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Summary of Bariatric Surgery Guideline of the Society of Endocrinology and Metabolism of Turkey

Türkiye Endokrinoloji ve Metabolizma Derneği Bariatrik Cerrahi Kılavuzu Özeti

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Abstract

Obesity is a common condition affecting approximately one-third of the adult population worldwide. Obesity results in a number of medical, psychosocial and economical problems, in many patients, it is usually difficult to achieve the desired weight loss with medical therapies, several surgical approaches for weight loss have been developed in the recent years and are described as bariatric or metabolic surgery. Though bariatric surgery promotes dramatic and reliable improvement in obesity and related complications, yet proper patient selection and careful selection of the bariatric method along with good pre- and post-operative management is very important for a successful therapy. Therefore, the authors aim to present a short review on the Bariatric Surgery Guideline of the Society of Endocrinology and Metabolism of Turkey. The indications and contraindications for bariatric surgery, description of commonly used bariatric surgical methods, preoperative preparation of obese patients prior to the surgery, early and late postoperative management and follow-up of the patients have been summarized in this review. This review has been written in accordance with the opinions and recommendations of the Hypertension, Lipid Metabolism and Obesity Study Group of the Society of Endocrinology and Metabolism of Turkey.

Keywords: Obesity; bariatric surgery; metabolic surgery; indications; contraindications; preoperative evaluation; postoperative following

Özet

Obezite, dünyadaki yetişkin nüfusun yaklaşık üçte birini etkileyen yaygın bir hastalık olup pek çok tıbbi, psikososyal ve ekonomik problemlere neden olmaktadır. Birçok hastada tıbbi tedaviler ile istenilen kilo kaybının sağlanamaması nedeniyle obezitenin tedavisi için günümüzde çeşitli cerrahi yaklaşımlar geliştirilmiş olup bunlar bariyatrik veya metabolik cerrahi olarak adlandırılmaktadır. Bariyatrik cerrahi sonuçları, obezite ve ilgili komplikasyonlarda çarpıcı ve uzun süreli iyileşmeyi desteklese de, uygun hastanın ve bariyatrik yöntemin seçimi, ameliyat öncesi ve sonrası değerlendirme ile takip, bariyatrik cerrahinin başarısı için çok önemlidir. Bu nedenle, Türkiye Endokrinoloji ve Metabolizma Derneği Bariyatrik Cerrahi Kılavuzunun kısa bir derlemesini yapmayı amaçladık. Bu derlemede, bariyatrik cerrahi endikasyon ve kontraendikasyonları, obez hastanın preoperatif dönemde hazırlanması, yaygın olarak kullanılan bariyatrik cerrahi yöntemler ve postoperatif dönemde hastanın takip ve tedavisi özetlenmiş olup Türkiye Endokrinoloji ve Metabolizma Derneği, Hipertansiyon, Lipid Metabolizması ve Obezite Çalışma Grubu görüş ve önerileri doğrultusunda hazırlanmıştır.

Anahtar kelimeler: Obezite; bariyatrik cerrahi; metabolik cerrahi; endikasyonlar; kontrendikasyonlar; preoperative değerlendirme; postoperatif takip

Introduction

Obesity, defined as a body mass index (BMI) ≥30 kg/m^2, is a significant public health concern worldwide. In the United States and Turkey, more than 35% of the adults are obese (1-3). Obesity is a serious medical condition associated with several comorbidities including type 2 diabetes, cardiovascular and cerebrovascular diseases, digestive, locomotor and respiratory disorders, cancers

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(e.g., colon, breast, and uterine) and psychosocial complications. Obesity also poses severe economic impact (4, 5). The cost of obesity complications and their treatment in the United States is roughly 200 billion US dollars, which accounted for over 20% of the US's entire healthcare spending in 2005 (6). The global economic impact of obesity was determined to be 2.0 trillion dollars in 2014 (5). Many studies have shown that weight loss reduces the risk of developing complications and may also improve the established conditions (7). Treatment options for obesity include surgical treatment [bariatric surgery (BS)] and non-surgical treatment. The non-surgical management usually comprises of dietary changes, physical exercise, and behavioral therapy aimed at reducing energy intake and increasing energy expenditure, in addition to various pharmacotherapies. Unfortunately, non-surgical approaches may be ineffective in achieving or sustaining weight loss in many obese patients. Therefore, the use of bariatric or metabolic surgical methods is increasing worldwide. According to the reports of the International Federation for the Surgery of Obesity and Metabolic Diseases (IFSO), a total number of 468,609 bariatric procedures were performed worldwide in 2013, out of which, 95.7% were laparoscopic procedures. Sleeve gastrectomy (SG) was the method that was most commonly used in the USA/Canada and in the Asia/Pacific regions; while in the Europe and Latin/South America regions, it was the second most commonly used method after Roux-en-Y Gastric Bypass (RYGB) (8). In Turkey, approximately 10,000 obese patients underwent bariatric surgery in 2016 (9).

