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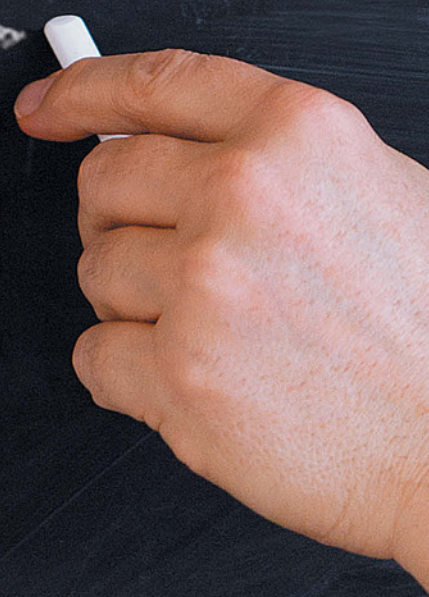

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EDUCATIONAL OBJECTIVES

Goal: To assist pharmacists on how to advise and educate patients with diabetes on medical nutrition therapy, physical activity, and health maintenance considerations.

After participating in this activity, pharmacists will be able to:

- Discuss the role of lifestyle changes in diabetes prevention and maintenance
- Identify dietary sources of carbohydrates, proteins, and fats
- Describe basic concepts of carbohydrate counting, the glycemic index, and meal planning for patients with diabetes
- List health maintenance considerations for the patient with diabetes
- Discuss sick-day management concepts for patients with diabetes

The University of Connecticut School of Pharmacy is accredited by the Accreditation Council for Pharmacy Education as a provider of continuing pharmacy education.

Pharmacists are eligible to participate in the knowledge-based activity, and will receive 0.2 CEUs (2 contact hours) for completing the activity, passing the quiz with a grade of 70% or better, and completing an online evaluation. Statement of credit is available via the online system.

ACPE #0009-9999-12-018-H01-P

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Drug Topics & University of Connecticut School of Pharmacy
Continuing Education
AN ONGOING CE PROGRAM OF THE UNIVERSITY OF CONNECTICUT SCHOOL OF PHARMACY AND *DRUG TOPICS*

Medical nutrition therapy, physical activity, and health maintenance considerations for patients with diabetes

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Abstract

With the prevalence of diabetes on the rise, timely and ongoing interventions are needed to promote healthy living and prevent chronic disease. Lifestyle modifications such as medical nutrition therapy (MNT) and physical activity have been shown to improve metabolic control, reduce the risk of developing type 2 diabetes, and decrease mortality. Therefore, all patients with pre-diabetes or existing diabetes should receive formal and ongoing MNT counseling in conjunction with regular physical activity. Meal planning utilizing all macronutrients is recommended to meet normal nutrient needs and glycemic control.

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Medication Therapy Management (MTM) in Patients with Diabetes CPE Series

Welcome to a new Medication Therapy Management (MTM) in Patients with Diabetes CPE Series, which has been designed for pharmacists who take care of patients with diabetes.

Starting last month and continuing through March 2013, pharmacists can earn up to 14 hours of CPE credit with 7 monthly knowledge-based activities from the University of Connecticut School of Pharmacy and *Drug Topics*. Last month, the professional development activity covered the pathophysiology, diagnosis, screening, and risk factors associated with diabetes mellitus.

This month, pharmacists will learn about medical nutrition therapy, physical activity, and health maintenance considerations for diabetic patients. In November and December 2012, the activities will focus on therapeutic considerations, including oral and injectable agents for diabetes care and management. In January 2013, the CPE article will cover macrovascular and microvascular complications of diabetes, and in February 2013, the focus will be psychosocial considerations in the management of the disease. In March 2013, the last knowledge-based activity will enable greater understanding of drug-induced hyper- and hypoglycemia, nonprescription medications, and complementary and alternative medicine for diabetes care.

The MTM CPE Series will also be offering application-based and practice-based activities for an additional 9 CPE credits. Online interactive case-based studies will be available with 1 hour of CPE credit, starting in February 2013.

The series will conclude with a live meeting at the University of Connecticut School of Pharmacy in May 2013, offering application of MTM concepts to the patient with diabetes and motivational interviewing skills development for health behavior change in diabetes management.

Diabetes mellitus is a complex metabolic disorder caused by various pathophysiologic abnormalities, most notably beta-cell dysfunction, increased peripheral resistance to insulin, and impaired incretin secretion/sensitivity.[1] It is estimated that approximately 26 million (8.3%) Americans have diabetes and an additional 79 million with pre-diabetes are at risk for developing the disease.[2] Persistent hyperglycemia can lead to both microvascular (nephropathy, neuropathy, and retinopathy) and macrovascular (coronary and peripheral vascular) complications. According to recent data, diabetes is the seventh leading cause of death in the United States and costs the healthcare system approximately $174 billion in direct and indirect medical costs.[2-4] Without targeted interventions for both prevention and treatment, the prevalence and cost of diabetes will continue to rise.

