Diabetes mellitus is the seventh leading cause of death in the United States\(^1\) and, like obesity, affects a substantial proportion of the U.S. population.\(^2\) It is estimated that approximately 11 million people aged 65 years or older in the United States have diabetes mellitus.\(^1\) In addition, comorbid diseases, including hypertension and cardiovascular disease, are increasing in individuals older than 75 years.\(^3\)
Cardiovascular disease is the leading cause of death among people with diabetes mellitus. Total U.S. health-care expenditures, including direct medical costs, spent on patients with diabetes mellitus amount to close to $180 billion per year, with patients in nursing homes accounting for 10% of that amount. It is not surprising that health-care providers, including physicians who provide long-term care, are faced with many challenges in the geriatric patient with diabetes mellitus. These challenges include managing multiple chronic conditions and dealing with the direct and indirect costs that burden not only patients but the national economy as well. Obviously, a primary endpoint in treatment is glycemic control leading to prevention of microvascular complications without adverse reactions. Hypoglycemia is another cause of concern in light of studies that show increased cardiovascular mortality among patients undergoing intensive glucose control. At what timeline in the management process of treating diabetes mellitus should the reigns of glucose control be loosened so as to prevent further comorbidity in the elderly? Approximately 1 of 4 residents of nursing homes is admitted with a diagnosis of diabetes mellitus. In an analysis of nursing home residents, those with diabetes mellitus were found to have numerous medical complexities, including coronary heart disease and peripheral vascular disease, neurologic complications (eg, stroke), chronic pain, depression, dementia and polypharmacy. It has also been shown that nursing home residents with diabetes mellitus are at increased risk of falls. Hypoglycemia can be a risk in patients who have conditions causing decreased cognition, such as dementia and stroke.

**Pharmacologic management**

According to the California Healthcare Foundation/American Geriatric Society guidelines for treating elderly patients with diabetes mellitus, treatment should include management of hyperlipidemia, cessation of tobacco abuse, use of aspirin (if not contraindicated), and use of angiotensin-converting enzyme (ACE) inhibitors for control of hypertension. Several medications are helpful in controlling glycosylated hemoglobin (HgA1c) levels in patients with diabetes mellitus. However, health-care providers must be cautious in using these medications with elderly individuals because of comorbidities and possible adverse effects.

The sulfonylureas work by increasing the amount of insulin produced by the pancreas. Special care must be taken when using sulfonylureas in patients who have chronic kidney disease or who are at risk of dehydration, because the elimination of these agents can be delayed in such patients, increasing the risk of hypoglycemia. The biguanides can decrease the production of glucose without the risk of hypoglycemia, as well as lower triglyceride levels, but these agents should not be given to patients with advanced kidney and liver disease. A condition called lactic acidosis occurs rarely in such patients, though this condition is more common in patients who have impaired renal function and should not be given in patients with a serum creatinine to \( \geq 1.5 \text{ mg/dl} \). Biquanides can be used in patients with stable heart failure.

The thiazolidinediones can help in lowering a patient’s glucose levels and in improving HgA1c levels by increasing the insulin sensitivity of adipose tissue, skeletal muscle and the liver. These medications are contraindicated in patients with cardiovascular disease and stroke. In fact, the U.S. Food and Drug Administration (FDA) has restricted the access of rosiglitazone; as of November 2011, this drug is restricted to patients enrolled in the Avandia-rosiglitzone Medicine Access Program. The \( \alpha \) glucosidase inhibitors delay glucose absorption and other monosaccharides in the small intestine. Although an adjunct to diabetes management, this class of medications can cause diarrhea, abdominal pain and transaminitis, and \( \alpha \)-glucosidases are contraindicated in patients with liver cirrhosis and chronic intestinal disease and/or inflammatory bowel disease.

Various types of insulins are available for treating patients with diabetes mellitus, and geriatric patients can have various reactions to these agents depending on their diets and comorbidities. The fast-acting insulins (eg, aspart, glulisine, lispro) start acting within 15 minutes. They are usually given at or near meal times and, as a result of their short duration of action, lower blood sugar levels within 45 to 90 minutes. The fast-acting insulins are safe for a majority of geriatric patients—especially those patients who reside in properly staffed extended-care facilities with logistically planned meal times (where such adverse reactions as hypoglycemia can be averted).

Intermediate-acting insulins and insulin mixtures have delayed onsets of action and extended half-lives. Health-care providers must exercise caution when using these agents in geriatric patients, whose dietary habits, decreased cognition, and multiple complexities can lead to adverse effects if not properly monitored.