At present, the long term outcomes of weight loss, after BS, have been found to be up to 20 years. Several randomized controlled studies have reported a weight loss of 17.3% to 33.8% in the surgical intervention groups at a period of 2-5 years after BS. In contrast, the control groups showed lower weight loss (1.4% to 10.2%) (10). In a recently conducted retrospective study, Maciejewski et al. (11) reported that patients undergoing RYGB lost 21% more of their baseline weight at 10 years as compared to their nonsurgical controls. Though some patients who underwent BS, regained weight, at 10 years after surgery; yet, 72% of the patients still showed a weight loss of more than 20%. In contrast, at 10 years follow-up, less than 10% of the nonsurgical subjects exhibited a weight loss of 20% or more. It was concluded from the Swedish Obese Subjects (SOS) study data that mean changes in body weight after 2 and 20 years were -23% and -18% in the surgical group and 0% and -1% in the control group, respectively. Patients who underwent bariatric surgery showed a long-term reduction in overall mortality [hazard ratio (HR)=0.71; p=0.01] as well as decreased incidences of diabetes (HR=0.17; p<0.001), myocardial infarction (HR=0.71; p=0.02), stroke (HR=0.66; p=0.008) and cancer (for women: HR=0.58; p=0.0008; for men: n.s.] as compared to the usual care group (12). The remission of diabetes mellitus is seen in 60% to 80% of the patients 1 to 2 years after BS while it still persists in approximately 30% of patients at 15 years (13).

Ignored issues for bariatric surgery in the present studies

Although all studies on BS suggest that surgical procedures can help achieve significant weight loss, the long term success rates have shown a decline (14). Modifiable risk factors associated with poor outcome include open surgery and the type of bariatric surgery performed; the non-modifiable risk factors include male gender, older age, super obesity (BMI ≥50 kg/m^2) with a history of congestive heart failure, prior coronary intervention, peripheral vascular disease, deep venous thrombosis (DVT), pulmonary embolism (PE), obstructive sleep apnea (OSA), chronic use of corticosteroids, impaired functional status, and chronic renal failure (15-17). Therefore, further studies utilizing new clinical risk-stratification systems for optimizing patient selection criteria and consequently, patient outcomes, are required. The individuals, especially females, undergoing gastric bypass surgery at ages younger than 35 years lack mortality benefit (18). Moreover, the suicide rate increases after surgery in patients, particularly in females more than 35 years of age. Hence, preoperative psychiatric analysis of patients in this population is extremely important (19). The antidiabetic benefits of surgery often wane over time. In 35-50% patients or even more, in whom remission of diabetes is eventually seen, eventually experience recurrence at later years. The highest disease-free period is seen in individuals undergoing RYGB (median duration: 8.3 years). Baseline duration of diabetes (e.g., >8 years), use of insulin, and poorer glycemic control are associated with lower rates of diabetes remission and a higher risk of relapse (20). Almost all trials reporting BS outcomes were designed retrospectively, except for SOS which was a prospective study. Although SOS study reported a lower incidence of cancer in the BS group, as compared to the control group, this result was evident only in the females and not in the males (21). Moreover, the reported reduction in risk was only for cancers likely known to be associated with obesity, and not for non-obesity-related cancers (22). Therefore, well-designed randomized prospective trials are required to aid in proper patient selection for BS. The authors suggest the use of multidisciplinary approach in order to achieve maximum benefits from BS.

Cost effectiveness of bariatric surgery

Although BS is known to have striking results in the management of obesity, the financial benefits of BS for healthcare systems have not yet been clearly demonstrated. The SOS study showed that, in the first 6 years after surgery, costs were higher for the BS patients as compared to their controls, but not thereafter. Drug costs were lower for the surgical group at the period of 7-20 years (23).

