Reducing cardiovascular risk in patients with type 2 diabetes

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Supported by an independent educational grant from Merck & Co. Inc.
Reducing cardiovascular risks in patients with type 2 diabetes

It is well established that patients with type 2 diabetes mellitus have a higher risk of having a cardiovascular event than patients without diabetes. It is important that healthcare workers who take care of patients try to minimize this risk. We all counsel patients on weight loss, smoking cessation, and blood pressure control. Some patients are able to achieve their goals with only lifestyle changes, but as is more often the case, some assistance is required. This help may come in the form of medications, education, and even surgery.

Patients who have diabetes mellitus should be cognizant of the need to take their condition and its comorbidities seriously. Letting patients know that the American Diabetes Association considers diabetes to be a coronary heart disease equivalent may help patients understand why it is so important to try to reduce risk factors in every way possible. Another sobering fact is that patients who have diabetes are two times as likely to die as patients without diabetes who are the same age. Patients with diabetes need to be educated on how a heart attack may present atypically. They may be familiar with the symptoms of chest pressure, diaphoresis, back pain, heartburn, or other less obvious symptoms of MI in patients with diabetes. An aggressive, multipronged approach, with education as the foundation, is needed in patients with diabetes. Involving family members is invaluable, if the patient is amenable to their participation.

The present issue of AOA HealthWatch explores the management of some comorbidities of diabetes. Cassandra Ramar, DO, and W. Joshua Cox, DO, review the current guidelines for management of dyslipidemia in diabetic patients and review medication classes and their indications for use. In addition, the authors look at suggested goals—numbers for patients to achieve on their lipid panels—as well as medication interactions, side effects, and combination therapies.

Jarrod M. Harrall, DO, and Andrea Tufo, OMS IV, discuss taking a multifactorial approach to management of CVD risk factors with both pharmaceutical interventions and lifestyle modifications.

Jennifer Capra, OMS IV, and George Kolo, DO, explore the role of surgery as a treatment and adjunct to reduce cardiometabolic risk factors in diabetics. The authors highlight the burden of obesity, both from a health and financial standpoint, then review different modalities utilized by patients to reduce weight, as well as the varying degrees of success attainable by each method. The types of bariatric surgeries as well as the potential risks and benefits, and indications are summarized. Costs and the efficacy of surgery finish off the article.

The surgery topic is especially timely, as the results of 2 new randomized controlled trials were recently revealed. One study compared bariatric surgery vs standard medical therapy and the other compared bariatric surgery to intensive medical therapy. Both of these were conducted in morbidly obese patients who had type 2 diabetes. In both of the studies, the patients who underwent surgery had significant (vs the medical therapy groups) improvement in both their obesity, as well as control of their diabetes.2,3 Surgery has the potential for many complications, but should not be discarded as a potential treatment option until all of the factors have been explored, and risks assessed. While more research needs to be done on outcomes, this is an interesting approach to the problem of diabetes and obesity. In addition, as technology improves, the potential exists for surgeries to be done more frequently and with improved outcomes.

Finally, Jaclyn Alred, OMS IV, and I present a patient’s perspective about bariatric surgery. One of my patients with diabetes, “Lindsey G,” had pondered for quite some time about whether or not to have this surgery. She developed type 2 diabetes as an adult, and after gradually increasing doses of medication, which were started after lifestyle changes were unsuccessful, was placed on insulin, which caused further weight gain. She has a great attitude, and we are happy to report that she is doing well after having had bariatric surgery.

References

Gautam J. Desai, DO, is an associate professor in the Department of Family Medicine at Kansas City University of Medicine and Biosciences College of Osteopathic Medicine in Missouri. He is a Fellow of the American College of Osteopathic Family Physicians, and serves on various committees for the AOA, ACOFP, NBOME, and other organizations. He can be reached at GDesai@kcumb.edu.
World Health Organization statistics indicate that more than 1.5 billion people are overweight, and 500 million of them are obese.\(^1\) Globally, overweight and obesity make up the fifth leading cause of death.\(^1\) These physical conditions are also a huge financial burden to society. They are typically accompanied by worsening comorbidities that lead to an increasing number of disabilities and decreased productivity in the work place.
Overweight and obese employees tend to have a higher number of absences from work, sick leave, and disability, as well as higher risks of work-related injuries. The comorbidities associated with obesity and overweight include asthma, coronary artery disease, diabetes mellitus, gallstones, gastrointestinal reflux disease, hernias, hypertension, osteoarthritis, and sleep apnea. Diabetes mellitus—the focus of the present article—is responsible for approximately 44% of the financial burden related to obesity.

Cardiovascular disease is also prevalent today, with men having a 42% risk and women a 25% risk, of coronary heart disease. In patients with diabetes mellitus, this risk increases. A study that evaluated the prevalence of heart disease among individuals with and without diabetes mellitus and obesity found that the lifetime risk of diabetes in the obese population is about 74%. The study further found that the risk of cardiovascular disease in the obese population with diabetes rises to 50% in women and 90% in men.

Diabetes mellitus is prevalent in 44% of the overweight and obese population. Obese patients with diabetes mellitus not only suffer from complications of the disease, but they also must endure the high costs of medications and of such weight-loss efforts as special diets, gym memberships, and counseling. Conventional efforts to lose weight, such as behavioral changes, tend to have the most long-term benefits, but surgical interventions provide the most durable and effective method of reversing obesity. An estimated $174 billion was spent in 2007 in the United States as a result of diabetes mellitus, and about 1 in 10 US health care dollars goes to the care of patients with diabetes.

Obesity and overweight are caused essentially by an imbalance of energy consumed and energy expended. Obese and overweight individuals typically consume foods that are high in fats and sugars and spend insufficient time exercising because of a sedentary lifestyle. One study that evaluated the effects of dietary content on body composition showed that greater protein intake vs less protein intake did not affect the individual’s body fat content. Although the study suggested that high-protein diets might affect how energy is expended and how lean body mass is stored, body fat storage was not affected. Rather, calories alone accounted for increases in fat, with individuals who ate less protein gaining less weight. Thus, the composition of dietary intake is important to body composition and energy expenditure, but it is simply a mathematical equation of input minus output that equals a net gain of calories and weight.

**Methods of weight loss**

Weight-loss strategies that include diet and exercise are an effective way to decrease weight and maintain a healthy lifestyle. However, such strategies often require major behavioral and lifestyle changes that many individuals find difficult to adhere to. Thus, lifestyle modifications do not always result in long-term change or successful weight management. An individual’s sex and age can affect the success of a weight-loss plan. Men tend to lose weight faster than women, and older individuals have a lower metabolic expenditure than younger individuals.

In a study that evaluated different strategies of diets for their effects on weight loss (eg, low-calorie diets, balanced-deficit diets, low-fat and low-carbohydrate diets), adherence was found to be the most important factor in the success of the diets. Weight-loss effectiveness did not vary significantly with type of diet. Dietary changes combined with behavioral changes, including increased physical activity, proved to be the most effective strategy that produced the greatest weight loss.
Additional investigation showed that weight loss was further increased by an average of almost 9 pounds over a 12-month period with more intense physical activity. Weight loss was increased by another 17 pounds with the combination of behavioral therapy and diet.

**Pharmacologic therapy**

Two drug therapies—sibutramine hydrochloride and orlistat—are approved by the US Food and Drug Administration (FDA) for medical management of weight loss. The effectiveness of sibutramine and orlistat, however, is limited to static control of obesity rather than long-term reduction of weight. Patients often regain weight after discontinuing the medications.

Sibutramine inhibits reuptake of norepinephrine, serotonin, and dopamine in the neural pathway to stimulate the brain’s satiety center and decrease food intake, resulting in the possible adverse effects of constipation and insomnia. Sibutramine can also increase blood pressure and heart rate in some patients. In such cases, the medication must be discontinued. Orlistat inhibits lipases in the gastrointestinal tract, preventing the absorption of fat. Adverse effects associated with orlistat include abdominal pain, fecal urgency or incontinence, and liquid or soft stool. A patient typically experiences at least 1 of these gastrointestinal adverse effects.

