

Adolescent Diabetes: A Routine Visit?

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Case Objectives

- Appreciate the increasing prevalence of obesity and type 2 diabetes mellitus (T2DM) among adolescents in the United States.
- Understand the screening, diagnostic, and management guidelines for T2DM in adolescents.
- Appreciate the importance of rapport, confidentiality, non-verbal cues, and hidden agenda to adolescent health care and health outcome.
- Know the components and basic principles of the adolescent sexual history.
- Review some common errors in the care of adolescent patients and strategies to prevent them.

Case & Commentary: Part 1

A 15-year-old adolescent presented to her pediatrician for ongoing management of type 2 diabetes mellitus (T2DM). The girl had been overweight for most of her childhood and continued to gain weight in her early teen years. Her BMI of 29 placed her in the upper 99th percentile for her age and sex. She had presented to the clinic 18 months earlier with fatigue and polyuria. At the time, she had an elevated fasting blood sugar and hemoglobin A1c (HbA1c; a serum marker indicating elevated blood sugar levels for many months) and was diagnosed with type 2 diabetes. She was treated with long-acting insulin (glargine), short-acting insulin (aspart), and an oral agent (exenatide). This clinic visit was part of routine follow-up for her diabetes.

This patient presented with two chronic conditions of increasing prevalence among adolescents in the United States: obesity and T2DM. The Centers for Disease Control and Prevention (CDC) defines overweight and obesity in adults 19 years and older as body mass index (BMI) ≥ 25 and ≥ 30 , respectively, and in youth aged 2-19 years as BMI ≥ 85 th and ≥ 95 th percentile, respectively, for age and sex.⁽¹⁾ According to the National Health and Nutrition Examination Surveys (NHANES), obesity among adolescents aged 12-19 years increased from 5.0% in 1976-1980 to 17.6% in 2003-2006.^(2,3) While genetic susceptibility may increase the likelihood of obesity in an individual, population genetics have not

changed rapidly enough over this period to explain the nearly fourfold rise among adolescents (nor the threefold rise among younger children).(2,3) Evidence suggests that these trends are explained primarily by behavioral and environmental changes resulting in higher caloric intake and lower physical activity.(4-8)

Adolescent obesity is associated with physical, emotional, and social adversity during adolescence and with premature disability and death during adulthood.(9) Of individuals with T2DM, 80% are overweight or obese, and the prevalence of T2DM in adolescents is also increasing. A 2002-2003 multicenter study of diabetes in US youth younger than 20 years found that T2DM accounted for 35% of new cases of diabetes diagnosed in adolescents 10-19 years compared to 2% in children younger than 10 years. The female-to-male relative risk was 1.6 for T2DM, compared to 1.0 for type 1 diabetes mellitus (T1DM). The estimated incidence rates (per 100,000 person-years) of T2DM among 15- to 19-year-old youth by race/ethnicity were as follows: American Indian 49.4, Asian/Pacific Islander 22.7, African American 19.4, Hispanic 17.0, and non-Hispanic white 5.6.(10,11) A separate study of African American and Latino children younger than 17 years with newly diagnosed diabetes demonstrated more females (62% vs. 50%) and older age (13.1 years vs. 10.5 years) for T2DM than T1DM.(12)

Both T1DM and T2DM in children and adolescents usually present with symptoms of hyperglycemia (i.e., polyuria, polydipsia, weight loss, blurred vision) in the setting of glycosuria (glucose excretion in the urine). Factors associated with T2DM in children and adolescents include the following: non-white, non-European descent; age older than 10 years; Tanner stage ?2; overweight or obesity; T2DM in a first- or second-degree relative; findings or conditions associated with insulin resistance (e.g., acanthosis nigricans, dyslipidemia, hypertension, polycystic ovary syndrome [PCOS], small-for-gestational-age birthweight); and absence of islet cell or glutamic acid decarboxylase antibodies. However, no single factor can be used to differentiate types 1 and 2. For example, 15%-25% of youth with new T1DM are overweight or obese.(13) Ketosis and ketoacidosis are more common in patients with T1DM but occur in more than 30% of youth with new T2DM.(13-15) C-peptide levels and islet cell autoimmunity eventually can help distinguish types 1 and 2, but levels in the two types may overlap for up to a year following diagnosis.(13,16)

Who should be tested for diabetes? The 2009 Standards of Medical Care in Diabetes published by the American Diabetes Association (ADA) recommends that asymptomatic children and adolescents who are overweight or obese and have at least two additional risk factors for T2DM be tested with a fasting glucose level every 3 years, beginning at age 10 years or pubertal onset.(17) Additional risk factors include family history of T2DM, findings or conditions associated with insulin resistance (see above), and maternal history of diabetes or gestational diabetes. Once ADA diagnostic criteria for diabetes are met, type 2 is presumed in the patient with obesity and at least two other risk factors.(17)

Although adolescents with T2DM are treated similarly to adults, there are a few key differences. Education about diet, exercise, and glucose monitoring should begin at diagnosis for all patients and may be the only therapy for those who are asymptomatic and able to achieve glycemic control (i.e., pre-prandial blood glucose <250 mg/dL, HbA1c <9%, or ketosis). When glycemic control is achieved, the insulin can be tapered off.(13,17,18) Although metformin and insulin are the only medications for T2DM approved in the United States for patients younger than 18 years (13), another oral hypoglycemic agent typically is prescribed before insulin for adolescents with inadequate glycemic control and without ketosis. It may be added to metformin or used alone if metformin is not tolerated.

