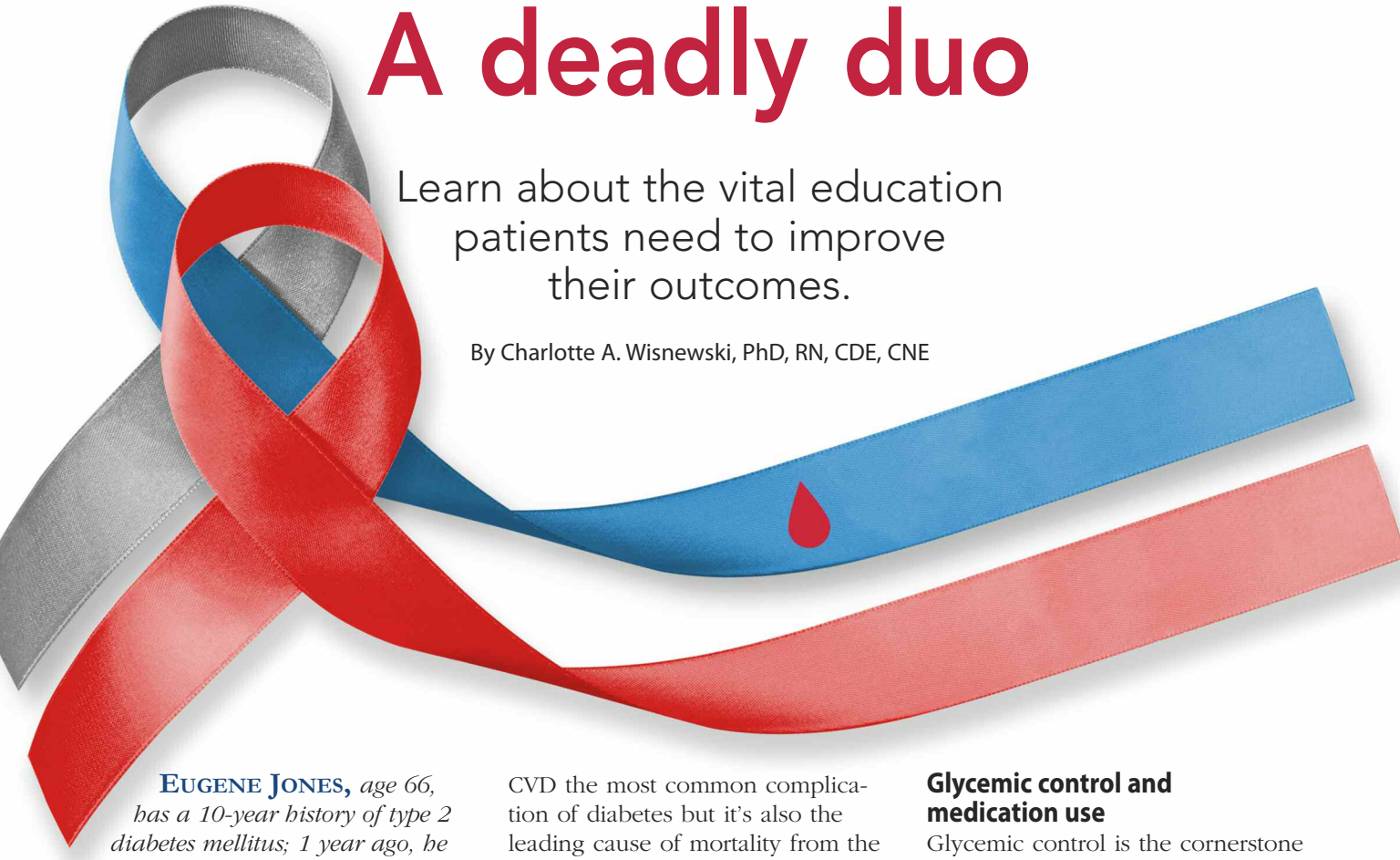
Diabetes and cardiovascular disease: A deadly duo



Learn about the vital education patients need to improve their outcomes.

