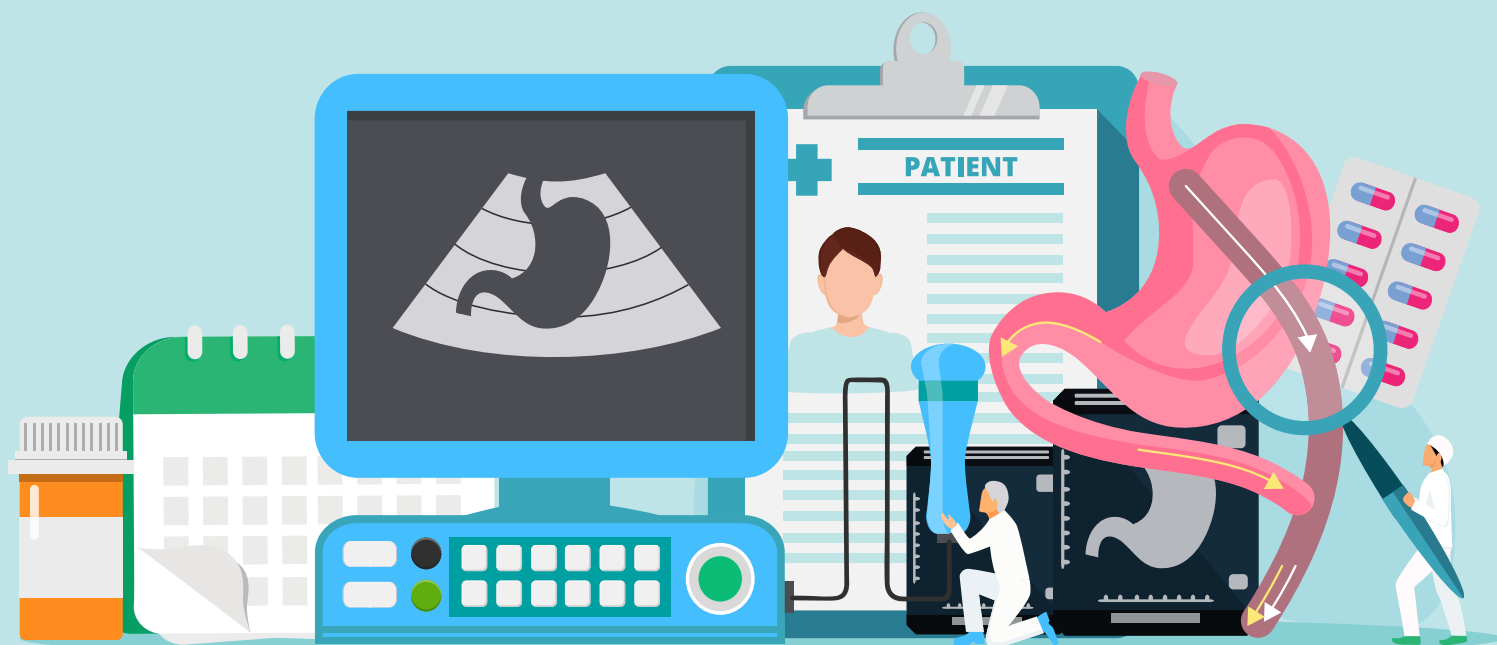


PHARMACIST & TECHNICIAN CE:

The Pharmacy Professional's Role in Medication Management for Bariatric Surgery Patients

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Obesity is a chronic, costly, and increasingly common disease in the United States. According to the National Health Statistics report, pre-pandemic, adult obesity (age 20 and over) was estimated at 41.9% with severe obesity estimated to affect 9.2% of the United States population.¹ Children and adolescents (aged 2-19) have a much lower rate of obesity, at 19.7%.¹ These numbers continue to increase annually, with adult obesity rising 11.4% and severe obesity rising 4.5% since 2000. The cost of obesity and related diseases is also increasing with most recent estimates of excess medical costs of \$1,861 per person correlating with an estimated \$172.42 billion dollars annually in 2019.² The higher the body mass index (BMI), the higher the estimated annual per-patient cost. The state of Wisconsin's statistics for obesity are starkly higher than the rest of the United States. The Wisconsin Department of Health Services reports that

CE FOR PHARMACISTS & TECHNICIANS

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Learning Objectives

- Describe the prevalence of the obesity epidemic locally in Wisconsin and the United States. (P,T)
- List 3 major types of bariatric surgery and the associated anatomy changes' effects on medication absorption. (P,T)
- Identify nutritional deficiencies associated with bariatric surgery and recommend appropriate vitamin and mineral supplementation. (P,T)
- Suggest medication adjustments and alternative pharmacotherapeutic options for the post-bariatric surgery patient. (P)
- Recommend appropriate annual laboratory monitoring for the post-bariatric surgery patient. (P,T)

the percent of adults with an "overweight" BMI (25-30) is 36.1% and the percentage of adults with "obesity" (BMI greater than 30) is 32.3%.³ The higher rates of obesity in Wisconsin are theorized to be related to increased consumption of packaged foods

and decreased physical activity.

The Centers for Disease Control and Prevention (CDC) defines a "healthy weight" as one with a BMI of 18.5 to <25 for adults aged 20 or over.⁴ A BMI of 25 to 30 is defined as "over-weight"

and a BMI of 30 or higher is defined as “obesity”. Obesity is further categorized as class 1 (BMI of 30 to <35), class 2 (BMI of 35 to <40) and class 3 (BMI of 40 or higher); class 3 is also known as “severe” or “morbid” obesity. Obesity continues to be a complex disease and is thought to be caused by a variety of precipitating factors, including, but not limited to, eating habits, physical activity, sleep hygiene, genetics, and social determinates of health.⁵ Obesity is associated with a higher rate of co-morbid diseases including, but not limited to, diabetes, hypertension, sleep apnea, and joint problems. Medical and surgical treatments for obesity have increased over time, allowing patients to realize a healthier weight, prolonging life and decreasing co-morbid health conditions. Along with pharmacological therapies for obesity, bariatric surgery is a proven intervention for obesity with long-term positive outcomes. Pharmacists must have a keen awareness of bariatric surgery and its effects on medication absorption to assist patients in their ongoing healthcare journeys.

