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대한가정의학회 비만대사증후군연구회 춘계학술대회

Postoperative Management of Bariatric Surgery

SNUH 민경하

Contents

1. Overview
2. Long-term Surgical Complication Management
3. Nutritional Management
4. Other Common Medical Conditions
Following Bariatric Surgery
5. Conclusion

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1. Overview



Surgery for Obesity and Related Diseases 16 (2020) 175–247

SURGERY FOR OBESITY
AND RELATED DISEASES

Guidelines

Clinical practice guidelines for the perioperative nutrition, metabolic, and nonsurgical support of patients undergoing bariatric procedures – 2019 update: cosponsored by American Association of Clinical Endocrinologists/American College of Endocrinology, The Obesity Society, American Society for Metabolic & Bariatric Surgery, Obesity Medicine Association, and American Society of Anesthesiologists

Mechanick, J. I., et al. (2013). "Clinical practice guidelines for the perioperative nutritional, metabolic, and nonsurgical support of the bariatric surgery patient—2013 update: cosponsored by American Association of Clinical Endocrinologists, the Obesity Society, and American Society for Metabolic & Bariatric Surgery." *Surgery for Obesity and Related Diseases* 9(2): 159-191.

Postprocedure checklist*

Checklist item	LAGB	SG	RYGB	BPD/DS
Follow-up				
✓ Visits: initial, interval until stable, once stable (mo)	1, 1–2, 12	1, 3, 6, 12	1, 3, 6–12	1, 3, 6
✓ Monitor progress with weight loss and evidence of complications each visit	✓	✓	✓	✓
✓ SMA-21, CBC/plt with each visit (and iron at baseline and after as needed)	✓	✓	✓	✓
✓ Avoid nonsteroidal anti-inflammatory drugs	✓	✓	✓	✓
✓ Adjust postoperative medications	✓	✓	✓	✓
✓ Consider gout and gallstone prophylaxis in appropriate patients	✓	✓	✓	✓
✓ Need for antihypertensive therapy with each visit	✓	✓	✓	✓
✓ Lipid evaluation every 6–12 mo based on risk and therapy	✓	✓	✓	✓
✓ Monitor adherence with physical activity recommendations	✓	✓	✓	✓
✓ Evaluate need for support groups	✓	✓	✓	✓
✓ Bone density (DXA) at 2 yr	✓	✓	✓	✓
✓ 24-hr urinary calcium excretion at 6 mo and then annually [†]	x	x	x	✓
✓ B ₁₂ (annually; MMA and Hcy optional; then q 3–6 mo if supplemented)	✓	✓	✓	✓
✓ Folic acid (RBC folic acid optional), iron studies, 25-vitamin D, iPTH	x	x	✓	✓
✓ Vitamin A (initially and q 6–12 mo thereafter)	x	x	Optional	✓
✓ Copper, zinc, selenium evaluation with specific findings	x	x	✓	✓
✓ Thiamine evaluation with specific findings	✓	✓	✓	✓
✓ Consider eventual body contouring surgery	✓	✓	✓	✓
✓ Lifestyle medicine evaluation: healthy eating index; cardiovascular fitness; strength training; sleep hygiene (duration and quality); mood and happiness; alcohol use; substance abuse; community engagement	✓	✓	✓	✓
✓ Hemoglobin A1C, TSH evaluation in long-term follow-up	✓	✓	✓	✓

Mechanick, J. I., et al. (2013). "Clinical practice guidelines for the perioperative nutritional, metabolic, and nonsurgical support of the bariatric surgery patient—2013 update: cosponsored by American Association of Clinical Endocrinologists, the Obesity Society, and American Society for Metabolic & Bariatric Surgery." *Surgery for Obesity and Related Diseases* 9(2): 159-191.

Primary Care Treatment of Patients Following Bariatric Surgery in 2020

Yijun Chen, MD; Zhaoping Li, MD; Erik Dutson, MD

Box. Assessments for Patients After Bariatric Surgery

Assessments for every clinic visit

Weight loss

Level of exercise

Vitamin and mineral supplementation being taken

Comorbidity assessment (type 2 diabetes, hypertension, sleep apnea, joint pain)

Potential bariatric surgery complications

Annual laboratory assessments

Complete blood cell count

Complete metabolic panel

Vitamin B₁₂

Hemoglobin A_{1c}

Thyroid-stimulating hormone

Lipid evaluation based on risks

Folate, iron studies, 25-hydroxyvitamin D, and zinc for Roux-en-Y gastric bypass surgery

