



CLINICAL REPORT

Menstruation in Girls and Adolescents: Using the Menstrual Cycle as a Vital Sign

AMERICAN ACADEMY OF PEDIATRICS

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Guidance for the Clinician in Rendering
Pediatric Care**ABSTRACT**

Young patients and their parents often are unsure about what represents normal menstrual patterns, and clinicians also may be unsure about normal ranges for menstrual cycle length and amount and duration of flow through adolescence. It is important to be able to educate young patients and their parents regarding what to expect of a first period and about the range for normal cycle length of subsequent menses. It is equally important for clinicians to have an understanding of bleeding patterns in girls and adolescents, the ability to differentiate between normal and abnormal menstruation, and the skill to know how to evaluate young patients' conditions appropriately. Using the menstrual cycle as an additional vital sign adds a powerful tool to the assessment of normal development and the exclusion of pathological conditions.

INTRODUCTION

Young patients and their parents frequently have difficulty assessing what constitutes normal menstrual cycles or patterns of bleeding. Girls may be unfamiliar with what is normal and may not inform their parents about menstrual irregularities or missed menses. Additionally, girls often are reluctant to discuss this very private topic with a parent, although they may confide in another trusted adult. Some girls will seek medical attention for cycle variations that actually fall within the normal range. Others are unaware that their bleeding patterns are abnormal and may be attributable to significant underlying medical issues with the potential for long-term health consequences.

Clinicians also may be unsure about normal ranges for menstrual cycle length and for amount and duration of flow through adolescence. Clinicians who are confident in their understanding of early menstrual bleeding patterns may convey information to their patients more frequently and with less prompting; girls who have been educated about menarche and early menstrual patterns will experience less anxiety when they occur.¹ By including an evaluation of the menstrual cycle as an additional vital sign, clinicians reinforce its importance in assessing overall health status for both patients and parents. Just as abnormal blood pressure, heart rate, or respiratory rate may be key to the diagnosis of potentially serious health conditions, identification of abnormal menstrual patterns through adolescence may permit early identification of potential health concerns for adulthood.

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The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Key Words

menarche, menstruation, adolescent

Abbreviation

PCOS—polycystic ovary syndrome

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NORMAL MENSTRUAL CYCLES

Menarche

From the early 1800s to the mid-1950s, menarche occurred at increasingly younger ages in the United States, but there has been no further decline in the last 40 to 50 years. This finding also has been seen in international studies of other developed urban populations.² The US National Health and Nutrition Examination Surveys have found no significant change in the median age at menarche over the past 30 years except among the non-Hispanic black population, which has a 5.5-month earlier age at menarche than it did 30 years ago.³ Age at menarche varies internationally and especially in less developed countries; in Haiti, for example, the mean age at menarche is 15.37 years.^{4,5} This knowledge may be especially pertinent for practitioners with a large number of immigrant families in their patient population. Although onset of puberty and menarche typically occur at a later age in females from less well-developed nations, 2 large studies have confirmed that a higher gain in body mass index (BMI) during childhood is related to an earlier onset of puberty.^{6,7} This earlier onset of puberty may result from attainment of a minimal requisite body mass at a younger age. Other possible explanations for the perceived trend in timing and progression of puberty are environmental factors, including socioeconomic conditions, nutrition, and access to preventive health care.⁸

Despite variations worldwide and within the US population, median age at menarche has remained relatively stable, between 12 and 13 years, across well-nourished populations in developed countries. The median age of females when they have their first period or menarche is 12.43 years (see Table 1).³ Only 10% of females are menstruating at 11.11 years of age; 90% are menstruating by 13.75 years of age. The median age at which black female adolescents begin to menstruate is earlier (12.06 years of age) than the median age for Hispanic (12.25 years of age) and non-Hispanic white (12.55 years of age) females.³ Although black girls start to mature earlier than non-Hispanic white and Hispanic girls, US females complete secondary sexual development at approximately the same ages.⁹

