Hypoglycemia: A Serious Complication for the Older Adult with Diabetes

The risk of dangerous low blood glucose events increases with age.

ABSTRACT: Hypoglycemic events range from mild to severe and occur at an increased rate among older adults with diabetes. Some diabetes medications increase the risk of hypoglycemia, as can inadequate nutrition, cognitive impairment, and other factors. While hypoglycemia can often be easily treated, the physiologic, sensory, and cognitive changes of aging can inhibit bodily mechanisms that produce warning symptoms of low blood glucose and impair the ability to recognize such symptoms when they occur. Severe hypoglycemic events in older adults can have devastating consequences. Nurses are well positioned to assess for hypoglycemia and to educate the growing population of older adults with type 2 diabetes on its prevention.

Keywords: diabetes, hypoglycemia, hypoglycemia unawareness, older adults, type 2 diabetes

Mr. J. is an 86-year-old man who has had type 2 diabetes for 15 years. (This case is a composite based on my experience.) His medications include glipizide 5 mg by mouth daily and 10 units of glargine insulin taken subcutaneously at the same time each night. Since his diagnosis, his glycated hemoglobin (HbA_{1c}) level has usually been in the 7% to 7.5% range. Mr. J.'s wife recently died, and he is now preparing his own meals and eating alone. On a recent trip to his primary care provider, he was found to have lost 8 lbs., but said he was managing well enough by himself. He does not have help at home. One morning, his daughter arrived at his home before lunch and found him confused and diaphoretic. She called 911, and when the emergency medical technicians arrived and tested his blood glucose level, they found it to be 53 mg/dL. He was brought to the ED for care.

Sound familiar? According to the Centers for Disease Control and Prevention (CDC), of the estimated 43 million adults in the United States who are 65 or older, about one in four has diabetes.[1] Most of these individuals have type 2 diabetes, which accounts for 90% to 95% of diabetes diagnoses. As the population ages in the coming years, nurses in every type of health care setting will care for older adults with diabetes. Hypoglycemia is a potentially serious complication experienced by older adults with diabetes. From 2006 to 2009, the rate of ED visits for hypoglycemia for adults with diabetes ages 75 or older was almost three times as high as that for middle-aged adults with diabetes

(and almost twice as high as that for those ages 65 to 74).[2]

A hypoglycemic event in an older adult, particularly a severe one, may lead to a number of complications, including accidents and falls, unconsciousness, seizures, cardiac events, and death.[3] Preventing, recognizing, and when necessary, treating hypoglycemia in a timely manner can save a patient's life or head off a process of steep decline. Nurses are on the front line in assessing older adults for risk of hypoglycemia and educating them on its causes.

HYPOGLYCEMIA RISK FACTORS

Hypoglycemia may be mild or more severe. Though people react differently to lower than normal blood glucose levels, hypoglycemia symptoms typically start when blood glucose drops below about 70 mg/dL.[4] (A normal blood glucose range for a person without diabetes is about 70 to 99 mg/dL on waking and 70 to 140 mg/dL after meals[5]; target ranges are usually higher for those with type 1 or type 2 diabetes, depending on a variety of factors, including risk–benefit analysis.) Some common symptoms of low blood

