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Sobering predictions have been included in recent publications analyzing contemporary and historical trends in the worldwide prevalence of obesity. Manpreet S. Mundi, MD, of the Division of Endocrinology, Diabetes, Metabolism, and Nutrition at Mayo Clinic in Rochester, Minnesota, says: "Currently, the overall prevalence of obesity (defined as a body mass index [BMI] ≥ 30 kg/m²) in the United States is 33% and is expected to rise to approximately 50% over the next 20 years. What is particularly concerning for the US health care industry is that individuals with a BMI of 40 kg/m² or more (Class III obesity) are the most rapidly growing subset in the obese population. In fact, we have recently seen a 50% increase in individuals with a BMI greater than 40 kg/m² and a 75% increase in the prevalence of individuals with a BMI greater than 50 kg/m²."

Dr Mundi continues: "The devastating impact of obesity's rising prevalence is imminent, in terms of both our citizenry's health and the financial well-being of our health care industry. Major studies performed over the past few decades have found a clear correlation between obesity and the development of chronic metabolic conditions, such as type 2

diabetes mellitus, hypertension, and hyperlipidemia. We are also obtaining data regarding structural changes to the heart itself. Novel imaging techniques, such as cardiac magnetic resonance imaging, have demonstrated a direct correlation between left ventricular [LV] mass and BMI and fat mass. A recent study revealed that the LV mass doubles at a BMI of 50 kg/m² compared with a BMI of 20 kg/m². Other studies have also shown associations between obesity and dementia (including Alzheimer disease), obstructive sleep apnea, osteoarthritis, and overall mortality rate. In fact, we may be seeing the first generation of individuals with a lower life expectancy than their parents."

Maria L. Collazo-Clavell, MD, of the Division of Endocrinology, Diabetes, Metabolism, and Nutrition at Mayo Clinic in Rochester, notes: "Despite aggressive research efforts, a novel weight management drug without notable adverse effects is not on the horizon. On the contrary, recent data have forced the US Food and Drug Administration to remove from the market many long-standing weight management agents, such as sibutramine, because of their adverse-effect profile. Bariatric surgery continues to be the most effective means of

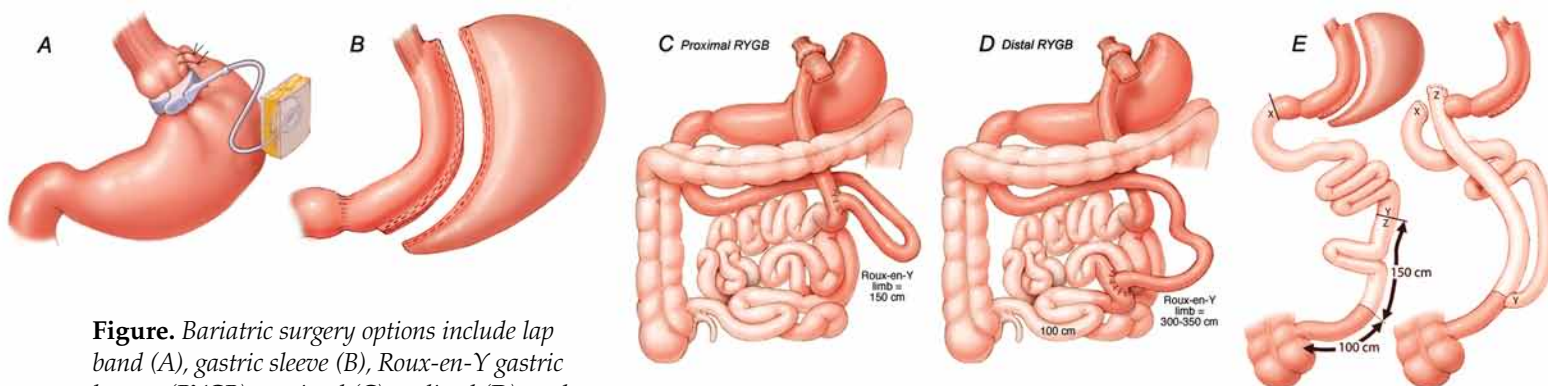


Figure. Bariatric surgery options include lap band (A), gastric sleeve (B), Roux-en-Y gastric bypass (RYGB) proximal (C) or distal (D), and duodenal switch (E).



