Jeffrey I. Mechanick, M.D., F.A.C.P. F.A.C.P., F.A.C.N., E.C.N.U.
Clinical Professor of Medicine
Director, Metabolic Support
Division of Endocrinology, Diabetes, and Bone Disease
Icahn School of Medicine at Mount Sinai, New York

AACE President 2013-2014

PERIOPERATIVE NUTRITIONAL AND METABOLIC MANAGEMENT OF THE BARIATRIC SURGERY PATIENT:

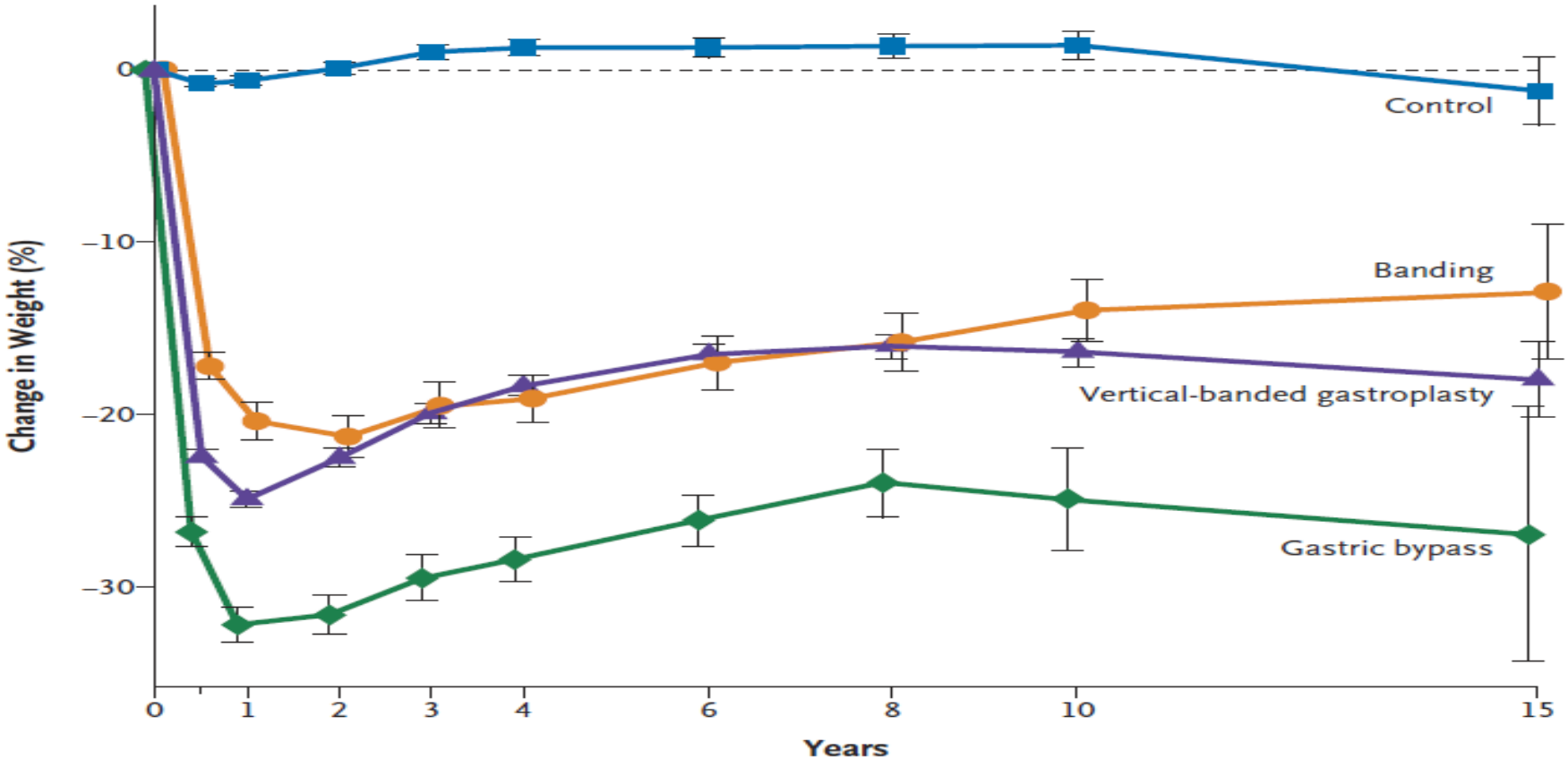
2013 AACE-TOS-ASMBS GUIDELINES OVERVIEW

Disclosures and Attributions

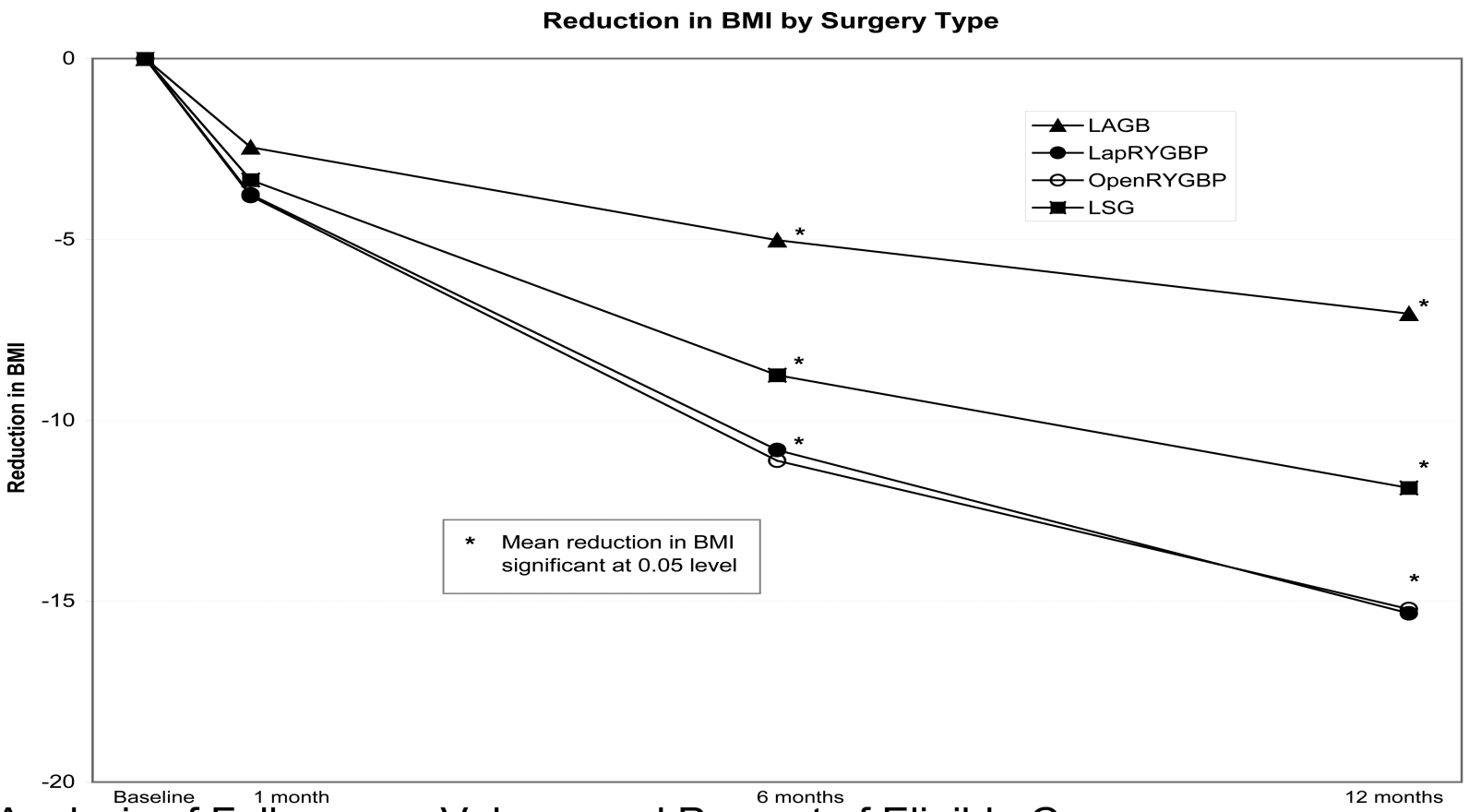
- Abbott Nutrition International – received honoraria for program development and lectures
- Vivus – slidesets from educational grant to AACE

Introduction: Clinical Evidence

Swedish Obese Subjects Study (N=4047)
Sjostrom et al. N Engl J Med 2007; 357: 741-752