Other possible complications of orlistat use include malabsorption of lipophilic medications, such as cyclosporine—in which case the use of orlistat should be suspended until the other medication is no longer used.

**Bariatric surgery**

In 1991, the National Institutes of Health (NIH) developed general guidelines for better assessing the need for bariatric surgical procedures. According to the guidelines, bariatric surgery should be performed only if the patient has a body mass index (BMI) of 40 or greater, is well informed and motivated, has acceptable risk for surgery, and has previously undergone unsuccessful nonsurgical weight-loss attempts. Other indications for bariatric surgery, according to the NIH, are a BMI of 35 or greater with severe comorbidities, such as diabetes mellitus or sleep apnea. The NIH notes that gastric bypass is an effective type of bariatric surgery for losing weight and decreasing BMI. Patients can lose as much as 60% of excess body weight with the gastric bypass Roux-en-Y procedure and as much as 50% of excess body weight with the adjustable laparoscopic banding procedure.

Bariatric surgery can be life-changing for individuals battling diabetes mellitus. This article will focus on the reduction of risk factors for type 2 diabetes. The American Diabetes Association (ADA) has defined diabetes remission after bariatric surgery as a glycated hemoglobin (HbA1c) level of less than 6% without the use of hypoglycemic medications for at least 1 year after surgery. In an analysis of diabetes remission rates (based on this ADA definition) following any of 3 types of bariatric surgery, remission was achieved in 34.4% of the patients studied. Remission rates varied among types of bariatric surgery, with a rate of 41% after gastric bypass surgery, 26% after sleeve gastrectomy, and 7% after gastric banding.

**Types of bariatric surgery**

Bariatric surgery induces 2 main types of mechanisms of weight loss—restriction or malabsorption—or a combination of both mechanisms may occur. Restrictive surgical procedures decrease the amount of space available for the stomach to hold food intake, such as by removing part of the stomach, decreasing the rate at which the stomach can empty, or narrowing the outlet through gastric banding. Commonly performed restrictive procedures include vertical gastric banding and laparoscopic adjustable gastric banding. These procedures limit the amount of space in the stomach, preventing the individual from overeating and prolonging the time it...
tions, such as diabetes mellitus, heart disease, or sleep apnea. This procedure also allows for progressive weight loss. In each postprocedure year, there can be a gradual increase in weight loss that can be achieved by adjusting the band. Unfortunately, laparoscopic adjustable gastric banding has a high complication rate because of band erosion, infection, and tube disconnections. More than half of patients undergoing this procedure require reoperation.9

An example of a surgical procedure that uses a combination of restriction and malabsorption is Roux-en-Y, in which a small part of the stomach is rerouted further down the gastrointestinal tract. This procedure may be performed laparoscopically, allowing for quicker recovery time and decreased postoperative complications.9 The Roux-en-Y procedure has allowed for a weight-loss success rate of as much as 65%.9

Although these 2 procedures, laparoscopic adjustable gastric banding and Roux-en-Y, are the most commonly performed weight-loss surgeries, other forms of bariatric surgery, such as sleeve gastrectomy and biliopancreatic diversion, are also performed. However, these less common procedures are not discussed in the present article.

Cost and cost-effectiveness
Studies have evaluated the safety and cost-effectiveness of bariatric surgery, as well as the effects of this surgery on diabetes mellitus. In 2006, the Centers for Medicare & Medicaid Services (CMS) issued a National Coverage Decision stating that laparoscopic adjustable gastric banding would be reimbursed in addition to other approved bariatric procedures, though these reimbursed procedures had to be performed at accredited centers.11 The CMS coverage decision resulted in a decrease in mortality and morbidity after bariatric procedures, as well as an increase in the use of laparoscopic adjustable gastric banding and decreases in the other bariatric procedures.11

The CMS has approved coverage of bariatric surgery for any patient with a BMI greater than 35 and with clinically significant comorbidities (per previously mentioned NIH guidelines).12,13 These comorbidities include T2DM and previous failures of medication therapy for obesity.12 To be covered, the surgeries must be performed at centers that meet CMS requirements.

The cost of bariatric surgery without insurance varies according to procedure, medical center, and geographic region. The average cost for gastric bypass surgery ranges from $18,000 to $35,000, including imaging, preprocedure visit, preoperative laboratory tests, anesthesia, and facility and/or surgeon fees.14 This cost does not include behavioral counseling before and after surgery, nor the use of supplemental vitamins.14 The cost of adjustable band procedures ranges from $17,000 to $30,000, including anesthesia and hospital and surgeon fees, as well as radiography, radiology, and laboratory test fees.14 These costs usually also include postsurgical visits related to band adjustments for 1 year. After 1 year, the cost for band adjustments is typically $100 to $175 per visit.14

Obesity has resulted in estimated medical expenditures of $147 billion each year in the United States, with diabetes mellitus adding costs of more than $150 billion each year.2

Can bariatric surgery decrease the health care costs and overall medical expenses of patients? A study published in January 2012 analyzed the preprocedure and postprocedure costs to the individual patient with type 2 diabetes mellitus undergoing bariatric surgery.15 Costs were analyzed in 1-year increments and included office visits, hospital visits, medications, and other health care expenses. Among patients receiving bariatric surgery, the total health care costs were higher after surgery than before the procedure.15 In addition, inpatient and hospitalization costs after surgery increased over time and were highest 2 to 6 years after the procedure.15
Overall, the health care costs of these patients did not decrease after bariatric surgery. The study further showed that there is a decrease in medication costs after bariatric surgery, inferring that patients have a decreased requirement for diabetic medications after surgery. In regard to cost variation depending on type of surgery, costs were lower in patients undergoing laparoscopic surgery than in those who elected or required open surgical procedures.

Although research suggests that costs of patient visits and overall health care expenditures may increase after bariatric surgery, the economic value of increased productivity and mobility of patients has not been measured after these surgical procedures. Increased productivity and mobility are invaluable outcomes that can lead to decreased comorbidities and improved quality of life.

**Long-term effects of obesity**

Obesity affects the endocrine system and can cause a “domino effect” of complications. Adipose tissue releases inflammatory substances that act on various other tissues, potentially disrupting the endothelial lining of the vasculature, leading to atherosclerosis. Some of these inflammatory substances can also act on the liver and on skeletal muscle, creating insulin resistance and, ultimately, diabetes mellitus. This development is of special concern in the growing pediatric obese population, in whom the incidences of diabetes mellitus and cardiovascular complications are increasing.

Diabetes mellitus is a known risk factor for cardiovascular complications and can increase a patient’s risks for coronary artery disease, stroke, myocardial infarction, and other vascular complications. As many as 80% of patients with diabetes mellitus die of cardiovascular complications, and individuals with diabetes have a 5-times greater risk of mortality than patients without diabetes. Therefore, if resolution of diabetes mellitus can be achieved through bariatric surgery, cardiovascular improvements can be expected to follow. Bariatric surgery may also induce improvements in glucose tolerance, lipid control, and hypertension.

Obesity causes increased strain on the heart, doubling the risk of heart failure compared to the risk in individuals who are not obese. Many obese people with such a condition are said to have “obesity cardiomyopathy.” However, this term applies only to patients without other causes of cardiomyopathy, such as diabetes mellitus, hypertension, and hyperlipidemia. Cardiovascular risks are also associated with obstructive sleep apnea, which, in turn, is often associated with obesity and can develop into right-sided heart failure and pulmonary hypertension.