Indications for Bariatric Surgery

The careful selection of patients is crucial in obtaining successful results from BS. All patients must be followed at least 3 to 6 months ahead of the surgery in an endocrinology department and should be encouraged to lose weight prior to the surgery because even a small reduction in weight can reduce surgical complications while increasing the success of the surgery. This period can also predict which patient would benefit from the surgical procedure. If it is clear that an adequate weight loss cannot be achieved despite appropriate nonsurgical therapy, then only a BS should be opted for. In some candidates, nonsurgical therapy can result in a decrease in the patient's BMI to the extent that the patient no longer meets the BS indication. Though a majority of surgeons suggest that such a

decrease in BMI should not stop the candidate from surgery, in this situation the patient's choice should be taken into consideration. BS indications for nondiabetic and diabetic patients are shown in Tables 1 and 2 (24-26).

Issues need to be taken into consideration in patients with diabetes

1- Antidiabetic therapy: insulin secretagogues, thiazolidinediones, and insulin can often result in weight gain. Therefore, weight loss or weight neutral antidiabetic drugs (e.g., metformin, alpha glucosidase inhibitors, DPP-4 inhibitors, GLP-1 agonists and SGLT 2 inhibitors) must be preferred for treating diabetic patients whenever possible (24).
2- Patients must be enquired about their concomitant medications possibly promoting weight gain (e.g., anticholinergics, antihistamines, antidepressants, antipsychotics, anticonvulsants including gabapentin, glucocorticoids, and oral contraceptives containing progestins) and, whenever possible, they must either be stopped or changed with alternatives or their use must be minimized (24).
3- Younger age, shorter duration of diabetes, non-use of insulin, and better glycemic control are consistently associated with higher rates of remission of diabetes and/or lower risk of recurrence (20).
4- It has been reported that bariatric surgery improves the metabolic profiles and daily insulin requirements of morbidly obese patients with type 1 diabetes; however, more long term studies are required to establish the role of bariatric surgery in such patients (27).

Contraindications for Bariatric Surgery

BS should not be used only for controlling hyperglycemia or for preventing cardiovascular risk in non-obese patients. Absolute or relative contraindications of BS are shown in Table 3 (25, 26, 28-30).

Concerns and Suggestions for Bariatric Surgery

Bariatric surgery is costly and poses several potential health risks. Potential risks associated with the surgical procedure include general surgical complications such as bleeding, infection, a number of systemic problems and death. Long term risks include dumping syndrome, vitamin and mineral deficiencies, anemia, hernia, bowel obstruction, gallstones, osteoporosis, and, rarely severe hypoglycemia resulting from hypersecretion of insulin and death (31). Long-term nutritional and micronutrient deficiencies occur with a varied frequency depending on the type of surgery. Postprandial hypoglycemia most frequently occurs with RYGB. In a study, hypoglycemia occurred in 11% of the 450 patients who underwent RYGB or vertical sleeve gastrectomy (32). Patients undergoing BS may be at an increased risk for substance abuse (i.e., tobacco, alcohol, and illicit drug use) (33). Patients who undergo BS also show increased rates of depression and other major psychiatric disorders (34, 35). Hence, patients having a history of alcohol or substance abuse, significant depression, suicidal ideation, or other mental health conditions must be assessed by an experienced psychiatrist for management of obesity prior to their consideration for surgery. Patients with any preoperative psychopathology must be followed up at regular intervals after BS for the optimization of management.

Table 1. The candidates for bariatric surgery.

BMI categories (kg/m2)	Patient situation
>40	Patients without coexisting illness and for whom bariatric surgery would not be associated with excessive risk
35.0-39.9	Patients with at least one severe obesity-related comorbidity, including but not limited to T2DM, hypertension, hyperlipidemia, OSA, OHS, NAFLD or NASH, pseudotumor cerebri, GERD, asthma, venous stasis disease, severe urinary incontinence, debilitating arthritis, or considerably impaired quality of life
30.0-34.9	Patients with T2DM, metabolic syndrome, and the Asian origin may be considered for bariatric surgery*
<30	There is no evidence to support recommending a bariatric surgical procedure for the management of T2DM alone*

GERD: Gastroesophageal reflux disease; OHS: Obesity-hypoventilation syndrome; OSA: Obstructive sleep apnea; NAFLD: Nonalcoholic fatty liver disease; NASH: Nonalcoholic steatohepatitis; T2D: Type 2 diabetes mellitus.
* See Table 2.

Table 2. Treatment modalities of overweight and obese type 2 diabetic patients.