Four modifiable risk factors are believed to contribute to the development of chronic disease: lack of physical activity, poor nutrition, tobacco use, and excessive alcohol consumption.[5] According to 2010 data from the Centers for Disease Control and Prevention (CDC), approximately 36% of patients with diabetes are sedentary and 84% are overweight or obese.[2] Because both physical inactivity and poor nutrition are risk factors for the development of type 2 diabetes, prevention and treatment approaches must include lifestyle interventions. The American Diabetes Association (ADA) recommends that all patients with pre-diabetes and established type 2 diabetes implement lifestyle changes at the time of diagnosis.[6]

Lifestyle interventions for diabetes prevention

At the core of diabetes management is lifestyle modification, which includes medical nutrition therapy (MNT) and physical activity. MNT and physical activity are both individually effective prevention and treatment strategies, but their combination has been shown to delay the development of type 2 diabetes, according to findings from the Diabetes Prevention Program (DPP) study.[7]

The DPP was a randomized, controlled trial to assess whether lifestyle interventions or treatment with metformin could prevent or delay the onset of diabetes in high-risk individuals (those with impaired glucose tolerance). A total of 3,234 nondiabetic patients between 25 and 85 years of age were randomly assigned to 1 of 3 groups: intense lifestyle interventions, standard lifestyle recommendations plus metformin 850 mg twice daily, or standard lifestyle recommendations plus placebo. Standard lifestyle recommendations highlighted general healthy eating tips and were provided by written instruction and through an annual 20- to 30-minute in-person session. Those in the intense lifestyle intervention group were prescribed a healthy low-calorie, low-fat diet in conjunction with 150 minutes per week of moderate-intensity physical activity. The goal was to lose and maintain a 7% reduction in body weight. Average follow-up was 2.8 years.

> All patients with diabetes should receive formal and ongoing MNT counseling in conjunction with regular physical activity.

At the conclusion of the study, those in the intensive lifestyle intervention group had a 58% reduction in the risk for developing type 2 diabetes compared to a 31% reduction observed in the metformin group.[7] DPP study findings confirm the impact of early lifestyle changes in reducing the incidence of diabetes. For this reason, the ADA recommends that all patients with pre-diabetes or existing diabetes should receive formal and ongoing MNT counseling in conjunction with regular physical activity.[6]

Medical nutrition therapy

Medical nutrition therapy involves an as-

TABLE 1

BENEFITS OF MEDICAL NUTRITION THERAPY FOR DIABETES

End point	Expected outcome	When to evaluate
Glycemic control		6 weeks to 3 months
A1c	1%-2% (15%-22%) decrease, depending on duration of diabetes	
Plasma glucose (fasting)	50-100 mg/dL decrease	
Lipids		6 weeks; if goals are not achieved, intensify MNT and evaluate again in 6 weeks
Total cholesterol	24-32 mg/dL (10%-13%) decrease	
LDL cholesterol	15-25 mg/dL (12%-16%) decrease	
Triglycerides	15-17 mg/dL (8%) decrease	
HDL cholesterol		
No exercise	3 mg/dL (7%) decrease	
Exercise	No decrease	
Blood pressure (in patients with diagnosed hypertension)	5 mm Hg decrease in systolic and 2 mm Hg decrease in diastolic	Measured every medical visit

Abbreviations: A1c, glycosylated hemoglobin; HDL, high-density lipoprotein; LDL, low-density lipoprotein; MNT, medical nutrition therapy

Source: Ref 8, 12, 13

sessment of a person's nutritional status and offers individualized treatment approaches including nutrition therapy, patient education, and/or the use of dietary supplements.[8] It is a vital component in the improvement of various medical conditions. Several randomized, controlled trials, observational studies, and meta-analyses have demonstrated that MNT improves glycemic control and promotes weight loss.[9-11]

The United Kingdom Prospective Diabetes Study is among the largest randomized, controlled trials to show this benefit.[9] Over 3,000 newly diagnosed patients with type 2 diabetes received nutrition counseling from a registered dietician (RD) for up to 3 months prior to study randomization. During this time, the mean glycosylated hemoglobin (A_{1c}) decreased 1.9%.[9] **Table 1** summarizes some additional benefits of MNT.[8,12,13]

It is worth noting that MNT interventions for patients with established type 2 diabetes differ in several ways from interventions for prevention. Because of the progressive nature of diabetes, MNT interventions progress from prevention or delay of obesity, to the prevention or delay of type 2 diabetes, to strategies to improve metabolic control. The overall goals of MNT are listed in **Table 2**.[14] Regulation of blood glucose is the primary focus of MNT for patients with diabetes, so dietary techniques that help maintain glycemic control and prevent hyperglycemia or hypoglycemia are essential.[15] A patient-specific nutrition prescription that involves a mix of carbohydrate, protein, and fat (macronutrients) should be created, preferably by an RD.[6] The nutrition prescription should be based on the lifestyle changes that the patient is willing to make more than the percentages of carbohydrates, proteins, and fats.[12] Currently, there is no single recommended "diabetic diet." Many studies have tried to identify the optimal percentage of macronutrients for patients with type 2 diabetes; however, it appears that such a plan does not exist.[16] Using the Dietary Reference Intakes (DRI) seems to be the best diet approach.[16]

Although MNT is usually provided by an RD, pharmacists are well suited to offer nutritional advice as part of medication therapy management (MTM) services and routine patient counseling. The following discussion is intended to help the pharmacist gain familiarity with each macronutrient as well as to appreciate the anticipated effects of macronutrients on blood glucose control.