A recent study demonstrated that obese patients who underwent bariatric surgery had a statistically significantly reduced cardiovascular risk compared to obese patients who did not undergo bariatric surgery. These patients had decreased incidence of stroke and myocardial infarction and an overall reduction of fatal events. It has also been shown that surgically induced weight loss can alter the metabolic functioning of patients through restrictive and malabsorptive mechanisms. One study demonstrated a statistically significant improvement in insulin sensitivity in individuals both with and without diabetes mellitus after bariatric surgery. That study also found a correlation between decreasing BMI with increasing insulin sensitivity.

**Final notes**

Obesity, diabetes mellitus, and cardiovascular complications are tightly linked. Thus, weight loss and management of coexisting diseases are highly important factors for decreasing the number of
cardiovascular events and future complications related to diabetes mellitus. Although behavioral and lifestyle changes can promote adequate weight loss, the majority of the population is unable to achieve these changes. Pharmacologic agents can help, though they do not produce lifelong metabolic effects that result from weight loss through such surgery, but they alter the metabolic function in obese individuals. It is apparent that bariatric surgery is beneficial in inducing weight loss and can alter the metabolic function in obese individuals. Patients not only benefit from weight loss through such surgery, but they also benefit from the physical, endocrine, and metabolic effects that result from altering the structure of the gastrointestinal tract.

Studies suggest that bariatric surgery is more cost-effective and beneficial than conservative methods of weight reduction. Unfortunately, to our knowledge there are no lifelong studies comparing costs for patients who received bariatric surgery vs those who did not undergo the surgery. Nevertheless, one might assume that the lifelong costs of cardiovascular complications associated with obesity and diabetes mellitus would be more than costs after weight reduction from surgery. Bariatric surgery also has the potential to lengthen the patient’s lifespan. It is important to keep in mind that insurance companies and the Medicare program cover bariatric surgery through guidelines they have established for beneficiaries.

Most obese patients will be unable to achieve the lifestyle and behavioral changes necessary to reduce their cardiometabolic risks. If the obese patient is mentally, physically, and financially able to proceed, bariatric surgery can offer an effective and satisfying outcome.

References

Primary prevention of coronary artery disease in patients with type 2 diabetes mellitus

Jarrod M. Harrall, DO
Andrea Tufo, OMS IV

The Centers for Disease Control and Prevention (CDC) estimated that 18.8 million people in the United States had diagnosed diabetes mellitus in 2010, with an additional 7 million people having diabetes that was undiagnosed.¹
Currently, the diagnosis of diabetes mellitus is made with repeat testing based on 1 of the following 3 findings:

1. glycosylated hemoglobin (HbA1c) level is > 6.5%;
2. fasting plasma glucose level is > 126 mg/dL;
3. 2-hour plasma glucose level is > 200 mg/dL during an oral glucose tolerance test. Adults with diabetes mellitus are 2 to 4 times more likely to die of cardiovascular disease (CVD) or stroke than are adults without diabetes.1

Although mortality from CVD has decreased among patients with type 2 diabetes mellitus (T2DM) in recent years, the rate of CVD-related death remains higher in the population with T2DM than in the population without this disease.1 In 2004, heart disease was listed as the cause of death on 68% of death certificates for people older than 65 years with diabetes mellitus.1 Therefore, it is especially important to decrease cardiovascular risk factors in this population. According to the CDC, control of low-density lipoprotein cholesterol (LDL-C levels), as well as blood pressure, can substantially reduce the risk of CVD in individuals with diabetes mellitus.1

Cardiovascular disease risk assessment

An important aspect of the management of diabetes mellitus is assessing CVD risk to determine the individual goals for each patient. Despite the known increased risk of CVD in individuals with diabetes, there remains a large population of such individuals who do not meet the goals outlined in the American Diabetes Association (ADA) standards of medical care in diabetes.2 By taking multiple factors into account, the physician can tailor the treatment goals of each patient to improve care and meet the ADA goals. This is especially important for high-risk patients, in whom the disease tends to be the least well controlled.1 The key factors in defining these goals appear to be the patient’s age, duration of disease, lipid panel results, degree of blood pressure control, HbA1c level, and tobacco use. Three calculators used to determine global risks of patients with diabetes mellitus have been discussed in consensus statements published by the ADA and the American Heart Association (AHA): the Framingham Heart Study risk calculator (http://hp2010.nhlbihin.net/atp3ii/calculator.asp?usertype=prof), the United Kingdom Prospective Diabetes Study (UKPDS) risk engine (www.dtu.ox.ac.uk/riskengine/), and the ADA’s Diabetes Personal Health Decisions (PhD) risk assessment tool.5 However, the ADA retired the diabetes PhD risk assessment tool at the end of 2011, intending to have a new, improved online risk assessment tool available sometime in the first half of 2012.6

Furthermore, it is important to note that the ADA has recently questioned the validity of the Framingham risk calculator, noting that the Framingham Risk Score may overestimate risk by assuming that all patients with diabetes are at high risk of developing CVD.3,4

Lifestyle modification

Appropriate lifestyle modifications have been shown to stabilize glycemic control and to prevent and decrease CVD risk factors. In a 4-year study, the Look AHEAD (Action for Health in Diabetes) research group examined the effects of lifestyle modifications on CVD risk factors.7 In the study, participants were divided into a “diabetes support and education group” (DSE, the control group) and an “intensive lifestyle intervention group” (ILI).7 The ILI group was told to adhere to a 1200-1800-calorie diet and 175 minutes of physical activity each week. Risk factors evaluated at the end of the study were weight, fitness, HbA1c level, systolic blood pressure, diastolic blood pressure, LDL-C levels, high-density lipoprotein cholesterol (HDL-C) levels, and triglyceride levels.

With the exception of LDL-C levels, which were significantly greater in the ILI group than in the DSE group (P = .009), all of the CVD risk factors measured in the Look AHEAD study were decreased in members of the ILI group (P < .001 to P = .01).7 The study also found that when compared to the number of members in the DSE group, fewer members of the ILI group began to take diabetic medications over the 4-year period.

Specific ADA lifestyle recommendations and goals for decreasing the risk of CVD include moderate weight loss (ie, 7% - 10% of body weight per year) and dietary modification.2 Dietary guidelines include several recommendations for the limitation of fat. Patients should limit fat intake to 25% to 35% of total daily calories, and any fats consumed should consist of mainly monounsaturated and polyunsaturated fats. Saturated fats should be limited to less than 7% of energy intake, and dietary cholesterol intake should be less than 200 mg/day. Recommendations also include fiber intake of at least 14 grams per 1000 calories.

In addition to diet, physical activity is an important lifestyle intervention for decreasing CVD risk. Patients should be chal-
lenged to achieve at least 150 minutes of moderate-intensity aerobic activity, or at least 90 minutes of vigorous aerobic activity, each week.

Smoking is another modifiable risk factor of CVD. Patients who smoke should be counseled and advised to quit as soon as possible. Those patients who are willing to stop smoking should be offered access to cessation programs.

**Lipid control**

The ADA recommends that patients with diabetes mellitus but without known CVD maintain an LDL-C level of less than 100 mg/dL as a primary goal. Patients with diabetes mellitus and known CVD should strive for an even lower LDL-C goal, of less than 70 mg/dL. Research suggests that HDL-C and triglycerides have less influence than LDL-C on cardiovascular events in people with diabetes. In the ACCORD (Action to Control Cardiovascular Risk in Diabetes) trial, the addition of fenofibrate to statin therapy led to an increase in HDL-C levels and a decrease in triglyceride levels in a group of individuals with T2DM. However, these changes did not result in a decreased incidence of cardiovascular events compared to the group receiving statin therapy alone.

It appears, however, that the raw numbers do not provide a complete picture. The 2001 National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III), as well as the 2004 updated guidelines, maintain that, although LDL-C should be the primary treatment target in diabetes mellitus, there is considerable benefit in risk stratification of patients based on secondary treatment goals. An important point that should be kept in mind is that the lipid profile in patients with diabetes is more atherogenic than in those without diabetes, making the full lipid profile crucial to treatment decisions. Another reason to consider treatment targets in addition to LDL-C is the complicated cascade of events in the lipid metabolism of people with diabetes.