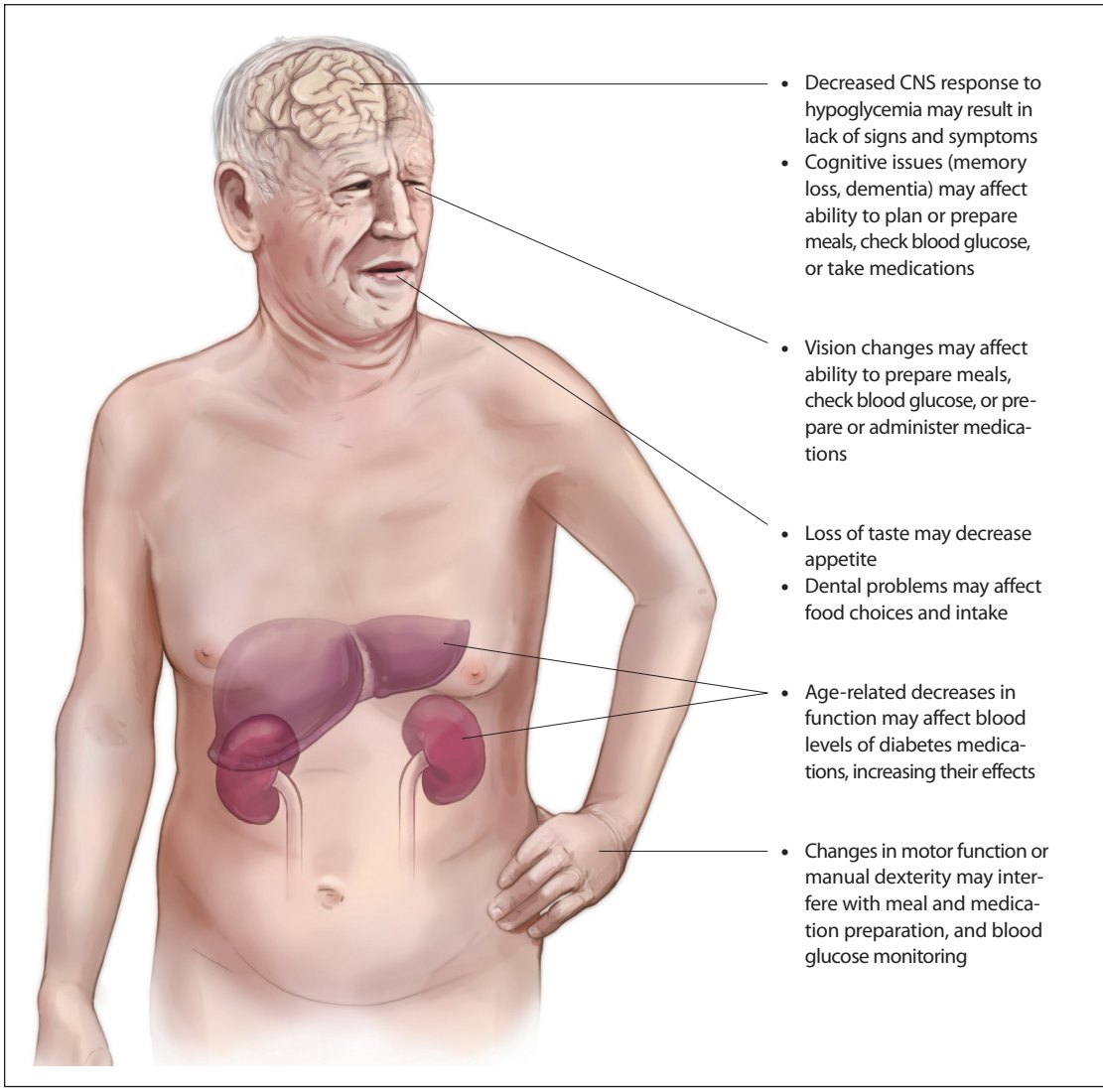

Figure 1. Factors that increase the risk or decrease awareness of hypoglycemia in older adults with diabetes. In addition to those factors shown above, many nondiabetes medications, too-low HbA_{1c} targets, delayed meals, and social factors that decrease food intake may all result in hypoglycemia. CNS = central nervous system; HbA_{1c} = glycated hemoglobin.

Table 1. Hypoglycemia: Signs, Symptoms, and Treatment[4, 5]

Signs and Symptoms of Hypoglycemia[a]
Intense hunger
Shakiness
Nervousness/anxiety
Sweating, chills, clamminess
Difficulty speaking
Confusion, including delirium
Tachycardia
Dizziness or lightheadedness
Nausea
Sleepiness
Irritability
Blurred or impaired vision
Headaches
Weakness and fatigue
Lack of coordination/clumsiness/loss of balance
Waking with damp pajamas or sheets
Crying out or having nightmares
Seizures
Unconsciousness
Treatment
1. If blood glucose level is < 70 mg/dL, consume 15 g of fast-acting carbohydrates (see below).
2. Recheck blood glucose after 15 minutes.
3. If hypoglycemia continues, consume another 15 g of carbohydrates.
4. When blood glucose returns to ≥ 70 mg/dL, eat a small snack if the next meal or snack is more than an hour away.
15 g of fast-acting carbohydrates:
• glucose tablets (follow package directions)
• glucose gel tube (follow package directions)
• 1/2 cup (or 4 oz.) juice or regular (not diet) soft drink
• 1 tbsp. sugar, honey, or corn syrup
• 2 tbsp. raisins
• 8 oz. nonfat or 1% milk
• 5-6 pieces of hard candy

[a] Some of these may be more subtle in the older adult.

glucose include diaphoresis, nervousness, irritability, shakiness, confusion, sleepiness, tachycardia, and lightheadedness. In many cases, mild hypoglycemia can be easily treated by eating or drinking 15 g of glucose-rich foods or liquids, such as four to five glucose tablets or 4 oz. of juice (see Table 1[4, 5]).

A number of factors can make both mild and more severe hypoglycemic episodes more likely in older adults with diabetes. These factors include inadequate nutrition, irregular self-monitoring of glucose levels, increased hypoglycemia unawareness, and the effects of some diabetes medications (see Table 2[6]).