Pause&Ponder

How do you try to motivate patients to adapt healthy lifestyle changes? Take time to engage a patient the next time you are at your practice site.

There is no single recommended "diabetic diet."

Carbohydrates. Carbohydrates have the greatest postprandial influence on blood glucose levels and serve as the primary stimulus for insulin release. Carbohydrates are significant sources of energy, water-soluble vitamins, minerals, and fiber. Food sources include grains such as pasta, bread, and cereal; fruits; milk; sweets or desserts; and starchy vegetables such as corn, beans, and peas. Carbohydrates can be further classified by their grain content. Refined carbohydrates have had the bran and germ (components of the wheat plant) removed during milling. This process removes the fiber and other key vitamins and minerals.[17] Examples of refined carbohydrates include white bread, white rice, and many pastry products. Whole grains, or unrefined carbohydrates, have the bran and germ intact and therefore are good sources of fiber, as well as other nutrients such as selenium, potassium, and magnesium.[17] Examples of whole grains include 100% whole wheat bread, brown rice, and bulgur.

The consumption of carbohydrates from refined carbohydrate-containing food sources such as sugar-sweetened beverages, high fructose corn syrup, white grain products, and potatoes has significantly increased in the United States during the past decade.[18] The U.S. Department of Agriculture reported that individuals cur-

rently consume too many refined grains and not enough whole grains and complex carbohydrates. Recent studies have linked highly refined carbohydrate diets with diabetes, heart disease, obesity, and various cancers. One study concluded that U.S. men and women who consume more than 5 servings of white rice per week are at increased risk of developing type 2 diabetes compared to those who consume less than 1 serving of white rice per month.[19] Metabolic studies have also shown that high-carbohydrate diets increase levels of fasting triglycerides.[20,21]

Despite the glycemic effects carbohydrates have on the body, low-carbohydrate diets are not supported by the ADA or the Academy of Nutrition and Dietetics.[22] For non-pregnant women, less than 130 g daily (the low-carbohydrate standard) is not recommended because brain cells and red blood cells have an absolute requirement for glucose as an energy source.[23]

Not only do the type and quantity of carbohydrates affect glucose levels but several factors also influence glycemic response to foods.[24] These include amount of carbohydrates, type of sugar, nature of the starch, cooking and food-processing method, and food particle size and form.[22] Other factors that influence glycemic response are fasting and preprandial glucose concentrations and the severity of glucose intolerance.[22] Many studies have demonstrated that similar glycemic responses occur from a variety of carbohydrate sources when the amount of carbohydrates is consistent.[12] Recommended carbohydrate intake is 45% to 65% of total calories.[24]

Protein. Proteins are molecules composed of amino acids that are responsible for various cellular functions including muscle growth and repair.[16] Despite much research, protein does not appear to slow the absorption of carbohydrates; therefore adding protein to the diet will not decrease glucose levels.[16] Even in those with well-controlled type 2 diabetes, studies show that protein does not have an effect on blood glucose concentrations.[16,25] Therefore the consumption of protein will not correct or prevent hypoglycemia, nor will it raise glucose concentrations.[26] Of total daily calories, 10% to 20% from protein are recommended for those who do not have compromised renal function.[22] For those with renal insufficiency, protein should be limited to 0.8 g/kg daily or less than 10% of total calories.[23] Food sources of protein include meats, poultry, fish, and dairy.

TABLE 2

GOALS OF MEDICAL NUTRITION THERAPY

Achieve and maintain:

- Blood glucose concentrations in the normal range or as close to normal as is safely possible to prevent or reduce the risk for complications of diabetes
- A lipid and lipoprotein profile that reduces the risk for vascular disease
- Blood pressure levels in the normal range or as close to normal as is safely possible
- Nutrient intake and lifestyle modifications that prevent, or at least slow, and treat the chronic complications of diabetes
- Individualized MNT taking into account personal and cultural preferences and willingness to change
- Pleasure of eating maintained by limiting food choices only when indicated by scientific evidence

Abbreviations: MNT, medical nutrition therapy *Source: Ref 14*

Fat. Fats and lipids make up approximately 34% of the energy in the human diet.[16] Fat acts as insulation and is essential for the digestion and absorption of fat-soluble vitamins and phytochemicals. Fat also aids in cellular membrane structure. Food sources include oils, salad dressings, mayonnaise, nuts, and butter. Unlike protein, fats have been shown to delay glucose absorption.[15] Because individuals with diabetes are at high risk of developing cardiovascular disease, the ADA recommends that only 25% to 35% of total calories come from fat, with less than 7% of those calories from saturated fat.[22] Both saturated and trans fats should be avoided or minimized due to their atherogenic properties.

Polyunsaturated and monounsaturated fatty acids have gained recent attention for their potential beneficial effects on serum lipids. Patients with diabetes should replace saturated and trans fatty acids with sources of either monounsaturated or polyunsaturated fatty acids to help reduce low-density lipoprotein cholesterol.[16] Food sources of monounsaturated fatty acids include olive and canola oil, avocados, cashews, and select fish oils. Food sources of polyunsaturated fatty acids include vegetable oil, flaxseed oil, walnuts, and shellfish.