In patients with diabetes mellitus, two major consequences of insulin resistance occur in lipid metabolism—the unrestricted release of hormone-sensitive lipase and the functional loss of lipoprotein lipase, both of which result in increases in free fatty acids, triglycerides, and very-low-density lipoprotein cholesterol (VLDL-C). With an increase in triglycerides, there is also an increase in cholesterol ester transfer proteins, resulting in structural changes in the LDL-C and HDL-C particles. These changes make the cholesterol particles easier targets for lipolysis by hepatic lipase. When acted on by hepatic lipase, LDL-C is converted from large, buoyant (ie, “fluffy, puffy”) particles into smaller, denser, and more numerous particles known to be more atherogenic. The increase in triglycerides causes HDL-C to be catabolized by the kidneys, thus directly lowering the HDL-C level.

The burden of lipoproteins other than LDL-C that contribute to atherogenesis can be determined by calculating either the apolipoprotein B (ApoB) or non-HDL-C level. Apolipoprotein B is present in each particle of chylomicron, LDL-C, VLDL-C, intermediate-density lipoprotein, and lipoprotein-a, all of which are considered atherogenic. Non-HDL-C reflects the sum of LDL, VLDL-C, intermediate-density lipoprotein, and lipoprotein-a. Both ApoB and non-HDL-C have been shown to be better predictors of cardiovascular events than LDL-C. The level of ApoB can be obtained only by direct laboratory measurement. The level of non-HDL-C can be determined with a basic lipid profile (by subtracting HDL-C from total cholesterol) in a nonfasting state.

In the consensus conference report from the ADA and the American College of Cardiology Foundation (ACCF), the goals for ApoB, LDL-C, and non-HDL-C in patients at cardiometabolic risk are as follows:

- **High risk:** ApoB is < 90 mg/dL, LDL-C < 100 mg/dL, non-HDL-C < 130 mg/dL
- **Very high risk:** ApoB is < 80 mg/dL, LDL-C < 70 mg/dL, non-HDL-C < 100 mg/dL

Consideration of these additional factors will allow clinicians to increase the accuracy of CVD risk prediction for patients with diabetes mellitus.

**Blood pressure control**

Current ADA recommendations for blood pressure control in patients with diabetes mellitus include the initiation of drug therapy if systolic blood pressure (SBP) is more than 140 mm Hg and if diastolic blood pressure (DBP) is more than 90 mm Hg based on 2 measurements on
separate days. In patients with confirmed SBP ranging between 130 and 139 mm Hg, or confirmed DBP ranging between 80 and 89 mm Hg, lifestyle modification alone should be tried for 3 months. If after these lifestyle modification efforts, SBP of less than 130 mm Hg or DBP of less than 80 mm Hg is not achieved, treatment with pharmaceutical agents should be started.

The ACCORD trial compared standard blood pressure control (target SBP is < 140 mm Hg) with intensive blood pressure control (target SBP is < 120 mm Hg) in patients with diabetes mellitus. The researchers used the rate of cardiovascular events as an indicator of optimal blood pressure control. The investigators found no statistically significant difference in the total number of cardiovascular events in the intensive vs the standard blood pressure control group. They did note, however, that patients in the intensive control group had a higher incidence of adverse effects from medications and used a larger number of antihypertensive medications compared with patients in the standard control group.

**Glycemic control**

The ADA recommends an HbA1c level of less than 7% as a goal for glycemic control in patients with diabetes mellitus. This laboratory value should be monitored every 6 months in patients with stable glycemic control.

In an investigation of the benefits of tight glycemic control in patients with diabetes, the ACCORD researchers divided participants into an intensive therapy group and a standard therapy group. The intensive therapy group was given the goal of keeping their HbA1c level below 6.0%, and the standard therapy group was given the goal of keeping their HbA1c level between 7.0% and 7.9%. Participants in the intensive therapy group were forced to quit treatment before the study was completed because they had a higher risk of mortality than the standard care group.

The investigators concluded that standard glycemic control, such as that recommended by the ADA, along with control of other cardiovascular risk factors, is the best overall approach to treatment of patients with T2DM. The Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications (DCCT/EDIC) study and the UKPDS have demonstrated that HbA1c levels less than 7% will decrease the incidence of CVD. In the DCCT/EDIC study, in which patients with type 1 diabetes mellitus were followed up for 17 years, a 42% reduction in CVD risk was found in those patients undergoing intensive glycemic control. In the UKPDS, which followed up patients with T2DM for 10 years, the risk of myocardial infarction was decreased by 15% to 33% in individuals using intensive glycemic treatment.

Authors of the ACCORD trial concluded that other comorbidities were the cause of the higher mortality observed in the intensive treatment group. Because of the discrepancy in outcomes between standard glycemic control and intensive glycemic control, some authors have suggested that patients with longstanding diabetes mellitus or other comorbidities be given more time to achieve their glycemic goals (eg, 6 months to 1 year). In addition, if a patient has a longstanding diagnosis of diabetes (eg, 10-15 years), HbA1c goals should remain at 7.0%. By contrast, a more recent diagnosis of diabetes may prompt an HbA1c goal of 6.0.

**Aspirin in primary prevention**

In 2007, the ADA and AHA jointly recommended that low-dose aspirin (acetylsalicylic acid, 75-162 mg/day) be used as a primary prevention strategy in patients with diabetes mellitus who are at increased cardiovascular risk. After publication of this recommendation, the Japanese Primary Prevention of Atherosclerosis With Aspirin for Diabetes (J-PEA) and the Prevention of Progression of Arterial Disease and Diabetes (PADS) trials raised doubts about the efficacy of low-dose aspirin in patients with diabetes mellitus. As a result of those results, the ADA, AHA, and ACCF convened in 2009 to review and synthesize available evidence and update recommendations. During the evaluation to determine the updated recommendations, the joint committee considered not only the benefits of aspirin for preventing coronary artery disease, but also the known problem of gastrointestinal bleeding with daily use of aspirin.

The joint committee concluded that low-dose aspirin (75-162 mg/day) for CVD prevention is “reasonable” for adults with diabetes mellitus who have no history of vascular disease but who are at increased risk of CVD (10-year risk is > 10%) and are not at increased risk of bleeding. The committee added that aspirin should not be recommended for CVD prevention if patients are at low risk of CVD (10-year risk
is < 5%), noting that the potential adverse effects from bleeding offset the potential benefits. Low-dose aspirin “might be considered” for CVD prevention in patients with diabetes who are at intermediate risk of CVD (10-year risk = 5%-10%).\textsuperscript{12}

The joint committee also stressed that all modifiable CVD risk factors should be addressed and optimally managed for patients using aspirin. Helping patients reach their individual cardiovascular goals through such management will decrease their 10-year CVD risk, meaning that fewer patients with diabetes mellitus will need to continue taking aspirin and be at risk for the adverse effects of this medication.

Final notes
It is evident that prevention of CVD in patients with T2DM requires a multifactorial approach. This approach includes management of CVD risk factors with both pharmaceutical interventions and lifestyle modifications. Many patients with diabetes mellitus are currently not achieving recommended treatment goals and targets. By improving the quality of care for these patients, we can decrease the occurrence of CVD and promote a happier and healthier life for individuals with diabetes mellitus.

References

Andrea Tufa, OMS IV, is a fourth-year medical student at Kansas City University of Medicine and Biosciences. She will continue her medical training at the Fort Wayne Medical Education Program, Family Medicine Residency in Fort Wayne, Indiana.
Illnesses associated with diabetes mellitus make up the seventh leading cause of death worldwide. In 2003, an estimated 194 million adults had diabetes mellitus worldwide, and this number is expected to reach 333 million by 2025.¹
As the prevalence of diabetes mellitus increases, so does the incidence of complications of the disease, as well as the cost of morbidity and mortality related to these complications. In the United States, 14% of health care dollars are spent treating patients with diabetes mellitus, with half of this money spent managing such complications as heart disease, stroke, nephropathy, and retinopathy.