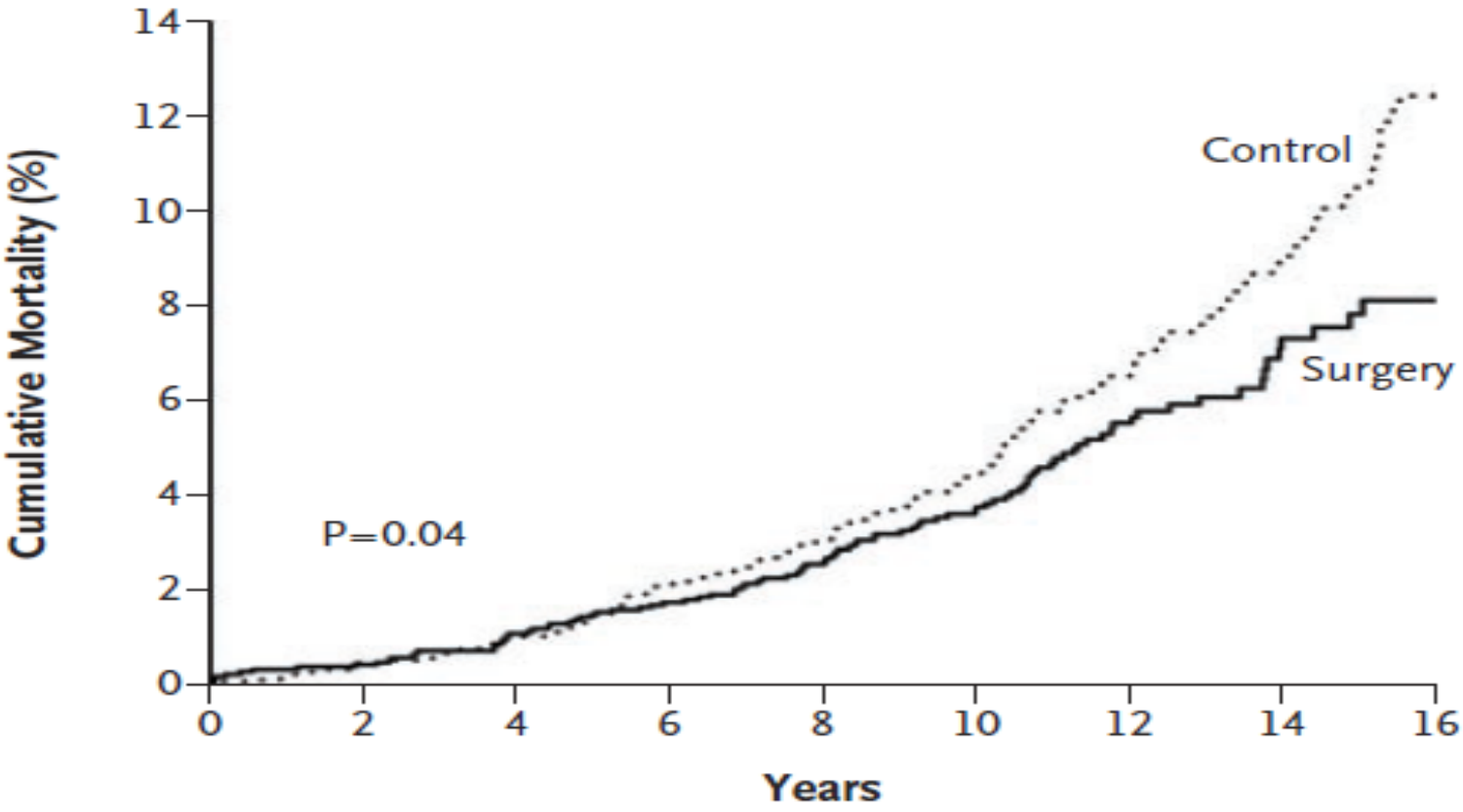
Hutter et al. Ann Surg 2011; 254: 410
Prospective Observational Study (N=28,616)



Analysis of Follow-up – Volume and Percent of Eligible Cases

	Baseline	1 month	6 months	12 months
LSG "N" for Analysis	944	826	317	**52**
% Available for follow-up with Data	100%	87%	82%	70%
LAGB "N" for Analysis	12,193	8,697	6,988	2,871
% Available for follow-up with Data	100%	72%	81%	74%
LapRYGBP "N" for Analysis	14,491	12.179	8.585	3,734
% Available for follow-up with Data	100%	80%	79%	71%
OpenRYGBP "N" for Analysis	988	789	563	229
% Available for follow-up with Data	100%	79%	73%	63%

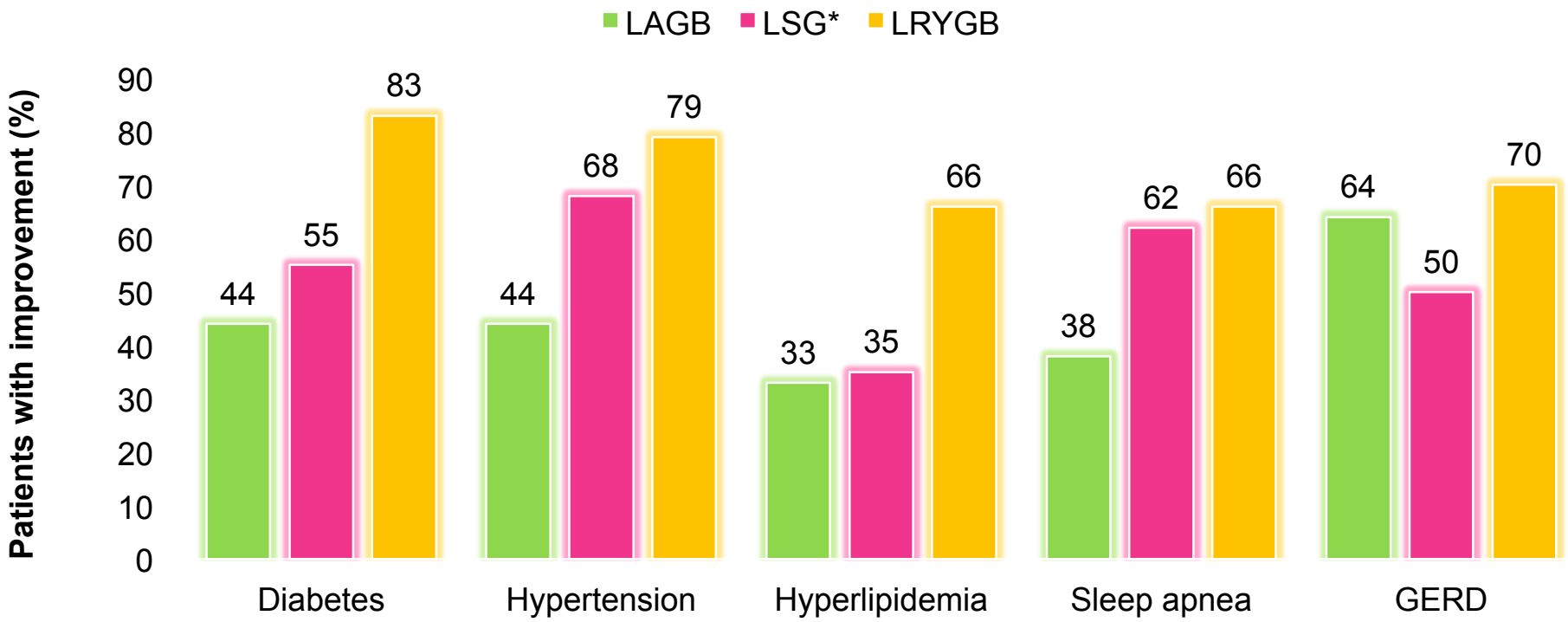
Swedish Obese Subjects Study (N=4047)
Sjostrom et al. N Engl J Med 2007; 357: 741-752



No. at Risk

Surgery	2010	2001	1987	1821	1590	1260	760	422	169
Control	2037	2027	2016	1842	1455	1174	749	422	156

Hutter et al. Ann Surg 2011; 254: 410
Prospective Observational Study (N=28,616)

