Management of Children & Adolescents with Type I Diabetes mellitus

**CARE MANAGEMENT OVERVIEW**

Diabetes mellitus (DM) is a group of metabolic diseases in which a person has high blood sugar. This high blood sugar produces the symptoms of frequent urination, increased thirst, and increased hunger. Untreated, diabetes can cause many complications. Acute complications include diabetic ketoacidosis (high blood sugar) and/or hypoglycemia (low blood sugar). Serious long-term complications include heart disease, kidney failure, and small blood vessel disease resulting in circulation problems, leading to poor wound healing, and damage to the retina (and potential blindness).

It is estimated that diabetes affects 382 million people worldwide, and the prevalence is increasing in every country. Among adults in the United States, the estimated overall prevalence of diabetes ranges from 5.8 to 12.9 percent (median 8.4 percent). Using data from a national survey for people aged 20 years or older, the prevalence of type 2 diabetes in the United States from 2007 to 2009, was as follows: Native Americans (as high as 33.5%), Non-Hispanic Blacks (12.6%), Hispanics (11.8%), Asian Americans (8.4%), and Non-Hispanic Whites (7.1%).

In the early 1990s, type 2 diabetes represented about 3 percent of pediatric diabetes in the United States. By 2003, type 2 diabetes represented about 20 percent of pediatric diabetes, and, depending on locale, nearly half of the cases of diabetes among adolescents 15 to 19 years of age.

**Major Diabetes Complications**

- Retinopathy - damage to blood vessels in the retina.
- Cerebrovascular disease - a condition that affects the circulation of blood to the brain.
- Coronary heart disease - a disease in which plaque builds up inside the coronary arteries.
- Nephropathy – kidney damage.
- Peripheral vascular disease - the obstruction of large arteries, often affecting the lower limbs.
- Neuropathy - nerve damage in the peripheral nervous system.
- Ulceration and amputation - for diabetic foot.

**Normal Regulation of Glucose**

Normally, the level of glucose in the blood is carefully regulated by insulin and glucagon. Glucagon raises blood glucose levels and insulin lowers blood glucose levels. After a meal, blood glucose levels rise and the glucose enters the pancreatic beta-cells. In the pancreatic beta-cells, glucose sensors trigger a sequence of events that releases insulin. The release of insulin lowers blood sugar in two ways: it decreases glucose production by the liver or it increases glucose uptake by skeletal muscle and fatty tissues.

Glucagon is a naturally occurring hormone that is also produced in the pancreas. The main function of glucagon is to react to a situation where there is a low level of blood glucose present. The release of glucagon into the bloodstream helps to
restore blood glucose levels back to a point that is considered acceptable for the general function of the body.

The Liver and Diabetes

The liver acts as the body’s glucose (or fuel) reservoir, and helps to keep circulating blood sugar levels and other body fuels steady and constant. The liver both stores and manufactures glucose depending upon the body’s need. The need to store or release glucose is primarily signaled by the hormones insulin and glucagon. During a meal, the liver stores glucose as glycogen for a later time when the body needs it. High levels of insulin and suppressed levels of glucagon during a meal promote storage of glucose as glycogen. Depending on whether you need more or less glucose, your body will convert glycogen to glucose, or convert glucose into glycogen and store it in the liver.

Management of the Three Types of Diabetes

Diabetes is due to either the pancreas not producing enough insulin, or because the body does not respond properly to the insulin that is produced. Click each tab on the left to find out more about the three types of diabetes.

**Type 1.** Results from the body's failure to produce insulin. This form was previously referred to as "insulin-dependent diabetes mellitus" (IDDM) or "juvenile diabetes." Must be managed with insulin as the pancreas is no longer able to manufacture a sufficient amount of insulin. A pancreas transplant may be considered for people with type 1 diabetes who have severe complications of their disease.

**Type 2.** Results from insulin resistance, a condition in which cells fail to use insulin properly. This form was previously referred to as non-insulin-dependent diabetes mellitus (NIDDM) or "adult-onset diabetes". May be treated with medications, with or without insulin. Bariatric surgery (gastric bypass, lap-band or sleeve procedures) has been successful in many with severe obesity and type 2 diabetes management.

**Gestational.** The third main form and occurs when pregnant women, without a previous diagnosis of diabetes, develop a high blood glucose level. Gestational diabetes usually resolves after the birth of the baby.