Fiber. Although fiber is not classified as a macronutrient, it is worth discussing. Fiber is readily found in fruits, vegetables, and whole grain products. Fiber, specifically the soluble form, has been studied not only for its potential beneficial effects on glycemic control but also for its effects on serum lipids.[27] Soluble fiber has viscous properties that help delay gastric emptying. Similarly, insoluble fiber has also been shown to lower postprandial glucose levels.[27] Several studies have linked fiber (whole grains) to lower fasting insulin and glycemic responses. The Coronary Artery Risk Development in Young Adults (CARDIA) study showed that over 10 years, low-fiber diets were associated with higher fasting insulin levels and weight gain.[28] Additionally, in the Framingham Offspring Study of 2,943 men and women, fasting insulin concentrations were lowest in those who consumed a high intake of whole grain foods.[29] Fiber consumption is strongly encouraged by the Academy of Nutrition and Dietetics for those with and without diabetes. Specific evidence is lacking to recommend higher intakes for those with diabetes compared to those who do not have diabetes.[22] Current recommendations suggest a consumption of 25 to 35 g of fiber daily.[6]

Meal planning. Meal planning is an integral component of MNT. The total amount of carbohydrates available for meals and snacks can be chosen by various methods, including carbohydrate counting or use of the glycemic index (GI). No specific meal plan is endorsed by the ADA. In fact, it is suggested to use meal-planning methods as healthy eating tools only.

TABLE 3

CARBOHYDRATE EXCHANGE LIST

Food list	Carbs (g)	Protein (g)	Fat (g)	Calories
Starch	15	0-3	0-1	80
Fruit	15	0	0	60
Milk				
Whole	12	8	8	160
2%	12	8	5	120
1%	12	8	3	110
Fat Free	12	8	0	90
Sweets	15	Varies	Varies	Varies
Nonstarchy vegetables	5	2	0	25
Meat				
High-fat	0	7	8+	100
Medium	0	7	4-7	75
Lean	0	7	0-3	45
Plant-based	Varies	7	Varies	Varies
Fat	0	0	5	45
Alcohol	Varies	0	0	100

Source: Ref 30

An important priority for food and meal planning is the total amount of carbohydrates that a person consumes for meals and snacks. Carbohydrate counting assists patients with diabetes in determining the portions and amounts of carbohydrates allotted for each meal and/or snack. Carbohydrate counting portions foods so that 15 g of carbohydrate, regardless of type, equals 1 serving or 1 exchange.[16] Exchange lists are grouped into 6 categories: starch, fruit, milk, vegetables, meat or meat substitutes, and fat. Foods on each list contain similar macronutrient values and can therefore be "exchanged" for each another. **Table 3** provides a list of carbohydrate exchanges.[30]

This approach focuses on the amount of carbohydrates, not their source. For effective carbohydrate counting, an individual must have a meal plan, an understanding of which foods contain carbohydrates, proficiency at reading nutrition labels, and tools for measuring food. Individuals who choose to count carbohydrates should test their blood glucose level both before eating and 1 to 2 hours after. This will help patients determine whether they are eating adequate amounts of food and will also reinforce the impact of carbohydrates on glucose control.

The amount of carbohydrates that is appropriate for consumption at mealtimes and for snacks should be determined by an RD and should be based on the individual's glucose control, food preferences, and eating habits. As mentioned previously, there is no specific diabetic diet that meets the needs of all patients.

Use of the GI is an alternate meal-planning technique. The GI is a rating scale that measures the changes in blood glucose after the consumption of carbohydrates.[15] Certain foods, such as white potatoes, cause an immediate rise in glucose followed by a less rapid fall, whereas others, such as apples, create smaller increases over a much longer period.[24]

It is important to note that the GI does not measure how rapidly blood glucose levels increase. The GI ranks carbohydrate exchanges according to their postprandial effect and compares these rankings on a weight-to-weight basis in grams.[15] This is then compared with the response of a reference food (usually glucose or white bread) of a similar amount.[31] Foods having a GI value less than 55 are considered low GI foods and result in less postprandial fluctuations. Moderate GI foods are those falling between 55 and 70. Foods with a GI value greater than 70 are considered high GI foods and will cause greater postprandial glucose elevations as well as hyperinsulinemia. It is important to note that although consumption of low GI foods may help stabilize blood glucose, they are not always low in calories or fat. Examples of low GI foods include Kellogg's All-Bran cereal, brown rice, spaghetti, carrots, beans, apples, and grapefruit. Foods with a moderate GI include pita bread, oatmeal cookies, and tortilla chips. Food with high GI include bagels, whole wheat and white bread, pumpkin, French fries, potatoes, and many nutrition and sports bars.[32]

Physical activity

As discussed previously, physical inactivity is a primary, modifiable risk factor for the development of type 2 diabetes. According to data from the CDC, more than one-third of all U.S. adults do not meet national recommendations for aerobic physical activity.[33] Interventions that aim to increase activity have been shown to have important benefits in patients with and at risk for developing diabetes. Studies have linked regular physical activity with a reduction in cardiovascular mortality, enhanced patient quality of life, and improved glycemic control.[34-37]

Currently, the ADA endorses the recommendations set forth in the 2008 Physical Activity Guidelines for Americans.[38] All