Other vitamin laboratory measurement if deficiency is suspected

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2. Long-term Surgical Complication Management

Table 1. Prevalence, Presentation, Diagnosis, and Management of Common Bariatric Complications

Complication	Prevalence	Presentation	Diagnosis	Management
GERD	2%-30% (highest in patients who undergo SG)	Heartburn, chest pain, and nausea	Clinical diagnosis; EGD only indicated for severe symptoms	PPI therapy; conversion to RYGB for severe GERD refractory to PPI treatment
Dumping syndrome	40% (primarily in patients who undergo RYGB)	Colicky abdominal pain, diarrhea, nausea, and tachycardia	Clinical diagnosis; blood glucose level	Avoid food with high simple sugar content and replace with high-fiber, complex carbohydrate, and high-protein food; acarbose
Cholelithiasis	30%	Right upper quadrant pain if symptomatic	Abdominal ultrasonography	Cholecystectomy for symptomatic cholelithiasis (approximately 10% of patients may need cholecystectomy after bariatric surgery)
Marginal ulcer	1%-16% in patients who undergo RYGB	Upper abdominal pain, nausea, and vomiting	EGD	Smoking cessation; avoid NSAIDs; PPI and Carafate; endoscopic or surgical procedures for refractory cases
Stricture of anastomosis	1%-10% in patients who undergo RYGB	Dysphagia, nausea, and vomiting	Upper gastrointestinal tract series; EGD	Endoscopic dilation; surgical revision
Gastric banding complications	40%-50%	Nausea, vomiting, and food intolerance; port site infection; and abdominal pain	EGD; KUB radiographic imaging; computed tomographic imaging of abdomen	Band adjustment for tight band; band revision or removal for slippage, erosion, or severe GERD; conversion to RYGB or SG to prevent weight regain
Hypoglycemia	Up to one-third of patients who undergo RYGB have hypoglycemia, and most are asymptomatic; 11.6% are symptomatic	Confusion, heart palpitation, shakiness, and excessive sweating	Blood glucose and insulin level; continuous glucose monitoring	Dietary counseling; high-protein, high-fiber, and low-carbohydrate diet; acarbose; gastric bypass reversal reserved for patients with refractory symptoms
Bowel obstruction/internal hernia	1.5%-5% in patients who undergo RYGB	Nausea, vomiting, and abdominal pain	KUB radiographic imaging; computed tomographic imaging of abdomen	Low threshold for surgical exploration for unexplained abdominal pain after RYGB

Chen, Y., et al. (2020). "Primary care treatment of patients following bariatric surgery in 2020." *Jama* 324(9): 888-889.

Benefits and Risks of Bariatric Surgery in Adults A Review

David E. Arterburn, MD, MPH; Dana A. Telem, MD, MPH; Robert F. Kushner, MD; Anita P. Courcoulas, MD, MPH

Box 2. Early and Late Complications of Gastric Bypass and Sleeve Gastrectomy Procedures

Sleeve gastrectomy

Complications <30 days postprocedure (early)

- Venous thromboembolism
- Gastrointestinal or intra-abdominal bleeding
- Staple line leak
- Wound infection

Complications \geq 30 days postprocedure

- Sleeve stricture
- Gastroesophageal reflux disease
- Cholelithiasis
- Incisional hernia
- Nutritional and vitamin deficiencies

Gastric bypass

Complications <30 days postprocedure (early)

- Bowel obstruction
- Venous thromboembolism
- Gastrointestinal or intra-abdominal bleeding
- Anastomotic leak
- Wound infection
- Internal hernia

Complications \geq 30 days postprocedure (late)

- Anastomotic stricture
- Bowel obstruction
- Marginal ulceration
- Cholelithiasis
- Incisional hernia
- Nutritional and vitamin deficiencies
- Dumping syndrome
- Malabsorption
- Gastrogastic fistula
- Internal hernia

1) GERD

- **Prevalence** : 2-30% (highest in patients who undergo SG)
- **Presentation** : heartburn, chest pain, nausea
- **Diagnosis** : clinical diagnosis, EGD only indicated for severe symptoms
- **Management** : PPI therapy
 - > conversion to RYGB for severe GERD refractory to PPI treatment

2) Marginal ulcer

- **Prevalence** : 1 ~ 16% in patients who undergo RYGB
- **Presentation** : upper abdominal pain, nausea, vomiting
- **Diagnosis** : EGD (* occur near the gastrojejunostomy and result from acid injuring the jejunum)
- **Management** : smoking cessation, avoid NSAIDs,