The regimen prescribed for the patient in the case presentation is both unusual and unclear. First, although metformin is the preferred pharmacotherapy for this patient, no comment is made of past or current use. Second, while insulin glargine has demonstrated effectiveness in adults with T2DM, it is best used with metformin to boost insulin sensitivity.^(13,19) Third, exenatide, described as an oral agent in the case presentation, is available only for subcutaneous administration; is indicated for adjunctive therapy with metformin, a sulfonylurea, or a thiazolidinedione; is not approved for use in patients younger than 18 years; and is associated with gastrointestinal symptoms in up to 40% of adults.⁽²⁰⁾ Fatalities from acute, fulminant pancreatitis have been reported among patients using exenatide. It therefore should be discontinued immediately if pancreatitis or unexplained abdominal pain develops.

Case & Commentary: Part 2

The girl had often been a challenging historian, providing conflicting and sometimes vague answers to questions. On this visit, she complained of intermittent abdominal pain for a few days but could not be more specific. She also complained that her acne had worsened, and she requested treatment for it. As part of screening for polycystic ovarian disease, she stated that her periods were always regular and she had no new or excessive hair in a male pattern of distribution. However, she did mention that, 2 days earlier, she had accidentally "peed my pants" but did not know why. The rest of the review of systems was unremarkable.

On physical examination, she was a quiet and depressed morbidly obese girl in no distress. She had acanthosis nigricans on her neck, groin, and axilla and had severe acne on her face. The examination of her abdomen was limited by obesity, but she was non-tender and there were no masses or enlarged organs palpated. The rest of the examination was unremarkable. On her laboratory studies, her HbA1c remained elevated. She was prescribed a topical cream for her acne, and her insulin was increased slightly. She was told to watch her menstrual cycles closely and call back if they were noted to be irregular or if the abdominal pain worsened.

The following day, the pediatrician's office received a call from an obstetrician reporting that the patient had delivered a healthy baby girl by Caesarian section in the early hours of the morning. The gestational age was thought to be around 34 weeks. The pediatrician realized that the "abdominal pain" may have been contractions and that the incontinence may have been amniotic fluid ("water breaking"). On further history, the adolescent girl stated that she was raped 7 months earlier and was afraid to tell anyone. She and her family were provided appropriate counseling and resources.

The remarkable events that unfold in Part 2 quickly turn our attention away from T2DM. The patient description in the first sentence prepares us for, and may bias us toward, discounting the nonspecific complaints that follow. The challenge for all providers who care for adolescent patients is to consider prevalent issues of adolescence that may underlie the patient's demeanor. Reticeance, conflicting information, and symptoms without apparent explanation suggest an adolescent who is unable or unwilling to discuss symptoms, ask questions, or describe events that are frightening, confusing, or embarrassing. Any concerning or unusual behavior during a visit may cue the clinician to explore those aspects of the

adolescent history summarized by the mnemonic "HEADSS": *Home*, *Education* (i.e., school), *Activities* (e.g., peers, work), *Depressive* or other symptoms, *Sexuality*, and *Substance* use. On the first visit and periodically thereafter, the clinician should discuss confidentiality with the patient and parent(s).

Adolescents who are assured conditional confidentiality (i.e., confidentiality will be protected unless the risk of harm is high) are more likely to disclose personal information about sexuality, mental health, and substance use than those with whom it is not discussed.⁽²¹⁾

We are not told explicitly whether during this or prior visits the clinician had taken an appropriate sexual history. CDC practice guidelines call for a sexual history and testing for sexually transmitted infections and pregnancy in all adolescent females with unexplained abdominal pain and urinary symptoms.⁽²²⁾ Despite these recommendations, a 2009 review of emergency department visits by adolescents with urinary complaints revealed that 30% of records did not document a sexual history.⁽²³⁾ Even when physicians believe it is pertinent to the patient's presentation, 24% in one survey admitted they would not obtain a sexual history.⁽²⁴⁾

A sensitive and thoughtful sexual history in a confidential setting may have revealed this patient's prior sexual assault and led to the pregnancy diagnosis. The following principles can help guide discussion of sexuality with an adolescent patient: confidentiality, within the limits of state law and patient safety; normalization of the topic as a routine component of health care; development of interview techniques that convey clinician comfort with the topic; respect for sexual diversity, including sexual orientation; avoidance of jargon or terms that may be misinterpreted (e.g., "sexual activity"); and knowledge about local resources related to adolescent sexual health. The clinician should be prepared to ask specific, usually open-ended questions pertaining to oral, vaginal, and anal intercourse; age of first intercourse and number of lifetime partners; use of condoms and other birth control; and sex by force or coercion, or in exchange for money, food, or shelter.