Manpreet S. Mundi, MD, Maria L. Collazo-Clavell, MD, and Paul A. Lorentz, RN

long-term weight management in persons with medically complicated obesity, producing a resolution or improvement in many debilitating and life-threatening medical problems, as well as substantially improving quality of life. Not surprisingly, the number of bariatric procedures performed yearly has dramatically increased over the past decade. As of 2011, approximately 225,000 bariatric operations are performed annually in the United States, a nearly 500% increase since 2000."

Several operative procedures (Figure), including gastric banding ("lap band"), sleeve gastrectomy, Roux-en-Y gastric bypass, and duodenal switch (also referred to as *biliopancreatic diversion with duodenal switch*), are offered at Mayo Clinic, with the Roux-en-Y gastric bypass being the most common (approximately 74% of all cases). Dr Mundi explains: "Given its lackluster long-term performance, the laparoscopic gastric band procedure has been performed with decreased frequency at Mayo Clinic. A different type of restrictive procedure, the sleeve gastrectomy [Figure], has taken its place. This operation continues its historical role as the first part of the duodenal switch; however, in recent years, it has emerged as a stand-alone procedure. Sleeve gastrectomy has become the procedure of choice for the management of medically complicated obesity in patients with liver disease. In conjunction with our liver transplant service, we are studying the clinical outcomes of sleeve gastrectomies performed at various stages of liver failure. Long-term outcome data for the sleeve gastrectomy are lacking. Yet, early results show considerable promise in terms of weight loss

and improvement or remission of weight-related comorbidities."

Paul A. Lorentz, RN, of the Division of Endocrinology, Diabetes, Metabolism, and Nutrition at Mayo Clinic in Rochester, comments: "Despite the overwhelming benefits to our patients, bariatric surgery is not without complications. As such, presurgical patient selection and postsurgical follow-up are critically important. To provide optimum patient care, we have implemented an integrated, multidisciplinary approach to each patient seeking bariatric surgery. On referral, the patient begins a journey toward surgery by meeting with an endocrinologist specializing in nutrition, a psychologist specializing in behavior modification, and a registered dietician. A patient-specific, comprehensive medical weight management plan, centered on cognitive behavioral therapy, is then developed. When our behavior modification program is successfully completed, which on average takes 3 months, the patient is scheduled to meet with a surgeon to discuss which surgery may be best for him or her."

Mr Lorentz explains further: "Our multidisciplinary approach continues after surgery, with shared medical appointments that occur several times in the year following surgery and annually thereafter. This small group-based model allows for peer support among patients, while controlling health care costs and limiting educational redundancy. Patients continue to be engaged as they incorporate lifestyle changes, with the hope of achieving greater and sustained weight loss. This practice model has been well accepted by our patients, as evidenced by a substantial decrease in missed appointments. Patients also report a preference for this model when compared with the conventional (one-on-one) model of care."

Dr Mundi concludes: "Despite these successes, continued efforts and research are needed to combat the obesity epidemic. An area of active investigation is the unfortunate phenomenon of weight regain after bariatric surgery. We aim to identify the factors contributing to weight regain and the potential interventions to prevent and manage it. In conjunction with several collaborators, we are offering multifaceted programs, which include various components of nutritional, behavioral, and medical therapies. In addition, we are exploring novel surgical treatment methods, including endoscopic procedures, that are targeted at weight maintenance after surgery."

The Mayo Clinic Dan Abraham Healthy Living Center

In 1932, Charles H. Mayo, MD, one of the founders of Mayo Clinic, said: “The object of all health education is to change the conduct of individual men, women, and children by teaching them to care for their bodies well.” Decades later, thanks to the generous gift of Danny Abraham, the Dan Abraham Healthy Living Center (DAHLC) became the cornerstone of integrated campus wellness initiatives at Mayo Clinic in Rochester, Minnesota. The DAHLC provides an environment to help Mayo Clinic staff achieve and maintain wellness.