By Charlotte A. Wisnewski, PhD, RN, CDE, CNE

EUGENE JONES, *age 66, has a 10-year history of type 2 diabetes mellitus; 1 year ago, he suffered a myocardial infarction (MI). During today's routine clinic appointment, his fasting blood glucose level is 215 mg/dL and his blood pressure is 160/94 mm Hg. He tells the nurse he sometimes forgets to take his diabetes and high blood pressure medications—metformin, metoprolol, and low-dose aspirin. He states that he walks about 15 minutes daily and tolerates the exercise well.*

Diabetes mellitus occurs in four main forms, all of them marked by hyperglycemia. The most common forms are type 1, which results from autoimmune destruction of pancreatic beta cells, and type 2, caused by insulin resistance or an insulin secretory defect. Diabetes of all types increases the risk for cardiovascular disease (CVD). (See *Diabetes complications*.)

Coexisting diabetes and CVD make for a deadly duo. Not only is CVD the most common complication of diabetes but it's also the leading cause of mortality from the disease, responsible for an estimated 80% of deaths. (See *A dangerous comorbidity*.) This article discusses CVD risk reduction for patients with diabetes and describes the nurse's role in helping them manage it.

CNE
1.45 contact hours

LEARNING OBJECTIVES

1. Identify education needs for people with both diabetes and cardiovascular disease (CVD).
2. Describe CVD risk management education for people with diabetes and CVD.
3. Discuss how nurses can enhance effectiveness of patient education.

The author and planners of this CNE activity have disclosed no relevant financial relationships with any commercial companies pertaining to this activity. See the last page of the article to learn how to earn CNE credit.

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Glycemic control and medication use

Glycemic control is the cornerstone of diabetes care. In conjunction with lifestyle management, most patients need medication to attain good glycemic control. Those with type 1 diabetes require insulin; those with type 2 may need both insulin and oral or injectable medications. Teach newly diagnosed patients to monitor their blood glucose levels to guide medication dosing and manage hyperglycemia, which can help them avoid diabetes complications.

For patients on insulin, the recommended pre-meal glycemic target is a blood glucose level of 80 to 130 mg/dL; the post-meal target at 2 hours is 140 to 180 mg/dL. For patients not on insulin, the precise number of times to monitor blood glucose at home isn't established, but they should monitor their level enough times per week to obtain a good picture of glycemic control.

To determine the patient's overall glycemic control, the hemoglo-

Diabetes complications

Both type 1 and type 2 diabetes can lead to:

- cardiovascular disease (the most common complication)
- macrovascular problems of the cardiac vessels, resulting in myocardial infarction
- cerebrovascular damage, causing stroke
- microvascular defects involving the eye and blood vessels, leading to blindness
- vascular involvement of the kidneys, causing chronic renal disease
- damage to nerves, resulting in neuropathies of both the upper and lower extremities
- damage to GI tract nerves, leading to problems in gastric motility.

bin A1c (HbA1c) level should be measured two to four times yearly. (See *Why is HbA1c important?*)

Relatively new diabetes medications include liraglutide (approved in 2010) and empagliflozin (approved in 2014). Liraglutide is an adjunct to diet and exercise to improve glycemic control in adults with type 2 diabetes. Studies show it lowers glycemic levels, helps reduce weight and blood pressure, decreases heart-failure hospitalizations, and lowers the risk of death from cardiovascular causes. Empagliflozin lowers blood glucose levels in adults and helps reduce CVD deaths, nonfatal MIs, nonfatal strokes, and heart-failure hospitalization rates. (Be aware that manufacturers, as part of the drug application process, must test new diabetes medications for cardiovascular safety.)

Nutritional guidelines

The American Diabetes Association (ADA) recommends referring all newly diagnosed patients to a registered dietitian (RD) experienced in diabetes education. Medicare pays for this 1-hour dietary education session, as do many insurance companies. Patients who aren't newly diagnosed can receive this benefit if they've received diabetes education as a paid service. You can request an order for a dietitian consult; after the consult, reinforce the education provided and answer the patient's questions.

Dietary plans

Ideally, the initial dietary plan should be developed by an RD familiar with diabetes guidelines or certified in diabetes education (CDE). You can play a critical role by helping patients understand details of the plan and reinforcing it. If a dietitian or CDE isn't available initially, teach the patient about a heart-healthy meal plan to help decrease cardiovascular risk factors.