TABLE 4

TYPES OF MODERATE-INTENSITY EXERCISES

- Brisk walking
- Cycling
- Swimming (moderate effort)
- General home care / cleaning
- Mowing lawn
- Home repair / painting
- Fishing (standing / casting)
- Golf (carrying clubs / pulling cart)
- Tennis and other racket sports

Source: Ref 38

patients with diabetes are encouraged to perform at least 150 minutes of moderate-intensity aerobic activity per week.[6] Moderate intensity is defined as activity requiring a metabolic equivalent task (MET) score of 3.0 to 6.0 or using 50% to 70% of maximum heart rate.[39] A 2007 meta-analysis of 10 prospective cohort studies showed that patients who engaged in moderate-intensity activity had an approximate 30% lower risk of type 2 diabetes compared to sedentary adults.[40] Examples of moderate-intensity activities are included in **Table 4**.[38]

Patients are discouraged from going more than 2 consecutive days without exercise. For those with type 2 diabetes, additional recommendations apply. Unless contraindications exist, patients with type 2 diabetes should engage in 2 weekly sessions of resistance training involving large muscle groups.[41] Combining both aerobic and resistance training appears to have synergistic effects in patients with type 2 diabetes and reduces A_{1c} more than either alone.[42]

Walking at least 2 hours weekly is associated with a reduction in mortality in adults with diabetes.

Starting an exercise program can be overwhelming and confusing for patients. Pharmacists and other healthcare professionals can play an integral role in helping to educate patients about the benefits of exercise and assisting with the development of an exercise plan. For patients who may be unwilling to modify their current behavior, barriers to change should be explored. Motivational interviewing techniques including expressing empathy, resisting the righting reflex, reflective listening, and supporting self-efficacy can be used.[43]

For patients new to exercise, an effective activity suitable for all ages is walking. A 2003 prospective cohort study found that walking at least 2 hours per week was associated with a significant reduction in both all-cause and cardiovascular mortality in adults with diabetes compared to sedentary adults.[44] Walking is safe, easily accessible, and appropriate for patients of advanced age or those with mobility challenges (e.g., arthritis). Use of a pedometer can help track the number of steps walked daily. A general goal is to walk 10,000 steps daily.[38] Patients struggling to achieve this goal can start by walking as tolerated and work to increase the number of steps over time. Achieving this daily goal may help build self-efficacy and motivate patients to adhere to their exercise plan.

Although the benefits of increased physical activity are plentiful, exercise-induced hypoglycemia can occur, especially for patients taking insulin or oral secretagogues. Signs and symptoms may include mental confusion, irritability, tingling or tremor of the hands, fatigue, sweating, and visual changes. This form of hypoglycemia is believed to be the result of hyperinsulinemia and the body's inability to adapt to the reduced need for insulin during exercise.[45] In an effort to reduce the risk of exercise-induced hypoglycemia, patients with diabetes can be provided with these counseling tips:

- Always carry a quick-acting glucose source that provides 15 g of carbohydrate to correct low blood sugars. An example is 3 glucose tablets or 1 tablespoon of table sugar.
- Carry a self-monitoring blood glucose (SMBG) meter at all times. If you start to experience the signs and symptoms of hypoglycemia, test your blood sugar to verify and treat appropriately.
- For patients with type 1 diabetes, referral to a certified diabetes educator (CDE), RD, or primary care provider (PCP) is suggested before the commencement of any exercise program. Patients with type 1 diabetes may need insulin dose adjustments or modifications to their carbohydrate consumption before workouts.

Pause&Ponder

Reflect on your current practice: What one change related to MNT could you make to improve the care of your patients with diabetes?

Other health maintenance considerations for diabetes management

Immunizations. The risk of developing serious illness from influenza and pneumonia are highest in children, adults older than 65 years of age, and those with chronic disease.[46] The ADA recommends that patients with diabetes receive appropriate and timely vaccinations. All patients 6 months and older should receive a yearly influenza vaccine.[6] Patients should be immunized with the trivalent inactivated influenza vaccine (TIV) via intramuscular injection.[47] Furthermore, the pneumococcal polysaccharide vaccine (PPSV23) should be given to all patients with diabetes 2 years of age and older.[47] A one-time revaccination dose is recommended for individuals 19 years through 64 years of age who were previously immunized when they were younger than 65 years of age, as long as the previous dose was administered more than 5 years earlier.[6] Patients with diabetes may have additional comorbid conditions such as hepatitis that may require supplemental vaccination. Administration of the hepatitis B series should be considered, based on current CDC recommendations.

Foot, eye, and oral care. It is estimated that a majority of diabetes-induced foot amputations are the result of an avertable foot complication.[48] Patient education about foot care can help minimize foot complications associated with diabetes. Proper foot care requires these main interventions: an annual, comprehensive foot exam (usually performed by a podiatrist) and daily foot monitoring.[6] The annual foot exam can identify early signs of peripheral artery disease, peripheral neuropathy, and other foot complications such as ulcers, foot infections, and hypertrophic nails. Visual inspection of foot integrity and musculoskeletal deformities, assessment of pedal pulses, and testing for loss of protective sensations are

TABLE 5

FOOT CARE RECOMMENDATIONS

- Maintain blood glucose in the target range
- Check feet daily for cuts, blisters, or other abnormalities
- Wash and dry feet daily
- Maintain adequate foot hydration
- Trim/cut toenails when needed
- Wear proper fitting shoes and socks at all times
- Avoid walking barefoot
- Increase physical activity

Source: Ref 49

integral components of the exam.[6] Patients can take an active role in preventing foot complications by performing daily foot inspections, wearing protective footwear, and maintaining adequate foot hydration. **Table 5** lists additional foot care recommendations.[49] Many pharmacists have also been trained to conduct foot exams as part of MTM services.