Mayo Clinic leadership is committed to the health of the staff, as well as interested in reducing staff health care costs. The mission statement of the organization now includes wellness: “The Mayo Clinic mission is to inspire hope and contribute to health and well-being by providing the best care to every patient through integrated clinical practice, education, and research.” Kerry D. Olsen, MD, of the Department of Otolaryngology at Mayo Clinic in Rochester, serves as the medical director and Beth A. Warren, MBA, is the business director of the DAHLC. Dr Olsen and Ms Warren direct the Mayo Clinic Healthy Living Committee, which establishes the strategic direction for employee wellness and includes persons from the Division of Preventive, Occupational, and Aerospace Medicine; the Division of Endocrinology, Diabetes, Metabolism, and Nutrition; the Division of Cardiovascular Diseases; the Department of Orthopedic Surgery; Food Services; Human Resources; Patient Education; Research; and Communications.

Ms Warren explains: “The current operation includes 95 staff team members—both allied health and physician staff—and 115,000 square feet of studio, equipment, and programming space. However, the center is not merely an exercise center, although there are 165 cardiovascular machines, an indoor track, and exercise and lap pools. The center aims to address all areas of wellness, including aerobic condition-



Beth A. Warren, MBA, and M. Molly McMahon, MD

ing, strength and flexibility, emotional health, stress reduction, weight reduction, and healthy nutrition. The DAHLC staff pride themselves on establishing motivating relationships with members and a nonthreatening atmosphere that welcomes all staff, including those new to this type of facility. Membership tops 16,600, with nearly 4,000 users per day. Low membership fees are incentive based and depend on the member's use of the center.”

Programs include wellness consultations and evaluations; small-group training classes that incorporate cardiovascular strength, balance, and flexibility; group fitness classes in mind/body (eg, yoga, tai chi, Pilates, Alexander Technique); aquatic programs and classes in a lap pool or fitness pool; strength training; and cycle classes. Relaxation services include massage, hydromassage, and acupuncture. Programs targeted at specific conditions, such as back health, sleep, and pregnancy, were developed to meet employee needs. On-site child care also is available.

M. Molly McMahon, MD, of the Division of Endocrinology, Diabetes, Metabolism, and Nutrition at Mayo Clinic in Rochester, says: “Primary care clinicians can refer patients to the center using the same system used to order consultations or other tests. Health and wellness coaches meet with the person to determine which programs or activities would be beneficial.



Figure 1. Mayo Clinic Dan Abraham Healthy Living Center.



Figure 2. Water aerobics class.



Figure 3. *Cycling class at the Dan Abraham Healthy Living Center.*

Staff training protocols, business procedures, and policies and space requirements are compatible with accreditation requirements, similar to any clinical care area at Mayo Clinic. Employees can have point-of-care testing for certain biochemical tests or can attend free screening nights, such as skin assessments and sports medicine evaluations. A wellness champion program aims to oversee and train wellness leaders for individual work areas, in order to engage Mayo Clinic staff at all campus sites.”

An article in the next issue of *Mayo Clinic Endocrinology Update* will highlight the nutrition programs at the DAHLC and the plans for expansion that will welcome Mayo Clinic patients to the facility.

Hypocalcemia After Thyroid Surgery

The most common complication after total or near-total thyroidectomy is hypocalcemia secondary to hypoparathyroidism, which occurs in about a third of cases. In many cases, this complication is asymptomatic. However, when symptoms develop, they can range from mild paresthesias to painful tetany and even life-threatening complications, such as laryngeal spasm or arrhythmia. Some patients may report nonspecific concerns, such as muscle aches, weakness, or twitching. Symptomatic hypocalcemia is also the primary reason for a prolonged hospitalization after thyroidectomy. A successful thyroid operation is dependent in part on preventing or effectively treating hypocalcemia-related symptoms.