PPI (* There is no consensus on the formulation or dose of therapy)

+ Sucralfate (1gram 4 times a day for a minimum of three months)

(* medical management : successful in 85 to 95 percent)

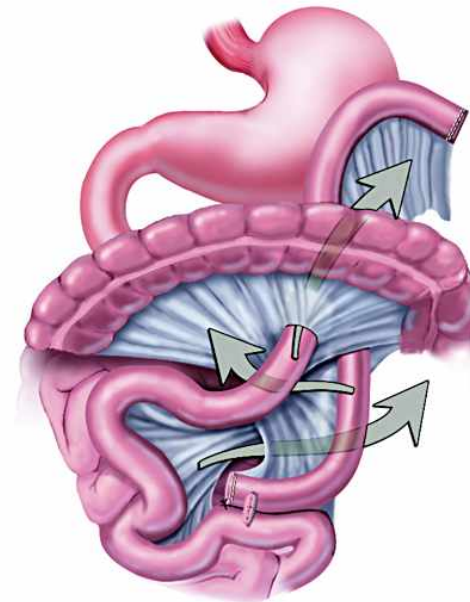
-> endoscopic or surgical procedures for refractory cases (if marginal ulcers perforate or if persistent pain or recurrent bleeding occurs despite maximal medical therapy)

3) Bowel obstruction/ Internal Hernia

- **Prevalence** : 1.5-5% in patients who undergo RYGB
- **Presentation** : Nausea, vomiting, abdominal pain
- **Diagnosis** : KUB, abdominal CT
- **Management** : Low threshold for surgical exploration

for unexplained abdominal pain after RYGB

Internal hernias



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4) Stricture of anastomosis

- **Prevalence** : 1-10% in patients who undergo RYGB
- **Presentation** : Dysphagia, nausea, vomiting
- **Diagnosis** : EGD, Upper GI series
- **Management** : Endoscopic dilation
 - > surgical revision

5) Cholelithiasis

- **Prevalence** : 30%
- **Presentation** : Right upper quadrant pain if symptomatic
- **Diagnosis** : Abdominal ultrasonography
- **Management** : Cholecystectomy for symptomatic cholelithiasis

(approximately 10% of patients may need cholecystectomy after bariatric surgery)

6) Dumping syndrome

- **Prevalence** : 40% (primarily in patients who undergo RYGB)
- **Presentation** : Colicky abdominal pain, diarrhea, nausea, tachycardia
- **Diagnosis** : clinical diagnosis, blood glucose level
- **Management** : Dietary modification

(Avoid food with high simple sugar content and replace with high-fiber, complex carbohydrate, and high-protein food)

Behavioral modification

(small, frequent meals and separating solids from liquid intake by 30 minute)

* early dumping is self-limiting and resolves within 7 to 12 weeks

7) Postprandial hyperinsulinemic hypoglycemia

* Previously referred to as 'Late dumping syndrome'

- **Prevalence** : 0.1-0.3% in patients who undergo RYGB
- **Presentation** : Confusion, heart palpitation, shakiness, excessive sweating
- **Diagnosis** : blood glucose (<50mg/dL) and insulin (>3mUL/L) level
- **Management** : Dietary counseling (high-protein, high-fiber, and low-carbohydrate diet)
 - > medication (eg, nifedipine, acarbose, diazoxide, or octreotide)
 - > gastric bypass reversal reserved for patients with refractory symptoms

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3. Nutritional Management

- **Before surgery** : Despite excessive calorie intake,

patients with obesity have high rates of micronutrient deficiencies
- **After surgery** : Develop new deficiencies even years after the operation was performed
 - > related to the **altered surgical anatomy** after gastric bypass surgery

(eg, B12, calcium, iron)
 - > related to **decreased nutrient intake** after surgery and **rapid weight loss in general**

(eg, thiamine)

3. Nutritional Management

- **After gastric bypass surgery** : restrictive & malabsorptive procedure

-> iron, vitamin B12, folate, calcium, and vitamin D deficiencies

- **After SG surgery** : restrictive type

-> vitamin B1, vitamin B12, and calcium deficiencies

3. Nutritional Management

- **Postsurgical screening** : every three to six months in the first year after bariatric surgery,
and annually thereafter
- **Supplementation** : lifelong vitamin and mineral supplementation
(all patients who have undergone bariatric surgery)
-> preferably 2 adult multivitamins plus minerals (eg., iron, folic acid, and thiamine),
elemental calcium, vitamin D, and vitamin B12

Chen, Y., et al. (2020). "Primary care treatment of patients following bariatric surgery in 2020." *Jama* 324(9): 888-889.