In addition to the unasked questions noted above, the case illustrates the disjunctions that may exist between clinician questions and adolescent answers or between past history and current findings on physical examination. An adolescent who has always had menstrual periods of varying interval and duration may perceive her cycles as regular. An adolescent with a family history of PCOS may not perceive her pattern or quantity of hair growth as different, excessive, or new. The BMI of 29 noted in Part 1 is below the threshold for adult obesity, yet the patient is described as "morbidly obese" on physical examination in Part 2. Although there is no firm definition of morbid obesity in children and adolescents, the term typically refers to BMI greater than 35. This discrepancy suggests that something besides adiposity is contributing to this patient's appearance.

Teen pregnancy and childbearing are prevalent and increasing in the United States. After a 30% decline between 1991 and 2005, the rates are again on the rise.⁽²⁵⁻²⁷⁾ Pregnancy rates in 2007 per 1000 females aged 15-19 years varied nearly threefold by race/ethnicity (Hispanic 132.8, black 128, white 45.2).⁽²⁷⁾ As shown in the [Table](#), the proportion of mothers with third-trimester or no prenatal care was 15.6% for mothers aged 10-14 years compared with 4.7% for those 20-24 years, and the proportions with preterm delivery were 22.2% and 12.7%, respectively.⁽²⁷⁾ This patient delivered prematurely at 34 weeks.

One may wonder if the adolescent in this case was aware of her pregnancy. Adolescents are less likely than adults to recognize or acknowledge pregnancy, even when seeking care for pregnancy-related symptoms. A study of pregnant adolescents younger than 16 years seen in the emergency department of a university-affiliated hospital revealed that 91% of those in whom pregnancy was diagnosed presented with abdominal or genitourinary symptoms, compared with 22% of those in whom pregnancy was missed. Of those adolescents in whom pregnancy was diagnosed, less than 10% had mentioned the possibility of pregnancy, and 10.5% denied history of sexual intercourse.(28)

Rates of sexual abuse in the United States peak during adolescence. In 2004-2006, there were 152.6 and 163.7 emergency department visits for sexual assault per 100,000 females aged 15-17 years and 18-19 years, respectively.(27) A 2009 meta-analysis of 21 studies revealed that a history of childhood sexual abuse increased the odds of teen pregnancy by 2.2-fold and estimated that 45% of pregnant teens have a history of sexual abuse.(29)

The issues with which this adolescent presents are disturbingly common yet often unrecognized. Remaining alert to population trends and individual cues may help us care for adolescents with greater sensitivity, efficiency, and effectiveness.

Take-Home Points

- The rates of overweight, obesity, and T2DM are increasing among US adolescents. The incidence of T2DM in children and adolescents is highest in 15- to 19-year-old females who are Native American, Asian/Pacific Islander, African American, and Hispanic.
- The management of T2DM in adolescents begins with education about diet, exercise, body weight, and glucose monitoring. Metformin and insulin are the only medications for T2DM approved in the United States for patients younger than 18 years.
- The sexual history is an essential component of adolescent health care. Principles that facilitate the history include confidentiality, clinician comfort, respect for sexual diversity, avoidance of jargon, and knowledge about local resources related to adolescent sexual health.
- Adolescents are less likely than adults to recognize or acknowledge pregnancy, even when seeking care for pregnancy-related symptoms.
- Sexual abuse in the United States peaks during adolescence and is associated with a twofold increased risk of pregnancy.

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Table

Table. Pregnancies, Births, and Sexual Violence among Females Aged 10-24 Years—National Vital Statistics System and Multiple Surveillance Studies, United States, 2004-2006.(27)

Characteristic	Age Group (Years)			
	10-14	15-17	18-19	20-24
Estimated no. of pregnancies	16,000	252,000	477,000	1,665,000
No. of births	6396	138,943	296,493	1,080,437
No prenatal care (%)	3.8	2.0	1.5	1.3
Third-trimester or no prenatal care (%)	15.6	7.6	5.8	4.7
Preterm (22.2	14.7		12.7
Pregnancy unwanted or mistimed at conception as reported by mothers within 5 years of delivery and stratified by age at delivery (%)		88.0	71.4	44.7
No. of emergency department (ED) visits attributed to nonfatal sexual assault injuries	27,469	28,388	19,777	29,553
Rate per 100,000 population of ED visits for nonfatal sexual assault injuries (CI)	90.0 (59.3- 120.7)	152.6 (92.8- 212.4)	163.7 (101.7- 225.6)	97.1 (59.9- 134.26)

Source: Gavin L, MacKay AP, Brown K, et al. Sexual and reproductive health of persons aged 10–24 years—United States, 2002–2007. *MMWR Surveill Summ.* 2009;58:1-58.

<http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5806a1.htm#tab4p>

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