Menarche typically occurs within 2 to 3 years after thelarche (breast budding), at Tanner stage IV breast development, and is rare before Tanner stage III development.¹⁰ Menarche correlates with age at onset of puberty and breast development. In girls with early onset

of breast development, the interval to menarche is longer (3 years or more) than in girls with later onset.¹¹⁻¹³ By 15 years of age, 98% of females will have had menarche.^{3,14}

Traditionally, primary amenorrhea has been defined as no menarche by 16 years of age; however, many diagnosable and treatable disorders can and should be detected earlier, using the statistically derived guideline of 14 to 15 years of age.^{3,14} Thus, an evaluation for primary amenorrhea should be considered for any adolescent who has not reached menarche by 15 years of age or has not done so within 3 years of thelarche. Accordingly, lack of breast development by 13 years of age also should be evaluated.¹⁵

Cycle Length and Ovulation

Menstrual cycles are often irregular through adolescence, particularly the interval from the first to the second cycle. According to the World Health Organization's international and multicenter study of 3073 girls, the median length of the first cycle after menarche was 34 days, with 38% of cycle lengths exceeding 40 days. Variability was wide: 10% of females had more than 60 days between their first and second menses, and 7% had a first cycle length of 20 days.¹⁶ Most females bleed for 2 to 7 days during their first menses.¹⁷⁻¹⁹

Early menstrual life is characterized by anovulatory cycles,^{20,21} but the frequency of ovulation is related to both time since menarche and age at menarche.²¹⁻²³ Early menarche is associated with early onset of ovulatory cycles. When the age at menarche is younger than 12 years, 50% of cycles are ovulatory in the first gynecologic year (year after menarche).

By contrast, it may take 8 to 12 years after menarche until females with later-onset menarche are fully ovulatory.²³ Despite variability, most normal cycles range from 21 to 45 days, even in the first gynecologic year,¹⁶⁻¹⁸ although short cycles of fewer than 20 days and long cycles of more than 45 days may occur. Because long cycles most often occur in the first 3 years postmenarche, the overall trend is toward shorter and more regular cycles with increasing age. By the third year after menarche, 60% to 80% of menstrual cycles are 21 to 34 days long, as is typical of adults.^{16,18,24} An individual's normal cycle length is established around the sixth gynecologic year, at a chronologic age of approximately 19 or 20 years.^{16,18}

Two large studies, one cataloging 275 947 cycles in 2702 females and another reporting on 31 645 cycles in 656 females, support the observation that menstrual cycles in girls and adolescents typically range from 21 to approximately 45 days, even in the first gynecologic year.^{25,26} In the first gynecologic year, the fifth percentile for cycle length is 23 days and the 95th percentile is 90 days. By the fourth gynecologic year, fewer females are having cycles that exceed 45 days, but anovulation is still

TABLE 1 Normal Menstrual Cycles in Young Females
Menarche (median age): 12.43 years
Mean cycle interval: 32.2 days in first gynecologic year
Menstrual cycle interval: typically 21–45 days
Menstrual flow length: ≤7 days
Menstrual product use: 3–6 pads/tampons per day

significant for some, with the 95th percentile for cycle length at 50 days. By the seventh gynecologic year, cycles are shorter and less variable, with the fifth percentile for cycle length at 27 days and the 95th percentile at only 38 days. Thus, during the early years after menarche, cycles may be somewhat long because of anovulation, but 90% of cycles will be within the range of 21 to 45 days.¹⁶

ABNORMAL MENSTRUAL CYCLES

Prolonged Interval

A number of medical conditions can cause irregular or missed menses in adolescents. Although secondary amenorrhea has been defined as the absence of menses for 6 months, it is statistically uncommon for girls and adolescents to remain amenorrheic for more than 3 months or 90 days—the 95th percentile for cycle length. Thus, it is valuable to begin evaluation of secondary amenorrhea after the absence of menses for 90 days. Therefore, girls and adolescents with chaotically irregular cycles with more than 3 months between periods should be evaluated, not reassured that it is “normal” to have irregular periods in the first gynecologic years.