The American Society of Metabolic and Bariatric Surgery (ASMBS) and the National Institutes of Health (NIH) define obesity and guidelines for bariatric surgery consideration. In 1991, the NIH defined guidelines for bariatric surgery; however, since that time, there has been an increase in studies on the obesity epidemic, which has added to the body of knowledge surrounding obesity and bariatric surgery. In 2022, the NIH updated its guidelines for bariatric surgery based on new studies and understanding.⁶ Metabolic and bariatric surgery (MBS) is recommended for patients with a BMI of 35 or greater, regardless of comorbidities, including that MBS should be considered for patients with a BMI of 30 or greater with metabolic disease. Obesity is also associated with a chronic low-grade inflammatory state and certain levels of immune dysfunction. These prolonged states of inflammation and immune dysfunction lead to a disruption of homeostasis and predisposition to metabolic disease. Metabolic disease increases your risk of cardiovascular disease, diabetes and stroke and occurs when a patient has at least three of the following:

- Low levels of high-density lipoprotein (HDL) less than 40 mg/dL in people assigned male at birth (AMAB) and

TABLE 1. Metabolic and Bariatric Surgery Procedures^{8,9}

Procedure	Target Weight Loss (%)	Favorable Aspects	Unfavorable Aspects
Laparoscopic Adjustable Gastric Banding (LAGB)	20-25%	<ul style="list-style-type: none"> • No anatomic alteration • Removable • Adjustable 	<ul style="list-style-type: none"> • High explant rate • Erosion • Slip/Prolapse
Sleeve Gastrectomy (SG)	25-30%	<ul style="list-style-type: none"> • Easy to perform • No anastomosis • Reproducible • Few long-term complications • Metabolic effects • Versatile for challenging patient populations 	<ul style="list-style-type: none"> • Leaks difficult to manage • New onset gastroesophageal reflux disease (GERD)
Roux-en-Y Gastric Bypass (RYGB)	30-35%	<ul style="list-style-type: none"> • Strong metabolic effects • Standardized techniques • Low major complication rate • Effective treatment for GERD • Can be used as second stage after SG 	<ul style="list-style-type: none"> • Few proven revisional options for weight regain • Marginal ulcers • Possibility of internal hernias • Long-term micronutrient deficiencies
Biliopancreatic diversion with duodenal switch (BPD/DS)	34-45%	<ul style="list-style-type: none"> • Very strong metabolic effects • Durable weight loss • Effective for patients with very high BMI • Can be used as second stage after SG 	<ul style="list-style-type: none"> • Malabsorptive • 3-5% protein-calorie malnutrition • New onset GERD • Possibility of internal hernias • Duodenal dissection • Technically challenging • Higher rates of micronutrient deficiencies than RYGB
Single Anastomosis Duodenal-Ileal Bypass with Sleeve Gastrectomy (SADI-S)	Undefined	<ul style="list-style-type: none"> • Effective for long-term weight loss and remission of Type 2 Diabetes Mellitus • Simpler procedure compared to RYGB or BPD/DS • Can be used as second stage after SB 	<ul style="list-style-type: none"> • Decreased absorption of vitamins and minerals than SG or LAGB • Only short-term outcome data • New onset GERD • Increased risk for loose stools and diarrhea

LAGB: laparoscopic adjustable gastric banding, SG: sleeve gastrectomy, GERD: gastroesophageal reflux disease, RYGB: Roux-en-Y gastric bypass, BDP/DS: biliopancreatic diversion with duodenal switch, BMI: body mass index, SADI-S: single anastomosis duodenal-ileal bypass with sleeve gastrectomy.

HDL less than 50 mg/dL in people assigned female at birth (AFAB)

- Fasting blood glucose level greater than 100 mg/dL
- Elevated blood pressure (systolic greater than 130 mmHg and/or diastolic greater than 85 mmHg
- Excess abdominal weight (waist circumference greater than 40 inches in people AMAB or greater than 35 inches in people AFAB)
- Triglyceride level greater than 150 mg/dL⁷