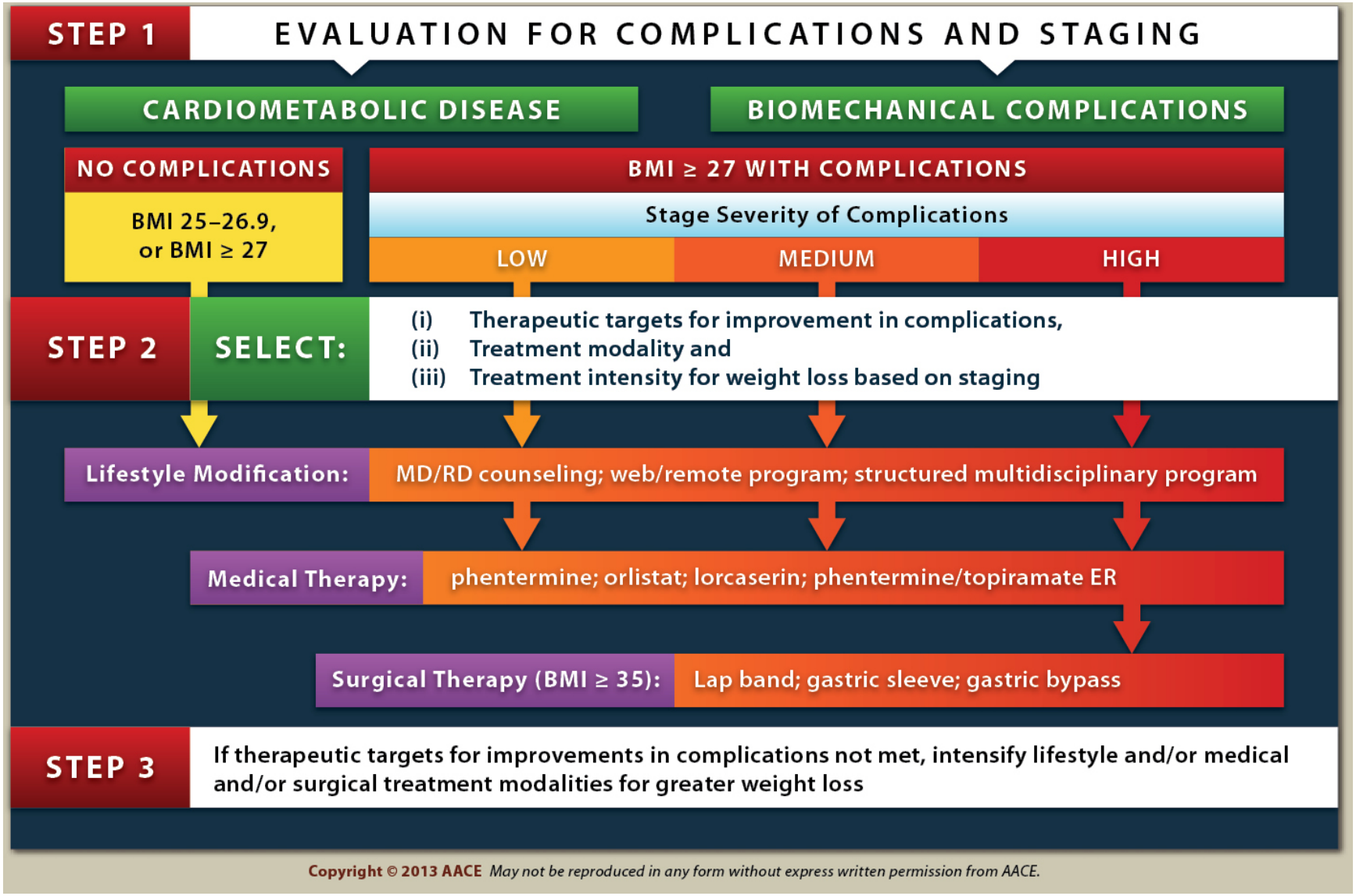


Hormone	Potential post-surgical effect
↑ GLP-1	• Increased satiety and decreased food intake
↑ Peptide YY	• Increased satiety and decreased food intake • Possible alterations to energy expenditure
↑ Oxyntomodulin	• Increased satiety and decreased food intake

↑ GLP-2	• Increased mucosal cell mass in response to injury, leading to
	  • Long-term increases in GLP-1 and PYY
	  • Gut proliferation, reducing malabsorption

↓ GIP	• Reduced fat accumulation and long-term weight loss/maintenance
↓ Ghrelin(?)	• Reduced appetite, possibly mediated by vagal denervation
Vagus denervation	• Reduced hunger signals? • Alterations in GI hormone release?
Altered gut flora	• Shift in Bacteroidetes and Firmicutes bacterial populations to proportions more like those found in lean individuals

AACEComplication-Centric Model For Overweight/Obesity Care



2008 AACE-TOS-ASMBS CPG

AMERICAN ASSOCIATION OF CLINICAL ENDOCRINOLOGISTS, THE OBESITY SOCIETY, AND AMERICAN SOCIETY FOR METABOLIC & BARIATRIC SURGERY MEDICAL GUIDELINES FOR CLINICAL PRACTICE FOR THE PERIOPERATIVE NUTRITIONAL, METABOLIC, AND NONSURGICAL SUPPORT OF THE BARIATRIC SURGERY PATIENT

Jeffrey I. Mechanick, MD, FACP, FACE, FACN, Robert F. Kushner, MD, Harvey J. Sugerman, MD, J. Michael Gonzalez-Campoy, MD, PhD, FACE, Maria L. Collazo-Clavell, MD, FACE, Safak Guven, MD, FACP, FACE, Adam F. Spitz, MD, FACE, Caroline M. Apovian, MD, Edward H. Livingston, MD, FACS, Robert Brolin, MD, David B. Sarwer, PhD, Wendy A. Anderson, MS, RD, LDN, and John Dixon, MD

American Association of Clinical Endocrinologists, The Obesity Society, and American Society for Metabolic & Bariatric Surgery Medical Guidelines for Clinical Practice are systematically developed statements to assist healthcare professionals in medical decision making for specific clinical conditions. Most of the content herein is based on literature reviews. In areas of uncertainty, professional judgment was applied.

These guidelines are a working document that reflects the state of the field at the time of publication. Because rapid changes in this area are expected, periodic revisions are inevitable. We encourage medical professionals to use this information in conjunction with their best clinical judgment. The presented recommendations may not be appropriate in all situations. Any decision by practitioners to apply these guidelines must be made in light of local resources and individual patient circumstances.

The American Society for Parenteral & Enteral Nutrition fully endorses sections of these guidelines that address the metabolic and nutritional management of the bariatric surgical patient.

AACE THE OBESITY SOCIETY ASMBS American Society for Metabolic & Bariatric Surgery aspen

2004 AACE G4G

Table 5
Levels of Scientific Substantiation in Evidence-Based Medicine[a]

Level	Description	Comments
1	Prospective, randomized, controlled trials—large	Data are derived from a substantial number of trials, with adequate statistical power involving a substantial number of outcome data subjects Large meta-analyses using raw or pooled data or incorporating quality ratings Well-controlled trial at one or more centers Consistent pattern of findings in the population for wh dat Con evi ket
2	Prospective controlled trials with or without randomization—limited body of outcome data	Lim tri Wel Lim Inco the Wel
3	Other experimental outcome data and nonexperimental data	Non Unc Any 3 c Retr Case Con sup
4	Expert opinion	Inad nec lite Exp The

Table 6
Grade-Recommendation Protocol Adopted by the American Association of Clinical Endocrinologists, The Obesity Society, and American Society for Metabolic & Bariatric Surgery[a]

Grade	Description	Recommendation
A	≥1 conclusive level 1 publications demonstrating benefit >> risk	Action recommended for indications reflected by the published reports Action based on **strong** evidence Action can be used with other conventional therapy or as **"first-line" therapy**
B	No conclusive level 1 publication ≥1 conclusive level 2 publications demonstrating benefit >> risk	Action recommended for indications reflected by the published reports *If* the patient refuses or fails to respond to conventional therapy; must monitor for adverse effects, if any Action based on **intermediate** evidence Can be recommended as **"second-line" therapy**
C	No conclusive level 1 or 2 publication ≥1 conclusive level 3 publications demonstrating benefit >> risk *or* No risk at all and no benefit at all	Action recommended for indications reflected by the published reports *If* the patient refuses or fails to respond to conventional therapy, provided there are no significant adverse effects; **"no objection" to recommending their use** *or* **"No objection" to continuing their use** Action based on **weak** evidence
D	No conclusive level 1, 2, or 3 publication demonstrating benefit >> risk Conclusive level 1, 2, or 3 publications demonstrating risk >> benefit	**Not recommended** Patient is advised to **discontinue use** Action not based on any evidence

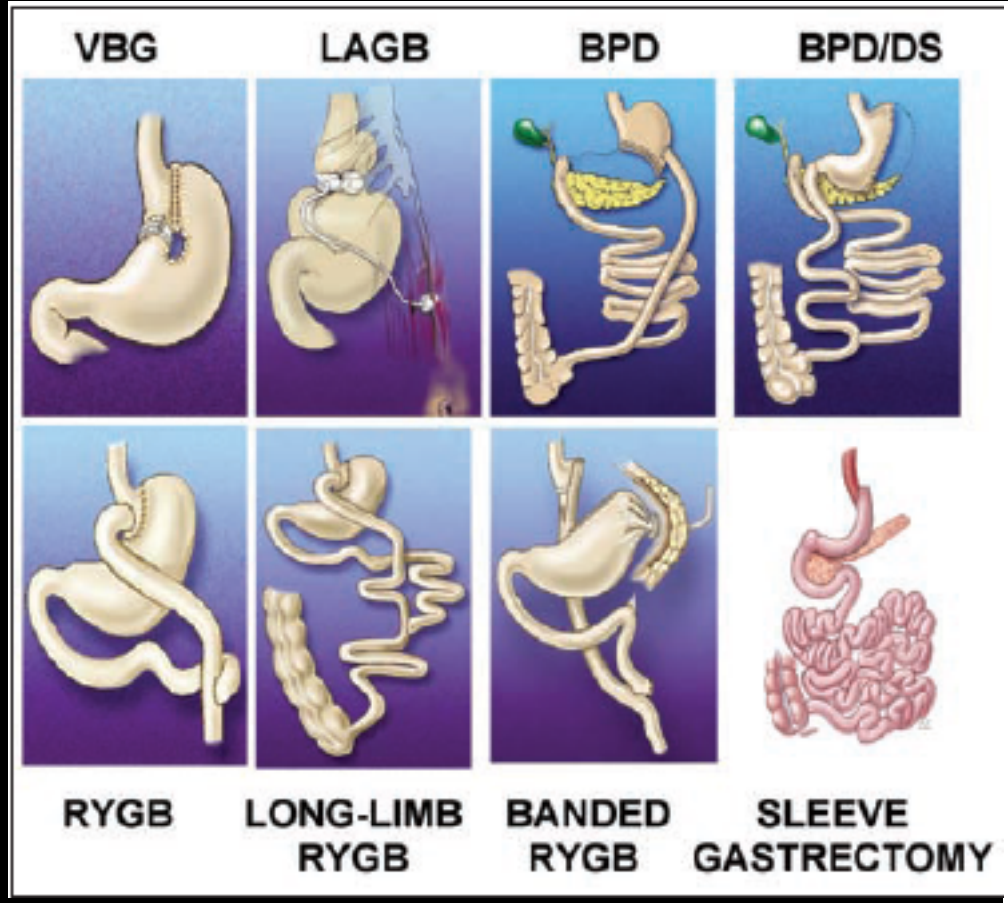


Table 1
Types of Bariatric Surgical Procedures

Primary
- Vertical banded gastroplasty
- Gastric banding
- Silastic ring gastroplasty
- Laparoscopic adjustable gastric band (LAGB)
- Roux-en-Y gastric bypass
  - Standard
  - Long-limb
  - Distal
- Biliopancreatic diversion (BPD)
- BPD with duodenal switch (BPD/DS)
- Staged restrictive and malabsorptive procedure