Melanie L. Richards, MD, of the Department of Surgery at Mayo Clinic in Rochester, Minnesota, says: “The thyroid surgeon is ultimately responsible for preventing hypocalcemia. The amount of thyroid tissue removed directly correlates with the risk of parathyroid injury. Patients who undergo a thyroid lobectomy are virtually guaranteed not to have hypoparathyroidism. Thyroid surgeons must navigate a fine line between risk and benefit when determining the extent of thyroidectomy. They must be meticulous in the preservation of the parathyroid glands and at the same time remove an adequate amount of thyroid tissue to treat the underlying pathologic characteristics. Thus, in cases of differentiated thyroid carcinoma, they must allow for possible treatment with radioactive iodine.”

Dr Richards continues: “Postthyroidectomy



Melanie L. Richards, MD, and Marius N. Stan, MD

hypoparathyroidism is usually related to disruption in blood supply rather than to inadvertent removal of parathyroid glands. When parathyroid glands are of uncertain viability, they are minced and autotransplanted into a strap muscle, such as the sternocleidomastoid muscle. Although a patient needs only a single healthy parathyroid gland to have normal parathyroid function, the surgeon’s goal is to leave the patient with 4 functioning parathyroid glands. Despite meticulous surgical technique, nearly 30% of patients will have transient hypoparathyroidism after total thyroidectomy if parathyroid hormone [PTH] levels are routinely checked in the early postoperative period. Fortunately, permanent hypoparathyroidism happens in only a few percent of patients.”

Marius N. Stan, MD, of the Division of Endocrinology, Diabetes, Metabolism, and Nutrition at Mayo Clinic in Rochester, says: “The prevention of symptomatic hypocalcemia

goes beyond the operating room. In a prophylactic fashion, vitamin D therapy can be initiated in the preoperative period since its deficiency is known to be common. Postoperatively, some physicians routinely treat all patients with supplemental calcium and vitamin D. Some clinicians recommend that calcium supplementation be limited to patients with hypocalcemia, whereas other clinicians may selectively treat patients on the basis of possible risk factors for symptomatic hypocalcemia, such as a large goiter or extensive malignancy [Table 1]. This variation in approach underscores the need for a widely accepted postoperative calcium management protocol for patients undergoing total thyroidectomy.”

Dr Richards explains: “Surgeons have used many different strategies to identify patients at risk for postoperative hypocalcemia. Before the advent of a readily available rapid PTH assay to assist with parathyroid adenoma operations, surgeons used absolute serum calcium levels or percentage decline in serum calcium concentration over time to guide treatment. This approach was not optimal because a number of patients may not have their calcium level reach a nadir until 48 hours or more postoperatively. Many patients were also found to have low serum calcium concentrations in the postoperative period because of intravenous fluids given and not because of hypoparathyroidism.”

She continues: “The serum half-life of PTH is only 2 or 3 minutes, and substantial declines in PTH occur before the patient even leaves the operating room. This timeline allows PTH levels to become the earliest and most reliable predictor of symptomatic hypocalcemia. A serum PTH concentration that is less than 10 pg/mL (reference range, 15–65 pg/mL) obtained at least 6 hours after thyroidectomy has more than 90% sensitivity and specificity for predicting symptomatic hypocalcemia. This degree of accuracy allows us to minimize unnecessary calcium and vitamin D supplementation and sequential laboratory testing. It guides us in instituting early treatment and leads to prevention of symptomatic hypocalcemia in the at-risk patients. Targeted education of these patients in the symptoms and management of hypocalcemia has the potential of reducing emergency room visits and readmissions. For practical purposes, a PTH check on the morning after thyroidectomy has increased specificity and minimizes blood draws if calcium prophylaxis is used in all patients.” The Figure shows a sample of a Mayo protocol used with postthyroidectomy PTH monitoring.