The incretin-based agents—glucagon-like peptide-1 (GLP-1) receptor agonists and dipeptidyl peptidase-4 (DPP-4) inhibitors—activate GLP-1 receptors, thereby increasing insulin secretion and decreasing glucagon secretion and lowering serum glucose concentrations. They have been shown to improve blood sugar levels in elderly individuals with type 2 diabetes mellitus. However, these incretin mimetics delay gastric emptying and can cause nausea and vomiting, pancreatitis and decreased appetite. Incretin-based agents can be safely used with both biguanides and thiazolidinediones, but hypoglycemia may occur when they are used with sulfonylureas in geriatric patients with chronic renal failure. They must also be used in caution in patients using insulin.

**Hypertension**

Treating older adults to reduce cardiovascular risk can be complicated. Hypertension, hyperlipidemia and diabetes mellitus can lead to ischemic heart disease, and hypoglycemia can result from the medications used to treat these patients. For many patients,
Looser glycemic goals?

When treating older patients who have hyperglycemia, it may be advisable to choose a looser, less-stringent glycemic target. This is especially true for patients in extended-care facilities. Such patients are, by definition, unable to care for themselves and, thus, they are at higher risk for fluid and dietary imbalances. Treatment for comorbid conditions can also affect glucose control. There are fluid and dietary restrictions for elderly patients with certain complexities (eg, patients who have had strokes and need honey-thickened liquids, or patients who have renal disease and need low-protein diets). These restrictions make monitoring of blood sugar levels and compliance with medication use very important in nursing homes. Hypoglycemia can also be a common risk in managing diabetes in the elderly. The complications in the physiology of aging have not only shown a reduction in the autonomic warning signs of hypoglycemia24 but a change in the pharmokinetics of diabetes medications leading to low glucose levels.25

De Lissovoy et al4 have suggested that management for hyperglycemia can be somewhat less rigorous in elderly patients than in younger patients. According to the American Diabetes Association, HgbA1c levels in most individuals should be less than 7% to prevent complications, such as neuropathy, nephropathy and retinopathy, and hospital readmissions.26 In elderly individuals with diabetes mellitus, however, looser glucose goals with higher HgbA1c levels may actually be safer.27 Hagemann et al28 found that slightly elevated HgbA1c levels (ie, 6%-8%) in elderly patients with diabetes mellitus were associated with increased levels of cognition and improved everyday functioning.

Lipid levels

Dyslipidemia is a major risk factor in the pathogenesis of atherosclerotic heart disease and a major cause of death in elderly people. Type 2 diabetes mellitus is associated with an at least two-fold increased risk of coronary heart disease,29 and coronary heart disease in individuals with diabetes mellitus is closely associated with elevated triglyceride levels and decreased high-density lipoprotein cholesterol (LDL-C) levels.30 Therefore, it is not surprising that the lipid-lowering 3-hydroxy-3-methylglutaryl-CoA reductase inhibitors (ie, “statins”) are often used in the elderly population.

The benefits of statins are insurmountable in the reduction of atherosclerotic heart disease and cerebrovascular morbidity and mortality. In a double-blind, placebo-controlled study, statins were found to be as affective in decreasing lipid levels in elderly people as in middle-aged people, with no difference in adverse effects between the age groups.30 The American Diabetes Association recommends an LDL-C goal of less than 100 mg/dL in patients with diabetes mellitus, regardless of whether the patient has preexisting cardiovascular disease.30,31 In patients with clinical cardiovascular disease and an LDL-C level of greater than 100 mg/dL, pharmacologic treatment should be initiated at the same time that lifestyle intervention is started.30,31 Although evidence suggests that the advantage of using statins outweighs their risk in elderly patients with diabetes mellitus, health-care providers need to use good clinical judgment in using these agents—remaining aware of the possible adverse effects and interactions of statins in treatment for hyperlipidemia.29,31-33

Osteopathic approaches

As osteopathic physicians, we should always concentrate on nonpharmacologic approaches in treating our elderly patients with diabetes mellitus. Such approaches include weight loss, decreased salt intake, exercise, and counseling on tobacco abuse. We must always practice the four basic tenets of osteopathic medicine:34

- The body is a unit.
- The body possesses self-regulatory mechanisms.
- Structure and function are reciprocally interrelated.
- Rational therapy is based on an understanding of the body unit, self-regulatory mechanisms, and the interrelationship of structure and function.

We should also make sure that our patients are taking adequate vitamin...
supplements, including the B complexes and vitamin D—as well as omega-3 fatty acids and adequate calcium, phosphorus and magnesium. We need to be aware of all medications that our patients are using, along with the potential adverse effects and interactions associated with these agents. The gastrointestinal ulcers, leg edema and hypertension associated with nonsteroidal anti-inflammatory drugs, and the fatigue and depression linked to β-blockers are a few examples of such adverse effects.

Finally, being aware of associated risks factors—such as obesity, chronic kidney disease, and chronic liver disease—and understanding patients’ psychosocial and economic status are important in the decision-making process and treatment of our elderly patients with diabetes mellitus.

References