Secondary
- Reversal of gastric restriction
- Revision of Roux-en-Y gastric bypass
- Revision of BPD
- Revision of BPD/DS
- Conversion of LAGB to Roux-en-Y gastric bypass
- Conversion of LAGB to BPD or BPD/DS

Investigational
- Gastric bypass with LAGB
- Robotic procedures
- Endoscopic (oral)-assisted techniques
- Gastric balloon
- Gastric pacer
- Vagus nerve pacing
- Vagus nerve block
- Sleeve gastrectomy

Table 2
Effects of Bariatric Surgery on Obesity-Related Comorbidities[a]

Comorbidity	Preoperative incidence (%)	Remission >2 years postoperatively (%)	Reference
T2DM, IFG, or IGT	34	85	103
Hypertension	26	66	104
Hypertriglyceridemia and low HDL cholesterol	40	85	105
Sleep apnea	22 (in men) 1 (in women)	40	106
Obesity-hypoventilation syndrome	12	76	107

[a] HDL = high-density lipoprotein; IFG = impaired fasting glucose; IGT = impaired glucose tolerance; T2DM = type 2 diabetes mellitus.
Adapted from Greenway (4).

Table 3
Rates for Remission of Type 2 Diabetes Mellitus Reported After Bariatric Surgery[a]

Procedure	Remission rate (%)
Vertical banded gastroplasty	75-83
Laparoscopic adjustable silicone gastric banding	40-47
Roux-en-Y gastric bypass	83-92
Biliopancreatic diversion	95-100

[a] Data from Greenway (4).

Table 4
Reported Weight Loss as Percentage of Excess Body Weight After Bariatric Surgery[a]

Procedure	Follow-up period (y)		
	1-2	3-6	7-10
Vertical banded gastroplasty[b]	50-72	25-65	…
Gastric banding[c]	29-87	45-72	14-60
Sleeve gastrectomy[d]	33-58	66	…
Roux-en-Y gastric bypass[e]	48-85	53-77	25-68
Banded Roux-en-Y gastric bypass[f]	73-80	66-78	60-70
Long-limb Roux-en-Y gastric bypass[g]	53-74	55-74	…
Biliopancreatic diversion ± DS[h]	65-83	62-81	60-80

Table 7

Selection Criteria for Bariatric Surgery[a]

Factor	Criteria
Weight (adults)	BMI ≥40 kg/m^2 with no comorbidities BMI ≥35 kg/m^2 with obesity-associated comorbidity
Weight loss history	Failure of previous nonsurgical attempts at weight reduction, including nonprofessional programs (for example, Weight Watchers, Inc)
Commitment	Expectation that patient will adhere to postoperative care Follow-up visits with physician(s) and team members Recommended medical management, including the use of dietary supplements Instructions regarding any recommended procedures or tests
Exclusion	Reversible endocrine or other disorders that can cause obesity Current drug or alcohol abuse Uncontrolled, severe psychiatric illness Lack of comprehension of risks, benefits, expected outcomes, alternatives, and lifestyle changes required with bariatric surgery

Table 8
Metabolic Complications of Bariatric Surgery[a]

Complication	Clinical features	Management
Acid-base disorder	Metabolic acidosis, ketosis	Bicarbonate orally or intravenously; adjust acetate content in PN
	Metabolic alkalosis	Salt and volume loading (enteral or parenteral)
Bacterial overgrowth (primarily with BPD, BPD/DS)	Abdominal distention Pseudo-obstruction Nocturnal diarrhea Proctitis Acute arthralgia	Antibiotics (metronidazole) Probiotics
Electrolyte abnormalities (primarily with BPD, BPD/DS)	Low Ca, K, Mg, Na, P Arrhythmia, myopathy	Enteral or parenteral repletion
Fat-soluble vitamin deficiency	Vitamin A—night vision Vitamin D—osteomalacia Vitamin E—rash, neurologic Vitamin K—coagulopathy	Vitamin A, 5,000-10,000 U/d Vitamin D, 400-50,000 U/d Vitamin E, 400 U/d Vitamin K, 1 mg/d ADEK, 2 tablets twice a day (http://www.scandipharm.com)
Folic acid deficiency	Hyperhomocysteinemia Anemia Fetal neural tube defects	Folic acid supplementation
Iron deficiency	Anemia	Ferrous fumarate, sulfate, or gluconate Up to 150-300 mg elemental iron daily Add vitamin C and folic acid
Osteoporosis	Fractures	DXA, calcium, vitamin D, and consider bisphosphonates
Oxalosis	Kidney stones	Low oxalate diet Potassium citrate Probiotics
Secondary hyperparathyroidism	Vitamin D deficiency Negative calcium balance Osteoporosis	DXA Serum intact PTH level 25-Hydroxyvitamin D levels Calcium and vitamin D supplements
Thiamine deficiency (vitamin B_1)	Wernicke-Korsakoff encephalopathy Peripheral neuropathy Beriberi	Thiamine intravenously followed by large-dose thiamine orally
Vitamin B_{12} deficiency	Anemia Neuropathy	Parenteral vitamin B_{12} Methylmalonic acid level

Table 9
Suggested Meal Progression After Roux-en-Y Gastric Bypass

Diet stage[a]	Begin	Fluids/food	Guidelines
Stage I	Postop days 1 and 2	Clear liquids Noncarbonated; no calories No sugar; no caffeine	On postop day 1, patients undergo a Gastrografin swallow test for leaks; once tested, begin sips of clear liquids
Stage II **Begin supplementation:** **Chewable** multivitamin with minerals, × 2/d **Chewable or liquid** calcium citrate with vitamin D	Postop day 3 (discharge diet)	**Clear liquids** • Variety of no-sugar liquids or artificially sweetened liquids • Encourage patients to have salty fluids at home • Solid liquids: sugar-free ice pops **PLUS full liquids** • ≤15 g of sugar per serving • Protein-rich liquids (limit 20 g protein per serving of added powders)	
Stage III	Postop days 10-14[a]	Increase clear liquids (total liquids 48-64+ ounces per day) and replace full liquids with soft, moist, diced, ground or pureed protein sources as tolerated **Stage III, week 1:** eggs, ground meats, poultry, soft, moist fish, added gravy, bouillon, light mayonnaise to moisten, cooked bean, hearty bean soups, cottage cheese, low-fat cheese, yogurt	
Stage III	4 weeks postop	Advance diet as tolerated; if protein foods, add well-cooked, soft vegetables and soft and/or peeled fruit. Always eat protein first	
Stage III	5 weeks postop	Continue to consume protein with some fruit or vegetable at each meal; some people tolerate salads at 1 month postop	
Stage IV Vitamin and mineral supplementation daily.[b] May switch to pill form if <11 mm in width and length after 2 months postop	As hunger increases and more food is tolerated	Healthy solid food diet	

Table 10
Suggested Meal Progression After Laparoscopic Adjustable Gastric Band Procedure

Diet stage[a]	Begin	Fluids/food	Guidelines
Stage I	Postop days 1 and 2	Clear liquids Noncarbonated; no calories No sugar; no caffeine	On postop day 1, patients may begin sips of water and Crystal Light; avoid carbonation
Stage II **Begin supplementation:** **Chewable** multivitamin with minerals, × 2/d **Chewable or liquid** calcium citrate with vitamin D	Postop days 2-3 (discharge diet)	**Clear liquids** • Variety of no-sugar liquids or artificially sweetened liquids **PLUS full liquids** • ≤15 g of sugar per serving • Protein-rich liquids (≤3 g fat per serving)	Patients should consume a minimum of 48-64 ounces of total fluids per day: 24-32 ounces or more of clear liquids plus 24-32 ounces of
Stage III	Postop days 10-14[a]	Increase clear liquids (total liquids 48-64 fl oz or more per day) and replace full liquids with soft, moist, diced, ground or pureed protein sources as tolerated **Stage III, week 1:** eggs, ground meats, poultry, soft, moist fish, added fat-free gravy, bouillon, light mayonnaise to moisten, cooked bean, hearty bean soups, low-fat cottage cheese, low-fat cheese, yogurt	
Stage III	4 weeks postop	Advance diet as tolerated; if protein foods tolerated in week 1, add well-cooked, soft vegetables and soft and/or peeled fruit	
Stage III	5 weeks postop	Continue to consume protein with some fruit or vegetable at each meal; some people tolerate salads at 1 month postop	
Stage IV Vitamin and mineral supplementation daily[b]	As hunger increases and more food is tolerated	Healthy solid food diet	
Fill/adjustment	~6 weeks postop and possibly every 6 weeks until satiety reached	Full liquids × 2-3 days post-fill, then advance to Stage III, week 1 guidelines above, as tolerated for another 2-3 days, then advance to the final stage and continue	