Table 1. Patient Characteristics Consistent With an Increased Risk of Postthyroidectomy Symptomatic Hypocalcemia

- Large goiter
- High-risk malignancy
- Lymphadenectomy
- Low preoperative calcium or vitamin D level
- Graves’ disease
- Breast-feeding
- Reoperation
- Coincident primary hyperparathyroidism
- Calcium malabsorption
 - Postgastric bypass
 - Celiac disease
 - Therapy with proton pump inhibitors

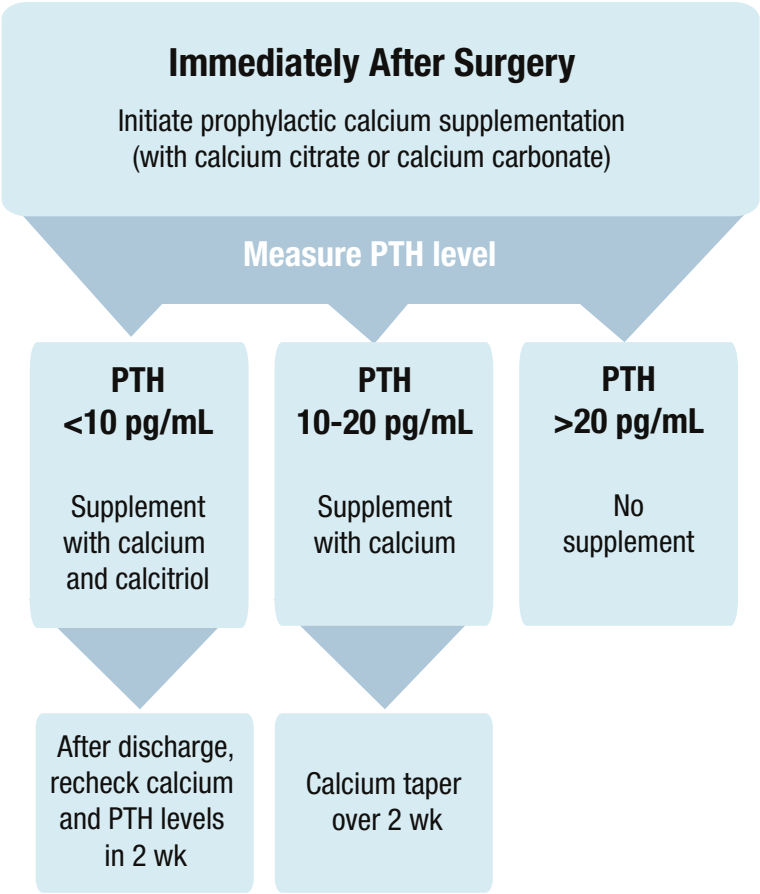


Figure. Algorithm for managing hypocalcemia after total or near-total thyroidectomy. PTH indicates parathyroid hormone.

Dr Stan notes: “It is important to consider calcium carbonate malabsorption secondary to underlying intestinal pathology, prior bariatric operations, or the use of antacids. Patients need gastric acid to absorb calcium carbonate. Calcium citrate is not dependent on an acidic environment for absorption and is an optimal form of supplementation for patients treated with antacid agents, such as proton pump inhibitors. Intravenous calcium supplementation in the form of calcium gluconate can rapidly treat severe symptoms and critical hypocalcemia. However, the total calcium content in the intravenous forms is low [Table 2] and the adverse effects of intravenous administration are serious.”

Dr Stan explains further: “Persistent hypocalcemia should lead to investigation of magnesium levels and their appropriate correction when necessary. If both thyroid disease and primary hyperparathyroidism were addressed surgically, the syndrome of ‘hungry bones’ should be considered when PTH levels are appropriately elevated for the degree of hypocalcemia. Future management of severe postoperative hypocalcemia may also include teriparatide, which is a synthetic recombinant PTH 1-34 peptide given as a subcutaneous injection. Potential advantages of teriparatide in this clinical setting include rapid correction of hypocalcemia with symptoms reduction, decreased need for intravenous calcium use, and shortened duration of hospitalizations. Teriparatide therapy is also likely to reduce hypercalciuria and the need for large amounts of calcium and calcitriol. Currently, we have

Table 2. Elemental Calcium Content in Intravenous and Oral Calcium Formulations

Formulation Type, Amount	Elemental Calcium Level, mg (%)
Calcium gluconate, 1 g	93 (9.3)
Calcium chloride, 1 g	273 (27.3)
Calcium carbonate, 1.25 g	500 (40.0)
Calcium citrate, 1.9 g	400 (21.0)

an ongoing prospective study evaluating the effects of teriparatide on postthyroidectomy hypocalcemia.”