Patients can use various dietary patterns to help control hyperglycemia. For those who take fixed daily insulin doses, a consistent carbohydrate intake is best because it emphasizes consuming the same amount of carbohydrates at the same time every day. Carbohydrate counting can be critical in maintaining glycemic control. When metabolized, carbohydrates increase blood glucose, whereas fat and protein metabolism contributes relatively little toward the blood glucose level.

With overweight or obese patients, emphasize healthy eating along with caloric reduction to promote weight loss. Teach patients about the Mediterranean-style diet, which includes plenty of fruits and vegetables and favors monounsaturated fats over unhealthy fats. This diet lowers CVD risk factors and increases glycemic control. ADA also recommends eating fatty fish at least twice weekly. Recommendations for intake of saturated fats, trans fats, cholesterol, and sodium are the same as for the general population.

Dietary goals must be individualized to each patient; no one dietary pattern is recommended for everyone with diabetes and CVD. Teach patients who are elderly, cognitively challenged, or faced with health-literacy concerns how to make healthy dietary choices and control their food portions. To help all patients maintain a positive attitude, emphasize that while changing dietary habits can be challenging, they can achieve success by focusing on one or two goals at a time instead of trying to change all their eating habits simultaneously.

A dangerous comorbidity

Complications of cardiovascular disease (CVD) can occur in both type 1 and type 2 diabetes. One European study found that in type 1 diabetes, CVD deaths increased 50% for every 1% rise in the hemoglobin A1c level. In a Japanese study, CVD was the leading cause of death in patients who had type 1 diabetes for more than 20 years.

CVD usually manifests as myocardial infarction (MI) or heart failure in patients with diabetes and raises the risks of MI and other macrovascular conditions two- to fourfold. Many patients with type 2 diabetes exhibit CVD on diagnosis. Increasingly strong evidence links type 2 diabetes with insulin resistance, hypertension, systemic inflammation, abnormal vascular endothelial function, high low-density lipoprotein levels, and low high-density lipid levels—all of which promote CVD development or exacerbation. Known as metabolic syndrome, these conditions are common in patients with type 2 diabetes or CVD.

The nurse teaches Mr. Jones to follow a low-fat diet with carbohydrates from whole grains, fruits,

and vegetables. His wife states she is willing to prepare meals using the principles the nurse has taught. The couple also agree to see a dietitian together for further education. The nurse calls the diabetes outpatient department to schedule Mr. Jones for an appointment with an RN who is a CDE and arranges for him to start an outpatient education program for patients with diabetes.

Alcohol intake

Alcohol intake guidelines for patients with diabetes are the same as for the general population—a limit of one drink daily for women and no more than two drinks daily for men. Teach patients that excessive alcohol intake is cardiotoxic, raising the risk for MI, heart failure, and atrial fibrillation. On the other hand, moderate alcohol intake can provide some benefit: In a study of patients with type 2 diabetes, moderate alcohol consumption (especially wine) was linked to reduced risks of cardiovascular events and all-cause mortality. Nonetheless, most people with type 2 diabetes need to lose weight and avoid weight gain, so any alcohol intake needs to be a planned consumption item.

Teach patients who choose to consume alcohol that they're at increased risk for delayed hypoglycemia, especially if they're taking insulin, sulfonylureas, or a meglitinide. Inform them that drinking heavily without eating can block the liver from releasing stored glycogen into the bloodstream, causing hypoglycemia. Also tell them that drugs that reduce blood glucose can increase hypoglycemia risk.

Physical activity guidelines

An active lifestyle is a basic component of diabetes management. Definitive evidence shows regular activity lowers blood glucose levels, improves insulin action, and reduces CVD risk factors. Yet studies show that fewer than 40% of adults with diabetes are physically active. What's more, many report they receive less education on physical activity—and less encouragement to be physically active—than they receive on other aspects of diabetes management.