Table 11
Suggested Meal Progression After Biliopancreatic Diversion (± Duodenal Switch)

Diet stage[a]	Begin	Fluids/food	Guidelines
Stage I	Postop days 1 and 2	Clear liquids[b] Noncarbonated; no calories No sugar; no caffeine	Clear liquids started after swallow test
Stage II **Begin supplementation:** **Chewable** multivitamin with minerals, × 2/d **Iron supplement** • **Add vitamin C for absorption if not already included within the supplement** **Chewable or liquid** calcium citrate containing vitamin D, 2,000 mg/d **Vitamin B_{12}: at least** 350-500 µg crystalline daily; might need vitamin B_{12} intramuscularly **Fat-soluble vitamins: A, D, E, K** • High risk for fat-soluble vitamin deficiencies • A: 5,000-10,000 IU/d • D: 600-50,000 IU/d • E: 400 IU/d • K: 1 mg/d Advise ADEK tablets × 2/d	Postop day 3	**Clear liquids** • Variety of no-sugar liquids or artificially sweetened liquids • Encourage patients to have salty fluids at home • Solid liquids: sugar-free ice pops **PLUS full liquids**[b] • ≤15 g of sugar per serving • Protein-rich liquids	**Protein** malnutrition is the most severe macronutrient complication after BPD/DS; regular monitoring and assessment of protein intake and status are very important ~90 g of protein a day is recommended; since early postop this is difficult for most patients, set goal to consume ≥60 g of protein per day plus clear liquids, and increase as tolerated. Patients should consume a minimum of 64 ounces of total fluids per day; 24-32 ounces or more of clear liquids plus 4-5 eight-ounce servings a day of any combination of full liquids—**1% or skim milk, Lactaid nonfat milk, or nonfat soy milk fortified with calcium mixed with:** • Whey or soy protein powder (20-25 g protein per serving of protein powder) • Light yogurt, blended • Plain yogurt; Greek yogurt
Stage III	Postop days 10-14[a]	Increase clear liquids (total liquids, 75+ ounces per day), and replace full liquids with soft, moist, diced, ground or pureed protein sources as tolerated **Stage III, week 1:** eggs, ground meats, poultry, soft, moist fish, added nonfat gravy, bouillon, light mayonnaise to moisten, cooked bean, hearty bean soups, low-fat cottage cheese, low-fat cheese, light yogurt	Protein food choices are encouraged for 3-6 small meals per day; patients may be able to tolerate only a couple of tablespoons at each meal or snack. Encourage patients not to drink with meals and to wait ≥30 minutes after each meal before resuming fluids. Patients might need to continue with supplementation of protein drinks to meet protein needs (90 g of protein daily is the goal)
Stage III	6 weeks postop	Advance diet as tolerated; add well-cooked, soft vegetables and soft and/or peeled fruit. Always eat protein first	Patients should be counseled to focus on protein at every meal and snack and to avoid starches or concentrated carbohydrates; 10-12 ounces of lean meats, poultry, fish, or eggs or some combination of high biologic value protein and protein supplement powders. Adequate hydration is essential and a priority for all patients during the rapid weight-loss phase. Wait ≥30 minutes after meals before resuming liquids
Stage III	12 weeks postop	Continue to consume protein with some fruit or vegetable at each meal; some people tolerate salads at 1 month postop; starches should be limited to whole grain crackers with protein, potato, and/or dry low-sugar cereals moistened with milk. Protein continues to be a high priority	**AVOID** rice, bread, and pasta until patient is comfortably consuming 90 g of protein per day plus fruits and vegetables

Table 12
Consensus for Follow-up Nutrition and Metabolic Consultations After Bariatric Surgery, Stratified by Type of Procedure Performed and Presence of Comorbidities (Grade D)[a,b]

Procedure	Nutritional or metabolic comorbidities	First 6 months[c]	Second 6 months	Next year	Thereafter
VBG	No	q 3-6 mo	Once	Annually	Annually
	Yes	q 1-2 mo	Twice	q 6 mo	Annually
LAGB	No	q month prn	Once	Annually	Annually
	Yes	q month prn	Twice	q 6 mo	Annually
RYGB	No	q 2-3 mo	Once	q 6 mo	Annually
	Yes	q 1-2 mo	q 3-6 mo	q 6 mo	Annually
BPD/DS	No	q 2-3 mo	Twice	q 3-6 mo	Annually
	Yes	q 1-2 mo	q 6-12 mo	q 6-12 mo	q 6-12 mo

Table 13
Recommended Biochemical Surveillance of Nutritional Status After Malabsorptive Bariatric Surgical Procedures[a]

Surveillance factor	Roux-en-Y gastric bypass	Biliopancreatic diversion (± duodenal switch)
Time interval		
1st year	Every 3-6 mo	Every 3 mo
Thereafter	Annually	Every 3-6 mo depending on symptoms
Laboratory tests	CBC, platelets	CBC, platelets
	Electrolytes	Electrolytes
	Glucose	Glucose
	Iron studies, ferritin	Iron studies, ferritin
	Vitamin B_{12} (MMA, HCy optional)	Vitamin B_{12} (MMA, HCy optional)
	Liver function (GGT optional)	Liver function (GGT optional)
	Lipid profile	Lipid profile
	25-Hydroxyvitamin D	Albumin and prealbumin
	Optional:	RBC folate
	Intact PTH	Fat-soluble vitamins (6-12 mo)
	Thiamine	Vitamin A
	RBC folate	25-Hydroxyvitamin D
		Vitamin E
		Vitamin K_1 and INR
		Metabolic bone evaluation[b]
		Intact PTH (6-12 mo)
		24-Hour urine calcium (6-12 mo)
		Urine N-telopeptide (annually)
		Osteocalcin (as needed)
		Metabolic stone evaluation (annually)
		24-Hour urine calcium, citrate, uric acid, and oxalate
		Trace elements (annually or as needed)
		Zinc
		Selenium
		Miscellaneous (as needed)
		Carnitine
		Essential fatty acid chromatography

Table 14
Routine Nutrient Supplementation After Bariatric Surgery[a]

Supplement	Dosage
Multivitamin	1-2 daily
Calcium citrate with vitamin D	1,200-2,000 mg/d + 400-800 U/d
Folic acid	400 μg/d in multivitamin
Elemental iron with vitamin C	40-65 mg/d
Vitamin B_{12}	≥350 μg/d orally or 1,000 μg/mo intramuscularly or 3,000 μg every 6 mo intramuscularly or 500 μg every week intranasally

Table 15
Diagnostic Testing and Management for Skeletal and Mineral Disorders in Patients Who Have Undergone Roux-en-Y Gastric Bypass, Biliopancreatic Diversion, or Biliopancreatic Diversion With Duodenal Switch[a]

Condition	Diagnostic testing	Management
Metabolic bone disease	Serum calcium, phosphorus, magnesium 25-Hydroxyvitamin D Bone-specific alkaline phosphatase (or osteocalcin) Intact parathyroid hormone Spot urine or serum N-telopeptide 24-Hour urine calcium excretion 1,25-Dihydroxyvitamin D (if renal compromise) Vitamin A and K_1 levels Albumin and prealbumin Dual-energy x-ray absorptiometry (at 3 sites) at baseline and 2-year follow-up per ISCD and NOF recommendations[c]	Calcium citrate or gluconate Vitamin D_2 or D_3 orally Calcitriol orally Vitamin D intramuscularly (if available) Alendronate, ibandronate, or risedronate orally Ibandronate, pamidronate, or zoledronate intravenously[b] Calcitonin intranasally Human recombinant parathyroid hormone where appropriate
Nephrolithiasis	Urinalysis 24-Hour urine specimen for calcium, oxalate, citrate Renal ultrasonography	Low oxalate diet Calcium orally Cholestyramine Potassium citrate Lithotripsy Urologic surgery

Table 16
Potential Members of a Bariatric Surgery Team

- Bariatric surgeon
- Bariatric coordinator (advanced practice nurse or well-educated registered nurse)
- Internist with nutrition or bariatric medicine experience
- Registered dietitian
- Medical consultants[a]
  - Psychologist or psychiatrist
  - Endocrinologist
  - Physician nutrition specialist[b]
  - Certified nutrition support clinician[c]
  - Sleep medicine specialist
  - Cardiologist
  - Gastroenterologist
  - Physiatrist
- Office support personnel

Table 17
Screening and Management of Comorbidities Before Bariatric Surgery[a]