Irregular menses may be associated with many conditions, including pregnancy, endocrine disorders, and acquired medical conditions, because all of these conditions are associated with derangement of hypothalamic-pituitary endocrine function (see Table 2). Commonly, polycystic ovary syndrome (PCOS) causes prolonged intervals between menstrual periods, especially in patients with signs of androgen excess. The pathogenesis of PCOS is unclear; many experts believe that PCOS results from primary functional intraovarian overproduction of androgen. Others believe that excessive luteinizing hormone secretion from the pituitary gland, which stimulates a secondary ovarian androgen excess, has a role in causing the disorder. Still others hypothesize that PCOS may be related to hyperinsulinism. Whatever its origins,

PCOS accounts for 90% of hyperandrogenism among females and, by definition, is characterized by amenorrhea and oligomenorrhea. Before the diagnosis is confirmed, hyperprolactinemia, adrenal and ovarian tumors, and drug effects (such as those caused by danazol and several psychotropic medications) must be ruled out. Additionally, although uncommon in the general population, congenital adrenal hyperplasia should be ruled out by a negative 17- α -hydroxyprogesterone test result (serum concentrations less than 1000 ng/dL).²⁷ Treatment of PCOS should target menstrual irregularities, hirsutism if present, obesity, or insulin resistance.

Menstrual irregularities can be caused by disturbance of the central gonadotropin-releasing hormone pulse generator as well as by significant weight loss, strenuous exercise, substantial changes in sleeping or eating habits, and severe stressors. Menstrual disturbances also occur with chronic diseases, such as poorly controlled diabetes mellitus; with genetic and congenital conditions, such as Turner syndrome; and with other forms of gonadal dysgenesis. The diagnosis of pregnancy always should be excluded, even if the history suggests the patient has not been sexually active.

Excessive Menstrual Flow

A female’s first period usually is reported to be of medium flow, and the need for menstrual hygiene products is not typically excessive. Although experts typically report that the mean blood loss per menstrual period is 30 mL per cycle and that chronic loss of more than 80 mL is associated with anemia, this has limited clinical utility because most females are unable to measure their blood loss. However, a recent study in adult women confirms that the perception of heavy menstrual flow is correlated with a higher objective volume of blood loss.²⁸

Attempts to measure menstrual blood loss on the basis of number of pads or tampons used per day or frequency of pad changes are subject to variables such as the individual’s fastidiousness, her familiarity or comfort with menstrual hygiene products, and even variation among types and brands of pads or tampons.²⁹ Most report changing a pad approximately 3 to 6 times a day, although external constraints such as school rules and limited time between classes may make menstrual hygiene more problematic for adolescents than adults. Menstrual flow requiring changes of menstrual products every 1 to 2 hours is considered excessive, particularly when associated with flow that lasts more than 7 days at a time. This type of acute menorrhagia, although most often associated with anovulation, also has been associated with the diagnosis of hematologic problems, including von Willebrand disease and other bleeding disorders, or other serious problems, including hepatic failure and malignancy.^{30–33}

The prevalence of von Willebrand disease is 1% in the general population. Von Willebrand disease is the most

TABLE 2 Causes of Menstrual Irregularity

Pregnancy
Endocrine causes
Poorly controlled diabetes mellitus
Polycystic ovary syndrome (PCOS)
Cushing disease
Thyroid dysfunction
Premature ovarian failure
Late-onset congenital adrenal hyperplasia
Acquired conditions
Stress-related hypothalamic dysfunction
Medications
Exercise-induced amenorrhea
Eating disorders (both anorexia and bulimia)
Tumors
Ovarian tumors
Adrenal tumors
Prolactinomas

common medical disorder associated with menorrhagia at menarche.³⁴ As many as 1 in 6 girls presenting to an emergency department with acute menorrhagia may have von Willebrand disease.³⁰ Therefore, hematologic disorders should be considered in patients presenting with menorrhagia—especially those presenting acutely at menarche. Hormonal treatment, in the form of estrogen therapy, may affect hematologic factors and mask the diagnosis. Blood collection to screen for hematologic disorders should be obtained before initiating treatment. Evaluating the patient may include referral to a hematologist or a specialized hemophilia treatment center for appropriate screening.