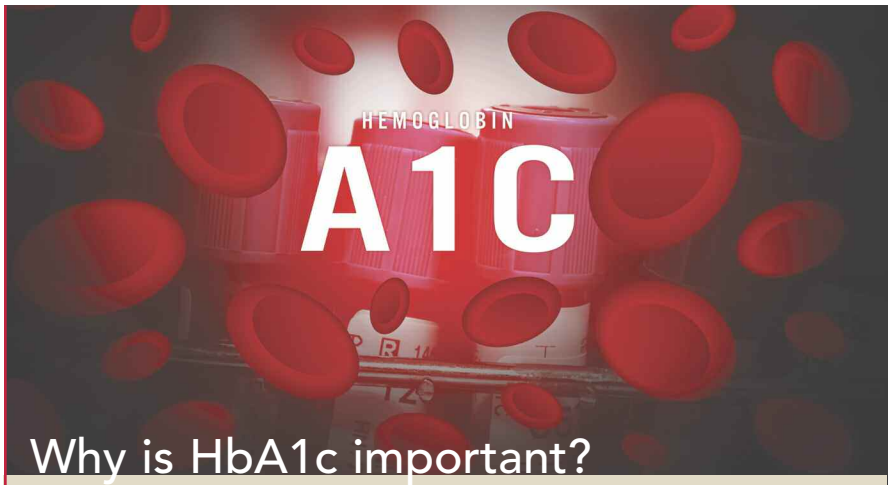
For patients with both type 2 diabetes and CVD, ADA recommends a pre-exercise evaluation, especially if the plan is to begin physical activity that's more intense than the patient's previous activity. This evaluation includes assessment for CVD risk factors and other possible long-term complications, such as retinopathy, nephropathy, and peripheral neuropathy—conditions that could influence the patient's ability to safely participate in physical activity.

Advise patients to start an exercise regimen slowly within the guidelines specified, and then to progress gradually to higher activity levels. Encourage them to get at least 150 minutes of moderate-intensity aerobic exercise per week and (unless contraindicated) to engage in two weekly sessions of resistance exercise using free weights or weight machines. Several studies report reductions in HbA1c and CVD risk factors when aerobic and resistance exercises are combined.

The types of exercise most effective in both improving glycemic control and reducing cardiac risk haven't been determined. Several current studies are focusing on the effects of high-intensity exercise at predetermined intervals. But many patients (especially older ones) may not be able to engage in high-intensity exercise safely due to obesity, long-term diabetes complications, or a prior sedentary lifestyle.

Exercise precautions

Be aware that diabetes can cause cardiovascular autonomic neuropathy (CAN), which leads to damage of the autonomic nerve fibers innervating the heart and blood vessels. This damage in turn leads to resting tachycardia, exercise intolerance, and postural hypotension. Be-



Why is HbA1c important?

The American Diabetes Association recommends a hemoglobin A1c (HbA1c) goal of 7% or lower for nonpregnant adults with diabetes. Some patients may need more stringent goals if they can be reached without significant hypoglycemia. For patients with advanced cardiovascular disease, significant hypoglycemia, extensive comorbidities, or limited life expectancy, the HbA1c goal should be less stringent (below 8%). Keep in mind that an HbA1c of 7% correlates to a blood glucose level of 154 mg/dL; an HbA1c of 8%, to a blood glucose level of 183 mg/dL.

Exercise: Not always a good thing

Did you know that physical activity may trigger hyperglycemia in patients with either type 1 or type 2 diabetes? When blood glucose is high, physical activity can push the level even higher due to insulin unavailability. By preventing glucose from entering muscle cells and other cells for utilization, insulin unavailability raises glucose levels in the bloodstream.

Guidelines for when to allow and not allow exercise vary among endocrinologists and other diabetes specialists. The Joslin Diabetes Clinic (associated with Harvard Medical School) recommends the following:

- Instruct patients with type 1 diabetes not to engage in physical activity if their blood glucose level exceeds 300 mg/dL.
- Inform patients with type 2 diabetes that physical activity is contraindicated when the blood glucose level exceeds 400 mg/dL.

cause CAN is an independent risk factor for myocardial ischemia, MI, and death, clinicians must be especially careful before recommending increased physical activity. Many patients may need to undergo cardiac stress tests and electrocardiogram studies before initiating more extreme physical activity.