Mechanick, J. I., et al. (2013). "Clinical practice guidelines for the perioperative nutritional, metabolic, and nonsurgical support of the bariatric surgery patient—2013 update: cosponsored by American Association of Clinical Endocrinologists, the Obesity Society, and American Society for Metabolic & Bariatric Surgery." *Surgery for Obesity and Related Diseases* 9(2): 159-191.

Nutrition Management of the Post-Bariatric Surgery Patient

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Nutrient	Schedule for Monitoring	
Vitamin B ₁₂	<ul style="list-style-type: none">• Preoperatively• After 6, 12, 18, and 24 months• Subsequently annually• <i>Quarterly for 3–6 months if supplemented</i>	
Folic acid	<ul style="list-style-type: none">• Preoperatively• After 6, 12, 18, and 24 months• Subsequently annually	
Vitamin D/calcium	<ul style="list-style-type: none">• Preoperatively• After 6, 12, 18, and 24 months• Subsequently annually• <i>If therapeutic doses of vitamin D administered—reevaluation after 1–3 months</i>• <i>If maintenance dose of vitamin D instituted—reevaluation after 3–4 months, then semiannually</i>	
Vitamin A	<ul style="list-style-type: none">• Preoperatively• <i>Optionally</i> after 24 months and annually thereafter• <i>Quarterly for 6–12 months if supplemented</i>	
Vitamin B ₁	<ul style="list-style-type: none">• <i>Optionally</i> after 3, 6, 12, 18, and 24 months and annually thereafter	
Vitamin K	<ul style="list-style-type: none">• Not recommended	
Iron	<ul style="list-style-type: none">• Preoperatively• 3, 6, 12, 18, and 24 months• Subsequently annually	

Handzlik-Orlik, G., et al. (2015). "Nutrition management of the post-bariatric surgery patient." Nutrition in Clinical Practice 30(3): 383-392.

1) Common nutritional deficiencies

Deficiency	Supplement dosage to prevent deficiency	Prevalence	Presentation	Diagnosis	Repletion treatment for deficiency
Vitamin D and calcium	Calcium: 1200-1500 mg/d; vitamin D3: 3000 IU daily	Up to 100%	Leg cramping, fatigue, tiredness, bone and back pain, depression, and bone loss	25-hydroxy vitamin D <20 ng/mL	Calcium deficiency: 1200-1500 mg/d calcium; vitamin D deficiency: vitamin D3 at least 3000 IU/d and as high as 6000 IU/d or 50 000 IU vitamin D2 1-3 times weekly
Vitamin B12	350-500 ug daily	Up to 20%	Pernicious anemia, numbness and paresthesia, light-headedness, tinnitus, and palpitations; patients with advanced stage can present with angina or congestive failure	Serum B12 < 200 pg/mL	1000 ug/d to achieve normal level
Folate	400-800 ug from multivitamin; women of childbearing age should take 800-1000 ug daily	Up to 65%	Changes in pigmentation or ulceration of skin or oral mucosa	Red blood cell folate <305 nmol/L	1000 ug/d to achieve normal level

Deficiency	Supplement dosage to prevent deficiency	Prevalence	Presentation	Diagnosis	Repletion treatment for deficiency
Vitamin A	5000-10 000 IU/d	Up to 70%	Difficulty seeing in dim light, poor wound healing, corneal changes, loss of taste, and hyperkeratinization of skin	Plasma retinol <10 ug/dL	Without corneal changes: 10 000-25 000 IU/d until clinical improvement; with corneal changes: 50 000-100 000 IU intramuscular for 3 d followed by 50 000 IU/d for 2 weeks; be aware of toxicity if patients develop blurred vision, bone pain, anorexia, and change of mental status when on high dose of supplementation
Iron	Men should receive at least 18 mg from multivitamin. Menstruating women should take 45-60 mg daily	RYGB: 20%-55%; SG: <18%	Fatigue and weakness; microcytic anemia; enteropathy; glossitis	Iron <50 ug/dL; ferritin <20 ug/dL; total iron binding capacity >450 ug/dL	Oral supplementation of 150-200 mg of elemental iron daily; if no response to oral therapy, intravenous infusion is indicated