A person with diabetes mellitus is twice as likely to die as a person without diabetes of the same age. Patients with diabetes have an increased incidence of coronary heart disease (CHD) and are more likely to experience a myocardial infarction. Some cases of myocardial infarction may remain undiagnosed, because angina can be masked by diabetes mellitus.

The American Heart Association considers diabetes mellitus to be a CHD equivalent. As such, diabetes mellitus puts a person at the same risk of experiencing a cardiovascular event as someone who has already had a myocardial infarction or has known CHD. Because of this high-risk classification, a patient with diabetes should be cared for in the same way as a patient with CHD.

Cardiovascular disease is the leading cause of mortality among patients with diabetes mellitus. The risk of CHD is doubled for a man with diabetes and tripled for a woman with diabetes. Diabetes mellitus is also a clinically significant risk factor for hypertension and hyperlipidemia. The staggering risks associated with diabetes and heart disease make the need for aggressive treatment of these conditions and their complications abundantly clear.

To decrease diabetes-associated morbidity, cardiovascular risk factors need to be as closely monitored and managed as are blood sugar levels in patients with diabetes mellitus. This management includes tight control of blood pressure and cholesterol levels. Lipid-lowering medications should be used for all patients with diabetes and known cardiovascular disease, and these medications should be strongly considered for patients with diabetes but without CHD.

Individuals with diabetes mellitus typically have a condition referred to as diabetic dyslipidemia, which is characterized by elevated levels of low-density lipoprotein cholesterol (LDL-C) and triglycerides, small LDL-C particles, and low levels of high-density lipoprotein cholesterol (HDL-C). Lowering a patient's LDL-C level has been shown to reduce the patient's cardiovascular complications by 20% to 30%.

In the present article, we summarize the currently available medicinal therapies and recommendations for the management of hyperlipidemia and other cardiometabolic risks in patients with diabetes mellitus.

Available medications
Before recommending any medication for managing cardiometabolic risks in a patient with diabetes mellitus, lifestyle modification should be attempted. Patients should be encouraged to decrease the amount of saturated fat and cholesterol in their diets and to increase their daily amounts of fiber and exercise. If such lifestyle modifications fail to lower a patient's LDL-C level sufficiently, a lipid-lowering agent should be initiated.

Several classes of medications are available for the management of hyperlipidemia, including statins (ie, 3-hydroxy-3-methylglutaryl coenzyme A reductase inhibitors), bile acid sequestrants, fibrinoid acid derivatives, nicotinic acid (ie, niacin), and cholesterol absorption inhibitors. The selection of medication class should be based on the patient's underlying lipid abnormality. However, statins have been shown to improve outcomes in patients with diabetes mellitus, regardless of whether the patients have underlying CHD.

The physiologic mechanisms responsible for the benefits of lipid-lowering agents are not completely understood. Clinical improvements are seen within 6 months of medication initiation—too soon for significant atherosclerotic regression to have occurred. Therefore, a multifactorial mechanism of lipid-lowering agents is suspected, including plaque stabilization, decreased thrombogenicity, and improved endothelial dysfunction.

For primary and secondary prevention of CHD, statins have been shown to be beneficial. Statins competitively inhibit 3-hydroxy-3-methylglutaryl coenzyme A reductase, decreasing the rate of cholesterol synthesis. Their actions lower levels of LDL-C and very-low-density lipoprotein cholesterol and moderately increase levels of HDL-C. In addition, triglyceride levels decrease by 20% to 40%, depending on the statin used and the dose prescribed.

The American Diabetes Association (ADA) suggests that triglyceride levels be decreased to 150 mg/dL and HDL-C levels be increased to 40 mg/dL in all patients.
with diabetes mellitus. Ideally, a patient with diabetes mellitus should have an LDL-C level at or below 100 mg/dL. Achievement of these goals usually requires a combination of lifestyle modification and drug therapy. When treating a patient who has an LDL-C level greater than 130 mg/dL, statin therapy should be initiated at the same time as lifestyle modifications. Of all available cholesterol-lowering drugs, statins have the strongest LDL-C lowering effects.

Within the statin drug class, rosuvastatin calcium has the greatest effect on LDL-C levels, followed closely by atorvastatin calcium. Rosuvastatin has also been found to have the greatest effect on increasing HDL-C levels and on decreasing triglyceride levels. Fluvastatin sodium is the least potent stain, but it has the fewest reported adverse effects among statins.

When choosing a statin to prescribe, the patient's overall lipid abnormalities should be taken into consideration. The lowest dose of medication should be tried first, with upward titration to reach the LDL-C goal. If a patient experiences an adverse reaction to the medication, a different drug in the same class should be tried. For patients who are intolerant to statins, a bile acid sequestrant or niacin should be attempted.

**Drug interactions and cautions**

Depending on the statin selected, the maximum daily dose varies. A majority of statins have a maximum dosage of 80 mg per day. Rosuvastatin and pravastatin sodium both have maximum dosages of 40 mg per day, but this may vary based on other medications being taken by the patient. For most statins, dosing schedules suggest spreading out administration to twice per day if the patient requires more than the minimum dose. Most cholesterol synthesis occurs at night, which is why recommendations call for most statins to be taken at night. This administration time may be altered depending on the half-life of the specific statin.

Patients may be predisposed to statin-related muscle injury if they are using certain other medications. Drugs that inhibit CYP3A4 (cytochrome P450, family 3, subfamily A, polypeptide 4) have been shown to increase the incidence of statin-induced myopathy when they are given in combination with statins. These drugs include cyclosporine, gemfibrozil, macrolide antibiotics, and human immunodeficiency virus (HIV) protease inhibitors. Atorvastatin, lovastatin, and simvastatin are all metabolized by CYP3A4. When treating a patient who is already taking a medication that is a strong inhibitor of CYP3A4, it is recommended that fluvastatin, pravastatin, or rosuvastatin—none of which are metabolized by CYP3A4—be the medication of choice to minimize potential drug interactions.

Clopidogrel is metabolized by CYP3A4, but studies have shown that there is little effect on clopidogrel's effectiveness when a statin is also administered. Niacin is metabolized by CYP3A4 and has been shown to cause myopathy when combined with a statin. However, this complication is rare and should not prohibit the use of statin-and-niacin combination therapy. The incidence of myositis is increased for patients who take statins in combination with cyclosporine or gemfibrozil, as well as for patients with severe renal insufficiency who take statins. Pravastatin is the
Medication of choice for patients requiring statin therapy who are already taking cyclosporine. If the physician determines that the benefit of adding fibric acid with a statin outweighs the risks, pravastatin or fluvastatin are the safest options. Caution should be used when choosing a statin for a patient who is taking warfarin. Atorvastatin, lovastatin, rosuvastatin, and simvastatin all enhance the effects of warfarin. For a patient who requires both warfarin and a statin, either fluvastatin, pitavastatin, or pravastatin should be prescribed; none of these have been shown to produce the same warfarin-enhancing effects as other medications in the statin family. Because any statin may alter the metabolism of digoxin, caution is advised for patients who must take both medications.

Although there are many potential drug interactions involving statins, the benefits of these medications far outweigh their risks for most patients. Adequate time should be spent counseling patients about potential adverse effects of statins, including the risks of using statins vs not using them for managing hyperlipidemia.

