Managing Hypoglycemia in the School Setting

By Alison B. Evert, RD, CDE

The health, safety, and educational progress of school children depend on the collaboration and cooperation among parents, care givers, school personnel, and the school nurse. This is especially true for children who have diabetes. In this case, care givers quickly learn that good blood glucose control is imperative to help reduce the risk of the devastating long-term complications of diabetes, often a parent's biggest fear. Safety concerns for school children with diabetes center on minimizing or reducing the likelihood of acute complications of diabetes, including hypoglycemia (low blood glucose) and hyperglycemia (high blood glucose). This article will focus on managing hypoglycemia, which often cannot be prevented, and is one of the major health risks to school children with diabetes.

In a recent position statement by the American Diabetes Association (ADA), entitled *Care of Children and Adolescents with Type 1 Diabetes* (http://care.diabetesjournals.org/cgi/content/full/28/1/186), near-normal glucose control is recommended for children (ADA, 2005). However, achieving good blood glucose control is not without risks, the greatest being hypoglycemia. On a daily basis, parents and care givers must carefully balance their child's glycemic control with their child's individual vulnerability to hypoglycemia (ADA, 2005).Young children have difficulty recognizing hypoglycemia and therefore care givers and school personnel must be educated about signs and symptoms of this acute complication. To address the metabolic needs of the developing child, the ADA has developed age-specific glycemic goals that can be used together with the healthcare plan provided by the child's healthcare team (see Table 1).

Hypoglycemia usually can be treated easily and effectively. Early recognition of its symptoms and prompt treatment are necessary for preventing severely low blood glucose levels. Severe hypoglycemia that is not treated promptly can lead to unconsciousness and convulsions, which can be life threatening. During the hours a child is in school, overseeing this careful balance in blood glucose levels is transitioned from parent/care giver to school personnel and the school nurse. Therefore, the school nurse and other school personnel must be familiar with the symptoms and treatment of hypoglycemia so that an urgent problem can be handled appropriately. If this is the case and hypoglycemia is severe, the school nurse or trained diabetes personnel must respond immediately.

The remainder of the article provides definitions, causes, symptoms, and treatment of hypoglycemia. In addition, you will find practical tips for dealing with hypoglycemia during the school day.

What is Hypoglycemia?

Hypoglycemia occurs when blood glucose levels fall below optimal levels (Umpierrez et al., 2002; Arnold, 2002). The level at which hypoglycemic symptoms occur varies for the individual child or adolescent. Cognitive impairment typically occurs at blood glucose concentrations less than 60 mg/dL (Ryan et al., 1990). A single episode of hypoglycemia lowers the plasma glucose threshold for autonomic activation, resulting in increased potential for further hypoglycemic events (ADA, 2005; Heller & Crye, 1991). Repeated episodes of hypoglycemia can result in abnormality of the counter-regulatory system, with failure of adrenergic responses (Betschart, 2001). When hypoglycemia occurs, the blood glucose level should be monitored more often to reduce the likelihood of recurrent episodes of hypoglycemia. Recent data suggest that children who have experienced severe hypoglycemia earlier in life may have some learning difficulties, in particular delayed spatial memory (Hershey et al., 1999).

Potential Causes

Children can experience symptoms of hypoglycemia or low blood glucose levels as a result of increased levels of physical activity, delayed meals or snacks, insulin or oral diabetes medications, illness, or hormonal influence. One of the greatest frustrations for the child, care givers and school personnel can be the occurrence of hypoglycemia despite scrupulous efforts to maintain optimal glycemic control. Sometimes the cause is simply unknown.

What Are the Symptoms of Hypoglycemia?

Hypoglycemia may be categorized according to the symptoms the child is displaying (ADA, 2005; Betschart, 2001):

- **Mild hypoglycemia** — dizziness, hunger, weakness, trouble concentrating, shakiness, tingling in extremities, sweating, fatigue, pale skin, palpitations, and occasionally headache and behavior changes such as irritability and anxiety. As noted previously, a young child may not recognize his or her symptoms of low blood glucose and may need assistance to treat it.
- **Moderate hypoglycemia** — May be associated with drowsiness, confusion, or aggressiveness. Someone else is usually required to administer treatment at this stage.
- **Severe hypoglycemia** — Symptoms are

associated with altered states of consciousness and may include the inability to take treatment orally due to disorientation, or even coma or seizures. Treatment at this stage requires glucagon or intravenous glucose.

How is Hypoglycemia Treated?

Mild to Moderate – If blood glucose level is 51–70 mg/dL

- Teach "the rule of 15" – treat low blood glucose levels with 15 g rapidly absorbed carbohydrate (e.g., 3 glucose tablets or 4 oz. fruit juice) and recheck blood glucose in 15 minutes. See Table 2 for sources of carbohydrate for treatment of low blood glucose (Evert, 2005).
- If blood glucose level is still suboptimal, treat again with 15 g carbohydrate and check blood glucose value in 15 minutes.
- The child should eat a meal or snack within the next 30 to 60 minutes to help prevent another episode of hypoglycemia.

