

# Case Study: Health Outcomes of a 58-Year-Old Man With Type 2 Diabetes Who Had Roux-en-Y Gastric Bypass

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## Presentation

J.M. is a 58-year-old man with a history of type 2 diabetes since 1996. He has struggled with his weight throughout most of his life, with his highest adult weight at 407 lb. In March 1998, J.M. enrolled in a phone-based counseling service with a registered dietitian (RD) offered through his managed care organization. The phone program is voluntary and consists of regular phone calls, usually every 2–4 weeks, to discuss diabetes and weight management.

J.M.'s height and weight on initial assessment were 69" and 335 lb. (BMI = 49.5 kg/m<sup>2</sup>). His hemoglobin A<sub>1c</sub> (A1C) was 5.4% on extended-release glipizide, 5 mg twice daily. His blood pressure was 144/78 mmHg, and his lipid panel revealed a total cholesterol of 220 mg/dl and an HDL cholesterol of 52 mg/dl. LDL cholesterol and triglycerides were not separately measured at that time. In addition to the diabetes medication, J.M. was also taking hydrochlorothiazide, 25 mg/day, and lisinopril, 10 mg/day, to manage hypertension.

Throughout the 3 years that J.M. participated in the phone program, he underwent several medical setbacks, including diagnoses of hypercholesterolemia and myasthenia gravis, a neuromuscular disorder characterized by muscle weakness and fatigue. The myasthenia gravis limited his ability to exercise regularly and caused symptoms such as diplopia, difficulty chewing and swallowing, and extensive fatigue. Months later, J.M. discovered a tumor growth, which was removed successfully in 2001. However, detection of the tumor caused him to lose motivation. He strug-

gled with setting lifestyle goals, especially regarding nutrition, because he felt he could not make a significant impact on his health. Consequently, J.M.'s weight continued to escalate and reached 350 lb. Several medications were added during these years to manage his increasingly poor health.

In September 2001, J.M.'s internal medicine physician encouraged him to seek surgical treatment for obesity. The provider believed the surgery would help alleviate some of the discomfort related to myasthenia gravis and improve diabetes outcomes. J.M. was reluctant to pursue this, although he was willing to attend an informational session on bariatric surgery. After the seminar and further discussions with his internist and primary care practitioner (PCP), J.M. decided to proceed with surgery.

He was scheduled for surgery in December 2002. At that time, his medical conditions included diabetes, hypertension, myasthenia gravis, sleep apnea, hypercholesterolemia, and recurrent cellulitis in his right leg. Medications included extended-release glipizide, 5 mg twice daily; metformin, 1,000 mg twice daily; simvastatin, 10 mg/day; lisinopril, 40 mg/day, pyridostigmine bromide, 60 mg twice daily; azathioprine, 300 mg/day; atenolol, 100 mg/day; furosemide, 80 mg/day; and aspirin, 81 mg/day. His presurgical weight was 368 lb. His blood pressure was 120/68 mmHg, and his A1C was 6.9%.

J.M. underwent Roux-en-Y gastric bypass (RYGB) with no significant events. This procedure is characterized by a reduced stomach capacity, usually 10–30 ml in size; bypassed duodenum;

and varying length of the proximal jejunum. The jejunum is then reconnected with the newly created stomach pouch, where a 10-mm diameter anastomotic gastrointestinal stoma regulates the rate of food consumption.

At discharge from the hospital, he was taken off all oral diabetes agents and placed on sliding scale insulin. Despite this, his blood glucose levels were 200–300 mg/dl, and his A1C increased. At his first postoperative visit, J.M.'s PCP restarted his presurgical diabetes medications, extended-release glipizide, 5 mg twice daily, and metformin, 500 mg twice daily. (The presurgery metformin dosage was 1,000 mg twice daily.) He also continued lisinopril (at 20 mg/day instead of the presurgery 40 mg/day) and simvastatin.

In April, 4 months after surgery, J.M. was experiencing some hypoglycemic episodes in the late afternoon. His A1C was 4.7%, and his doctor decided to discontinue the extended-release glipizide.

J.M. had lost 110 lb since his surgery. His lipid levels had decreased (total cholesterol 179 mg/dl, HDL 35 mg/dl, LDL 122 mg/dl, and triglycerides 109 mg/dl). He reported that he was feeling much better and that the myasthenia gravis had improved, allowing him to be more physically active. He cut back to one 60-mg tablet/day of pyridostigmine bromide. He denied any diplopia or difficulty chewing, swallowing, or breathing. His atenolol was decreased to 25 mg/day as his blood pressure continued to improve.

Overall, J.M.'s quality of life significantly improved after having gastric bypass surgery. He had tried unsuccessful-

fully to lose weight for most of his life and had experienced several comorbidities as a result. By his 2-year postoperative follow-up, J.M. had lost nearly 155 lb (BMI 32 kg/m<sup>2</sup>, down from 54 kg/m<sup>2</sup>), which amounted to a 71% excess weight loss. His diabetes and myasthenia gravis are now under excellent control with less medication. More importantly, he is able to participate actively in his favorite hobbies of hunting and fishing.