	BMI categories (kg/m^2)				
Treatment modalities	25.0–26.9	27.0–29.9	30.0–34.9	35.0–39.9	>40
Diet, exercise, and behavioral therapy	+	+	+	+	+
Drug therapy*		+	+	+	+
Metabolic surgery**			+[a]	+[b]	+[c]

* Potential benefits must be weighed against the potential risks of the drugs. If there is an absence of drug tolerance, safety or effectivity (<5% weight loss after 3 months), drug therapy should be stopped.
** Only for selected and motivated patients.
[a] It is considered for patients whose diabetes cannot be regulated.
[b] It is recommended for patients whose diabetes cannot be regulated.
[c] It is recommended for all patients regardless of glycemic regulation.

Table 3. Contraindications for bariatric surgery.

Extreme ages (<18 and >65 years)[a,b]
BMI < 40, 35 or 30[c]
Untreated endocrinological disorders (e.g., Cushing, hypothyroidism, insulinoma)
Untreated eating disorders (e.g., bulimia nervosa)
Untreated major depression or psychosis
Severe coagulopathy
Severe cardiac disease restraining anesthesia
Current drug and alcohol abuse
Inability to adhere to nutritional recommendations (e.g., life-long vitamin replacement)
Pregnancy[d]
Portal hypertension
Neoplasia
Several digestive system disorders (e.g., chronic pancreatitis[e], severe GERD[f,] Crohn[e,h])

GERD: gastroesophageal reflux disease

[a] Patients with diabetes, hypertension or other severe comorbidities in the extreme age categories may be considered appropriate surgical candidates.

[b] Functional age is more important than chronological age.

[c] See Table 1.

[d] Candidates for BS should avoid pregnancy before and 18 months after surgery.

[e] for gastric band, [f] for sleeve gastrectomy, [h] for RYGB and biliopancreatic diversion.

Preparation of Patients for Bariatric Surgery

All candidates must undergo medical, psychological and anesthetic risk assessment prior to bariatric surgery. A multidisciplinary team including an endocrinologist, a dietician, a psychiatrist, a nurse specialist and an experienced surgeon is required for overall assessment, success, and support of the patient considered for a bariatric surgical procedure. Medical assessment should include a complete history, physical examination and several laboratory tests (Table 4) (20, 25, and 26). Patients with upper gastrointestinal symptoms such as dysphagia, reflux, and pain must be evaluated using an esophagogastroduodenoscopy and an ultrasonography to detect any *H. pylori* infection, anatomical abnormalities such as a hiatal hernia and other pathologies like ulcers, polyps, masses, nonalcoholic fatty liver disease or gallstones.

Surgical Procedures

The surgical treatment of obesity was initially developed from the observation of weight loss associated with the procedures of removal of stomachs or small intestines (36). Since the last decade, the number of bariatric surgical procedures has greatly increased because of the increase in the prevalence of obesity and the recognition of benefits associated with surgery (10). The exploration of the BS began with the resection of one-meter small bowel by Henriksson *et al.* (37). Around the beginning of the year 2000, RYGB and gastric banding were the most commonly used procedures for BS (8). At the present time, sleeve gastrectomy, RYGB, gastric banding, and biliopancreatic diversion with a duodenal switch are the most common bariatric procedures, respectively (38). The bariatric surgical procedures are classified into three main categories: malabsorptive procedures, restrictive volume procedures, and mixed procedures. In general, laparoscopic bariatric procedures are preferred over open bariatric procedures due to the lower risk of early postoperative morbidity and mortality.

Malabsorptive procedures

A. Biliopancreatic diversion with duodenal switch

Biliopancreatic diversion is primarily a malabsorptive and a partially reversible procedure. Addition of duodenal switch to the biliopancreatic diversion is an adaptation of the standard procedure. It is a complex procedure and is associated with high rates of complications such as gastrointestinal side effects and vitamins and protein deficiencies. Therefore biliopancreatic diversion with duodenal switch is likely to be used only in patients with 'super obesity' (BMI above 50 kg/m^2) (39, 40).

B. Restrictive volume procedures

Sleeve gastrectomy

Sleeve gastrectomy is believed to be the most commonly performed procedure worldwide (41). In this procedure, the stomach is vertically divided to reduce its size to about 25%. It is an irreversible procedure. It has relatively fewer risks of complications due to the relatively quick operating time and the protection of anatomical configuration (40).

Gastric banding

In this procedure, an adjustable band is placed around the proximal part of the stomach to form a small pouch (9). Though it has lower rates of morbidity and mortality, yet it exhibits less beneficial effects than the other procedures. It is associated with a higher risk of need for reoperation and weight regain (42, 43).