Routine chemistry studies (with fasting blood glucose, liver profile, and lipid profile), urinalysis, prothrombin time (INR), blood type, complete blood cell count, iron studies
Vitamin B_1 (optional), vitamin B_{12}-folic acid assessment (RBC folate, homocysteine, methylmalonic acid) (optional)
Vitamins A and D (E and K optional) (if malabsorptive procedure planned), iPTH
Helicobacter pylori screening (optional) (if positive and epigastric symptoms present, then treatment with antibiotics and proton pump inhibitor)
Thyroid-stimulating hormone (thyrotropin) (optional)
Total or bioavailable testosterone, DHEAS, Δ_4-androstenedione (if polycystic ovary syndrome suspected) (optional)
Overnight dexamethasone suppression, 24-hour urinary cortisol, 11 PM serum or salivary cortisol level screening tests (if Cushing syndrome suspected)
Cardiovascular evaluation (chest radiography, electrocardiography, and echocardiography if pulmonary hypertension or cardiac disease is known or suspected)
Gastrointestinal evaluation (gallbladder evaluation optional in asymptomatic persons or at the discretion of the surgeon, upper endoscopy if epigastric discomfort)
Sleep apnea evaluation if suspected; arterial blood gases if obesity-hypoventilation syndrome suspected or in superobese patients
Psychologic-psychiatric consultation

Table 18
Medications Associated With Body Fat Weight Gain[a]

Class and subclass	Drug
Psychiatric or neurologic agents	
Antipsychotic agents	Phenothiazines, olanzapine, clozapine, risperidone
Mood stabilizers	Lithium
Antidepressants	Tricyclics, MAOIs, SSRIs, mirtazapine
Antiepileptic drugs	Gabapentin, valproate, carbamazepine
Steroid hormones	
Corticosteroids	…
Progestational steroids	…
Antidiabetes agents	Insulin, sulfonylureas, thiazolidinediones
Antihypertensive agents	β-Adrenergic and α_1-adrenergic receptor blockers
Antihistamines	Cyproheptadine
HIV protease inhibitors	…

Table 19
Obesity-Related Review of Organ Systems

Cardiovascular
- Hypertension
- Congestive heart failure
- Cor pulmonale
- Varicose veins
- Pulmonary embolism
- Coronary artery disease

Endocrine
- Metabolic syndrome
- Type 2 diabetes mellitus
- Dyslipidemia
- Polycystic ovary syndrome, androgenicity
- Amenorrhea, infertility, menstrual disorders

Musculoskeletal
- Hyperuricemia and gout
- Immobility
- Osteoarthritis (knees and hips)
- Low back pain
- Carpal tunnel syndrome

Integument
- Striae distensae (stretch marks)
- Stasis pigmentation of legs
- Lymphedema
- Cellulitis
- Intertrigo, carbuncles
- Acanthosis nigricans
- Acrochordon (skin tags)
- Hidradenitis suppurativa

Respiratory
- Dyspnea
- Obstructive sleep apnea
- Hypoventilation syndrome
- Pickwickian syndrome
- Asthma

Gastrointestinal
- Gastroesophageal reflux disease
- Nonalcoholic fatty liver disease
- Cholelithiasis
- Hernias
- Colon cancer

Genitourinary
- Urinary stress incontinence
- Obesity-related glomerulopathy
- End-stage renal disease
- Hypogonadism (male)
- Breast and uterine cancer
- Pregnancy complications

Neurologic
- Stroke
- Idiopathic intracranial hypertension
- Meralgia paresthetica
- Dementia

Psychologic
- Depression and low self-esteem
- Body image disturbance
- Social stigmatization

Table 20
Laboratory and Diagnostic Evaluation of the Obese Patient
Based on Presentation of Symptoms, Risk Factors, and Index of Suspicion[a]

Suspected condition	Studies to consider and interpretation
Obstructive sleep apnea (daytime sleepiness, loud snoring, gasping or choking episodes during sleep, and awakening headaches)	• Polysomnography for oxygen desaturation, apneic and hypopneic events • Measurement of neck circumference (>17 inches [>43.2 cm] in men, >16 inches [>40.6 cm] in women) • Otorhinolaryngologic examination for upper airway obstruction (optional)
Alveolar hypoventilation (pickwickian) syndrome (hypersomnolence, possible right-sided heart failure including elevated jugular venous pressure, hepatomegaly, and pedal edema)	• Polysomnography (to rule out obstructive sleep apnea) • Complete blood cell count (to rule out polycythemia) • Blood gases (Pa_{O_2} decreased, Pa_{CO_2} elevated) • Chest radiography (enlarged heart and elevated hemidiaphragms) • Electrocardiography (right atrial and right ventricular enlargement) • Pulmonary function tests (reduced vital capacity and expiratory reserve volume) (optional) • Right heart pressure measurement (optional)
Cushing syndrome (moon facies, thin skin that bruises easily, severe fatigue, violaceous striae)	• Elevated late-night salivary cortisol level (>7.0 nmol/L diagnostic, 3.0 to 7.0 nmol/L equivocal) • Repeatedly elevated measurements of cortisol secretion (urine free cortisol [upper normal, 110 to 138 nmol/d] or late-night salivary cortisol levels) may be needed
Diabetes mellitus	• Fasting blood glucose (≥126 mg/dL on 2 occasions), random blood glucose (≥200 mg/dL with symptoms of diabetes), or 120 minutes post-glucose challenge (≥200 mg/dL) • Glycosylated hemoglobin (hemoglobin A1c) ≥7.1% • Microalbuminuria (>30 mg/d) at baseline • BP measurement and fasting lipid profile
Hypothyroidism	• Supersensitive TSH (> assay upper limit of normal range)
Metabolic syndrome	3 of 5 criteria needed for diagnosis: • Triglycerides >150 mg/dL • HDL cholesterol <40 mg/dL (men) or <50 mg/dL (women) • BP >130/>85 mm Hg • Fasting glucose >110 mg/dL • 120 minutes post-glucose challenge 140 to 200 mg/dL
Polycystic ovary syndrome (oligomenorrhea, hirsutism, probable obesity, enlarged ovaries may be palpable, hypercholesterolemia, impaired glucose tolerance, persistent acne, and androgenic alopecia)	• Morning blood specimen for total, free, and weak testosterone, DHEAS, prolactin, thyrotropin, and early-morning 17-hydroxyprogesterone level (normal values vary according to laboratory). Testing should be done OFF oral contraceptives (optional) • Lipid profile
Hypertension	• Mean of 2 or more properly measured seated BP readings on each of 2 or more office visits with use of a large BP cuff (prehypertension 120-139/80-89 mm Hg; hypertension 140-159/90-99 mm Hg) • Electrocardiography, urinalysis, complete blood cell count, blood chemistry, and fasting lipid profile
Liver abnormality, gallstones	• Liver function tests (serum bilirubin and alkaline phosphatase elevated) • Gallbladder ultrasonography (optional)
Hepatomegaly, nonalcoholic fatty liver disease	• Liver function tests elevated 1 to 4 times normal (ALT usually > AST, serum bilirubin, prothrombin time, decreased albumin) • Imaging study (ultrasonography or computed tomography) (optional) • Minimal or no alcohol intake with negative testing for viral hepatitis, autoimmune disease, and congenital liver disease • Definitive diagnosis with liver biopsy • Upper endoscopy to rule out esophageal varices if cirrhosis suspected

Table 21
Educational Resources on Bariatric Surgery

Textbooks

Buchwald H, Cowan GSM Jr, Pories WJ, eds. *Surgical Management of Obesity*. Philadelphia, PA: Saunders, 2007.

DeMaria EJ, Latifi R, Sugerman HJ. *Laparoscopic Bariatric Surgery: Techniques and Outcomes*. Austin, TX: Landes Bioscience, 2002.

Farraye F, Forse A, eds. *Bariatric Surgery: A Primer for Your Medical Practice*. Thorofare, NJ: SLACK Incorporated, 2006.

Inabnet WB, DeMaria EJ, Ikramuddin S, eds. *Laparoscopic Bariatric Surgery*. Philadelphia, PA: Lippincott Williams & Wilkins, 2004.

Mitchell JE, de Zwann M, eds. *Bariatric Surgery: A Guide for Mental Health Professionals*. New York, NY: Routledge, Taylor & Francis Group, 2005.

Sugerman HJ, Nguyen N, eds. *Management of Morbid Obesity*. Philadelphia, PA: Taylor & Francis Group, 2005.

Society Web sites

American Association of Clinical Endocrinologists	http://www.aace.com
American Dietetic Association	http://www.eatright.org
American Obesity Association	http://www.obesity1.tempdomainname.com/
American Society for Metabolic & Bariatric Surgery	http://www.asbs.org/
Association for Morbid Obesity Support	http://www.obesityhelp.com/
International Federation for the Surgery of Obesity	http://www.obesity-online.com/ifso/
Obesity Action Coalition	http://obesityaction.org
The Obesity Society	http://www.obesity.org

Clinical practice guidelines

Guidelines for the Clinical Application of Laparoscopic Bariatric Surgery
http://www.guideline.gov/summary/summary.aspx?doc_id=4383&nbr=3301&string=bariatric+AND+surgery

Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report
http://www.ncbi.nlm.nih.gov/books/bookres.fcgi/obesity/obesity.pdf

VA/DoD Clinical Practice Guideline for Management of Overweight and Obesity
http://www.oqp.med.va.gov/cpg/OBE/OBE_CPG/GOL.htm

SAGES/ASBS Guideline for Laparoscopic and Conventional Surgical Treatment of Morbid Obesity
http://www.asbs.org/html/lab_guidelines.html

Rationale for the Surgical Treatment of Morbid Obesity
http://www.asbs.org/Newsite07/patients/resources/asbs_rationale.htm

Guidelines for Granting Privileges in Bariatric Surgery
http://www.asbs.org/html/about/grantingprivileges.html