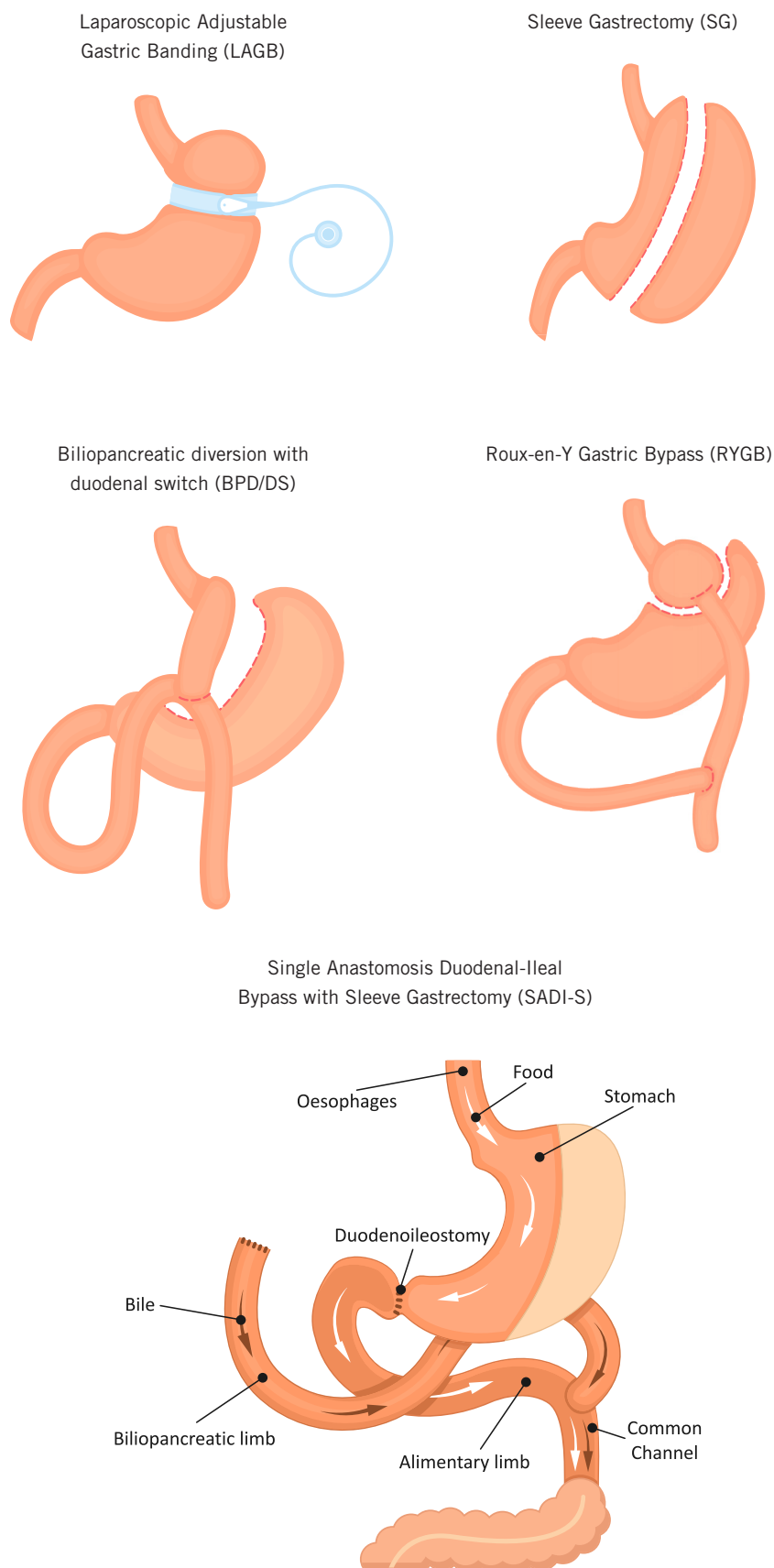
The most common bariatric procedures

have evolved from the vertical banded gastroplasty (VBG) and the Roux-en-Y gastric bypass (RYGB) in 1991, with the RYGB and sleeve gastrectomy accounting for approximately 90% of all procedures performed today.⁶ Metabolic and bariatric surgery has a low perioperative mortality rate of <0.2% and is preformed using minimally invasive surgical approaches such as laparoscopic or robotic-assisted techniques. After a decision by the healthcare professional and patient to undergo MBS, the pharmacist can play a large role in evaluation and adjustment of

medications during all stages of weight loss surgery (pre-surgical, perioperatively, and long-term).

Pharmacologic considerations and nutritional supplementation are generally managed similarly regardless of the MBS performed; however, there are some variations. To understand the nuances, it is important to understand the different types of procedures performed. Table 1 outlines the most common MBS types and the favorable and unfavorable outcomes most associated with each type; Figure 1 shows anatomical changes associated with each procedure. The laparoscopic adjustable gastric banding procedure is a minimally invasive procedure where there is no surgical change in anatomy. This works by placing an adjustable band around the top part of the stomach, creating a small pouch above the band. The band can be expanded and tightened with the addition of fluid via a small port underneath the skin. This procedure has fallen out of favor, as it does not have a profound effect on diabetes type 2 or metabolism; it simply helps patients feel full sooner.⁹ The sleeve gastrectomy is currently one of the two most common surgical procedures for MBS. In this procedure, the stomach is stapled to create a small pouch separate from the remaining 80% of the stomach. This newer, smaller stomach holds less food and fluid, and the portion of the stomach that holds the “hunger hormone” is bypassed. This surgical procedure does not involve bypassing or altering the intestines. The Roux-en-Y gastric bypass is the other most common procedure performed, in which the stomach is again separated into two smaller segments. The portion of the stomach that holds food is approximately the size of an egg and the larger part is completely bypassed, along with a portion of the small intestine. This procedure allows for less absorption of nutrients due to bypassing portions of the intestines and is considered a malabsorptive procedure. The biliopancreatic diversion with duodenal switch is another less common procedure that is similar to the sleeve gastrectomy, in which a smaller, tube-like, curved stomach is created. This smaller stomach is then attached further down to the small intestine, bypassing 75% of the small intestine, the most of any current procedure, allowing for less absorption of nutrients. This procedure is thought to have

FIGURE 1. Anatomical Illustration of MBS Procedures^{9,10}



the largest effect on the hunger hormones and the improvement of diabetes. The final procedure, and the newest one, is the single anastomosis duodeno-ileal bypass with sleeve gastrectomy. This procedure starts out like the sleeve gastrectomy, in which a smaller stomach is made and then connected to the intestine several feet downstream, allowing for a good amount of weight loss in a surgically simpler procedure.⁹ All procedures, with the exception of the laparoscopic gastric banding, are considered malabsorptive procedures and have an effect on medication metabolism, requiring the keen eye of a pharmacist to ensure patients are set up for success prior to, immediately after, and long-term after the procedure.