Safety precautions for physical activity differ depending on whether the patient has type 1 or type 2 diabetes. Usually, blood glucose levels drop during physical activity. In type 1 diabetes, hypoglycemia is a risk and many patients must increase carbohydrate intake before exercise, reduce their pre-exercise or pre-meal insulin, or use a continuous glucose monitoring device to determine exactly when to increase carbohydrate intake. Alternatively, they can modify medication doses based on recommendations from their diabetes healthcare provider. With type 2 diabetes, exercise is less likely to bring on hypoglycemia. However, in some cases, exercise increases blood glucose. (See *Exercise: Not always a good thing.*)

The nurse encourages Mr. Jones to increase his walking time to 30 minutes daily at least 3 days per week over the next 2 to 3 weeks and to discuss weight lifting with his provider at a future appointment. She reminds him to keep a 15-g (60-calorie) quick-acting carbohydrate snack, such as glucose tablets, in his pocket in case his blood glucose level drops while walking. To motivate him to increase his walking time, she encourages him to use a wearable activity tracker device or to install a free walking app on his cell phone. Mr. Jones states that he's interested in this option and will consider installing a step-tracker app on his phone.

Cardiovascular risk-management education

As a nurse, you're responsible for teaching patients with diabetes about their increased CVD risk. To help patients reduce this risk, teach them about the importance of smoking cessation, lowering blood pressure to recommended levels, taking statin medication as prescribed to reduce high lipid levels, and losing weight (as appropriate). Hypertension and dyslipidemia aren't just comorbid conditions with diabetes; they're also independent risk factors for CVD. Altering cardiovascular risk factors can help lower morbidity and mortality in these patients.

Smoking

Routinely assess patients for all forms of nicotine use. Discourage smoking and encourage patients who smoke to begin a smoking-cessation program. Smoking cessation can help lower blood pressure and prevent albuminuria (a risk factor for diabetic nephropathy). Inform patients that weight gain after smoking cessation doesn't negate the significant cardiovascular benefit of stopping smoking. If your state or hospital offers free quit-smoking programs, provide a referral as needed.

Also evaluate the patient's exposure to passive smoke. If others in the household can't be persuaded to stop smoking, urge them not to smoke inside the home or around the patient. Finally, caution patients not to use e-cigarettes because they contain nicotine.

Mr. Jones states that neither he nor his wife smoke. Although his adult son smokes, he does so only on the patio when he visits so as not to expose others to the smoke.

Hypertension

ADA recommends that patients with blood pressure above 140/90 mm Hg be treated to reduce pressure. Those at high risk for CVD should have lower targets, such as below 130/80 mm Hg. Encourage patients to take antihypertensive medications as prescribed, stressing that they'll likely need to take these lifelong.

To reach their blood pressure goal, many patients need multiple drug therapy with such drugs as angiotensin-converting enzyme (ACE) inhibitors, angiotensin-receptor blockers, thiazidelike diuretics, and certain calcium channel blockers. Some evidence suggests that taking at least one antihypertensive medication at bedtime can help to reduce cardiovascular events and mortality.

Encourage patients to lose weight if needed, increase physical activity, lower sodium intake, consume plenty of fruits and vegetables, and increase potassium intake. All of these factors can help lower blood pressure.

The nurse reminds Mr. Jones of the importance of taking his antihypertensive medications daily as prescribed. She asks him to record his

blood pressure twice daily over the next 2 weeks to determine if he has "white coat" syndrome, in which blood pressure rises only when taken by medical personnel. If his blood pressure is still high at his next 2-week visit, his primary care provider may add another antihypertensive class (probably an ACE inhibitor) to his current regimen. The nurse teaches Mr. Jones tips to help him remember to take his medications—putting an alarm on his cell phone, using pill boxes with a slot for each day of the week, and taking medications at the same time each day.

Recommended lipid levels in patients with diabetes

This chart shows recommended values for lipid components in patients with diabetes.