Deficiency	Supplement dosage to prevent deficiency	Prevalence	Presentation	Diagnosis	Repletion treatment for deficiency
Vitamin B1	At least 12 mg daily, preferably from a 50-mg dose from a B-complex supplement or multivitamin once or twice daily	1%-49%	Fatigue, nausea, weakness, tingling, and loss of vision; ophthalmoplegia, ataxia, and confusion (Wernicke encephalopathy) in severe deficiency	Thiamine diphosphate <70 nmol/L	Oral therapy: 100 mg 2-3 times daily until symptoms resolve; intravenous therapy: 500 mg once or twice daily for 3-5 days followed by 250 mg daily for 3-5 days or until symptoms resolve
Zinc	RYGB: 100%-200% of the recommended daily allowance of zinc (8-22 mg/d) from multivitamin; SG: 100% of the recommended daily allowance of zinc (8-11 mg/d) from multivitamin	RYGB: up to 40%; SG: up to 19%	Rash, acne, change in taste, increased infection, infertility, hair loss, and growth retardation	<70 ug/dL for women; <74 ug/dL for men	60 mg of zinc twice daily to achieve normal level; toxicity and copper deficiency must be monitored carefully

2) Protein malnutrition

- **Prevalence** : up to 18%–25% (malabsorptive surgeries)
- **Presentation** : anemia, edema, alopecia, asthenia
- **Diagnosis** : blood test (hypoalbuminemia <3.5 mg/dL)
body composition (body bioimpedance, DEXA)
- **Management** : 1.1–1.5 g/kg ideal body weight/d of protein supply is needed
: Of total energy intake, 10%–35% should be delivered with protein

3) Iron deficiency

- **Prevalence** : 20-55% (RYGB), <18% (SG)
- **Presentation** : fatigue, weakness, enteropathy, glossitis
- **Diagnosis** : blood test (iron <50ug/dL, ferritin <20ug/dL, TIBC >450ug/dL)
- **Management** : 150-200mg of elemental iron daily

-> if no response to oral therapy, IV infusion is indicated

4) Vitamin D, Calcium deficiency

- **Prevalence** : up to 100%
- **Presentation** : leg cramping, fatigue, tiredness, bone and back pain, depression, bone loss
- **Diagnosis** : blood test (25-hydroxy vitamin D < 20ng/mL)
- **Management** : 1200-1500mg/d calcium

at least 3000IU/d vitamin D3

5) Vitamin A deficiency

- **Prevalence** : up to 70%
- **Presentation** : difficulty seeing in dim light, poor wound healing, corneal changes, loss of taste, hyperkeratinization of skin
- **Diagnosis** : blood test (plasma retinol < 10ug/dL)
- **Management** : (without corneal changes) 10,000 to 25,000 IU daily orally until clinical improvement

6) Vitamin B1 (thiamine) deficiency

- **Prevalence** : 1-49%
- **Presentation** : fatigue, nausea, weakness, tingling, loss of vision
- **Diagnosis** : blood test (thiamine diphosphate < 70nmol/L)
- **Management** : 100mg 2-3 times daily until symptoms resolve

7) Vitamin B12 (cobalamin) deficiency

- **Prevalence** : up to 20%
- **Presentation** : Pernicious anemia, numbness, paresthesia, lightheadedness, tinnitus, palpitation
- **Diagnosis** : blood test (serum B12 < 200pg/mL)
- **Management** : 1000ug of B12 PO (daily)

1000ug of B12 IM (monthly)

8) Folate deficiency

- **Prevalence** : up to 65%
- **Presentation** : changes in pigmentation or ulceration of skin or oral mucosa
- **Diagnosis** : blood test (folate < 305 nmol/L)
- **Management** : oral dose of 1000 µg/d to achieve normal level

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4. Other Common Medical Conditions Following Bariatric Surgery

- **Hypertension** : Blood pressure is routinely measured at every postoperative visit

antihypertensive medications should be reviewed at every visit
- **Diabetes** : evaluation of serum glucose level

insulin and/or oral hyperglycemics should be evaluated on each visit
- **Dyslipidemia** : evaluation of serum lipids and cholesterol

medications should be reviewed at every visit
- **Sleep Apnea** : may be reassessed with a sleep study in 6 to 12 months after surgery

(to reassess the continuous positive airway pressure (CPAP) requirement)

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5. Conclusion

- Primary care physicians **should be aware of**
the potential adverse outcomes after bariatric surgery,
including risk of weight regain, surgical complications, and nutritional deficiencies.
- **Multidisciplinary approach**
- **Lifelong follow-up!**

Thank you 😊

QnA