ANTICIPATORY GUIDANCE

Because development of secondary sex characteristics begins at ages as young as 8 years, primary care clinicians should include pubertal development in their anticipatory guidance to children and parents from this age on. Clinicians should take an ongoing history and perform a complete annual examination, including the inspection of the external genitalia. It is important to educate children and parents about the usual progression of puberty. This includes the likelihood that a child’s initial breast growth may initially be unilateral and slightly tender. Breast development will likely then become bilateral, but some asymmetry is normal. Young females and their parents should understand that the progression of puberty also includes the development of pubic hair, which will increase in amount over time and become thicker and curlier. Additionally, clinicians should convey that females will likely begin to menstruate approximately 2 to 2.5 years after breast development begins, keeping in mind that recent studies have suggested that the onset of both breast development and menarche may occur slightly earlier for black girls than for white girls.³⁵ Young females should understand that menstruation is a normal part of development and should be instructed on use of feminine products and on what is considered normal menstrual flow. Ideally, both parents and clinicians can participate in this educational process.

EVALUATION

Once young females begin menstruating, evaluation of the menstrual cycle should be included with an assessment of other vital signs. By including this information with the other vital signs, clinicians emphasize the important role of menstrual patterns in reflecting overall health status. Clinicians should ask at every visit for the first date of the patient’s last menstrual period. Clinicians should convey that the menstrual cycle is from the first day of a period to the first day of the next period and may vary in length.

Both the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists

recommend preventive health visits during adolescence to begin a dialogue and establish an environment where a patient can feel good about taking responsibility for her own reproductive health and feel confident that her concerns will be addressed in a confidential setting.^{36,37} These visits are also an opportunity to provide guidance to young females and their parents on adolescent physical development based on data that define normal pubertal development, menarche, and menstrual cyclicity.³⁸ Even during visits with adult patients who interact with adolescents or have children, education about appropriate expectations and normal patterns for the adolescent menstrual cycle may be helpful guidance in the decision to consider evaluation.

Asking the patient to begin to chart her menses may be beneficial, especially if the bleeding history is too vague or considered to be inaccurate. Although uncommon, abnormalities do occur. Confirming normal internal and external genital anatomy with a pelvic examination or ultrasonography can rule out significant abnormalities. Therefore, one might consider the menstrual cycle as a type of vital sign and an indicator of other possible medical problems. Using menarche or the menstrual cycle as a sensitive vital sign adds a powerful tool to the assessment of normal hormonal development and the exclusion of serious abnormalities, such as anorexia nervosa, inflammatory bowel disease, and many other chronic illnesses. Menstrual conditions that suggest the need for further evaluation are listed in Table 3.

Because menarche is such an important milestone in physical development, it is important to be able to educate young females and their parents regarding what to expect of a first period and about the range for normal cycle length of subsequent menses. Girls who have been educated about early menstrual patterns will experience less anxiety as development progresses.¹ It is equally important for clinicians to have an understanding of bleeding patterns of young females, the ability to differentiate between normal and abnormal menstruation,

TABLE 3 Menstrual Conditions That May Require Evaluation

Menstrual periods that:
● Have not started within 3 years of thelarche
● Have not started by 13 years of age with no signs of pubertal development
● Have not started by 14 years of age with signs of hirsutism
● Have not started by 14 years of age with a history or examination suggestive of excessive exercise or eating disorder
● Have not started by 14 years of age with concerns about genital outflow tract obstruction or anomaly
● Have not started by 15 years of age
● Are regular, occurring monthly, and then become markedly irregular
● Occur more frequently than every 21 days or less frequently than every 45 days
● Occur 90 days apart even for one cycle
● Last >7 days
● Require frequent pad/tampon changes (soaking more than 1 every 1–2 hours)

and the skill to know how to evaluate the young female patient appropriately.

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