Severe – If blood glucose level is under 40–50 mg/dL

- Extremely low glucose levels can cause loss of consciousness and/or convulsions. An unconscious child should not be given food or drink due to the risk of aspiration. The child should be positioned on his or her side to prevent choking.
- If the child is unconscious, call 911, or if indicated in child's Diabetes Medical Management Plan, the school nurse or other trained diabetes personnel should immediately administer an injection of glucagon (NDEP, 2003). Regulations about the use of glucagon vary in the school setting state by state (NDEP, 2003; ADA, 2005).
- The child's parents should be notified immediately as well.
- A glucagon dose of 30 mcg/kg body weight injected subcutaneously to a maximum dose of 1 mg will increase blood glucose levels within 5 to 15 minutes. Nausea and vomiting are frequent side effects of a glucagon injection (ADA, 2005). A lower dose of 10 mcg/kg body weight is associated with less nausea, but also a lesser glycemic response (Aman & Wranne, 1998). The dose of glucagon will depend on body weight and should be specified by the healthcare provider and in the child's Diabetes Medical Management Plan. The dose should be reviewed by the healthcare provider on a regular basis.
- The child's parents or care givers should supply the school with a glucagon kit. The expiration date on the glucagon kit should be checked regularly and should be replaced if it is expired.
- Glucagon may be stored at room temperature.

Additional Tips for Treatment of Hypoglycemia During the School Day (Evert, 2005)

- Refer to Figure 1 (Quick Reference Emergency Plan for the Student with Diabetes – Hypoglycemia (Low Blood Sugar). This handy reference was developed by the National Diabetes Education Program. It is part of a more complete resource, *Helping the Student with Diabetes – A Guide for School Personnel* (NDEP, 2004). Many schools have a copy of this form or a similar form in the school nurse's office as well as the copy in the child's classroom. Substitute teachers

TABLE 1

Blood Glucose Goals for Children

Note: Individual goals may differ from the ones shown. Obtain specific guidelines from the child's healthcare provider.

Age	Before Meals	Bedtime Goal	A1c
Toddlers and Preschoolers (< 6 years)	100-180 mg/dL	110-200 mg/dL	< 8.5 (but > 7.5) %
School-age (6-12 years)	90-180 mg/dL	100-180 mg/dL	< 8%
Adolescents and young adults (13-19 years)	90-130 mg/dL	90-150 mg/dL	< 7.5%*

Key concepts in setting glycemic goals:

- Goals should be individualized and lower goals may be reasonable based on benefit-risk assessment.
- Blood glucose goals should be higher in those listed above in children with frequent hypoglycemia or hypoglycemia unawareness.
- Postprandial blood glucose values should be measured when there is a disparity between preprandial blood glucose values and A1c levels.

*A lower goal (< 7.0%) is reasonable if it can be achieved without excessive hypoglycemia.

From ADA, 2005

TABLE 2

Sources of Carbohydrate for Treatment of Low Blood Glucose

Food	Age 5 years or younger (10 grams of carbohydrate)	Age 6-10 years (10-15 grams of carbohydrate)	Age 11 years or older (15 grams of carbohydrate)
Glucose tablets (1 tablet = about 5 grams of carbohydrate; check the label)	2	2-3	3-4
Sugar (1 teaspoon = 4 grams of carbohydrate)	2 teaspoons	3-4 teaspoons	4 teaspoons
Orange or apple juice (½ cup = 15 grams of carbohydrate)	⅓ cup	⅓-½ cup	½ cup
Regular soda pop (1 ounce = 3 grams of carbohydrate)	3 ounces	3-5 ounces	5 ounces
Milk (nonfat or 1%) (1 cup = 12 grams of carbohydrate)	½ cup	½ -1 cup	1 ¼ cup
Lifesavers (1 piece = 2.5 grams carbohydrate)	4 pieces	4-6 pieces	6 pieces
Sweet Tarts (1 piece = 1.7 grams carbohydrate)	6 pieces	6-8 pieces	8 pieces
Skittles (1 piece = 0.9 gram)	10 pieces	10-15 pieces	15 pieces
Raisins (1 tablespoon = 7½ grams of carbohydrate)	1– 1 ½ tablespoons	2 tablespoons	2 tablespoons
Fruit Roll-Ups (1 packet = approximately 15 grams of carbohydrate)	⅔ packet	⅔ – 1 packet	1 packet

Table reprinted with permission from the American Dietetic Association:
Evert, AB, Hess-Fischl, A. *Pediatric Diabetes*; Chicago, IL. American Dietetic Association, 2005.

often find this form not only helpful to identify the child with diabetes in the class, but also to review the procedure for dealing with hypoglycemia for the individual student.