Diabetic retinopathy remains the leading cause of blindness among adults worldwide.[50] Risk factors for its development include duration of diabetes, poor glycemic control, and concomitant hypertension.[51] In an effort to reduce the risk and slow the progression of retinopathy, glycemic and blood pressure control should be optimized.[6] For most patients this requires achieving an A_{1c} of 7% or lower and goal blood pressure of 130/80 mm Hg or lower.

For patients older than 10 years of age with type 1 diabetes, retinopathy screening should begin within 5 years of diagnosis. For those with type 2 diabetes, screening should start at the time of diagnosis.[6] Dilated eye exams should be performed by an ophthalmologist or optometrist who is knowledgeable and experienced in diagnosing diabetic retinopathy. After the initial screening, patients should be screened on a yearly basis.

Patients with diabetes are also at increased risk of developing oral complications, including but not limited to periodontitis, oral caries, gingivitis, taste disturbances, and oral infections.[52] Because diabetes itself causes gingival changes and increased susceptibility to infections, treating periodontal disease can be challenging.[53] Poor glycemic control, defined as an A_{1c} of 9% or higher, is a primary risk factor for developing oral complications, but smoking may also contribute. Therefore effective prevention and treatment strategies include maintaining glycemic control, tobacco cessation (in appropriate patients), and proper dental hygiene. The CDC recommends routine teeth cleaning and dental checks every 6 months. If periodontal disease is present, more frequent follow-up is suggested.[54] Patients can engage in proper oral care by brushing and flossing their teeth at least twice daily.

Sick-day management. Sick days are commonly referred to as a period of acute illness (e.g., infection, fever) during which blood glucose levels can fluctuate and be difficult to maintain. Patients with poorly controlled diabetes have enhanced susceptibility to infections due to altered immune response and chronic inflammation.[16]

Illnesses characterized by fever stimulate the production of stress hormones, which promote gluconeogenesis, resulting in hyperglycemia. Conversely, symptoms such as nausea, vomiting, and diarrhea induce hypoglycemia as a result of reduced dietary intake and delayed gastric emptying.[16]

Children, adolescents, and older adults are at high risk of developing complications from sick days. It is critical to work with these groups and develop a plan of care for coping with sick days.

Much of the guidance available discusses sick-day management strategies for children and adolescents.[55] Despite formal recommendations for adults, the following principles can be generalized to all patients as part of a sick-day plan:

Continue to take medications and insulin as prescribed. Uninterrupted use of oral antidiabetic agents and insulin can help prevent diabetic ketoacidosis and hyperglycemic hyperosmolar syndrome.

Increase the frequency of blood glucose testing. Encourage patients to test blood glucose every 3 to 4 hours. Those with severe illness and/or poorly controlled diabetes may need more frequent testing every 1 to 2 hours.

Maintain adequate fluid intake to prevent dehydration. Persistent hyperglycemia and fever can induce fluid loss. Older adults are at increased risk due to decreased thirst sensation, impaired response to intravascular volume depletion, and increased prevalence of diuretic use.[56] If symptoms of vomiting or diarrhea are present, counsel patients to consume electrolyte-containing beverages such as oral rehydration solution.

Notify PCP of acute illness. Because blood glucose can be difficult to regulate during acute illness, medication adjustments may be needed. Informing a PCP is also critical when persistent symptoms of fever, vomiting, diarrhea, and dehydration are experienced. Patients presenting with such symptoms may be referred to the emergency room for further evaluation and management.

Conclusion

With the prevalence of diabetes on the rise, timely and ongoing interventions are needed to promote healthy living and prevent chronic disease.

Lifestyle modifications such as MNT and physical activity have been shown to improve metabolic control, reduce the risk of developing type 2 diabetes, and decrease mortality.

All patients with pre-diabetes or existing diabetes should receive formal and ongoing diabetes self-management education, MNT counseling, and regular physical activity.

Meal planning utilizing all macronutrients is recommended to meet normal nutrient needs and glycemic control.

Effective diabetes management requires a team-based approach to care. Pharmacists and other healthcare professionals can play a pivotal role in helping patients achieve improved outcomes through ongoing education and patient engagement.