Monitoring patients receiving statin therapy

Before initiating statin therapy for a patient, baseline levels of liver enzymes and serum creatine kinase should be obtained. Six weeks after prescribing a new statin or after increasing a patient’s dose, the patient’s LDL-C levels should be checked. These levels should be rechecked every 6 to 12 months thereafter, depending on the patient. Routine monitoring of a patient’s creatine kinase levels is not recommended unless the patient complains of myositis-like symptoms. Routine monitoring of liver function should be carried out, as directed by the prescribing information of the medications used by the patient. The US Food and Drug Administration suggests that liver function testing be performed at the time of any increase in medication dose, as well as periodically throughout treatment.

Clinical studies have reported persistent elevation of liver enzyme levels in 0.5% to 3% of patients using statins. Typically, elevation in liver enzyme levels occurs during the first 3 months of statin therapy and is dose-dependent. Elevated liver enzyme levels are not necessarily an indication to stop treatment with statins. After an elevated level of liver enzymes has been confirmed by a second test, it is recommended that the statin dose be lowered or that the medication be changed to a different statin.

Known adverse effects of statins include myopathy, headaches, nausea, and sleep disturbances. The most commonly reported adverse effects are muscle pain and cramping. Toxic effects in muscle are another concern with the use of statin therapy. Patient signs and symptoms at presentation range from minor myalgias to rhabdomyolysis. Statin-induced myalgia is typically symmetrical, causing weakness and soreness in proximal muscles.

Patients with acute or chronic renal failure, obstructive liver disease, or hypothyroidism are more susceptible to statin-induced myopathy than are other patients. Rhabdomyolysis has not been observed in clinical trials of patients using statins unless they have certain risk factors. The most common risk factors involved drug interactions from the combined use of statins with cyclosporine or gemfibrozil. There have also been case reports of statin interactions involving digoxin, niacin, warfarin, antifungal medications, and macrolide antibiotics.

Although there have been multiple reports of pathologic associations with statins, the data supporting these associations are limited. A full analysis of current data suggests that statins are safe medications. For example, recent research indicates that rates of elevated liver and muscle enzyme levels did not differ between patients using statins and patients using placebo.
Combination drug therapy

Statins are the widely accepted first-line medications for treating patients with hyperlipidemia. Therefore, treatment should begin with a statin, titrated upward to the maximum tolerable dose before the addition of a second class of medication is considered. However, it may become necessary to use a combination of various lipid-lowering drugs to achieve desired lipid goals for a patient with diabetes mellitus. When a patient requires improvement of LDL-C, HDL-C, and triglyceride levels, a combination of niacin and a statin can be considered.6 The combination of a statin with a bile acid sequestrant or ezetimibe has been shown to reduce LDL-C levels more effectively than a higher dose of either medication alone.6

Because of the incidence of drug-induced myopathies in patients taking both a statin and gemfibrozil, the potential benefits of this medication combination should be thoroughly compared to the risks before prescribing it for a patient.11

Final notes

When treating a patient with diabetes mellitus, there are numerous factors to consider beyond glycemic control. With careful patient monitoring, lifestyle modification, and management with appropriate medications, CHD risk can be controlled, if not decreased, in patients with diabetes mellitus. Statin therapy is a safe and effective method of cholesterol management for these patients and should be considered in all cases.

References


Bariatric Surgery: Lindsey G’s Story

More than 1 in 3 adults in the United States were obese in 2010, according to the National Health and Nutrition Examination Survey.¹ The World Health Organization reports that, worldwide, more than 300 million people are obese, and more than 1.5 billion people are overweight.²
The epidemic of obesity, defined as a body mass index (BMI) of more than 30, is worsening. Since 1980, the prevalence of obesity has doubled throughout the world. The US Surgeon General has estimated a 50% to 100% increased risk of early death for obese individuals compared to patients with a BMI between 20 and 25, with more than 300,000 deaths yearly associated with obesity. A gain of 11 to 18 pounds will double an individual’s risk of type 2 diabetes mellitus (T2DM) compared to an individual without that weight gain. This risk is quadrupled if a person has gained 44 or more pounds. Sleep quality, mood, and overall quality of life are also adversely influenced by obesity.

The reasons for these obesity trends are multifactorial. For example, there is a widespread prevalence of high-calorie foods, which are often much cheaper than healthier options. In another example, many restaurants have increased their portion sizes throughout the years. Also—as has always been the case—many people may eat more than they normally would to celebrate good news, as well as to cope with bad news and stressors in everyday life.

The mass media often focuses on unhealthy, though stylish, body images, which may cause unrealistic expectations for patients’ self-images. Most people in the United States have at some time followed a diet in an effort to lose weight. The weight-loss industry is a multibillion dollar business. Many people find initial success with diets, but many also regain the weight that has been lost, and the vast majority of dieting individuals are unable to maintain a healthy weight. Medications have not been proven successful in the long-term treatment of obese patients. In fact, medications may have undesired, potentially harmful effects in many patients.

Advances in the surgical treatment of obese patients have made surgical options safer and more widely available. However, many factors must be considered before referring a patient for a surgical procedure. In the present article, we do not intend to suggest surgery as a solution for all overweight patients, but rather we wish to reveal an actual patient’s point of view and attitudes toward weight loss and surgery.

In the United States, more than 300,000 deaths yearly are associated with obesity.

Lindsey’s obesity and diabetes mellitus

A systematic review of the literature demonstrates that bariatric surgery can be efficacious in the treatment of patients with obesity and some of obesity’s comorbidities. A patient of 1 of the authors (G.J.D.) underwent this procedure and was willing to share her story. Her real name will remain confidential, but we will refer to her as “Lindsey G.” Her story reveals the challenges and thought processes that she went through before electing a surgical treatment for her obesity—the laparoscopic adjustable gastric band (LAGB) procedure.

The US Food and Drug Administration (FDA) approves LAGB for weight loss in obese adults with a BMI between 30 and 40, provided the adults have at least 1 obesity-related medical condition and have not achieved success with nonsurgical weight-loss methods (ie, lifestyle and behavior modification). The FDA also approves LAGB for patients with a BMI greater than 40 and patients who are 100 or more pounds overweight.

Lindsey was diagnosed as having T2DM in autumn 2009, at age 37 years. At that time, she weighed 479 pounds and was 69 inches (5 feet, 9 inches) tall. She took the...
diagnosis in stride, deciding to take action to decrease her reliance on medication and to avoid potential comorbidities of T2DM. Her husband and son were instrumental in providing moral support and in encouraging her to exercise. Lindsey tried to decrease portion size, and she gave up the nachos that she enjoyed eating. After obtaining a cardiac evaluation, she also began an exercise program, which initially consisted of walking outdoors. After she was able to walk several blocks, she added the use of a treadmill during periods of inclement weather.

Lindsey experienced mild aches and pains as her body acclimated to these activities. She would come in for osteopathic manipulative treatment for her back pain about once every 2 months. One day on the treadmill, she “stepped funny” and injured her left knee. This injury disrupted her exercise routine, and she became very frustrated. The orthopedic surgeon told her that she would eventually need surgical repair of her torn meniscus, along with femoral chondroplasty. For the present, however, the surgeon told her that he did not wish to do the surgery because of her excessive weight and risks for postoperative complications. He advised her to focus her efforts on weight loss. She diligently performed rehabilitation exercises for her knee, which helped relieve her knee pain, but she was not losing weight as fast as she would have liked. As Lindsey’s primary care physician, I (G.J.D.) explained to her that it was important to lose weight safely and gradually, and I suggested that she focus on small, achievable goals.

Lindsey sought a second opinion from an orthopedic surgeon regarding surgery for her knee. That surgeon agreed to the operation, and Lindsey underwent a partial meniscectomy and chondroplasty of her knee in April 2011. She faithfully continued to rehabilitate the knee after the surgery. Her family was supportive throughout her treatment.