- Ask students/care givers on an annual basis, or if they are new to your school, if they have experienced a severe hypoglycemic reaction and if the child lost consciousness. If yes, when was the date the last event occurred? Some students may need a higher level of observation due to a hypoglycemic unawareness. This information should ideally be kept in the student's Diabetes Medical Management Plan and it would also be helpful to share with the student's teacher.
- Youth should not be left unattended or be allowed to walk unaccompanied to receive treatment for hypoglycemia. Ideally, the child should not return to class or resume classroom activities or engage in physical activity until the blood glucose level is greater than 100 mg/dL.
- Encourage the use of low-fat carbohydrate foods to treat hypoglycemia, since fat delays the emptying of the stomach; high-fat foods can delay the recovery

FIGURE 1

NDEPs Quick Reference Emergency Plan for the Student with Diabetes - Hypoglycemia (Low Blood Sugar)

Quick Reference Emergency Plan

for a Student with Diabetes

Hypoglycemia (Low Blood Sugar)

Photo

Student's Name _____

Grade/Teacher _____ Date of Plan _____

Emergency Contact Information:

Mother/Guardian			**Father/Guardian**		
Home phone	Work phone	Cell	Home phone	Work phone	Cell

School Nurse/Trained Diabetes Personnel _____ **Contact Number(s)** _____

Never send a child with suspected low blood sugar anywhere alone.

Causes of Hypoglycemia
- Too much insulin
- Missed food
- Delayed food
- Too much or too intense exercise
- Unscheduled exercise

Onset
- Sudden

Symptoms

Mild
- Hunger
- Shakiness
- Weakness
- Paleness
- Anxiety
- Irritability
- Dizziness
- Sweating
- Drowsiness
- Personality change
- Inability to concentrate
- Other: _____

Circle student's usual symptoms.

Moderate
- Headache
- Behavior change
- Poor coordination
- Blurry vision
- Weakness
- Slurred Speech
- Confusion
- Other _____

Circle student's usual symptoms.

Severe
- Loss of consciousness
- Seizure
- Inability to swallow

Circle student's usual symptoms.

Actions Needed

Notify School Nurse or Trained Diabetes Personnel. If possible, check blood sugar, per Diabetes Medical Management Plan. When in doubt, always TREAT FOR HYPOGLYCEMIA.

Mild
- Student may/may not treat self.
- Provide quick-sugar source.
  3-4 glucose tablets
  or
  4 oz. juice
  or
  6 oz. regular soda
  or
  3 teaspoons of glucose gel
- Wait 10 to 15 minutes.
- Recheck blood glucose.
- Repeat food if symptoms persist or blood glucose is less than _____.
- Follow with a snack of carbohydrate and protein (e.g., cheese and crackers).

Moderate
- Someone assists.
- Give student quick-sugar source per MILD guidelines.
- Wait 10 to 15 minutes.
- Recheck blood glucose.
- Repeat food if symptoms persist or blood glucose is less than _____.
- Follow with a snack of carbohydrate and protein (e.g., cheese and crackers).

Severe
- Don't attempt to give anything by mouth.
- Position on side, if possible.
- Contact school nurse or trained diabetes personnel.
- Administer glucagon, as prescribed.
- Call 911.
- Contact parents/guardian.
- Stay with student.

From NDEP, 2003

time. (See Table 2 for examples.)

- Young school-age children (less than 10 years), due to their lower body weight, may need less than 15 grams of carbohydrate to treat mild hypoglycemia.
- A child using an insulin pump frequently needs only 15 grams of rapid-acting carbohydrate to restore the blood glucose level to optimal levels. Eating additional food is typically not necessary. Insulin pumps are filled with either rapid- or short-acting insulin. Since the child using a pump is receiving no intermediate-acting insulin (NPH, Lente) or long-acting insulin (glargine) there is less risk that the child will continue to experience low blood glucose levels.
- Prolonged periods of physical activity can cause reductions in blood glucose levels for as long as four to ten hours (or even longer) after the completion of physical activity. Hypoglycemia can also occur post-exercise due to repletion of depleted glycogen stores. More frequent blood glucose monitoring is recommended.

When a child with diabetes goes to school, special considerations or accommodations are needed to ensure that the school environment is safe and reduces the likelihood of acute diabetic complications, including hypoglycemia. School nurses and other school personnel must assist school children in recognizing and treating hypoglycemia. Young children are unable to provide their own diabetes care independently, and middle school and high school students should not be expected to provide all of their own diabetes care (ADA, 2005). Education about how to deal with hypoglycemia must be provided to parents/care givers as well as the school personnel and the school nurse. With a better understanding of how to deal with the highs and lows of blood glucose control, children with diabetes should certainly be able to succeed in school as well as their nondiabetic peers.

For more information on diabetes and hypoglycemia, visit the National Diabetes Education Program website and download the following school guide to help you ensure the health and safety of your diabetic students.

Helping the Student with Diabetes Succeed: A Guide for School Personal
http://www.ndep.nih.gov/diabetes/pubs/Youth_NDEPSchoolGuide.pdf or complete and fax in an order form for your free copy. http://www.ndep.nih.gov/diabetes/pubs/order.htm

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