References

1. Defronzo RA. Banting Lecture. From the triumvirate to the ominous octet: A new paradigm for the treatment of type 2 diabetes mellitus. *Diabetes.* 2009;58:773–795.
2. Centers for Disease Control and Prevention. 2011 National Diabetes Fact Sheet. *http://www.cdc.gov/diabetes/pubs/estimates11.htm#1.* Accessed July 30, 2012.
3. Centers for Disease Control and Prevention. Deaths: Preliminary data for 2010. NVSR. 2012;60(4);1-69. *http://www.cdc.gov/nchs/products/nvsr.htm.* Accessed July 30, 2012.
4. Centers for Disease Control and Prevention. Studies on the cost of diabetes. *http://www.cdc.gov/diabetes/pubs/costs/tables.htm#table1.* Accessed July 30, 2012.
5. Centers for Disease Control and Prevention. Chronic diseases and health promotion. *http://www.cdc.gov/chronicdisease/overview/index.htm.* Accessed July 30, 2012.
6. American Diabetes Association. Standards of medical care in diabetes–2012. *Diabetes Care.* 2012;35(Suppl 1):S11–S63.
7. Knowler WC, Barrett-Connor E, Fowler SE, et al; Diabetes Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med. 2002;346:393–403.*
8. Pastors JG, Warshaw H, Daly A, Franz M, Kulkarni K. The evidence for the effectiveness of medical nutrition therapy in diabetes management. *Diabetes Care.* 2002;25:608–613.
9. UK Prospective Diabetes Study 7: Response of fasting plasma glucose to diet therapy in newly presenting type II diabetic patients, UKPDS Group. *Metabolism.* 1990;39:905–912.
10. Delahanty LM, Halford BH. The role of diet behaviors in achieving improved glycemic control in intensively treated patients in the Diabetes Control and Complications Trial. *Diabetes Care.* 1993;16:1453–1458.
11. Norris SL, Engelgau MM, Narayan KM. Effectiveness of self-management training in type 2 diabetes: A systematic review of randomized controlled trials. *Diabetes Care.* 2001;24:561–587.
12. Franz MJ, Bantle JP, Beebe CA, et al. Evidence-based nutrition principles and recommendations for the treatment and prevention of diabetes and related complications. *Diabetes Care.* 2002;25:148–198.
13. American Dietetic Association. *Disorders of Lipid Metabolism. Evidence-Based Nutrition Practice Guidelines.* Chicago, IL: American Dietetic Association; 2011.
14. Bantle JP, Wylie-Rosett J, Albright AL, et al; American Diabetes Association. Nutrition recommendations and interventions for diabetes: A position statement of the American Diabetes Association. *Diabetes Care.* 2008;31(Suppl 1):S61–S78.
15. Sheard NF, Clark NG, Brand-Miller JC, et al. Dietary carbohydrate (amount and type) in the prevention and management of diabetes. A statement by the American Diabetes Association. *Diabetes Care.* 2004;27:2266–2271.
16. Mahan LK, Escott-Stump S. *Krause's Food and Nutrition Therapy,* 12th ed. Philadelphia, PA: Saunders Elsevier; 2008.
17. Mayo Clinic. Health information. Whole grains: Hearty options for a healthy diet. *http://www.mayoclinic.com/health/whole-grains/NU00204.* Accessed July 30, 2012.
18. Lui S. Intake of refined carbohydrates and whole grain foods in relation to risk of type 2 diabetes mellitus and coronary heart disease. *J Am Coll Nutr.* 2002;21:298–306.
19. Sun Q, Spiegelman D, van Dam RM, et al. White rice, brown rice, and risk of type 2 diabetes in US men and women. *Arch Intern Med.* 2010;170:961–969.
20. Jeppesen J, Schaaf P, Jones C, et al. Effects of low-fat, high-carbohydrate diets on risk factors for ischemic heart disease and postmenopausal women. *Am J Clin Nutr.* 1997;65:1027–1033.
21. Abbasi F, McLaughlin T, Lamendola C, et al. High carbohydrate diets, triglyceride-rich lipoproteins, and coronary heart disease risk. *Am J Cardiol.* 2000;85:45–48.
22. American Diabetes Association. Nutrition recommendations and interventions for diabetes: A position statement of the American Diabetes Association. *Diabetes Care.* 2007;30(Suppl 1):S48–S65.
23. American Diabetes Association. Standards of medical care in diabetes–2006. *Diabetes Care.* 2006;29(Suppl 1):S4–S42.
24. Institute of Medicine. *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids,* Cholesterol, Protein, and Amino Acids. Washington, DC: National Academies Press; 2002.
25. Gannon MC, Nuttall JA, Damberg G, Gupta V, Nuttall FQ. Effect of protein ingestion on the glucose appearance rate in people with type 2 diabetes. *J Clin Endocrinol Metab.* 2001;86:1040–1047.
26. Gray RO, Butler PC, Beers TR, Kryshak EJ, Rizza RA. Comparison of the ability of bread versus bread plus meat to treat and prevent subsequent hypoglycemia in patients with insulin-dependent diabetes mellitus. *J Clin Endocrinol Metab.* 1996;81:1508–1511.
27. Weickert MO, Pfeiffer AF. Metabolic effects of dietary fiber consumption and prevention of diabetes. *J Nutr.* 2008;138:439–442.
28. Ludwig DS, Pereira MA, Kroenke CH, et al. Dietary fiber, weight gain, and cardiovascular disease risk factors in young adults. *JAMA.* 1999;282:1539–1546.
29. McKeown NM, Meigs JB, Liu S, Wilson PW, Jacques PF. Whole-grain intake is favorably associated with metabolic risk factors for type 2 diabetes and cardiovascular disease in the Framingham Offspring Study. *Am J Clin Nutr.* 2002;76:390–398..