Prevention and treatment often involves:
- healthy diet
- physical exercise
- avoidance of tobacco
- maintaining an appropriate body weight (BMI)

Because diabetics have an increased risk for myocardial infarction and stroke, blood pressure control is also important. Due to circulatory problems in diabetics, wounds do not heal as well and skin ulcers can develop. For this reason, proper foot care is also important for people with the disease.

Tests for Diabetes

**Hemoglobin A1c (glycated hemoglobin)** is a form of hemoglobin that measures the average blood glucose level over periods of time. Normal levels of glucose produce a normal amount of glycated hemoglobin. As the average level of blood glucose increases Hemoglobin A1c increases in a predictable way.

**Fasting Plasma Glucose (FPG)** is a measured blood glucose level after 8 hours of no caloric intake.

**Oral Glucose Tolerance Test (OGTT)** tracks blood glucose levels over two hours following a glucose load.
DIAGNOSIS AND MANAGEMENT OF TYPE I DIABETES

The American Diabetes Association (ADA)\(^1\) recommends that testing for diabetes mellitus (DM) should start at age 10 (or at onset of puberty) and should continue every three years if the following criteria is met:

- Overweight (BMI >85th percentile for age and sex; weight for height >85th percentile; or weight >120% of ideal for height) \textbf{AND} two of the following risk factors:
  - Family history of type 2 diabetes in first- or second-degree relative
  - Race/ethnicity (Native American, African American, Latino, Asian American, Pacific Islander)
  - Signs of insulin resistance or conditions associated with insulin resistance (acanthosis nigricans, hypertension, dyslipidemia, polycystic ovary syndrome, or small for gestational age birthweight)
  - Maternal history of diabetes or GDM during the child’s gestation

The ADA\(^1\) also notes the increase of type 2 diabetes is adolescents in the last decade, particularly within minority populations while the disease is rare within the general population.

**Components of the Initial Visit\(^1\)**

**Medical History**
- Symptoms, and results of laboratory tests, related to the diagnosis of DM
- Recent or current infections or illnesses
- Previous growth records, including growth chart, and pubertal development
- Family history of DM, diabetic complications, and other endocrine disorders
- Current or recent use of medications that may affect blood glucose levels (e.g., glucocorticoids, chemotherapeutic agents, atypical antipsychotics, etc.)
- History and treatment of other conditions (e.g., endocrine and eating disorders, diseases known to cause secondary DM such as cystic fibrosis)
- Lifestyle, cultural, psychosocial, educational, and economic factors that might influence the management of DM
- Use of tobacco, alcohol, and/or recreational drugs
- Physical activity and exercise
- Contraception and sexual activity (if applicable)
- Risk factors for atherosclerosis (e.g., smoking, hypertension, obesity, dyslipidemia, and family history)
- Review of Systems (ROS) should include gastrointestinal function (including symptoms of celiac disease) and symptoms of other endocrine disorders (especially hypothyroidism and Addison’s disease)
- Prior hemoglobin A1c records
- Details of treatment programs (e.g., nutrition/diabetes self-management education, attitudes, health beliefs)
- Results of past testing for chronic diabetic complications (e.g., ophthalmologic, microalbuminemia screenings)
- Frequency, severity, and cause of acute complications such as ketoacidosis and hypoglycemia
- Current treatment, including medication(s), meal plan, results of glucose monitoring and patient’s use of own data

**Physical Examination**
- Height, weight, and BMI calculation (and comparison to age and sex-specific norms) and previous measurements
- Blood pressure determination and comparison to age-, sex-, and height-related norms
- Yearly funduscopic examination by an eye-care professional
- Oral examination
- Thyroid palpation
- Cardiac examination
- Abdominal examination (e.g., for hepatomegaly)
• Staging of sexual maturation
• Evaluation of pulses
• Hand/finger examination
• Foot examination
• Skin examination (for Acanthosis nigricans, SMBG testing sites, insulin-injection sites, etc.)
• Neurological examination

Laboratory Evaluation

If clinical evidence for DKA
• Serum glucose, electrolytes, arterial or venous pH, serum or urine ketones

If signs and symptoms are suggestive of type II DM
• Evidence of islet autoimmunity (e.g., islet cell [ICA] 512 or IA-2, GAD, and insulin autoantibodies)
• Evidence of β-cell secretory capacity (e.g., C-peptide levels) after 1 year, if diagnosis is in doubt
• A1C
• Lipid profile
• Annual screening for microalbuminuria
• Thyroid-stimulating hormone (TSH) levels
• Celiac antibodies at diagnosis or initial visit if not done previously