Preoperative Considerations

Prior to any MBS, a patient should be extensively evaluated which includes a comprehensive medical history, psychosocial history, physical examination, and appropriate laboratory monitoring.⁸ Patients should continue to follow a low-calorie, low-fat diet prior to bariatric surgery to help reduce liver size. An enlarged liver or fatty liver disease can increase risk of surgical complications. For this reason, most patients will be instructed to follow a low-fat, liquid diet for a minimum of 2 weeks prior to scheduled surgery. In addition to pre-surgical weight loss and liquid diet, a patient should be in relative glycemic control with a target A1c of 8% or less to decrease hospital stays and post-surgical complications. Routine screening for the following labs should be done prior to MBS: fasting blood glucose, fasting lipid panel, kidney function, liver profile, urine analysis, prothrombin time/INR, blood type, and complete blood count. Thyroid stimulating hormone testing is not required per ASMBS guidance; however, some insurances require this prior to surgery, and if a patient is found to be hypothyroid, levothyroxine should be initiated as monotherapy. Nutrient screening, including iron studies, cyanocobalamin (B12), folic acid, and vitamin D with more extensive testing for patients with symptoms and risks.

Patients with childbearing potential should avoid pregnancy before the procedure and for 12-18 months post-surgery.⁸ For malabsorptive procedures, patients who could become pregnant should be counseled on contraception, with the

preferred method by most surgeons an implanted or intrauterine device versus oral contraceptive pills that may have decreased or erratic absorption for the MBS patient. As rapid weight loss occurs after surgery, fertility is likely to significantly increase, making these discussions vital. A patient should wait the recommended length of time before conceiving to ensure they have returned to nutritional homeostasis to improve outcomes for the pregnant person and fetus. Discussions should include estrogen replacement products for all patients with AFAB anatomy. Patients on oral contraception should discontinue use at least 1 cycle prior to surgery, and patients utilizing hormone replacement therapy for postmenopausal symptoms should discontinue use at least 3 weeks prior to surgery to decrease post-procedure thromboembolic risk. Patients who smoke will need to be abstinent from nicotine for a minimum of 6 months prior to surgery and life-long thereafter, due to the risk for poor wound healing, anastomotic ulcer, and overall impaired health. In patients with a history of gout, prophylactic treatment for

TABLE 2. Pre-Operative Medication Consideration for Diabetes^{11,14}

Insulin Secretagogues	Discontinue use
Pre-mixed/ Rapid-acting	Decrease by 50%
NPH/Long-acting Insulin	Decrease by 30%
Metformin	Continue use
GLP-1 Analogs	Hold week prior to surgery
SGLT2 Inhibitors	Hold 3-4 days prior to surgery
DPP4 Inhibitors	Continue use
Thiazolidinediones	Continue use
Acarbose	Continue use

gouty attacks should be considered prior to surgery.

A pharmacist can play an important role in reviewing a patient's current medications and setting them up for success immediately after surgery. As most of the procedures are

BOX 1: CONSIDER THE FOLLOWING CASE

Alice Wilson (further known as AW) is a 38-year-old female with a current weight of 150 kg and height of 5 feet, 10 inches (BMI = 47.4). She presents to the pharmacist clinic for a pre-operative medication management session. AW has been struggling with her weight since college, feeling like she "has gained 15 pounds each year, regardless of what she does." During high school, she was an active teenager in both cheerleading and competitive dance. During and after college her activity level significantly decreased, and her consumption of pre-packaged foods did not change. Her stress level increased, and she continued to fail several diets, exercise plans and other efforts at weight loss. Her surgeon has recommended her for a Roux-en-Y gastric bypass surgery and insurance has approved. Her surgery is scheduled for 2 weeks from your consult.

Past medical history (PMH) significant for: anxiety, sleep apnea, GERD, hypertension, diabetes mellitus type 2, and lower back pain.

Medications prior to surgery include escitalopram 10 mg once daily, omeprazole 20 mg twice daily, hydrochlorothiazide/lisinopril 12.5 mg/20mg, metformin 1000 mg twice daily, glipizide 5 mg ER daily, and ibuprofen 200 mg as needed for pain.

AW has started her liquid diet today. She monitors her blood pressure twice daily at home and tests her blood sugars three times weekly. Blood pressures are currently controlled with an average of 130/70 mmHg and her blood sugars average 120 mg/dL. All other lab monitoring and imaging is normal.

- Which of AW's medications should be evaluated for pre-surgical potential medication adjustments or substitutions and what alternatives could you consider?
 - Glipizide ER 5 mg daily will need to be discontinued. Extended-release formulations are not preferred in patients undergoing bariatric surgery due to absorption changes, and sulfonylureas should be discontinued during the pre-surgical low-calorie diet phase.
 - Ibuprofen 200 mg as needed should be discontinued and an alternative therapy should be utilized. Tylenol 325 mg as needed could be a viable option based on past medical history and normal lab and imaging.

malabsorptive, patients are no longer able to appropriately metabolize most extended-release or sustained-release medications. A pharmacist can review a patient's medication list prior to surgery to adjust medications to immediate-release versions and help ensure successful therapeutic outcomes for the patient, which may include a careful review of diabetic and hypertensive medications due to the rapid weight loss that may occur before surgery with the liquid diet. Prior to surgery, a pharmacy team can also review the size of tablets/capsules and determine which, if any, can be crushed or opened. Immediately following bariatric surgery, patients are on liquid, full-liquid, or soft diets. Due to this, each patient will need a dosage form that is able to be chewed, crushed, cut, or opened to decrease potential discomfort from swallowing full tablets/capsules. While there has not been any guideline consensus on medication adjustments pre-surgery for diabetes and hypertension, some general principles do exist for medication adjustments during the preoperative, low-calorie-diet phase and can be seen in Table 2. Blood glucose checks should be continued twice daily during the low-calorie diet phase and, if blood glucose falls below 90 mg/dL or continued hypoglycemia, further adjustments may need to be made to ensure patient safety.¹¹

