enzyme that converts testosterone to the active androgen at the level of the hair follicle. Because this treatment can cause irregular bleeding and has potential teratogenic effects, it is usually prescribed in combination with an OCP. Electrolytes (potassium) should be checked periodically.

Table 1: Therapeutic options for polycystic ovary syndrome (PCOS)

Chief Complaint	First-line Therapy ^a	Second-line Therapy ^b
Oligomenorrhea	Estrogen/progestin	Metformin Progestins
Hirsutism, mild	Estrogen/progestin	Antiandrogen ^b Metformin
Hirsutism, moderate to severe	Estrogen/progestin <i>plus</i> Antiandrogen	Antiandrogen ^b
Overweight	Exercise/nutrition	Metformin <i>plus</i> Exercise/nutrition

- ^a Most medications, including oral contraceptives, are not specifically approved (i.e., are off-label) for PCOS.
- ^b Antiandrogens should be prescribed with estrogen/progestin contraceptives if there is any chance of pregnancy because of teratogenicity.

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Distribute Part III: Ask someone to read follow-up aloud.

Part III

Epilogue:

- You prescribe a ten day course of oral medroxyprogesterone to induce a withdrawal bleed and counsel Neha on the various treatment options.
- Neha returns two weeks later and is having a withdrawal bleed. You send her for additional labs including OGTT. Fasting (88 mg/dL) glucose level is normal, but

two-hour glucose (145 mg/dL) and fasting insulin (35 mcIU/ml) are both elevated. Lipid panel is normal. You counsel her on weight loss and recommend regular exercise and decreased caloric intake. Neha had decided that she would like to start on an oral contraceptive pill to address both PCOS and potential contraceptive needs.

- At a three month follow-up visit, Neha is having regular menses and no side effects to the pill. However she has gained 1 kg (although reports no appetite changes on the OCP) and continues to remain frustrated by hair growth and weight gain. You start metformin and a MVI (vitamin B12 levels may decrease by 10-30% on metformin), increasing up to 1000 mg twice daily after renal and liver function tests return normal. She also agrees to work with a nutritionist and increase her exercise.
- Neha decides to look into laser treatment options for hair removal.

Refer back to group's learning agenda and summarize the key teaching points that were made. This will give the group a sense of accomplishment, and emphasize the important messages. Suggest further sources of reading or other information if there are agenda items that were not covered in the discussion.

Clinical Pearls:

- Abnormal menses included those occur more frequently than every 21 days or less frequently than every 45 days (during early adolescence), or last longer than 7 days. Secondary amenorrhea is the absence of menses for > 3 months.
- The differential diagnosis for amenorrhea is broad but can be narrowed based on determination of primary versus secondary amenorrhea, and additional information gathered from patient history, growth charts, and physical exam.
- Pregnancy must be excluded in all adolescents with amenorrhea even those who deny sexual activity. Workup for amenorrhea should be tailored to each patient but in addition to urine HCG, at minimum, FSH, TSH, and prolactin levels should be ordered.
- There are multiple treatment options to address PCOS including lifestyle changes and pharmacologic options including hormones (estrogen/progestins or progestins), metformin, and/or anti-androgens.

Knowledge questions:

Ask learners to complete the knowledge questions in their packet. If time allows, questions and answers can be discussed as a group, or learners can complete and review answers on their own.

1. Which of the following statements is most correct?

- a. Adolescents with amenorrhea secondary to acquired hypothyroidism are typically underweight for height.
- b. Laboratory abnormalities in amenorrheic patients with anorexia nervosa typically show elevated FSH and LH level, and normal estradiol.

- c. Patients with MRKH have a 46, XX karyotype but absent or rudimentary ovaries, fallopian tubes, uterus, cervix, and vaginal canal
- d. Rapid progression of hirsutism and virilization (temporal hair recession, deepening of voice, clitoromegaly) in an adolescent with amenorrhea should prompt an immediate workup for androgen-producing ovarian or adrenal tumor.