Table 4.Preoperative medical assessment.

Complete H & P (obesity-related comorbidities, causes of obesity, BMI, weight loss history, commitment, and exclusions related to surgical risk)
Routine labs (FPG, lipid profile, kidney function, liver profile, urine analysis, prothrombin time/INR, blood type, CBC)
Nutrient screening (ferritin, B12, folic acid, and 25-vitamin D)
Cardiopulmonary evaluation (ECG, CXR, echocardiography if cardiac disease or pulmonary hypertension suspected. DVT evaluation if clinically indicated. Pulmonary function test for OSA patients.)
Sleep apnea screening (with one of the questionnaire-based methods such as STOP-Bang. Confirmatory tests, such as polysomnography only for those who are at high risk of having OSA based upon the initial screen)
Gastrointestinal evaluation (H. pylori screening in high-prevalence areas, liver, and gallbladder evaluation and upper endoscopy if indicated)
Endocrine evaluation (TSH for all patients; androgens with PCOS suspicion; exclusion of Cushing's syndrome; diagnosing type of diabetes, screening for diabetes complications, measurement of insulin reserve and A1c for diabetics)
Clinical nutrition evaluation by dietitian
Psychosocial-behavioral evaluation by psychiatrist
Documentation of medical necessity for bariatric surgery
Maintaining efforts for preoperative weight loss
Optimizing glycemic control
Pregnancy counseling
Smoking cessation counseling

CBC: Complete Blood Count; CXR: Chest X-Ray; DVT: Deep Venous Thrombosis; ECG: Electrocardiography; FPG: Fasting Plasma Glucose; H & P: History and Physical examination.

Mixed procedures

Roux-en-Y gastric bypass

RYGB is the gold standard for bariatric surgery and was the most commonly performed procedure until recently. However, currently, it has become the second most common bariatric surgical procedure (40, 44). Effects of this procedure include a reduction in stomach capacity, decreased absorption by the digestive tract, and alterations in gut hormone levels (45).

Early Postoperative Management

Postoperative care should involve a multidisciplinary team including a surgeon, an endocrinologist, a psychiatrist, a dietitian and a nurse specialized in bariatric surgical treatment. Evaluation of complete blood count, electrolyte level, renal and liver functions must be followed up every 12 h during the next 48 h and then every day for the next 3 days. Patients at a high risk of coronary artery disease should be monitored by telemetry within the first 24 h after surgery. Respiratory problems are common early postoperative complications following BS. Patients with significant comorbidities such as neuromuscular, pulmonary or cardiac problems are at a higher risk for respiratory complications; however, hypoxemia may develop in any patient (26, 46). Adequate hydration must be maintained; usually, 1.5 L of fluids must be administered per day either intravenously or orally (38). Pneumatic compression devices with subcutaneous unfractionated or low molecular weight heparin may be used for the prophylaxis of venous thromboembolism (47). Nausea and vomiting may occur and are directly correlated to the complexity of the procedure. Prophylaxis with antiemetic drugs significantly decreases the incidence of nausea and vomiting after surgery (46). In case rhabdomyolysis is suspected, serum creatine kinase level must be measured. Serum glucose levels should be monitored postoperatively in type 2 diabetic patients and hypoglycemia should be avoided in such patients (26).

As a rule, a low-sugar, clear liquid meal program can be initiated in the first 24 h, independent of the bariatric procedure performed unless an anastomotic leak occurs (46, 26). A dietician specialized in the bariatric diet should be consulted for postoperative meal initiation and progression (26). Generally, patients are discharged from the hospital at fourth to sixth days with full liquid diet. The amount of liquid intake and urine output must be self-monitored after discharge (46). A gradual diet program is implemented so that a solid diet can be tolerated by these patients at the end of 1-2 months (48). After the clear liquid diet period, the diet program is gradually progressed to full liquid diet for 10-14 days, followed by puree food for the next 10-14 days, to soft food for next 14 days and finally to regular food (Table 5) (49).

Patients should follow certain rules in staged meal progression diet program, which includes (26):

- eating three small meals during the day and chewing small bites of food thoroughly before swallowing,
- adhering to the principles of healthy eating (e.g., at least 5 daily servings of fresh fruits and vegetables),
- protein intake should be individualized according to age, gender and weight (minimal 60 gram/day protein intake and up to 1.5 gram/kg ideal body weight per day),
- the patient must keep away from concentrated sweets to reduce caloric intake, especially after RYGB to minimize the symptoms of dumping syndrome.