Referrals and Screening
• Yearly ophthalmologic evaluation
• Medical nutrition therapy by a registered dietitian; part of initial team education and on referral (as needed) - generally requires a series of sessions over the initial 3 months after diagnosis, then at least annually, with young children requiring more frequent re-evaluations
• Diabetes nurse educator; part of initial team education, or referral as needed at diagnosis - generally requires a series of sessions during the initial 3 months of diagnosis, then at least annual re-education
• Behavioral specialist; part of initial team education, or referral as needed (optimally for evaluation and counseling of patient and family at diagnosis) then as indicated to enhance support and empowerment to maintain family involvement in DM care tasks and to identify/discuss ways to overcome barriers in successful DM management

Depression screening annually for children ≥10 years of age, with a specialist referral when indicated.

Criteria for the Diagnosis of Diabetes mellitus (DM)\(^1\)

1. Symptoms of DM in association with a significantly elevated random plasma glucose ≥200 mg/dl (11.1 mmol/L). Random is defined as any time of day; without regard to the time period since the last meal. The classic symptoms of DM include: polyuria, polydipsia, and unexplained weight loss. OR;
2. A fasting plasma glucose ≥126 mg/dl (7.0 mmol/L) OR;
3. A two (2)-hour plasma glucose ≥200 mg/dl (11.1 mmol/L) during an oral glucose tolerance test (GTT). The GTT should be performed, as described by the World Health Organization (WHO), using a glucose load of 75 grams of anhydrous glucose dissolved in water or 1.75 gm/kg body wt, if the weight is <40 pounds (18 kg).

In the absence of unequivocal hyperglycemia, these diagnoses should be confirmed by repeat laboratory testing on a different day. The oral GTT is not recommended for routine clinical use, but may be required in the evaluation of patients when DM is still suspected despite a normal fasting plasma glucose level.

<table>
<thead>
<tr>
<th>Values by age</th>
<th>Plasma blood glucose goal range (mg/dl)</th>
<th>A1C</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toddlers and preschoolers (&lt;6 years)</td>
<td>100–180</td>
<td>110–200</td>
<td>&lt;8.5% (but &gt;7.5%)</td>
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</table>

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SPECIAL CONSIDERATIONS

Due to the obesity epidemic among children and adolescents, the American Academy of Pediatrics (AAP) convened a Subcommittee on Management of Type 2 Diabetes Mellitus (T2DM) in Children and Adolescents with the support of the American Diabetes Association, the Pediatric Endocrine Society, the American Academy of Family Physicians, and the Academy of Nutrition and Dietetics (2013). Key action statements for children and adolescents with T2DM:2

1. Ensure insulin therapy is initiated for those who are ketotic or in diabetic ketoacidosis and in whom the distinction between T1DM and T2DM is unclear; and should initiate insulin therapy for patients:
   a. who have random venous or plasma BG concentrations ≥250 mg/dL; OR,
   b. whose HbA1c is >9%.

2. In all other instances, initiate a lifestyle modification program, including nutrition and physical activity, and start metformin as first-line therapy for children and adolescents at the time of diagnosis of T2DM.

3. Monitor HbA1c concentrations every 3 months; intensify treatment if BG and HbA1c goals are not being met.

4. Advise patients to monitor finger-stick BG concentrations in those who:
   a. are taking insulin or other medications with a risk of hypoglycemia; OR,
   b. are initiating or changing their diabetes treatment regimen; OR,
   c. have not met treatment goals; OR,
   d. have intercurrent illnesses.

5. Incorporate the Academy of Nutrition and Dietetics’ Pediatric Weight Management Evidence-Based Nutrition Practice Guidelines in nutrition counseling both at the time of diagnosis and as part of ongoing management.

6. Encourage children and adolescents with T2DM to engage in moderate-to-vigorous exercise for at least 60 minutes daily and to limit nonacademic screen time to less than 2 hours per day.

Issues in Transition Between Pediatric and Adult Care3

Providers should pay careful attention to issues that can arise during the critical transition period:

- Differences between pediatric and adult care
- Poor control of glycemia and other risk factors
- Loss to follow-up
- Increased risk for acute complications
- Psychosocial issues
- Sexual and reproductive health issues
- Alcohol, smoking and drug abuse
- Emergence of signs of chronic diabetes complications

The following are ADA recommendations that providers should note during the transition period:

1. Prepare the teen patient for upcoming transition at least one year prior.
2. Preparation should include a direct focus on diabetes self-management education including the patient and parent(s); the goal is to gradually transfer diabetes care responsibilities from the parent or guardian to the teen. Areas of focus include glucose self-monitoring and insulin administration and should include scheduling appointments and ensuring a proper supply of medications and supplies.