2. *Which of the following questions should be asked to help narrow the differential diagnosis?*

- a. How do you feel about your weight? Are you trying to lose weight? How?
- b. Are you sexually active? Have you ever had intercourse?
- c. Are you using birth control pills? Any other medications?
- d. All of the above.

3. *You are seeing a 14 year old patient for primary amenorrhea. She began having breast development at 10 years of age but has never had a period. She has no significant past medical, family, or psychosocial history and takes no medications. Mom and older sister both had menarche at age 12. Review of systems is positive for abdominal pain that has been worsening over the past several months. She has a normal weight and height. Tanner V for both breast development and pubic hair distribution. External genital exam appears within normal limits including small hymenal opening. The remainder of her PE is normal with no significant findings. Which of the following is the most appropriate next step?*

- a. Reassure patient that no further workup is needed and would expect onset of menses within the next year.
- b. Counsel patient that she likely must gain weight before onset of menses can begin.
- c. Prescribe a course of medroxyprogesterone to induce a withdrawal bleed.
- d. Further assess patency, length and width of vaginal canal.

4. *Which of the following are considered co-morbidities of PCOS?*

- a. Impaired glucose tolerance
- b. non-alcoholic fatty liver disease (NAFLD)
- c. Elevated LDL and TG, decreased HDL
- d. all of the above

Answers to Knowledge Questions

1. *Which of the following statements is most correct?*

Preferred response: D, “Rapid progression of hirsutism and virilization (temporal hair recession, deepening of voice, clitoromegaly) in an adolescent with amenorrhea should prompt an immediate workup for androgen-producing ovarian or adrenal tumor.”

Ovarian and adrenal tumors including Sertoli and Leydig cell tumors can present with rapid onset of hirsutism and virilization. In addition to checking testosterone, DHEAS levels, and early morning 17OHP levels, serum DHEA and androstenedione concentrations should also be checked. Testosterone levels >150 ng/dL may raise suspicion for of tumor, but level should be verified in a specialized endocrine laboratory.

Ultrasound, CT or MRI is obtained for further evaluation if testosterone concentration is within the tumor range or rapid onset of virilization.

Adolescents with amenorrhea secondary to acquired hypothyroidism (and cortisol excess) are typically *overweight* for height, while those with poor nutrition including eating disorders, celiac disease, or inflammatory bowel disease are typically underweight for height. Laboratory abnormalities in amenorrheic patients with anorexia nervosa typically show suppressed FSH, LH level, and estradiol levels. Patients with MRKH have a 46, XX karyotype. The cervix, uterus, fallopian tubes, and upper 2/3rds of vaginal canal are often absent or not developed; however, they have normal ovaries and hormonal patterns.

2. *Which of the following questions should be asked to help narrow the differential diagnosis?*

Preferred response: D “All of the above.”

All of the above questions should be asked confidentially to help narrow the differential diagnosis. There are a multitude of medical problems associated with amenorrhea. Disordered eating behaviors, such as restricting and purging, and weight loss are risk factors for irregular menses.

All patients with amenorrhea should be asked whether they are sexually active. Clinicians should have a low threshold for pregnancy testing regardless of reported sexual history.

Multiple medications can induce amenorrhea including hormonal contraception such as depo-provera. Adolescents using low-dose COCs (20mcg EE) may also have amenorrhea or scant flow. Often times, adolescents may have obtained the method confidentially and family may not be aware. Drugs such as antipsychotics (e.g risperdal), phenothiazines, α methyl dopa, and protease inhibitors interfere with hypothalamic secretion of dopamine and may result in elevated prolactin levels and amenorrhea. A baseline prolactin level should be drawn before starting on these medications.

3. *Which of the following is the most appropriate next step?*

Preferred response: D. “Further assess patency, length and width of vaginal canal.”

Patient’s history (primary amenorrhea, abdominal pain, Tanner V pubertal development) raises concern for a genital anomaly despite a normal external exam. A patient with a transverse vaginal septum, or vaginal, cervical, or uterine agenesis typically have normal-appearing external genitalia. The most appropriate next step is to further assess for structural defects. A saline moistened cotton tipped applicator or Calgiswab should be gently inserted into the hymenal opening and slowly advanced. If there is a low septum or agenesis of canal, swab will not advance beyond 2 cm; a one finger examination of the vaginal canal will also allow assessment of length and width, along with palpation of cervix and uterus. Pelvic US can be obtained in patients not comfortable with an exam. For inconclusive ultrasound evaluations, and high level of suspicion for concern for structural lesions, MRI would be next step in assessment of pelvic organs.