While no guidelines mention blood pressure management during the preoperative stages, it is important to monitor blood pressure and symptoms of hypotension during any weight loss noted during the low-calorie-diet phase. Should blood pressure decrease, blood pressure medications should be adjusted accordingly. Prior to bariatric surgery, patients should be transitioned off all non-steroid anti-inflammatory medications and onto effective pain management therapy to ease the transition after surgery.⁸

Discharge Considerations

Immediately after surgery, and during the hospital stay, patients should be monitored closely for pain control, nausea, hypotension, hypoglycemia, dehydration, and other metabolic changes. Within 24 hours after surgery, patients will be started on a low-volume, low-sugar clear liquid diet.⁸ Continuing with a small volume diet that is also low-sugar is essential due to the significantly smaller stomach

TABLE 3. Madison VA Supplementation Order Set

Medication	Directions	Morning	Mid-Morning	Noon	Bed
Bariatric Pal Multivitamin ONE w/ 45mg iron	Take one capsule once daily (separate from calcium and antacids)	1			
Thiamine 100mg	Take one tablet once daily	1			
Bariatric Advantage Calcium Citrate (500mg calcium elemental)	Take one tablet three times daily		1	1	1

volume as well as the risk for dumping syndrome. This smaller, low sugar diet represents a significant decrease in caloric intake for the patient, which may affect blood pressure and blood glucose nearly immediately post-surgery. Dumping syndrome is characterized by food being “dumped” from the new smaller stomach pouch into the small intestine without being digested.¹² Dumping syndrome can occur early (within 10-30 minutes) or late (up to 1 to 3 hours post meal) and often results in abdominal cramping, elevated heart rate, lightheadedness, and diarrhea. The phenomenon of dumping syndrome may occur lifelong in up to 15% of patients

post-bariatric surgery after a large or sugary meal. This phenomenon is important for pharmacists to be aware of, as many liquid, chewable, or other dosage forms may include both a large volume or high amounts of sugar.

Prior to discharge, the pharmacist can ensure the appropriate medication list is prepared for the patient. New discharge medications for the bariatric patient include a multivitamin with iron, thiamine, and folic acid; elemental calcium; vitamin D; and vitamin B-12. The William S. Middleton Veterans Affairs Hospital in Madison, Wisconsin has a comprehensive bariatric surgery program, which has

BOX 2: CONSIDER AW'S BARIATRIC CASE

AW has successfully completed her Roux-en-Y gastric bypass surgical procedure and is ready to go home. Her home medication list from the medical team includes the following:

- Escitalopram 10 mg once daily
- Omeprazole 20 mg twice daily
- Lisinopril 10 mg once daily
- Metformin 1000 mg twice daily
- Bariatric Pal Multivitamin once daily
- Thiamine 100 mg once daily
- Bariatric Advantage Calcium Citrate three times daily
- Fondaparinux 5 mg once daily
- Oxycodone Liquid – 5 mg every 6 hours as needed for severe pain
- Acetaminophen 325 mg/5mL elixir – 650 mg every 6 hours as needed for pain

AW's husband takes her prescriptions to the outpatient pharmacy for filling. The pharmacist alerts AW's husband that they are currently out of the acetaminophen elixir and asks if he would like the acetaminophen suspension instead. The pharmacist alerts the husband that the suspension is 160 mg per 5 mL, so AW would need to take 20 mL of the suspension at a time to equal the approximate same dose as the elixir.

1. Is acetaminophen suspension an appropriate substitution for acetaminophen elixir in the post-bariatric surgery patient?
 - a. No, acetaminophen suspension contains high volumes of sugar, which could cause dumping syndrome, and the larger volume would be difficult for the post-bariatric surgery patient to handle on top of needing to take in oral nutrition.
2. Is the dose of Omeprazole appropriate for the post-bariatric patient?
 - a. No, bariatric surgery is often used as a treatment for GERD. This generally resolves quickly after surgery. Recommending to the attending to decrease the omeprazole to once daily for 1 week then discontinuation would be a better option to decrease polypharmacy and unnecessary treatment.

identified a combination of post-bariatric surgery vitamins that meet guideline-directed nutritional needs and are shown in table 3. Utilization of bariatric-specific vitamins helps ensure both the correct nutritional amounts and low-volume, low-sugar contents. Finally, deep venous thrombosis (DVT) prophylaxis may be continued upon discharge for patients at high risk, which may include previous history of DVT, limited mobility, or a known hypercoagulable state.

Implementation into Pharmacist Practice

William S. Middleton Memorial Veterans Affairs Hospital's primary care initiative over the course of 2023 set out to standardize the care that bariatric patients receive throughout its clinics. Through delegation and collaborative practice with nutrition experts, the Jesse Brown VA, the formulary team, and a pharmacy and therapeutics (P&T) committee meeting, the order sets and generalized approach were updated to reflect the newest ASMBS guidelines and provide patients with the

most thorough care possible. Pocket cards, checklists, lab and nutrient order sets, and note templates were created and provided to aid primary care pharmacists in their discussions with patients.

Ongoing Treatment and Monitoring

Ongoing and close monitoring of the post-bariatric patient is essential to ensure adequate supplementation and effective medication treatment lifelong. A pharmacist can provide effective follow-up and monitoring. The William S. Middleton VA has implemented a patient-aligned care team (PACT) clinical pharmacist practitioner (CPP) model for follow-up in conjunction with surgical team follow up. The recommended follow-up and monitoring are seen in Table 4 and Figure 2.