3. Inform patients of the differences between pediatric and adult providers in their approaches to care, as well as education regarding health insurance options and how to maintain coverage.

4. Provide a written summary to the patient and future adult care provider including an active problem list, compilation of medications, assessment of diabetes self-care skills, summary of past glycemic control and diabetes related comorbidities, as well as a summary of any mental health problems and referrals.

### MAJOR DEVELOPMENTAL ISSUES AND THEIR EFFECT ON DM IN CHILDREN AND ADOLESCENTS

<table>
<thead>
<tr>
<th>Developmental Stage (approx ages)</th>
<th>Normal developmental tasks</th>
<th>Type IDM management priorities</th>
<th>Family issues in type I DM management</th>
</tr>
</thead>
</table>
| **Infancy** (0–12 months)        | Developing a trusting relationship / “bonding” with primary caregiver(s) | • Preventing and treating hypoglycemia  
• Avoiding extreme fluctuations in blood glucose levels | • Coping with stress  
• Sharing the “burden of care” to avoid parent burnout |
| **Toddler** (13–36 months)       | Developing a sense of mastery and autonomy | • Preventing and treating hypoglycemia  
• Avoiding extreme fluctuations in blood glucose levels due to irregular food intake | • Establishing a schedule  
• Managing the “picky eater” • Setting limits and coping with toddler’s lack of cooperation with regimen  
• Sharing the burden of care |
| **Preschooler and early elementary school-age (3–7 years)** | Developing initiative in activities and confidence in self | • Preventing and treating hypoglycemia  
• Unpredictable appetite and activity  
• Positive reinforcement for cooperation with regimen  
• Trusting other caregivers with DM management | • Reassuring child that DM is no one’s fault  
• Educating other caregivers about DM management |
| **Older elementary school-age (8–11 years)** | • Developing skills in athletic, cognitive, artistic, social areas  
• Consolidating self-esteem with respect to the peer group | • Making DM regimen flexible to allow for participation in school/peer activities  
• Child learning short- and long-term benefits of optimal control | • Maintaining parental involvement in insulin and blood glucose monitoring tasks while allowing for independent self-care for “special occasions”  
• Continue to educate school and other caregivers |
| **Early adolescence (12–15 years)** | • Managing body changes  
• Developing a strong sense of self-identity | • Managing increased insulin requirements during puberty  
• DM Management and blood glucose control become more difficult  
• Weight and body image concerns | • Renegotiating parents and teen’s roles in diabetes management to be acceptable to both  
• Learning coping skills to enhance ability to self-manage  
• Preventing and intervening with diabetes-related family conflict  
• Monitoring for signs of depression, learning disorders, risky behaviors |
| **Later adolescence (16–19 years)** | Establishing a sense of identity after high school (decision about location, social issues, work, education) | • Begin discussion of the transition to a new DM team  
• Integrating DM into new lifestyle | • Supporting the transition to independence  
• Learning coping skills to enhance ability to self-manage  
• Preventing and intervening with diabetes-related family conflict  
• Monitoring for signs of depression, eating disorders, risky behaviors |
HEDIS AND STAR MEASURES

CMS and NCQA have not published measures for diabetes in children.

RELATED CLINICAL PRACTICE GUIDELINES

In addition to the information contained in this document, please reference the following CPGs: Cholesterol Management (HS-1005), Diabetes in Adults (HS-1009), and Hypertension (HS-1010).

REFERENCES


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MEDICAL POLICY COMMITTEE HISTORY AND REVISIONS

<table>
<thead>
<tr>
<th>Date</th>
<th>Medical Policy Committee History and Revisions</th>
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<tr>
<td>2/5/2015</td>
<td>Approved by MPC. Addition of Care Management Items.</td>
</tr>
<tr>
<td>5/2/2013</td>
<td>Approved by MPC. Include Key Action Statements (Copeland, &amp; et al., 2013).</td>
</tr>
<tr>
<td>6/7/2012</td>
<td>Approved by MPC. Added criteria from ADA (2010); transition between pediatric and adult care.</td>
</tr>
<tr>
<td>12/1/2011</td>
<td>New template design approved by MPC.</td>
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