Lipid component	Desirable or optimal level
Total cholesterol	< 200 mg/dL
Low-density lipoproteins	< 100 mg/dL
High-density lipoproteins	> 40 mg/dL for men and > 50 mg/dL for women
Triglycerides	< 150 mg/dL

Dyslipidemia

ADA recommends lipid-lowering treatment in patients with comorbid diabetes and CVD. Treatment begins with lifestyle interventions and medications (including statins), possibly along with lipid-lowering therapies. Lifestyle therapy focuses on:

- losing weight if needed
- reducing consumption of foods high in saturated fats, trans fats, and cholesterol
- increasing fiber intake.

A dietitian can guide the patient toward a low-fat diet with reduced intake of red meats and whole-fat dairy foods. Reinforce the dietitian's teaching.

Patients more than 40 years old with both diabetes and CVD need statins at a moderate- or high-dosage intensity level, as well as lifestyle therapy. The primary care provider may prescribe statins both to lower cholesterol and reduce cardiac risk. ADA's care standards specify which dosage levels to use based both on age (younger than age 40, 40 to 75, or older than 75) and cardiac risk. Explain the rationale for and importance of taking cholesterol-lowering drugs, describe adverse effects to watch for, and encourage patients to adhere to this important therapy. Also inform patients of the levels generally recommended for low-density lipoproteins, high-density lipoproteins, and triglycerides. (See *Recommended lipid levels in patients with diabetes.*)

Tell patients that their lipid levels should be monitored every 1 to 2 years once they've reached target levels, and that testing these levels helps monitor their adherence to therapy. Because statins harm fetal formation and are contraindicated in pregnant women, ensure that women taking these drugs aren't pregnant or planning to become pregnant.

Mr. Jones is prescribed a statin based on his cardiovascular and diabetes status and his age. He agrees to take the medication as ordered and to report adverse effects if they occur.

Obesity

Two measures of obesity are associated with CVD risk factors—body mass index (BMI) and waist circumference. BMI reflects overall generalized obesity; waist circumference indicates abdominal obesity. For men, waist circumference should be less than 40 inches; for women, less than 35 inches. One study found waist-to-hip ratio the best predictor of cardiovascular events and deaths in patients with diabetes.

Focus on helping obese patients limit their caloric intake, engage in physical activity every day, and lose weight slowly. Many patients quickly regain lost pounds; if this occurs, refer them to a weight-loss program.

Mr. Jones has a waist circumference of 45 inches. Because he will be eating a low-fat diet high in fruits and vegetables and will increase his activity level, he should see some weight loss.

Psychosocial factors

Evidence suggests psychosocial factors play a role in CVD development. With the strong link between diabetes and CVD, researchers are studying the impact of psychological processes on both. Depression has been shown to be associated with diabetes, although no causal effect is known. Not only is depression common in patients with diabetes, especially younger adults, but it also increases the risk of macrovascular complications, including MI. What's more, CVD mortality is higher in patients who have both diabetes and depression.

Many patients with diabetes also experience high anxiety levels related to diabetes complications, fear of insulin injections, hypoglycemic episodes, and other aspects of the disease. ADA recommends clinicians refer patients for treatment if they have signs or symptoms of anxiety, such as avoidance behaviors, excessive repetitive behaviors, or social withdrawal.

Be aware that exposure to chronic stressors, such as work stress, plays a role in diabetes onset and has been shown to worsen glycemic control. Although only limited evidence suggests that treat-

Patient-centered communication

When teaching patients, use a patient-centered communication style by listening actively, determining the patient's preferences, and assessing barriers to education and obtaining healthcare services. Inform patients that they're more likely to achieve good outcomes by being actively involved in their own care.

To draw out patients' ideas and solutions related to desired behavioral changes, you can use motivational interviewing techniques. Evidence suggests that in patients with type 1 diabetes, motivational interviewing can improve quality of life and glycemic outcomes and help patients overcome everyday challenges of managing diabetes. Ask patients to identify desired changes, and listen actively to help them explore their feelings and possible ambivalence toward change. Help them plan ways to deal with barriers, identify beliefs that might prevent or delay changes, and evaluate outcomes of the actions undertaken.

ing psychological factors improves CVD, most experts believe lifestyle interventions should be used to help patients struggling with mental health issues.