During post-bariatric follow-up visits, the pharmacist can play a large role in medication review and recommendations. A review of the current medication list during medication reconciliation is needed to ensure safe and effective medications are being utilized. Table 5 shows general

FIGURE 2. Post-Bariatric Surgery Laboratory Monitoring Recommendations⁸

**POST-BARIATRIC SURGERY
MONITORING GUIDANCE/ORDER SET:**

Routine labs after both RYGB and SG:
BMP, CBC, LFT, lipid, magnesium, TSH, A1c, total protein, iron studies, ferritin, Vitamin B12, folic acid, 25OH Vitamin D, PO4, thiamine

Additionally recommended after RYBG with routine labs:
Vitamin A, zinc, copper

Other labs only if needed:
Vitamin E, Vitamin K, selenium (to rule out deficiency if symptomatic)

24-h urinary calcium excretion (if history of renal stones or osteoporosis)

iPTH (if osteoporosis work-up)

Imaging:
DEXA at 2 years post-bariatric surgery recommended

TABLE 4. Post-Bariatric Surgery PACT CPP Follow-Up

Post-Op Timeline	PACT CPP Appointment Guidance	PACT CPP Responsibilities	Labs Needed?
4-6 weeks	<ul style="list-style-type: none"> 60 minutes recommended In-person visit recommended 	<ul style="list-style-type: none"> Complete full medication reconciliation and dosage form review Assess disease states and medication that need to be monitored/adjusted Review with patient timeline for post-op supplements and enter NF requests for supplements (via order set) Evaluate vitals, weight, and screen for post-op complications 	No
3 months	<ul style="list-style-type: none"> 30-minute appointment Order routine bariatric labs at least 3 days prior to appointment 	<ul style="list-style-type: none"> Assess medication/supplement adherence Assess disease states and medications that need to be monitored/adjusted Evaluate vitals, weight, and bariatric surgery labs Mail/Provide patient with supplement med chart 	Yes
Interim PACT CPP Visits as Needed for Chronic Disease State Management			
12 months	<ul style="list-style-type: none"> 30-minute appointment Order routine bariatric labs at least 3 days prior to appointment 	<ul style="list-style-type: none"> Assess medication/supplement adherence Renew bariatric supplement orders and review plan indefinite therapy Assess disease states and medications that need to be monitored/adjusted Evaluate vitals, weight, and bariatric surgery labs Discuss/order DEXA for 2-year post-op appointment 	Yes
24 months	<ul style="list-style-type: none"> 30-minute appointment Order routine bariatric labs at least 3 days prior to appointment Order DXA prior to appointment 	<ul style="list-style-type: none"> Assess medication/supplement adherence Renew bariatric supplement orders and review plan indefinite therapy Assess disease states and medications that need to be monitored/adjusted Evaluate vitals, weight, and bariatric surgery labs Evaluate DEXA and bone health 	Yes
Interim PACT CPP Visits as Needed for Chronic Disease State Management			
PACT - patient aligned care team; CPP - clinical pharmacist practitioner; NF - non-formulary; DEXA - dual energy x-ray			

recommendations for medications to avoid post-bariatric surgery. A good reference for patients who continue to have difficulty swallowing large tablet formulations is to reference the most up-to-date version of the Institute for Safe Medications Practices (ISMP) Do Not Crush List. The Pharmacist Letter has a comprehensive chart to further assist with adjustment of medications prior to bariatric surgery and recommends solid oral dosage forms to be no larger than the size of an M&M candy as to not block the band or stomach outlet.¹⁵

Pharmacists should also pay close attention to disease states that may have an increase for exacerbation or suppression post-bariatric surgery. Table 6 displays commonly assessed disease states by the PACT CPPs at the William S. Middleton VA. Following metabolic and bariatric surgery, a large percentage of patients may experience remission in many common obesity-related disease states including type 2 diabetes (92%), hypertension (75%), obstructive sleep apnea (96%), dyslipidemia (76%), and cardiovascular disease (58%).¹⁶

Post-Surgical Weight Gain

Maintaining weight loss after bariatric surgery takes diligence, and even with proper diet and exercise, some patients may be unsuccessful in maintaining a

TABLE 5. Medications to Avoid Post-Bariatric Surgery and Suggested Therapy Alternatives⁸

Medications to Avoid Post-Bariatric Surgery:	Alternatives and Suggestions:
Non-steroidal anti-inflammatory (NSAID)	Avoid indefinitely, use acetaminophen as alternative If necessary: <ul style="list-style-type: none">• Utilize topical formulations• Preferred NSAID: celecoxib• Use concurrent protein pump inhibitor with NSAID
<ul style="list-style-type: none">• Sulfonylureas• Thiazolidinediones	Avoid use
Diuretics	Discontinue directly after surgery to limit volume depletion, hypotension, & acute kidney injury
Oral bisphosphonates	Increased risk of esophageal ulcers, avoid indefinitely
Oral contraceptives	<ul style="list-style-type: none">• Decreased efficacy post-bariatric surgery• Consider patch, implant, diaphragm, condoms, IUD, or other non-oral routes.
AVOID XR/XL, ER, SR, CR, enteric coated, and prodrug formulation*	Switch to immediate release formulations
*Unless specific absorption studies are available in the bariatric surgery population, such as metoprolol	

healthy weight. This may be due to an obese patient's systemic leptin resistance, with higher levels at baseline.¹³ While patients may lose as much as 60% of excess weight after six month post-surgery and up to 77% of excess weight as early as 12 months after surgery, on average, six years after surgery, patients may only maintain

50% of their excess weight loss.¹⁶ Patients who experience weight gain may seek additional options for sustained weight loss and continued remission of disease states. Antiobesity medications may be safe in patients post-bariatric surgery. There is currently a general lack of studies in the post-surgical patients; however, patients