Dr Richards concludes: “The goal of calcium and vitamin D supplementation is to have the patient asymptomatic while keeping the serum calcium level just below or at the low end of normal. Hypercalciuria should also be avoided, which can be done by adding hydrochlorothiazide when oral calcium supplementation requirements are greater than 3 g of elemental calcium per day. These patients should be routinely monitored to avoid hypercalcemia when the parathyroid glands recover, which may take anywhere from several days to several months. Most patients have normal parathyroid function within 2 weeks. The diagnosis of permanent hypoparathyroidism should be considered when vitamin D and calcium supplementation is still required to maintain a normal serum calcium concentration more than 6 months postoperatively.”



Steven A. Smith, MD, received the 2011 Stop Diabetes: Act Award at the Minnesota Area American Diabetes Association Gala. Rebecca S. Bahn, MD, received the 2011 American Thyroid Association Distinguished Service Award. Michael D. Jensen, MD, received the 2011 Mayo Clinic Department of Medicine Landmark Contributions to the Literature Award.



David R. Farley, MD, received the 2011 Mayo Medical School Teacher of the Year Award. John M. Miles, MD, was named the Earl and Annette R. McDonough Professor.



Bryan McIver, MB, ChB, PhD, received the 2011 Mayo Clinic Fellows Association Teacher of the Year Award. Geoffrey B. Thompson, MD, was appointed to Vice President of the International Surgery Week to be held in Helsinki, Finland, in August 2013.



William F. Young Jr, MD, was elected to the position of President of The Endocrine Society, to start in June 2012. John C. Morris III, MD, completed a 9-year term as Chair of the Division of Endocrinology, Diabetes, Metabolism, and Nutrition.



M. Molly McMahon, MD, received the 2011 Department of Medicine Laureate Award. K. Sreekumaran Nair, MD, PhD, received the 2011 Department of Medicine Outstanding Mentor Award.

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2011 Samuel F. Haines Lecturer—Professor Ulla Feldt-Rasmussen, University of Copenhagen, and members of the Thyroid Core Group. Seated, left to right: Rebecca S. Bahn, MD, Ulla Feldt-Rasmussen, MD, PhD, MSc, and Bryan McIver, MB, ChB, PhD. Standing, left to right: Vahab Fatourehchi, MD, M. Regina Castro, MD, Ian D. Hay, MD, PhD, Stefan K. Grebe, MD, Michael D. Brennan, MD, Colum A. Gorman, MB, BCh, PhD, Diana S. Dean, MD, John C. Morris III, MD, and Hossein Gharib, MD.

Education Opportunities

15th Mayo Clinic Endocrine Course

April 16-21, 2012, Palma, Mallorca, Spain.

Designed for endocrinologists and interested internists and surgeons, the 15th Mayo Clinic Endocrine Course will address gaps in medical knowledge and barriers in clinical practice, in order to improve the outcomes of patients with endocrine and metabolic disorders. For more information about this course, please visit <http://www.mayo.edu/cme/endocrinology>.

12th Annual Mayo Clinic Nutrition and Wellness in Health and Disease

September 20-21, 2012, Scottsdale, Arizona.

Nutrition, physical activity, and other healthy lifestyle behaviors are vital components in the promotion of health and the treatment of disease. This course—designed for physicians, advanced practice clinicians, dietitians, nurses, and health and wellness staff—will provide a full-spectrum, in-depth overview of situations that clinicians encounter in the ambulatory setting, including obesity, obesity-associated medical conditions, effective ways to provide nutrition counseling, and other common nutrition issues, in addition to physical activity and wellness. Current clinical topics will be highlighted through presentations, interactive case studies, and panel discussions. The course will be held at the Westin Kierland Resort & Spa, Scottsdale, Arizona. For more information about this course, please call 800-323-2688 or visit <http://www.mayo.edu/cme/endocrinology>.

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