Suggestions for the Pre-Surgical Psychological Assessment of Bariatric Surgery Candidates
http://www.asbs.org/html/pdf/PsychPreSurgicalAssessment.pdf

A.S.P.E.N. Clinical Guidelines, Standards, and Safe Practices for Parenteral Nutrition
http://www.nutritioncare.org/lcontent.aspx?id=540

Commonwealth of Massachusetts Betsy Lehman Center for Patient Safety and Medical Error Reduction Expert Panel on Weight Loss Surgery, Executive Report, December 12, 2007, Prepublication Copy
http://www.mass.gov/Eeohhs2/docs/dph/patient_safety/weight_loss_executive_report_dec07/pdf

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

Jeffrey I. Mechanick, MD[1,]; Adrienne Youdim, MD[2]; Daniel B. Jones, MD, MS[3]; W. Timothy Garvey, MD[4]; Daniel L. Hurley, MD[5]; M. Molly McMahon, MD[5]; Leslie J. Heinberg, PhD[6]; Robert Kushner, MD[7]; Ted D. Adams, PhD, MPH[8]; Scott Shikora, MD[9]; John B. Dixon, MBBS, PhD[10]; Stacy Brethauer, MD[11]*

American Association of Clinical Endocrinologists Medical Guidelines for Clinical Practice are systematically developed statements to assist health-care professionals in medical decision making for specific clinical conditions. Most of the content herein is based on literature reviews. In areas of uncertainty, professional judgment was applied.

These guidelines are a working document that reflects the state of the field at the time of publication. Because rapid changes in this area are expected, periodic revisions are inevitable. We encourage medical professionals to use this information in conjunction with their best clinical judgment. The presented recommendations may not be appropriate in all situations. Any decision by practitioners to apply these guidelines must be made in light of local resources and individual patient circumstances.

ASMBS American Society for Metabolic & Bariatric Surgery

THE OBESITY SOCIETY

EASO

IFSO

iaso

International Federation for the Surgery of Obesity and metabolic disorders (IFSO)

ACS *to come*

2013 AACE-TOS-ASMBS CPG

Table 1
2010 American Association of Clinical Endocrinologists Protocol for Production of Clinical Practice Guidelines– Step I: Evidence Rating*

Numerical descriptor (evidence level)	Semantic descriptor (reference methodology)
1	Meta-analysis of randomized controlled trials (MRCT)
1	Randomized controlled trial (RCT)
2	Meta-analysis of nonrandomized prospective or case-controlled trials (MNRCT)
2	Nonrandomized controlled trial (NRCT)
2	Prospective cohort study (PCS)
2	Retrospective case-control study (RCCS)
3	Cross-sectional study (CSS)
3	Surveillance study (registries, surveys, epidemiologic study) (SS)
3	Consecutive case series (CCS)
3	Single case reports (SCR)
4	No evidence (theory, opinion, consensus, or review) (NE)

*1 = strong evidence; 2 = intermediate evidence; 3 = weak evidence; 4 = no evidence.

Table 2
A2010 American Association of Clinical Endocrinologists Protocol for Production of Clinical Practice Gudielines– Step II: Evidence Analysis and Subjective Factors

Study design	Data analysis	Interpretation of results
Premise correctness	Intent-to- treat	Generalizability
Allocation concealment (randomization)	Appropriate statistics	Logical
Selection bias		Incompleteness
Appropriate blinding		Validity
Using surrogate end points (especially in "first-in-its-class" intervention)		
Sample size (beta error)		
Null hypothesis versus Bayesian statistics		

Table 3
A 2010 American Association fo Clinical Endocrinologists Protocol for Production of Clinical Practice Guidelines– Step III: Grading of Recommendations; How Different Evidence Levels can be Mapped to the Same Recommendation Grade*

Best evidence level	Subjective factor impact	Two-thirds consensus	Mapping	Recomm-endation grade
1	None	Yes	Direct	A
2	Positive	Yes	Adjust up	A
2	None	Yes	Direct	B
1	Negative	Yes	Adjust down	B
3	Positive	Yes	Adjust up	B
3	None	Yes	Direct	C
2	Negative	Yes	Adjust down	C
4	Positive	Yes	Adjust up	C
4	None	Yes	Direct	D
3	Negative	Yes	Adjust down	D
1,2,3,4	NA	No	Adjust down	D

Table 4
2010 American Association of Clinical Endocrinologists Protocol for Production of Clinical Practice Guidelines– Step IV: Examples of Qualifiers That May Be Appended to Recommendations

Cost-effectiveness
Risk-benefit analysis
Evidence gaps
Alternative physician preferences (dissenting opinions)
Alternative recommendations ("cascades")
Resource availability
Cultural factors
Relevance (patient-oriented evidence that matters)

2010 AACE G4G

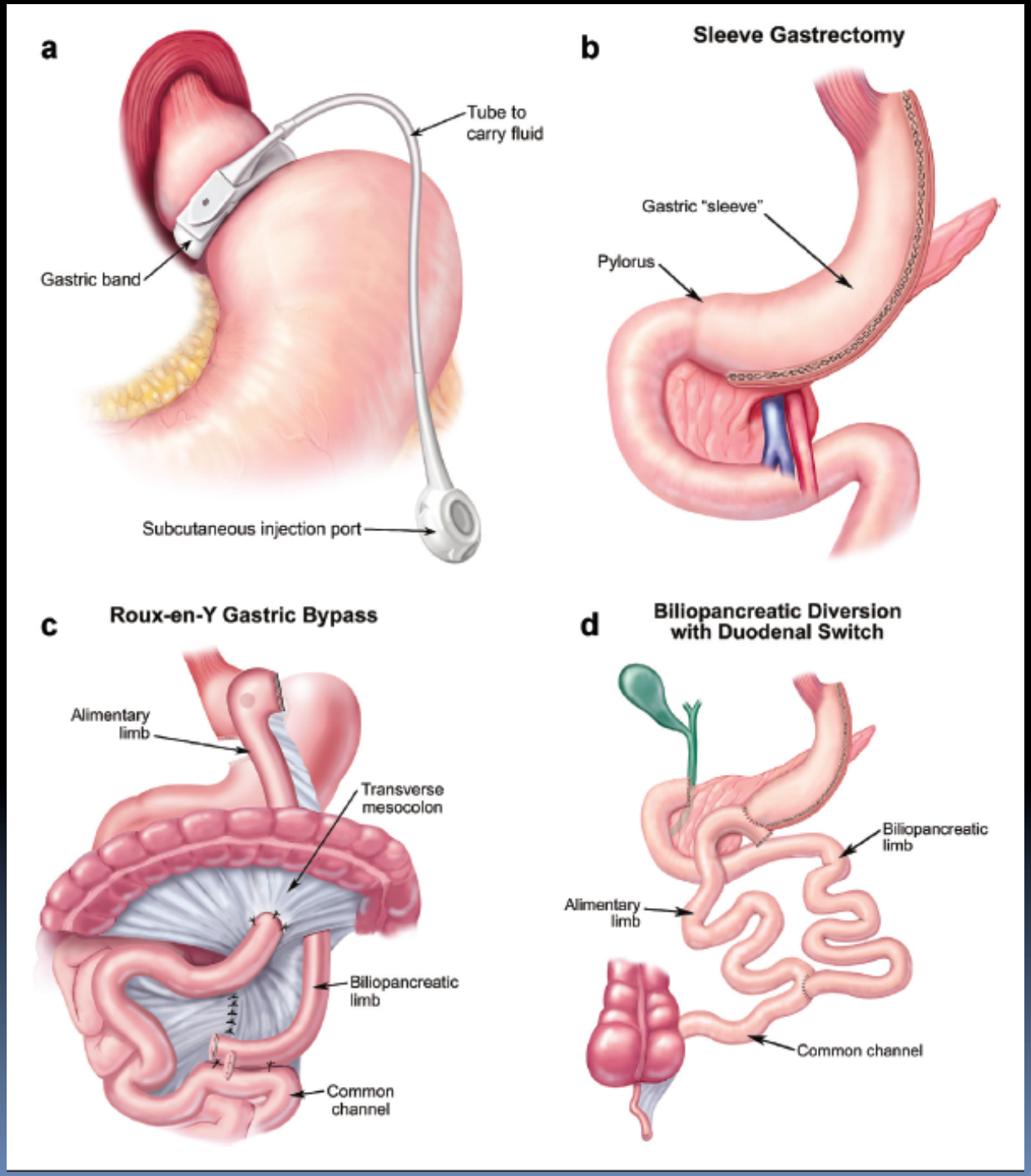

a
Tube to carry fluid
Gastric band
Subcutaneous injection port
b
Sleeve Gastrectomy
Gastric "sleeve"
Pylorus
c
Roux-en-Y Gastric Bypass
Alimentary limb
Transverse mesocolon
Biliopancreatic limb
Common channel
d
Biliopancreatic Diversion with Duodenal Switch
Biliopancreatic limb
Alimentary limb
Common channel