Nutritional follow-up is essential to obtain maximum weight loss while also avoiding macro- and micronutrient deficiencies and weight regain. Long-term vitamin and mineral supplementation must be considered to prevent micronutrient deficiencies. In all patients, vitamin and mineral supplementations consisting of a

Table 5. Gradual diet program and its timing.

Meal	Time
Low-sugar clear liquid meal	Usually, begin within first 24 h. Continue to hospital discharge (4–6 days)
Full liquid diet	10–14 days
Puree food	10–14 days
Soft food	14 days
Regular food	Usually, begin at the end of 1-1.5 month

daily dose of multivitamin should be initiated within the first month (50, 51). Recommended vitamin and mineral supplementation after BS is summarized in Table 6. Many patients may require additional micronutrient supplementation in addition to the recommended dosages. The extent and severity of micronutrient deficiency are associated with the extent and severity of disruption of normal gastrointestinal anatomy and physiology. Iron deficiency is the most common micronutrient deficiency following BS, especially in malabsorptive procedures. Vitamin D, vitamin B12, vitamin A, thiamine, and zinc are also some of the other micronutrients whose deficiencies may occur following malabsorptive surgeries. Protein malnutrition is the major macronutrient deficiency related to BS. Adequate protein intake must be provided (26, 38) to the patients.

Longterm Follow-Up

In patients with BS, lifelong follow-up visits are required. Most conditions associated with obesity (e.g., type 2 diabetes mellitus, hypertension, dyslipidemia, sleep apnea, arthritis, gastroesophageal reflux disease, and non-alcoholic fatty liver disease) either improve or resolve after surgery (38). Furthermore, various complications such as dumping syndrome, ulcers, cholelithiasis, nephrolithiasis, depression, stenosis, nutritional deficiencies and weight regain may arise in the long time (51, 52). Therefore, patients must be followed up regularly in terms of conditions associated with obesity or those that are likely to occur after BS. The frequency of follow-up depends on the performed BS. The interval of visits and parameters to be evaluated during follow are given in Table 7 (26).
The following conditions must be evaluated in cases of inadequate weight loss or weight regain (26);

- decreased patient adherence to lifestyle modification,
- use of medications likely to cause weight gain,
- development of maladaptive eating behaviors,
- psychological conditions,
- complications that may cause inadequacy of BS (e.g., pouch enlargement, anastomotic dilation, the formation of fistula in RYGB or inadequate band restriction in gastric banding).

To conclude, BS is an important treatment modality for obese patients. However, detailed preoperative assessment, appropriate postoperative management, and follow-up are essential for long term safety and success of the surgery.

Table 6. Recommended nutritional supplements after bariatric surgery.

Supplement	GB	SG	RYGB	BPD-DS
Mutivitamin plus minerals each containing iron, folic acid and thiamine (number of tablets)	1	2	2	2
Calcium citrate 1200–1500 mg/day or				
Calcium carbonate 2000 mg/day	+	+	+	+
Vitamin D at least 3000 IU titrate to >30 ng/dL	+	+	+	+
Vitamin B12 1000 µg/1–3 month im, 350–1000 µg/day oral	+	+	+	+
Iron 45–60 mg/day via multivitamin	-	+	+	+

GB: Gastric banding; SG: Sleeve gastrectomy; RYGB: Roux-en-Y gastric bypass; BPD/DS: Biliopancreatic diversion with duodenal switch.

Table 7. Long-term follow up of bariatric surgery patients.

	GB	SG	RYGB	BPD/DS
Visits (initial/interval) (month)*	1/1–2	1/3–6	1/3–6	1/3
Complete blood count (at each visit)	+	+	+	+
Lipid profile (every 6-12 months based on risk and therapy)	+	+	+	+
Urine calcium excretion (at 6 and 12. month)	+	+	+	+
Vitamin B12 (annually)	+	+	+	+
Iron studies, folic acid, vitamin D, PTH	-	-	+	+
Vitamin A (initially and annually)	-	-	optional	+
Copper, zinc, and selenium (if specific findings occur)	-	-	+	+
Thiamine (if specific findings occur)	+	+	+	+
DXA (at the second year)	-	-	+	+

GB: Gastric banding; SG: Sleeve gastrectomy; RYGB: Roux-en-Y gastric bypass; BPD/DS: Biliopancreatic diversion with duodenal switch; PTH: parathyroid hormone; DXA: Dual-energy X-ray absorptiometry,* annually after the first year.

Author Contributions

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