TABLE 6. Common Disease States and Recommendations for Monitoring Post-Bariatric Surgery

Diabetes	<ul style="list-style-type: none">• Discontinue sulfonylureas/ thiazolidinediones due to weight gain potential. Metformin preferred.• Decrease insulin by 50-70% directly post-surgery, reassess needs over time
Hypertension	<ul style="list-style-type: none">• Blood pressure decreases as early as 1-week post-surgery, monitor• Diuretics: discontinue soon after surgery to limit fluid depletion, can resume as needed once on a long-term diet• Other medications (beta blocker, ACEi/ARB, etc.): assess ongoing need based on comorbidities
Dyslipidemia	<ul style="list-style-type: none">• Effect on lipid panel is variable• Continue meds for lipids initially and re-evaluate for long term
Anticoagulation	<ul style="list-style-type: none">• VTE prophylaxis recommended for all patients with enoxaparin 40mg subcutaneously for 2-4 weeks• Warfarin: requirements typically decrease post-surgery, then return to normal within 6 months; monitor INR closely• DOAC's: check with Anticoagulation Clinic if therapy changes needed based on absorption site
GERD	<ul style="list-style-type: none">• Typically, 30-50% reduction in acid suppression therapy possible• Trial PPI tapers if no long-term indication noted• Avoid meds with GERD as potential side effect
Osteoporosis	<ul style="list-style-type: none">• Increased risk of osteoporosis, DEXA recommended at 2-years post-op• Calcium supplementation goal: 1200-1500 mg/day (calcium citrate preferred)• Vitamin D goal 30-50 ng/ml
Urinary symptoms	Improvements in urinary symptoms (frequency, urgency, stress incontinence) may be noted in many patients; consider trialing off therapy like antimuscarinics
Gallstones	<ul style="list-style-type: none">• Rapid weight loss can cause gallstone development in 30-70% of patients; consider prophylaxis in select patients with ursodiol 300mg daily x6 months.• Avoid medications that can develop gallstones (i.e. gemfibrozil)

Angiotensin converting enzyme inhibitor; ACEi, Angiotensin receptor blocker; ARB, Venous thromboembolism; VTE, Direct oral anticoagulant; DOAC, protein pump inhibitor; PPI, gastroesophageal reflux disease; GERD, dual energy x-ray; DEXA.

taking antiobesity medications after bariatric surgery were generally found to have the same side effects as patients who had not had bariatric surgery. Data on initiating antiobesity medications in the 6 months after surgery is lacking, but when patients have plateaued, these medications may be an effective adjunctive therapy to realize additional weight loss and sustained weight. When selecting a medication for weight loss, the same criteria for patients who have not undergone metabolic and bariatric surgery should be considered.

Conclusion

Bariatric surgery can be an effective option for patients to lose weight and improve overall health. While it comes with risks and complications, these are relatively minimal. Lifelong diligence with diet and exercise are necessary for success in addition to ongoing medication and laboratory monitoring due to inherent malnutrition risks with the anatomical changes in the gastrointestinal system after surgery. A pharmacist plays a critical role in patient success, ensuring safe and effective medication therapy and ongoing monitoring. A health system should standardize care and provide resources for staff to utilize for post-bariatric surgery patients to ensure the optimal medication management and long-term success.

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BOX 3: CONSIDER AW'S BARIATRIC CASE

AW is now 90 days post-bariatric surgery and returns to your clinic to review her medications and supplementations. She is delighted that she didn't have any complications and is now off all her blood pressure and diabetic medications.

1. What laboratory monitoring should you order for AW at this visit?
 - a. BMP, CBC, LFT, lipid, magnesium, TSH, A1c, total protein, iron studies, ferritin, Vitamin B12, folic acid, 25OH vitamin D, PO4, thiamine, vitamin A, zinc, copper
2. AW is interested in restarting her oral contraceptive therapy and asks for your recommendations on a particular therapy to start. What do you recommend?
 - a. Recommendations should be centered around patches, implants, diaphragms, or IUD's due to decreased absorption life-long for patients with a history of bariatric surgery.

[org/10.1371/journal.pone.0247307](https://doi.org/10.1371/journal.pone.0247307)

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Assessment Questions

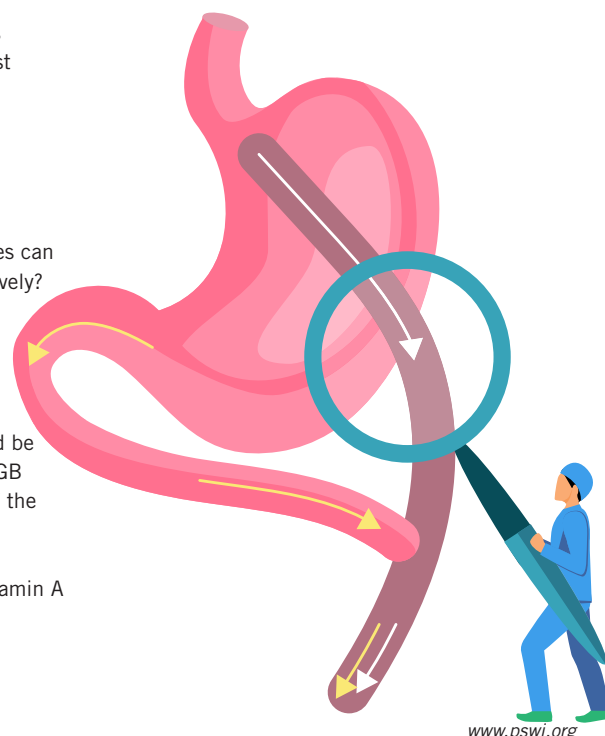
Pharmacist Assessment Questions

1. At what rate is the prevalence of obesity expanding in the United States since 2000 and how does this correspond to the rate in Wisconsin specifically?
 - a. Obesity's prevalence has increased by roughly 10% in the United States. The rate of increase in Wisconsin is much higher.
 - b. Obesity's prevalence has been stagnant over the past couple decades as a healthy lifestyle has been increasingly emphasized in the healthcare world.
 - c. Obesity's prevalence has increased by roughly 10% in the United States. The rate of increase in Wisconsin is relatively proportionate to that of the rest of the country.
 - d. Obesity's prevalence has increased by roughly 10% in the United States. Wisconsin's obesity rate has been increasing at a slower rate than those of the rest of the country.