Table 5
Preoperative Checklist for Bariatric Surgery*

✓	Complete H & P (obesity-related co-morbidities, causes of obesity, weight BMI, weight loss history, commitment, and exclusions related to surgical risk)
✓	Routine labs (including fasting blood glucose and lipid panel, kidney function, liver profile, lipid profile, urine analysis, prothrombin time/INR, blood type, CBC)
✓	Nutrient screening with iron studies, B_{12} and folic acid (RBC folate, homocysteine, methylmalonic acid optional), and 25-vitamin D (vitamins A and E optional); consider more extensive testing in patients undergoing malabsorptive procedures based on symptoms and risks
✓	Cardiopulmonary evaluation with sleep apnea screening (ECG, CXR, echocardiography if cardiac disease or pulmonary hypertension suspected; DVT evaluation if clinically indicated)
✓	GI evaluation (H pylori screening in high-prevalence areas; gallbladder evaluation and upper endoscopy if clinically indicated)
✓	Endocrine evaluation (A_{1c} with suspected or diagnosed prediabetes or diabetes; TSH with symptoms or increased risk of thyroid disease; androgens with PCOS suspicion (total/bioavailable testosterone, DHEAS, Δ_4-androstenedione); screening for Cushing's syndrome if clinically suspected (1 mg overnight dexamethasone test, 24-hour urinary free cortisol, 11 PM salivary cortisol)
✓	Clinical nutrition evaluation by RD
✓	Psychosocial-behavioral evaluation
✓	Document medical necessity for bariatric surgery
✓	Informed consent
✓	Provide relevant financial information
✓	Continue efforts for preoperative weight loss
✓	Optimize glycemic control
✓	Pregnancy counseling
✓	Smoking cessation counseling
✓	Verify cancer screening by primary care physician

*See text for abbreviations.

Table 6
Postoperative Checklist for Bariatric Surgery*

Checklist Item		LAGB	LSG	RYGB	BPDDS
Early postoperative care					
✓	monitored telemetry at least 24 hr if high risk for MI	✓	✓	✓	✓
✓	protocol-derived staged meal progression supervised by RD	✓	✓	✓	✓
✓	healthy eating education by RD	✓	✓	✓	✓
✓	multivitamin plus minerals (# tablets for minimal requirement)	1	2	2	2
✓	calcium citrate, 1200-1500 mg/d	✓	✓	✓	
✓	vitamin D, at least 3000 units/d, titrate to >30 ng/mL	✓	✓	✓	✓
✓	vitamin B_{12} as needed for normal range levels	✓	✓	✓	✓
✓	maintain adequate hydration (usually >1.5 L/d PO)	✓	✓	✓	✓
✓	monitor blood glucose with diabetes or hypoglycemic symptoms	✓	✓	✓	✓
✓	pulmonary toilet, spirometry, DVT prophylaxis	✓	✓	✓	✓
✓	if unstable, consider pulmonary embolus (PE), intestinal leak (IL)	PE	PE	PE/IL	PE/IL
✓	if rhabdomyolysis suspected, check CPK	✓	✓	✓	✓
Follow-up					
✓	visits: initial, interval until stable, once stable (months)	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 antiinflammatory drugs	✓	✓	✓	✓
✓	adjust postoperative medications	✓	✓	✓	✓
✓	consider gout and gallstone prophylaxis in appropriate patients	✓	✓	✓	✓
✓	need for antihypertensive therapy with each visit	✓	✓	✓	✓
✓	lipid evaluation every 6-12 months based on risk and therapy	✓	✓	✓	✓
✓	monitor adherence with physical activity recommendations	✓	✓	✓	✓
✓	evaluate need for support groups	✓	✓	✓	✓
✓	bone density (DXA) at 2 years	✓	✓	✓	✓
✓	24-hour urinary calcium excretion at 6 months and then annually	✓	✓	✓	✓
✓	B_{12} (annually; MMA and HCy optional; then q 3-6 months if supplemented)	✓	✓	✓	✓
✓	folic acid (RBC folic acid optional), iron studies, 25-vitamin D, iPTH	x	x	✓	✓
✓	vitamin A (initially and q 6-12 months thereafter)	x	x	optional	✓
✓	copper, zinc, and selenium evaluation with specific findings	x	x	✓	✓
✓	thiamine evaluation with specific findings	✓	✓	✓	✓
✓	consider eventual body contouring surgery	✓	✓	✓	✓

PREOPERATIVE ASSESSMENT

Cardio-vascular disease	• Existing cardiac disease: cardiology consultation prior to surgery • At risk for CHD: evaluate for perioperative β-adrenergic blockade • DVT and PE: consider prophylactic vena caval filter
Diabetes	• Optimize preoperative glycemic control: A1C <7%, FPG <110 mg/dL, 2-hr PPG <140 mg/dL • Review perioperative glycemic control protocol *before* surgery
GI disorders	• Evaluate GI symptoms prior to surgery • Patients with increased LFT results should undergo abdominal ultrasonography and viral hepatitis screen
Lipids	• Treat according to NCEP ATP III recommendations
PCOS	• Advise patients that fertility status may improve postoperatively
Psychiatric disorders	• Patients with known or suspected psychiatric illness should undergo formal mental health evaluation before surgery
Pulmonary disease	• Patients with pulmonary disease or sleep apnea should undergo formal pulmonary evaluation
Thyroid disease	• Initiate treatment for thyroid dysfunction before surgery

Likely to have effect *		Not likely to have effect, or evidence unclear†
↑ Weight loss	↓ Weight loss	
Mandatory weight loss immediately before surgery	Preoperative BMI ≥50 kg/m^2 Personality disorder	Number of previous weight loss attempts Binge eating, sweet eating, and other maladaptive eating habits Hunger Emotional eating Depression Anxiety Sexual abuse Self-esteem Alcohol use/abuse Other psychiatric disorders

*Based on ≥7 studies, with ≥50% of studies showing an association.

†Based on insufficient number of studies (<7) or ≥50% showing no association.

Preoperative Weight Loss May Be Beneficial

2012 Systematic Review[1]

- Evaluation of preoperative weight loss in the weeks immediately before surgery
- Results
  - Promote postop weight loss: 7 studies
  - No effect on postop weight loss: 6 studies
  - Reduce postop weight loss: 1 study
- Considerable heterogeneity in terms of study design and endpoints

AACE Recommendation[2]

- Preoperative weight loss should be considered for patients with hepatomegaly
  - Reduced liver volume improves operative exposure

1. Livhits M, et al. *Obes Surg*. 2012;22:70-89.
2. Mechanick JI, et al. *Endocr Pract*. 2008;14(suppl 1):1-83.

Common Surgical Complications

LAGB

- Band slippage and erosion
- Band and port infections
- Balloon failure
- Port malposition
- Esophageal dilatation

LSG, RYGB, BPD

- Anastomotic leak
- Pouch dilation
- Incisional hernia
- Staple line disruption or failure
- Stomal ulceration
- Gastrogastric fistula

Complication	Clinical Features	Management
Acid-base disorder	Metabolic acidosis, ketosis	Bicarbonate orally or intravenously; adjust acetate content in PN
	Metabolic alkalosis	Salt and volume loading (enteral or parenteral)
Bacterial overgrowth (primarily with BPD, BPD/DS)	Abdominal distention Pseudo-obstruction Nocturnal diarrhea Proctitis Acute arthralgia	Antibiotics (metronidazole) Probiotics
Fat-soluble vitamin deficiency	Vitamin A—night vision Vitamin D—osteomalacia Vitamin E—rash, neurologic Vitamin K—coagulopathy	Vitamin A, 5,000-10,000 U/d Vitamin D, 400-50,000 U/d Vitamin E, 400 U/d Vitamin K, 1 mg/d ADEK, 2 tablets twice a day (http://www.scandipharm.com)
Folic acid deficiency	Hyperhomocysteinemia Anemia Fetal neural tube defects	Folic acid supplementation

Complication	Clinical Features	Management
Iron deficiency	Anemia	Ferrous fumarate, sulfate, or gluconate Up to 150-300 mg elemental iron daily Add vitamin C and folic acid
Osteoporosis	Fractures	DXA, calcium, vitamin D, and consider bisphosphonates
Oxalosis	Kidney stones	Low oxalate diet Potassium citrate Probiotics
Secondary hyperparathyroidism	Vitamin D deficiency Negative calcium balance Osteoporosis	DXA Serum intact PTH level 25-Hydroxyvitamin D levels Calcium and vitamin D supplements
Thiamine deficiency (vitamin B_1)	Wernicke-Korsakoff encephalopathy Peripheral neuropathy Beriberi	Thiamine intravenously followed by large-dose thiamine orally
Vitamin B_{12} deficiency	Anemia Neuropathy	Parenteral vitamin B_{12} Methylmalonic acid

Procedure	Nutritional or metabolic comorbidities?	First 6 months	Second 6 months	Next 12 months	Thereafter
LABG	No	Monthly or as needed	Once	Once (annually)	Annually
	Yes	Monthly or as needed	Twice (every 3 months)	Twice (every 6 months)	Annually
RYGB	No	Every 2-3 months	Once	Every 6 months	Annually
	Yes	Every 1-2 months	Every 3-6 months	Every 6 months	Annually
BPD/DS	No	Every 2-3 months	Twice (every 3 months)	Every 3-6 months	Annually
	Yes	Every 1-2 months	Every 6-12 months	Every 6-12 months	Every 6-12 months

Conclusions

- Bariatric surgery has an evidence-based role in obesity care for certain patients
- Endocrinologists should be familiar with the indications for bariatric surgery, procedure selection process, and perioperative management, especially nutritional and metabolic