Patient should have further workup given she has not had menarche four years out from onset of secondary sexual characteristics. The patient is normal weighted, has fully

matured, and has evidence of estrogen production on exam; there is no evidence at this time that she will need to gain additional weight. Before a course of medroxyprogesterone is tried, congenital or structural anomalies should first be ruled out.

4. Which of the following are considered co-morbidities of PCOS?

Preferred response: D. “all of the above”

There are multiple co-morbidities of PCOS that have been identified. PCOS increases lifelong risk of infertility, endometrial hyperplasia and cancer, irregular uterine bleeding, metabolic syndrome, impaired glucose tolerance and type 2 diabetes, hypertension, and abnormal lipid profiles. Liver dysfunction, particularly elevation of ALT, has been found in up to 30% of patients with PCOS in whom causes other than NAFLD were ruled out. Other obesity-related disorders are also common including obstructive-sleep apnea which increases future cardiovascular risk.

References:

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Materials for Learners:

Packet should include the following:

- Handout #1: Etiology of Amenorrhea (figure 1), Treatment Options (table 1)
- Handout #2: Ferriman-Gallwey Scoring Diagram (figure 4)
- Clinical pearls
- Knowledge questions and answers
- References

Missing menses

Amenorrhea in the Adolescent

Part I:

Introduction:

A 17 year old female, Neha, comes into your office for a routine check-up. She tells you that she had not had her period in 7 months.

- Menarche at age 12, irregular from onset
- Breast and pubic hair development at age 10
- Cycles became longer over the past several years from every 2-3 months to now every 4-7 months

Current History:

Neha's last menstrual period was seven months ago lasting for about one week. She has not had any bleeding or spotting since then. This is the longest interval of time she has gone without having a period.

She reports she has been visiting a salon weekly for hair removal. She has always struggled with her weight and has noted continued increase over the past several years despite attempts at weight loss. She denies PMS symptoms. She has no significant cramping with her menses. She does not feel that acne is a problem although has occasional breakouts. Review of systems is also negative for headaches, visual changes, gastrointestinal symptoms, heat or cold intolerance, fatigue, and galactorrhea.

Past Medical History:

No previous diagnoses. Full-term infant, BW: 5 lbs 10 oz. She does not take any medications regularly.

Family History:

Only child. She reports her mother struggled to become pregnant. Father and multiples aunts and uncles have type 2 diabetes.

Missing menses

Amenorrhea in the Adolescent

Part II:

Next Steps:

Psychosocial History:

Neha has been sexually active with one male partner in the past but is not in a current relationship. No history of pregnancy or STI. Last intercourse was over a year ago. She denies alcohol, tobacco, or drug use. She admits she is bothered by her weight and feels “fat.” She has tried dieting but says that “it doesn’t work.” She does not skip meals nor restrict her diet; she denies diet pill, diuretic, and laxative use. She also denies history of bingeing and purging. No extraordinary stressors with family, friends or school. She does not engage in any sports or regular exercise but considers herself active.

Physical Exam:

Ht 64 in, 163 cm (50%) weight is 180 lbs, 82 kg (>95 %). BMI = 30.9 kg/m² (95%)
Heart rate is 72.