2. Regarding the different bariatric procedures, which statement is the MOST accurate?
 - a. The adjustable gastric band procedure and the Roux-en-Y gastric bypass procedure are the only two bariatric procedures that are reversible.
 - b. The biliopancreatic diversion with duodenal switch (BPD/DS) procedure produces the most profound weight loss.
 - c. The Roux-en-Y gastric bypass procedure has the most decreased rate of absorption of vitamins and minerals compared to the other procedures.
 - d. The laparoscopic adjustable gastric banding is prone to leakage.
3. What BMI is associated with being "severely" or "morbidly" obese?
 - a. 40 or higher
 - b. 30 or higher
 - c. 35 or higher
 - d. 25 or higher
4. Which of the following statements about obesity and bariatric surgery is INCORRECT?
 - a. Obesity is associated with a higher rate of comorbid conditions.
 - b. Bariatric surgery is a proven surgical treatment for obesity with positive long-term outcomes.
 - c. Bariatric surgery is recommended for patients with a BMI of 35 or greater, regardless of comorbidities, and should be considered for patients with a BMI of 30 or greater with metabolic disease.
 - d. Bariatric surgery is proven to correct obesity-induced low-grade inflammatory states that increase patients' immune dysfunction.
5. Which statement best describes a pharmacist's role in the management of patients undergoing bariatric surgery?
 - a. A pharmacist is crucial in medication management prior to, during, and post procedure as knowledge of absorption in a malabsorptive procedure is very important.
 - b. A pharmacist can not only manage medications in terms of absorption and formulation after a malabsorptive procedure, but also evaluate rapidly changing conditions, such as hypertension and diabetes, to properly treat patients' evolving disease states.
 - c. A pharmacist can predominantly monitor and provide education pertaining to the patients diet and exercise regimen to avoid future weight gain.
 - d. A pharmacist can help manage pre-surgical checklists and evaluations to get the patient the proper procedure as quickly as possible.
6. Prior to any MBS, a patient should be extensively evaluated which includes a:
 - a. A comprehensive medical history, a psychosocial history, a physical examination, and appropriate laboratory monitoring.
 - b. A comprehensive medical history, a psychosocial history, a meeting with a personal trainer, a physical examination, and appropriate laboratory monitoring.
 - c. A comprehensive medical history, a meeting with a personal trainer, a physical examination, and appropriate laboratory monitoring.
 - d. A comprehensive medical history, a physical examination, and appropriate laboratory monitoring.
7. **True or False:** Patients who can become pregnant need to be counseled on contraception, because as bariatric surgery can reduce the absorption of oral contraceptives and increase fertility.
 - a. True
 - b. False
8. How long do patients need to be abstinent from nicotine prior to and after their weight-loss procedure?
 - a. 6 months prior; patient may resume nicotine 6 months after the procedure
 - b. 3 months prior; patient may resume nicotine 6 months after the procedure
 - c. 6 months prior; indefinite afterwards
 - d. 3 months prior; indefinite afterwards
9. Which of the following formulations or medications are OKAY to use post bariatric surgery?
 - a. NSAIDs
 - b. Extended release formulations
 - c. Acetaminophen
 - d. Sulfonylureas
10. Which of the following disease states can bariatric surgery affect post-operatively?
 - a. Diabetes
 - b. Hypertension
 - c. Mental health
 - d. All of the above
11. Which of the following levels should be additionally monitored with the RYGB procedure as opposed to the rest of the available procedures?
 - a. Vitamin A, Zinc, Copper
 - b. 25OH Vitamin D, Thiamine, Vitamin A
 - c. TSH, Zinc, Iron
 - d. BMP, TSH, Thiamine
12. What combination of vitamins is essential for a patient upon discharge from the hospital immediately following bariatric surgery?
 - a. Multivitamin, Vitamin D, Ferrous Gluconate
 - b. Multivitamin, Vitamin B Complex, Calcium
 - c. Multivitamin, Thiamine, Calcium
 - d. Multivitamin, Ferrous Gluconate, Thiamine

Technician Assessment Questions

1. At what rate is the prevalence of obesity expanding in the United States since 2000 and how does this correspond to the rate in Wisconsin specifically?
 - a. Obesity's prevalence has increased by roughly 10% in the United States. The rate of increase in Wisconsin is much higher.
 - b. Obesity's prevalence has been stagnant over the past couple decades as a healthy lifestyle has been increasingly emphasized in the healthcare world.
 - c. Obesity's prevalence has increased by roughly 10% in the United States. The rate of increase in Wisconsin is relatively proportionate to that of the rest of the country.
 - d. Obesity's prevalence has increased by roughly 10% in the United States. Wisconsin's obesity rate has been increasing at a slower rate than those of the rest of the country.



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 - d. BMP, TSH, Thiamine
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 - b. Multivitamin, Vitamin B Complex, Calcium
 - c. Multivitamin, Thiamine, Calcium
 - d. Multivitamin, Ferrous Gluconate, Thiamine

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