Hypoglycemia unawareness. The body has mechanisms in place to respond to a drop in blood glucose. With aging, however, certain nervous system responses to hypoglycemia—including the release of stress hormones like epinephrine that cause warning symptoms such as a rapid heartbeat—may be reduced.[7] When this occurs, a person may not have any physical symptoms to indicate that blood glucose is low, or may be

less likely to notice symptoms. This is called hypoglycemia unawareness. While an increased risk of hypoglycemia unawareness may occur with aging, another contributing factor may be how long a person has had diabetes and how often that person has had low blood glucose.

Diabetes medications. A 2011 *New England Journal of Medicine* study found that two of the four medications or medication classes implicated in 67% of adverse drug reaction hospitalizations in older adults were those taken for the treatment of diabetes: insulins (13.9%) and oral hypoglycemic agents (10.7%) (the other two were warfarin and antiplatelet agents).[8] According to the CDC, a majority of older Americans with diabetes take at least one diabetes medication.[9] Multiple classes of oral and injectable medications are now available and widely prescribed alone or in combination to help lower blood glucose. Sulfonylureas, meglitinides, and insulin are drug classes that increase the risk of hypoglycemia. Metformin (a medication in the biguanides class) may also increase the risk of hypoglycemia when taken in combination with other diabetes medications. Insulin injections act to lower blood glucose directly. Insulin secretagogues, including long-acting sulfonylureas and the shorter-acting meglitinides, work by increasing insulin secretion in the body. Metformin decreases the amount of glucose produced by the liver and absorbed in the intestine, and increases insulin sensitivity.

As people with diabetes age, potential decreases in renal and hepatic function may influence the pharmacokinetics of drug metabolism.[7] These age-related declines in renal and hepatic function may make more of a medication active or available in the body, or increase the drug's half-life. Any of these changes can increase the risk of hypoglycemia. Such changes are not based on age alone, but the risk remains.

Among the sulfonylureas, glyburide has been identified as more likely to cause dangerous hypoglycemia in older adults. This is owing to age-related decreases in hepatic function that cause the medication to remain in the body longer; the American Geriatrics Society has recommended that this medication be avoided in the older adult.[10]

Metformin is widely used to manage type 2 diabetes in older adults. But the declines in renal function associated with aging can contribute to the increased risk of lactic acidosis in older adults taking metformin.[11] Although some guidelines use a specific serum creatinine level (at or above 1.5 mg/dL in men and at or above 1.4 mg/dL in women) to limit the use of metformin, in some instances creatinine monitoring has been

Table 2. Risk Factors for Hypoglycemia in the Older Adult[6]

Type	Risk Factors
Medications	
Insulin	Short- and long-acting forms
Sulfonylureas	Glyburide (Glynase, DiaBeta), glipizide (Glucotrol), glimepiride (Amaryl), among others
Meglitinides	Repaglinide (Prandin), nateglinide (Starlix)
Psychosocial	Living alone Inability to plan meals Depression Alcohol use Reduced food intake
Cognitive	Memory loss Dementia
Sensory	Hearing loss Vision changes Diminished taste
Motor	Decreased manual dexterity Impaired mobility Reduced physical activity Inadequate dentition
Medical comorbidities	Cardiovascular History of stroke
Physiologic	Decreased renal and hepatic function Decreased hypoglycemia awareness

replaced by the use of estimated glomerular filtration rate (eGFR).[11] Guideline suggestions have recommended reducing the dosing of metformin to half the maximum dose when the eGFR is between 30 and 45 mL/min/1.73 m^2. At this point, monitoring of renal function should occur every three months. Once the eGFR is below 30 mL/min/1.73 m^2, stopping metformin is recommended.[11]

The *dipeptidyl peptidase-4 inhibitors*, possible alternatives to metformin because of their low risk of hypoglycemia, may require decreased dosage with renal impairment but may still be used in the older adult.[7]

DIABETES MANAGEMENT

According to the American Association of Diabetes Educators, diabetes is managed through a combination of lifestyle changes such as diet and exercise, stress management, glucose monitoring, reducing health risks, and taking medication.[12] People with diabetes must juggle many facets of care daily, sometimes with help from family members. Older adults are a heterogeneous group, and must be evaluated individually. Some older adults may develop cognitive issues that will affect their ability to carry out self-care behaviors. Others may develop functional or sensory deficits that limit self-care activities.

It's important to consider whether HbA_{1c} goals can be attained without undue treatment burden or risk of severe hypoglycemia in the older adult with diabetes.