No thyromegaly. Lungs clear bilaterally. Heart RRR s1 s2. Breasts are Tanner V without galactorrhea. Her abdomen is soft, NT, ND, no masses on palpation. Her pubic hair is Tanner V and external genitalia are normal. No clitoromegaly (<3 mm width). Vaginal mucosa is pink, moist. A bimanual vaginal/abdominal exam reveals a firm, small uterus and normal ovaries bilaterally. Skin darkened, thickened over neck. Moderate papular acne on face and back. Dark thick hair on chin, sideburns, back, lower abdomen

Figure #2: Height and Weight Chart

2 to 20 years: Girls

NAME _____

Stature-for-age and Weight-for-age percentiles

RECORD # _____

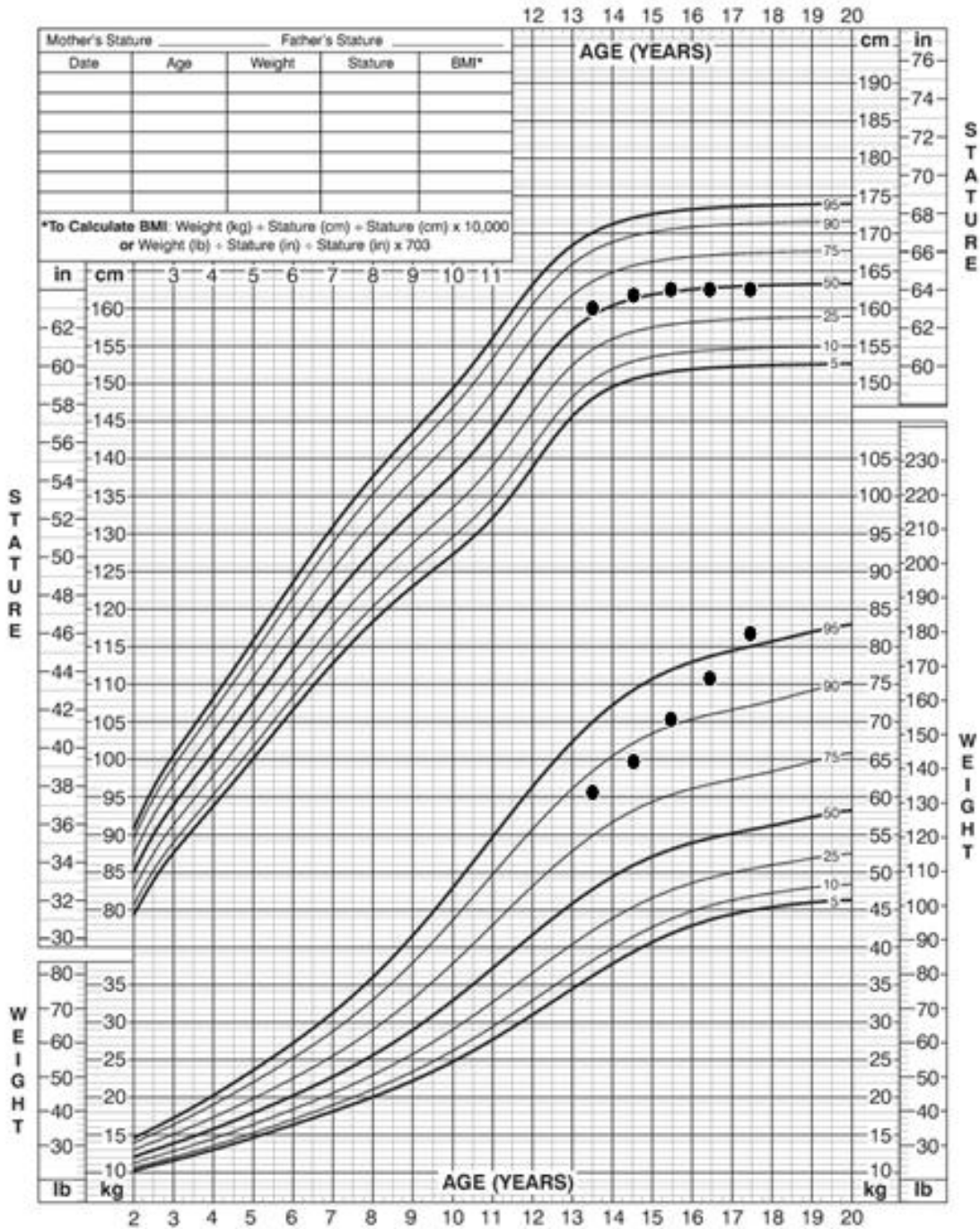
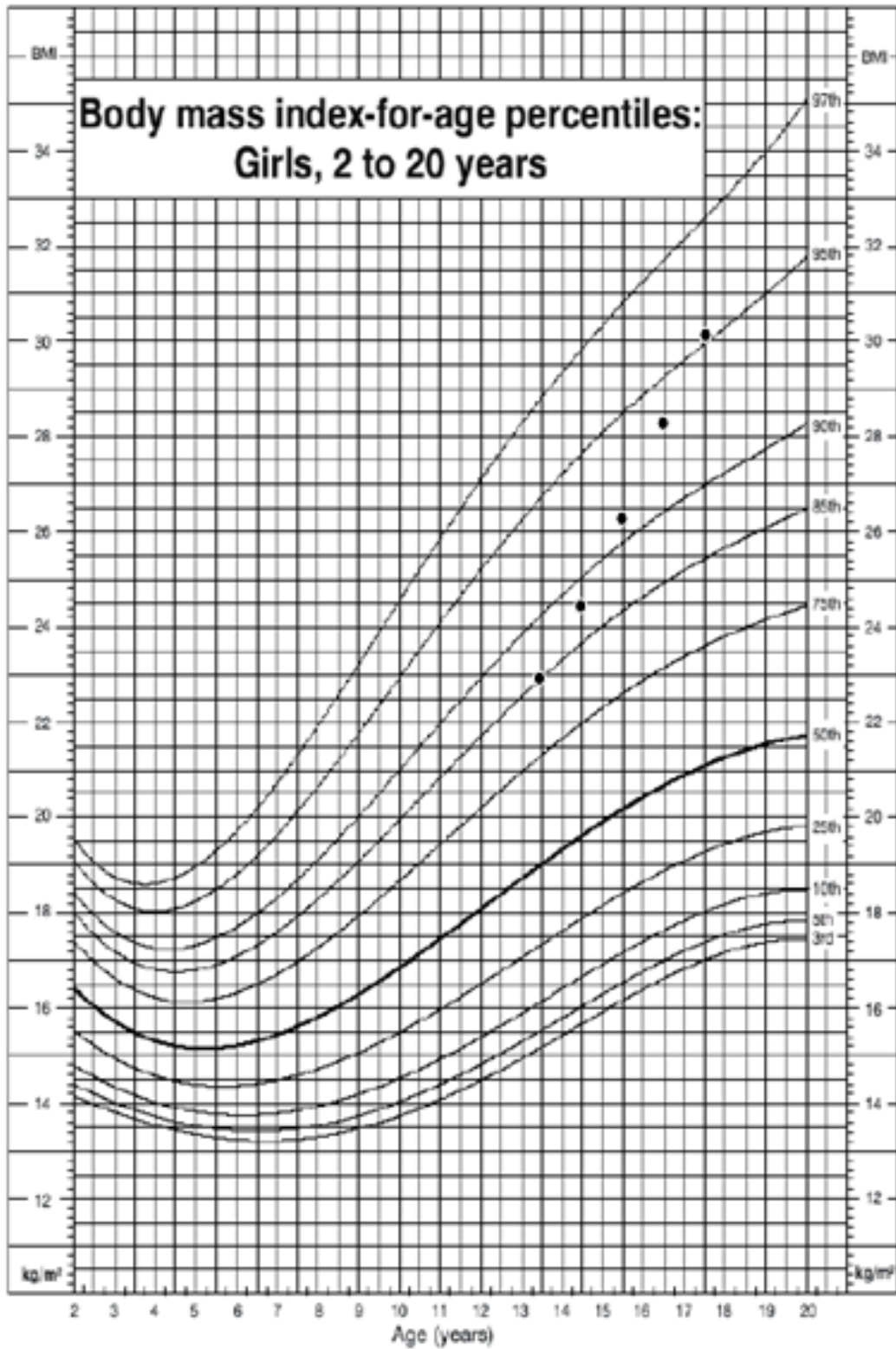