Mr. Jones seems to be in good spirits at this time and doesn't need special measures related to psychosocial aspects of diabetes. His nurse tells him that if he starts having unusual stressful feelings, he should seek counseling.

Nurse's role in patient education

When teaching patients who have comorbid diabetes and CVD, focus first on lifestyle risk factors that can intensify and worsen diabetes, CVD, and other common diabetes complications. (See *Patient-centered communication.*) To reduce complications and help patients maintain optimal health, emphasize the importance of good glycemic control, lifestyle interventions, and medications to control hypertension and hyperlipidemia. By providing comprehensive education, you can influence the health status of your patients with the dangerous duo of diabetes and CVD.

Charlotte A. Wisnewski is an associate professor at the University of Texas Medical Branch School of Nursing in Galveston.

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Please mark the correct answer online.

1. Which complication most often occurs in both type 1 and type 2 diabetes?

a. Cardiovascular disease (CVD)
b. Diabetic nephropathy
c. Diabetic neuropathy
d. Ophthalmologic disease

2. For patients on insulin, the recommended pre-meal glycemic target is a blood glucose level of

a. 60 to 90 mg/dL.
b. 80 to 130 mg/dL.
c. 100 to 150 mg/dL.
d. 140 to 180 mg/dL.

3. The American Diabetes Association recommends a hemoglobin A1c (HbA1c) goal of

a. 2%.
b. 5%.
c. 7%.
d. 10%.

4. Which statement related to empagliflozin is correct?

a. It raises blood glucose levels.
b. It is used for patients with type 1 diabetes.
c. It has been approved for several years.
d. It helps reduce CVD deaths.

5. Which of the following is appropriate dietary advice for a patient with diabetes who wants to reduce risk of CVD?

a. Eat a diet that favors monounsaturated fats.
b. Avoid fatty fish.
c. Reduce intake of vegetables.
d. Each fatty fish monthly.

6. Patients with diabetes should be told that excessive alcohol intake can lead to

a. diabetic neuropathy.
b. heart failure.
c. delayed hyperglycemia.
d. diabetic retinopathy.

7. Which of the following combination of exercises would be most helpful in reducing CVD risk in adults with diabetes?

a. Running and walking for up to 30 minutes per day, 7 days a week for 3 weeks each month
b. 150 minutes of moderate intensity activity per week and resistance exercise twice per week
c. One hour per day of physical activity and weight lifting three times per week
d. 45 minutes of low intensity activity weekly, resistance exercise two times per week

8. Which of the following statements related to glucose level and physical activity is correct?

a. Patients with type 1 diabetes should be told not to engage in physical activity if their blood glucose level exceeds 400 mg/dL.
b. Patients with type 2 diabetes should be told not to engage in physical activity if their blood glucose level exceeds 300 mg/dL.
c. Patients with type 1 diabetes should be told not to engage in physical activity if their blood glucose level exceeds 300 mg/dL.
d. Patients with type 2 diabetes should be told not to engage in physical activity if their blood glucose level exceeds 200 mg/dL.

9. Patients with diabetes are at risk for CV autonomic neuropathy, which

a. can lead to damage of the renal tubules.
b. is not associated with myocardial infarction.
c. can lead to damage of the central nervous system fibers.
d. is a risk factor for myocardial ischemia.

10. A patient with type 2 diabetes asks you how stopping smoking can improve his diabetes. Which of the following responses is *not* correct?

a. Smoking cessation can lower hypertension.
b. Smoking cessation can decrease albuminuria.
c. Smoking cessation can reduce diabetic nephropathy.
d. Smoking cessation can decrease weight gain.

11. Your 46-year-old patient with elevated lipids might be prescribed which class of drugs in addition to lifestyle interventions?

a. Biguanides
b. Sulfonylureas
c. Statins
d. Beta blockers

12. A good predictor of CV events and mortality in patients with diabetes is

a. length of time overweight.
b. weight-to-height ratio.
c. body lipid index.
d. waist-to-hip ratio.

13. Which of the following psychosocial factors have been found to have the strongest role in the pathogenesis of CV risk in diabetes?

a. Dementia
b. Depression
c. Bipolar disorder
d. Anxiety