30. Wheeler ML, Daly A, Evert A, et al. *Choose Your Foods: Exchange Lists for Diabetes,* 6th ed Alexandria, VA: American Diabetes Association and American Dietetic Association; 2008.
31. Jenkins DJ, Wolever TM, Taylor RH, et al. Glycemic index of foods: A physiological basis for carbohydrate exchange. *Am J Clin Nutr.* 1981;34:362–366.
32. Brand-Miller J, Foster-Powell K, Holt S, Burani J. *The New Glucose Revolution Complete Guide to Glycemic Index Values.* New York, NY: Marlowe; 2003.
33. Centers for Disease Control and Prevention. Prevalence of self-reported physically active adults—United States, 2007. *MMWR.* 2008;57:1297–1300. *http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5748a1.htm.* Accessed July 30, 2012.
34. Hu FB, Stampfer MJ, Solomon C, et al. Physical activity and risk for cardiovascular events in diabetic women. *Ann Intern Med.* 2001;134:96–105.
35. Tanasescu M, Leitzmann MF, Rimm EB, Hu FB. Physical activity in relation to cardiovascular disease and total mortality among men with type 2 diabetes. *Circulation.* 2003;107:2435–2439.
36. Nicolucci A, Balducci S, Cardelli P, Zanuso S, Pugliese G; Italian Diabetes Exercise Study (IDES) Investigators. Improvement of quality of life with supervised exercise training in subjects with type 2 diabetes mellitus. *Arch Intern Med.* 2011;171:1951–1953.
37. Umpierre D, Ribeiro PA, Kramer CK, et al. Physical activity advice only or structured exercise training and association with HbA1c levels in type 2 diabetes: A systematic review and meta-analysis. *JAMA.* 2011;305:1790–1799.
38. U.S. Department of Health and Human Services. 2008 physical activity guidelines for Americans. *http://www.health.gov/PAGUIDELINES/guidelines/default.aspx#toc.* Accessed July 30, 2012.
39. Pate RR, Pratt M, Blair SN, et al. Physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA.* 1995;273:402–407.
40. Jeon CY, Lokken RP, Hu FB, van Dam RM. Physical activity of moderate intensity and risk of type 2 diabetes: A systematic review. *Diabetes Care.* 2007;30:744–752.
41. Colberg SR, Sigal RJ, Fernhall B, et al; American College of Sports Medicine; American Diabetes Association. Exercise and type 2 diabetes. The American College of Sports Medicine and the American Diabetes Association: Joint position statement executive summary. *Diabetes Care.* 2010;33:2692–2696.
42. Church TS, Blair SN, Cocreham S, et al. Effects of aerobic and resistance training on hemoglobin A1c levels in patients with type 2 diabetes: A randomized controlled trial. *JAMA.* 2010;304:2253–2262.
43. Rollnick S, Miller WR, Butler CC. *Motivational Interviewing in Health Care: Helping Patients Change Behavior,* 1st ed. New York, NY: Guilford Press; 2008.
44. Gregg EW, Gerzoff RB, Caspersen CJ, Williamson DF, Narayan KM. Relationship of walking to mortality among US adults with diabetes. *Arch Intern Med.* 2003;163:1440–1447.
45. Kemmer FW. Prevention of hypoglycemia during exercise in type 1 diabetes. *Diabetes Care.* 1992;15:1732–1735.
46. Centers for Disease Control and Prevention. Prevention and control of influenza. Recommendations of the Advisory Committee on Immunization Practices (ACIP), 2008. *MMWR.* 2008;57:1-60. *http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5707a1.htm.* Accessed July 30, 2012.
47. Centers for Disease Control and Prevention. General recommendations on immunization. Recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR.* 2011;60:1-60. *http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6002a1.htm.* Accessed July 30, 2012.
48. Lavery LA, Armstrong DG, Vela SA, Quebedeaux TL, Fleischli JG. Practical criteria for screening patients at high risk for diabetic foot ulceration. *Arch Intern Med.* 1998;158:157–162.
49. American Diabetes Association. Living with diabetes: Foot care. *http://www.diabetes.org/living-with-diabetes/complications/foot-complications/foot-care.html.* Accessed July 30, 2012.
50. Klein BE. Overview of epidemiologic studies of diabetic retinopathy. *Ophthalmic Epidemiol.* 2007;14:179–183.
51. DynaMed. Diabetic retinopathy. *http://www.ebscohost.com/DynaMed/.* [Registration and login required.] Accessed July 30, 2012.
52. Lamster IB, Lalla E, Borgnakke WS, Taylor GW. The relationship between oral health and diabetes mellitus. *J Am Dent Assoc.* 2008;139:19S–24S.
53. Mealey BL. Periodontal disease and diabetes. A two-way street. *J Am Dent Assoc.* 2006;137:26S-31S.
54. Centers for Disease Control and Prevention. *The Prevention and Treatment of Complications of Diabetes Mellitus. A Guide for Primary Care Practitioners.* Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service; 1991.
55. Brink S, Laffel L, Likitmaskul S, et al. Sick day management in children and adolescents with diabetes. *Pediatr Diabetes.* 2009;10(Suppl 12):146–153.
56. Gaglia JL, Wyckoff J, Abrahamson MJ. Acute hyperglycemic crisis in the elderly. *Med Clin North Am.* 2004;88:1063–1084.