Figure #3: BMI Chart



Missing menses

Amenorrhea in the Adolescent

Laboratory results:

urine pregnancy test: negative

FSH: 5.4 IU/L

LH: 15.2 IU/L

TSH: 1.3 uU/ml (normal: 0.7-5.7)

Prolactin: 14.6 ng/ml (normal < 26)

Testosterone (free): 9.7 pg/mL (normal: 1.1-6.3)

Testosterone (total): 65 ng/dL (normal for Tanner V female: 10-55)

DHEAS: 286 mcg/dl (45-380)

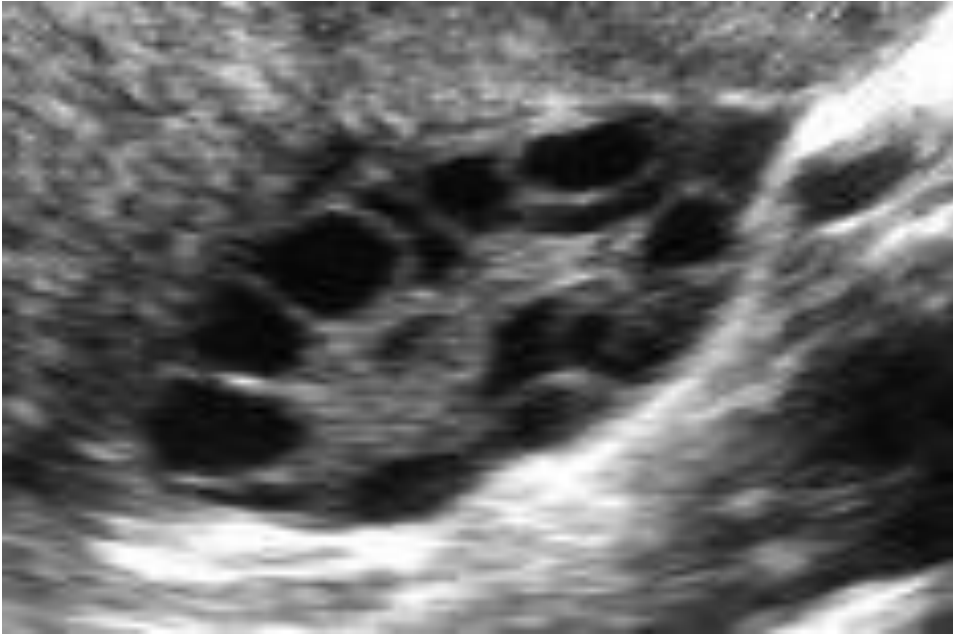
17OHP (7-8 AM draw): 91 ng/dL (normal <200)

NAAT (Aptima): negative for gc/chlamydia

Missing menses

Amenorrhea in the Adolescent

Figure 5: Polycystic ovaries



(With permission from Emans SJ, Laufer MR. Emans, *Laufer, Goldstein's Pediatric & Adolescent Gynecology*, 6th ed. Lippincott, Williams & Wilkins; Wolters Kluwer, 2012)

Missing menses

Amenorrhea in the Adolescent

Part III

Epilogue:

- You prescribe a ten day course of oral medroxyprogesterone to induce a withdrawal bleed and counsel Neha on the various treatment options.
- Neha returns two weeks later and is having a withdrawal bleed. You send her for additional labs including OGTT. Fasting (88 mg/dL) glucose level is normal, but two-hour glucose (145 mg/dL) and fasting insulin (35 mcIU/ml) are both elevated. Lipid panel is normal. You counsel her on weight loss and recommend regular exercise and decreased caloric intake. Neha had decided that she would like to start on an oral contraceptive pill to address both PCOS and potential contraceptive needs.
- At a three month follow-up visit, Neha is having regular menses and no side effects to the pill. However she has gained 1 kg (although reports no appetite changes on the OCP) and continues to remain frustrated by hair growth and weight gain. You start metformin and a MVI (vitamin B12 levels may decrease by 10-30% on metformin), increasing up to 1000 mg twice daily after renal and liver function tests return normal. She also agrees to work with a nutritionist and increase her exercise.
- Neha decides to look into laser treatment options for hair removal.