Setting realistic, safe goals. The 2012 position statement on the management of hyperglycemia in type 2 diabetes from the American Diabetes Association (ADA) and the European Association for the Study of Diabetes offers recommendations for diabetes care in older adults based on functional status, overall health, and comorbidities.[3] According to these guidelines, an HbA_{1c} level of less than 7.5% to 8%, or even higher, may be an appropriate goal for an older adult with a history of multiple comorbidities or hypoglycemia, and a shorter life expectancy. Tighter control, with an HbA_{1c} goal of less than 6.5% to 7%, may be more appropriate for healthy older adults with a long life expectancy. A 2012 consensus report from the ADA and the American Geriatrics Society makes similar recommendations: an HbA_{1c} level of less than 8.5% for older adults in poor health (long-term care, end-stage chronic illnesses, or cognitive impairment) and a goal of less than 7.5% for healthy older adults.[13] In all cases, it's important to consider whether these goals can be attained without undue treatment burden or risk of severe hypoglycemia. Moderate glycemic control may achieve the most relevant benefits, especially in the frail elder population. A substudy of the Action to Control Cardiovascular Risk in Diabetes (ACCORD) trial noted that although older adults in both the intensive and standard care groups were able to reach similar blood glucose targets as those reached by younger adults, they consistently experienced higher rates of hypoglycemia, with little evidence of a clinically significant cardiovascular disease benefit.[14] In fact, because increased hypoglycemia risk in older ACCORD subjects was noted during early follow-up, the recruitment of additional participants 80 years of age and older was stopped.

Medication and blood glucose testing regimes that are complicated may become harder to implement for some older adults. Meal schedules need to be followed, and data such as blood glucose test results need to be interpreted and acted on. Self-care activities become especially important when a person is taking medications such as insulin secretagogues or insulin, as the risk of hypoglycemia increases when normal blood glucose levels are in the lower range or with missed meals. Loss of the ability to safely and correctly perform self-care behaviors such as meal preparation, ensuring consistent carbohydrate portions, or self-monitoring of blood glucose levels can increase the risk of hypoglycemia.

In addition, sensory changes such as loss of taste can diminish appetite and affect food intake.[15] Problems with vision may affect the ability to prepare meals, use a glucose monitor, or even administer medications correctly. Dentition problems can affect food choices and intake. Any of these changes can lead to an increased risk of hypoglycemia in the older adult. Diseases that affect motor function or manual dexterity, such as arthritis or Parkinson's disease, may affect these same domains of self-care, again potentially altering glycemic levels.

NURSING CARE

Nurses are well positioned to recognize hypoglycemia in the older adult and apply their knowledge of diabetes and the aging process. Integrating aspects of diabetes care that include meal planning, medication management, self-monitoring, exercise, and other self-care activities can be a complicated process. Nurses,

particularly trained diabetes educators, are able to assess each person in the context of her or his environment and overall health, taking into consideration functional and cognitive status and recognizing barriers to self-care. Educating the older adult with diabetes, as well as caregivers and family, is important in preventing hypoglycemic events and in identifying individuals at increased risk for such potentially dangerous events.

Returning to the case of Mr. J., there are several areas where nursing intervention will be important in helping him remain safely in the community while minimizing his risk of hypoglycemia.

A comprehensive assessment will determine his current diabetes knowledge and self-care skills. Evaluation of his understanding of the need for consistent carbohydrate intake and meal planning and of his ability to shop and prepare meals will indicate areas where additional education or support may be needed. Demonstration of glucose level self-monitoring and assessment of Mr. J.'s ability to explain what the results mean will help in identifying areas where review or further instruction may be needed. For example, does Mr. J. understand his pre- and postmeal glycemic targets, how results that fall above or below this range may affect him, and what blood glucose levels indicate hypoglycemic risk? According to the ADA, a one-to-two-hour postmeal target blood glucose level of less than 180 mg/dL is recommended for most people with diabetes.[16] The premeal blood glucose target has been raised to 80 to 130 mg/dL, according to the most recent ADA standards of diabetes care.[16]

Again, these recommendations may be adjusted as part of an individualized diabetes care plan. Based on the nurse's assessment of Mr. J.'s diabetes self-management skills as well as the results of his blood glucose testing, his health care providers may order medication changes to support blood glucose control while minimizing the risk of hypoglycemia. The nurse will then be integral in helping Mr. J. implement any changes to the diabetes care plan. Assessing both his home environment (including home safety, adequate lighting, and access to cooking facilities) and his social and physical support (such as help with shopping, meal preparation, and medications) will be integral in helping to develop a plan for diabetes care that Mr. J. agrees to and can execute. In addition, if needed, a nurse can provide information about community resources for ongoing diabetes support or education through referral to an outpatient center. Mr. J. needs to understand the signs and symptoms of hypoglycemia, and how to recognize and treat them as well as how to prevent them. The nurse, looking at the big picture, may be the critical liaison between Mr. J. and his family and health care providers. Recognizing Mr. J.'s strengths and deficits, and working with Mr. J. to meet his needs, will reduce his risk of future hypoglycemic events. ▼

For 31 additional continuing nursing education activities on topics related to diabetes, and for 35 on topics related to older adults, go to www.nursingcenter.com/ce.

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