### Decision for bariatric surgery

In October 2010, Lindsey underwent LAGB bariatric surgery. The decision to undergo the surgery was based on Lindsey’s personal wishes. She discussed the surgery with her primary care physician (G.J.D.), and was well aware of the risks and potential benefits. At the time of the surgery, her weight was 417 pounds, and her BMI was 63.4. Similar to many obese patients, Lindsey’s list of medical conditions at this time consisted of T2DM as well as hypertension, hyperlipidemia, diabetic neuropathy, depressive disorder, chronic pain, obstructive sleep apnea (OSA), sciatica, and gout. She was using a continuous positive airway pressure (CPAP) machine to manage her OSA, and she was taking the following 13 medications for her other conditions. (She had also tried other, weight-neutral antidiabetic agents, but she quit using them because of adverse effects.)

**A table describing Lindsey’s daily prescription medication regimen is on page 22.**

When Lindsey was asked what diet she tried to help her lose weight before she chose to undergo bariatric surgery, she answered, “To be honest, I probably tried everything out there. I have done every diet imaginable. I tried taking Alli [orlistat; GlaxoSmithKline, Middlesex, England], Slim-Fast [Unilever, London, England], not eating meat. I even tried eating then purging my food.”

Lindsey described how she finally determined that bariatric surgery was necessary:

**It takes a long time before you decide to have the surgery. I got to a point where I knew I didn’t need to just do it for myself, but for my family too. I have a son and I’m married. But you have to do it for yourself, when you are ready. You can’t do it only for...**

Many people find initial success with diets, but many also regain the weight that has been lost, and the vast majority of dieting individuals are unable to maintain a healthy weight.
someone else, because it won’t work. I knew I needed to do it when I hit my top weight of 479 pounds a year before the surgery. I got down to 417 pounds before the surgery. I took a year to improve myself and do exactly what I needed to do, eat the right portion size. You have to be committed to do your part. You have to love yourself first. If you are not doing it to better yourself, then why do it?

Lindsey summarized her no. 1 reason for undergoing the surgery: “My goal was to get off the medications. I was tired of so many pills each day. The weight loss part was important too, but not the biggest issue.”

The process is easier if patients have support at home. For Lindsey, her family is her support system, as she explained:

My husband told me that he would love me no matter what size I am, but that he would support me to lose weight because that is what I wanted to do. My husband and son both support me so much. It is a household effort. We eat at home instead of going out, eat healthy portion sizes by using saucers, and we exercise together. My son is like my coach. We are all getting healthy together.

Lindsey’s goal was—and still is—to defeat her son at a game of 1-on-1 basketball.

**Bariatric surgery results**

Before undergoing bariatric surgery, Lindsey required insulin to maintain her blood glucose level, and her glycosylated hemoglobin (HbA1c) level was 6.4%. After the surgery she was able to discontinue insulin and maintain her blood glucose and HbA1c levels by taking only metformin 500 mg orally twice daily. With further diet, exercise, and weight loss, no medications were needed for these purposes by November 2011. At this time, her HbA1c level was 5.7%, and her pre- and postprandial glucose levels stayed in the range of 86 to 90 mg/dL with diet and exercise alone.

Lindsey’s positive experience is confirmed by the literature, which suggests that most patients have greatly improved glucose control after bariatric surgery. In some cases, patients may even experience,
as Lindsey did, a “cure,” with more than 50% of patients who had diabetes mellitus no longer having diabetes symptoms. Other parameters that have shown improvement after bariatric surgery include lipid levels and blood pressure levels. More than 50% of postsurgery patients no longer require medication to manage their hypertension or are able to reduce their doses of antihypertensive medication.

Lindsey was able to discontinue use of simvastatin and to maintain adequate cholesterol control with diet and exercise alone, which was reflective of her decreased weight. In March 2010, Lindsey’s blood pressure was 142/82 mm Hg while taking metoprolol 100 mg twice daily and lisinopril 10 mg daily. In November 2011, her blood pressure was 126/74 mm Hg despite discontinuation of these 2 antihypertensive medications. As with lipids, blood pressure improves following loss of weight, and in November 2011, Lindsey’s weight was down to 296 pounds.

Lindsey is no longer taking any antidepressant or antianxiety medications, and she states that she is “doing great, and I know I can always go back to my counselor if I start feeling bad again.” In addition, her food-purging behavior is absent. Some of her improved mood may be attributed to improved self-image, and Lindsey states that she is no longer uncomfortable being in public—which had been a problem for her before surgery.

When asked what she had wanted from the surgery, Lindsey answered as follows:

I wanted to do all the things I was afraid to do because of my weight. I wanted to run and ride a bike with my son, to go to Worlds of Fun [a local amusement park] with my son and actually ride on a ride, and I wanted to not have to buy 2 seats for myself on an airplane anymore.

Obese patients may give up social events and isolate themselves, vastly decreasing their quality of life. With her weight loss, Lindsey was able to go out and enjoy previously pleasurable activities again.

At the time the present article was being written, Lindsey said she was looking forward to a follow-up sleep evaluation to determine if she still had OSA. She was eager to discontinue her use of the CPAP machine, which is bulky and uncomfortable. Studies show that approximately half of obese patients experience a form of sleep disturbance. After weight-loss surgery, there is a substantial decrease in the prevalence of patients with sleep apnea, snoring, and sleep deprivation. Lindsey also reports no episodes of gout since having undergone bariatric surgery.

Diet and exercise

When asked to describe her current diet, Lindsey responded as follows:

I really don’t eat very much, because I am just not hungry like I used to be. I eat healthy small portions and use a saucer instead of a plate. When I used to fix a plate, it was a portion for 3 people. A saucer holds one serving size. I don’t eat bread. I don’t drink anything 2 hours before eating so that I am not full from liquids before meals and only take small sips of water while eating. Also, I let my silverware rest. I set my silverware down after taking a bite. People tend to take a bite of food, and then take the silverware and scoop it back up again before they have even swallowed. That can lead to overeating.

Lindsey discussed her typical exercise routine:

I exercise every day. I ride bikes with my son and walk outside or on the treadmill,
but water exercises at the YMCA are the best for my back. It may not sound like much, but now we park as far away from the store as we can just to get the extra steps in. I do everything I can to keep my body moving, because there were so many things that I could not do, but now I can. Nothing is going to stop me now!

Lindsey explained the reactions she has received from people since her weight-loss surgery:

People tell me every time they see me that I look like I have lost weight since they saw me last. They are motivated by me and want to lose weight too. I tell them to start inside their home, and then change outside their home. You cannot eat whatever you want and think that you can walk it off afterward—that isn’t how it works. You have to change how you eat first. Portion size is so important, and also exercise. You have to continually push yourself.

When asked to describe her current medical problems, she said, “The only problem I still have is back pain. My physicians want me to have back surgery, but I am going to continue to lose my weight first. I do not want anything to get in the way of my goal. I am 294 pounds now, but my goal weight is 150 pounds.”

Lindsey stated that she has had no adverse effects from her bariatric surgery. She summarized the impact that the surgery has had on her life as follows:

I can do so much more. I am so much happier. I can jump rope now and shoot baskets with my son and nephew. LAGB has done so much for me. But really, it was just the beginning, because you still have to exercise and eat right. For it to be a success, a combination of things has to happen. LAGB will work for anyone who does what they are supposed to do. I know people who got the Lap-band and you just want to smack them, because they were not ready to take it seriously. It isn’t what they did, it is what they didn’t do. They didn’t eat right, didn’t exercise, and didn’t do their part. They are heavier than they were before the surgery. What a waste of money!

“\textit{The only problem I still have is back pain. My physicians want me to have back surgery, but I am going to continue to lose my weight first.} \\
—Lindsey G.