### Questions

1. Are all overweight diabetic patients good candidates for weight loss surgery?
2. Do all diabetic patients experience an improvement in their diabetes control after surgery, and, if so, at what point would one expect to see an improvement?
3. What is the proper postsurgical management of blood glucose?

### Commentary

A patient's decision to have bariatric surgery is complex and must include a thorough understanding of all factors involved with the surgery, including operative risk and long-term complications. Because surgery involves major life changes, psychosocial factors must be addressed. Assessment should include the patient's values, goals, readiness to change, and personal and environmental resources.<sup>1</sup> A patient must be aware of the expected outcomes of the surgery, including the fact that most patients will never achieve an "ideal weight." Each patient must commit to participation in treatment and long-term follow-up.<sup>2</sup> Because patient selection is crucial to surgery outcomes, weight loss surgery should be limited to well-informed and highly motivated patients who meet one of the following criteria:<sup>3</sup>

- Class III obesity: BMI > 40 kg/m<sup>2</sup>
- Class II obesity: BMI >35 kg/m<sup>2</sup>, with diabetes and/or comorbidity related to obesity, such as hypertension, heart failure, or sleep apnea.<sup>4,5</sup>

Contraindications to surgery may include:<sup>2,3,6</sup>

- Inability to comply with long-term follow-up
- Psychiatric disorders, e.g., severe depression, personality disorders
- Active substance abuse
- Plans to become pregnant within 1 year

### Diabetes outcomes

The primary goal of bariatric surgery is to improve or alleviate obesity-related comorbidities. In a landmark study conducted by Pories et al.,<sup>7</sup> patients with type 2 diabetes who had gastric bypass showed a remarkable improvement in condition. In 83% of patients who were available for follow-up, normal levels of glucose and glycated hemoglobin were maintained up to 14 years postoperatively.

In a study by Schaur et al.<sup>8</sup> improvement in diabetes was seen in all participants. Fifty-two patients required insulin before having surgery, with a mean insulin dosage of 96 units/patient/day. After surgery, only 11 patients still required insulin, and the mean dosage decreased to 45 units/patient/day. Improvement was also seen with pharmacological therapy. Ninety-three patients required only oral agents before having surgery, with an estimated mean of 1.6 medications per patient. Only 12 of the 93 still needed oral agents after surgery, and the number of agents required decreased to 1.1 per patient. In 30% of the study participants, all diabetes medications were discontinued immediately after hospital discharge.

Similarly, a recent meta-analysis indicated that diabetes was completely resolved in 76.8% of patients and resolved or improved in 86.0%.<sup>9</sup> Resolution is defined as maintaining a blood glucose level within the target range while independent from all diabetes medication. The mechanisms behind diabetes resolution require further investigation. However several mechanisms have been proposed, including weight loss, reduced calorie intake, delayed transit

time from stomach to jejunum because of the small gastric outlet, and changes in gut hormone secretion because of bypass of the foregut.<sup>7,8,10</sup> Euglycemia appears in many cases to be immediate, even before significant weight loss occurs.<sup>7,10</sup>

Blood glucose management presents an unusual challenge to patients and diabetes care teams after RYGB. Many factors play a role in altering a patient's blood glucose level, including changes in glucose-lowering medications, NPO (nothing by mouth) status, inconsistent nutrient intake, decreased appetite, newly formed anatomy of the digestive tract, and changes in gut hormone secretion.

New research emphasizes the importance of achieving glycemic control while hospitalized.<sup>11</sup> Upper limits for blood glucose targets were recently established as follows:<sup>12</sup>

- Preprandial: < 110 mg/dl
- Peak postprandial: < 180 mg/dl
- Critically ill surgical patients (i.e., intensive care unit): < 110 mg/dl

Because most bariatric surgery patients are encouraged to avoid calorie-containing liquids, carbohydrate intake is limited in the initial phase after surgery. During hospitalization, such patients and their diabetes team need to work together to find an appropriate plan, including consistent carbohydrate intake, frequent monitoring of blood glucose, and use of insulin when necessary to maintain glycemic control.

### Clinical Pearls

- Bariatric surgery is a viable option in severely obese patients who have not been successful with more conventional weight loss approaches. RYGB has been shown to be extremely effective in promoting long-term weight loss and improving comorbid conditions. One study<sup>7</sup> showed a sustained 50% weight loss 14 years postoperatively.
- Stabilization of blood glucose can occur rapidly, even before significant weight loss. Frequent self-monitoring

of blood glucose is recommended, as well as regular monitoring by the diabetes care team both in the hospital and on discharge.

- The likelihood of complete resolution of diabetes is increased in patients with type 2 diabetes of short duration (< 5 years) and less severe disease (non-insulin dependent).<sup>8</sup> Therefore, the optimal time to intervene with bariatric surgery is early in the disease process.

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