Lindsey paid $2500 for her bariatric surgery, while insurance covered the remaining $14,000. She explained the struggle of paying for the surgery:

It was a long process. I have Medicaid and Medicare, but a secondary insurance was required and I had Blue Cross/Blue Shield. So I thought I was completely covered, but 2 weeks before the surgery, they [Blue Cross/Blue Shield] said I wasn’t. They said they were sorry and there was nothing they could do. They would cover gastric bypass, but not Lap-Band, but I didn’t want that [gastric bypass] surgery. At one point, I called the hospital to cancel my surgery, because I did not have the 10% that was not covered, but the surgeons let me do a promissory note, and now I just pay $100 each month until it is paid for.

Photos in this article include models who do not represent actual patients.
In January 2012, Lindsey weighed 294 pounds, and her BMI was 44.7. She is right on track for expected weight loss. Studies show that after LAGB surgery, a substantial number of patients have lost as much as 43% of their excess weight at 12-year follow-up.8

The decision to have bariatric surgery should be made only after the patient has tried other modalities for weight loss, and the physician needs to consider each patient’s individual circumstances before recommending or agreeing to such surgery, with due deliberation given to the risks. Although beyond the scope of the present article, there are many contraindications for, and complications of, bariatric surgery.

In response to the question of what medications she currently takes, Lindsey proudly said, “I’m only taking prenatal vitamins.” Her primary motivation for having the surgery was to become healthy enough to not need medications. She has reached her goal and has discontinued every medication she had been taking for her previous comorbidities of obesity.

Lindsey’s life was changed dramatically after having LAGB surgery. She remains dedicated to contributing to her weight loss through diet and exercise. She also plans to participate in organized walks to raise awareness and money for diabetes mellitus research. Lindsey is determined to stay healthy, which she believes will help her become a better mother.

References

Acknowledgments: We thank our patient (left) and her family for participating in the interview used in this article.
This quiz provides a convenient means for osteopathic physicians to assess their understanding of the scientific content of the May 2012 issue of AOA Health Watch.

To apply for one hour of Category 1-B continuing medical education credit, AOA members may take this quiz online at www.docmeonline.com, where this and other quizzes can be accessed by clicking on the link at the bottom of the home page. Quizzes that are completed online will be graded and credited to members’ CME activity reports.

Alternatively, osteopathic physicians can complete the print version of this quiz and send it to the mailing address or fax number below by November 30, 2013. For those who mail or fax this form, the AOA will record the fact that they submitted this quiz for Category 1-B CME credit.

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So that osteopathic physicians can easily check their answers to the quiz, the correct answers will be published in the next issue of AOA Health Watch. If you mail or fax this form to the Division of CME, the AOA will record the fact that you have submitted this form for Category 1-B CME credit for the current CME cycle.

For each of the questions that follow, circle the letter next to your answer.

1. Appropriate lifestyle modifications have been shown to
   a. stabilize glycemic control
   b. prevent CVD risk factors
   c. decrease CVD risk factors
   d. all of the above

2. A weight gain of 15 pounds will increase a person’s risk of developing type 2 diabetes mellitus when compared to a person who has not gained weight by how much?
   a. it will double the risk
   b. it will triple the risk
   c. it will quadruple the risk
   d. it will not increase the risk

3. The risk of CHD is
   a. doubled for a man with diabetes and tripled for a woman with diabetes
   b. doubled for a woman with diabetes and tripled for a man with diabetes
   c. equal for both women and men with diabetes
   d. none of the above

4. The American Diabetes Association (ADA) suggests that in all patients with diabetes mellitus
   a. triglyceride levels be decreased to 140 mg/dL
   b. triglyceride levels be decreased to 150 mg/dL
   c. HDL-C levels be decreased to 30 mg/dL
   d. none of the above

5. Routine monitoring of a patient’s creatine kinase levels is not recommended unless the patient complains of:
   a. muscle aches
   b. headache and nausea
   c. dizziness
   d. none of the above

6. According to guidelines from the National Institutes of Health, bariatric surgery should be performed only if the patient has a body mass index (BMI) of
   a. 40 or greater
   b. 35 or greater with comorbidities such as diabetes mellitus
   c. 20 or greater
   d. both a and b

7. Current ADA recommendations for blood pressure control in patients with diabetes mellitus include the initiation of drug therapy if
   a. systolic blood pressure is more than 140 mm Hg and diastolic blood pressure is more than 90 mm Hg
   b. systolic blood pressure is more than 120 mm Hg and if diastolic blood pressure is more than 80 mm Hg
   c. systolic blood pressure is more than 150 mm Hg and diastolic blood pressure is more than 75 mm Hg
   d. none of the above

8. What percent of patients achieved remission of their diabetes following any type of bariatric surgery?
   a. 14%
   b. 24%
   c. 34%
   d. none of the above
Quiz and answers to AOA Health Watch
DOs Against Diabetes Part 16

The correct answers to the following questions appear in **bold** type.

1. Which of the following plays a role in the development of T2DM?
   a. obesity
   b. stress
   c. genetic predisposition
   d. all of the above

2. If the ADA algorithm is used with a patient who has an HbA1c level of 10% at diagnosis, metformin at its maximum dose would bring the HbA1c down to only:
   a. about 8.5%
   b. about 7.5%
   c. about 6.5%
   d. about 5.5%

3. Cultural barriers to optimizing care for Hispanic patients with diabetes mellitus may best be summarized as:
   a. not wanting to seek care
   b. the stigma of insulin
   c. both of the above
   d. none of the above

4. A Mexican patient might be more willing to experiment with a new recipe if it:
   a. is written in Spanish
   b. comes from a Latino cookbook
   c. contains familiar ingredients
   d. all of the above

5. Mounting evidence suggests Hispanics have a genetic predisposition to:
   a. liver adiposity
   b. autoantibodies
   c. T cells
   d. none of the above

6. When insulin levels are low, a. lipolysis is stabilized
   b. an overproduction of free fatty acids occurs
   c. production of fatty acids diminishes
   d. none of the above

7. In 2011, the risk of Hispanics patients developing diabetes mellitus was greater than:
   a. non-Hispanic white males
   b. non Hispanic white women
   c. non-Hispanic elderly
   d. all of the above

8. In ethnic comparisons of prediabetes in overweight and obese children, Hispanic children, compared to non-Hispanic children were found to have:
   a. lesser rates of metabolic syndrome than non-Hispanic children
   b. lower levels of triglycerides and fasting blood glucose
   c. higher levels of high-density lipoprotein (HDL)
   d. greater waist circumferences

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Following are 10 key points to keep in mind to help patients with type 2 diabetes mellitus minimize cardiovascular risks.

1. Assess a patient’s cardiovascular disease risk and determine and define goals for each patient.
2. Advise patients that weight loss and management of coexisting diseases are highly important factors for decreasing the number of cardiovascular events and future complications related to diabetes mellitus.
3. Closely monitor and manage cardiovascular risk factors and follow-up with patients.
4. Advise patients to limit fat intake to 25% to 35% of total daily calories, and any fats consumed should consist of mainly monounsaturated and polyunsaturated fats.
5. Challenge patients to achieve at least 150 minutes of moderate-intensity aerobic activity, or at least 90 minutes of vigorous aerobic activity, each week.
6. Counsel patients who smoke to quit as soon as possible.
7. Consider statins for primary and secondary prevention of coronary heart disease when lifestyle and diet changes do not work.
8. Take into consideration the patient’s overall lipid abnormalities when choosing a statin. Try the lowest dose of medication first, with upward titration to reach the LDL-C goal.
9. Recheck the patient’s LDL-C levels six weeks after prescribing a new statin or after increasing a patient’s dose. Recheck these levels every 6 to 12 months thereafter, depending on the patient.
10. Consider discussing bariatric surgery with patients only after the patient has tried other modalities for weight loss. Consider each patient’s individual circumstances before recommending or agreeing to such surgery, with due deliberation given to the risks. Studies suggest that bariatric surgery is more cost-effective and beneficial than conservative methods of weight reduction. Unfortunately, to our knowledge there are no lifelong studies comparing costs for patients who received bariatric surgery vs those who did not undergo the surgery.