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ORIGINAL CONTRIBUTIONS

A Spanish Society joint SECO and SEEDO approach to the Post-operative management of the patients undergoing surgery for obesity

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Abstract

Purpose Bariatric surgery is the method of choice for the management or treatment of obesity. Bariatric surgery brings about several physiological changes in the body and is associated with set of complications. The aim of this study is to provide guidelines on post bariatric surgery management based on consensus by the Spanish society for Obesity Surgery (Sociedad Española de Cirugía de la Obesidad) (SECO) and the Spanish Society for the Study of Obesity (Sociedad Española para el Estudio de la Obesidad) (SEEDO).

Method The boards proposed seven experts from each society. The experts provided the evidence and a grade of recommendation on the selected topics based on systematic reviews/meta-analysis. A list of clinical practical recommendations levels of evidence and grades of these recommendations was derived from the consensus statements from the members of these societies.

Results Seventeen topics related to post-operative management were reviewed after bariatric surgery. The experts came with 47 recommendations and statements. The mean number of persons voting at each statement was 54 (range 36-76).

Conclusion In this consensus, we have designed a set of guidelines to be followed while managing patients after bariatric surgery. Expertise and knowledge of the clinicians are required to convey suitable considerations to the post-bariatric patients. There should also be extensive follow-up plans for the bariatric surgery patients.

Keywords Bariatric surgery · nutrition · malabsorptive techniques · pregnancy · SECO · SEEDO

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Introduction

Obesity is a global health issue with a progressive increase in the incidence rate. In 2016, World health organization has reported the obesity prevalence among adults to be 13% world-wide and 27.1% in Spain [1]. Obesity is associated with several co-morbidities that increase the disease burden and lead to mortalities in obese patients.

Bariatric surgery is an effective long-term treatment for treating obesity [2]. The annual incidence of bariatric surgeries in Spain was reported to be 6000 cases in 2011 and the number is gradually increasing every year. According to National registry of Spain, from 2010 to 2014, the most common type of bariatric surgery is Roux-en-Y gastric bypass (RYGB 42.6%), followed by sleeve gastrectomy (SG 39.6%). The other types of bariatric surgeries such as duodenal switch (DS 11.4%), single anastomosis duodenal ileal with sleeve (SADI-s), and BPD are also performed in smaller percentages [3– 4].

Despite the success of bariatric surgeries in yielding the intended results, they also cause numerous physiological changes and nutritional deficits in the body, which requires an integrative long-term follow-up [2]. It is important for the health care professionals to follow several evidence-based recommendations to address the multifaceted problems in managing a patient after bariatric surgery.

The aim of this article is to provide clinical guidelines for post bariatric surgery management based on a consensus coordinated by the Spanish society for Obesity Surgery (Sociedad Española de Cirugía de la Obesidad) (SECO) and the Spanish Society for the Study of Obesity (Sociedad Española para el Estudio de la Obesidad) (SEEDO).

Methodology

The executive board members from SECO and SEEDO decided to promote a Spanish consensus document in order to standardize guidelines for the management of postoperative patients undergoing bariatric surgery. The boards proposed seven experts from each Society. The experts were coupled in groups of two, and each group provided the evidence and a grade of recommendation on the selected topics based on systematic reviews/meta-analysis. First level information about nutritional management, micronutrients supplementation, management of comorbidities, pharmacotherapy after bariatric surgery, pregnancy after bariatric surgery, psychological aspects as well as weight regain prevention and management were derived from current evidences and existing guidelines. A short list of clinical practical recommendations was derived from the consensus statements from the members of these societies. The levels of evidence and grades of these recommendations were also reported. The degree of recommendation and evidence were as per the Oxford classification (Table 1). All statements and recommendations were reviewed 2 times by all experts. The statements regarding the topics were then voted at the general meeting coordinated by both societies in 2017 by all present members of all societies. In order to accept the statement, more than 80% of votes in favour were necessary. The statements that did not receive the minimal % for acceptance, were reviewed by all experts to understand the reason and considered for a reformulation. This article does not contain any studies with human participants or animals performed by any of the authors. Informed consent statement does not apply to this article.

Results

All the fourteen members reviewed 17 topics related to postoperative management following bariatric surgery and gave 47 recommendations and statements. All statements were reviewed by all members. All statements were then submitted to the voting process of all members during the consensus SECO-SEEDO session at the annual joint meeting. Only 2 statements did not receive a minimal accepting vote >70% (Recommendation number 5, Table 2) (micronutrient Supplements) and (Recommendation number 2, Table 7) (Systematic image tests in asymptomatic illness). These two statements were reviewed by experts and corrected. The mean number of persons voting at each statement was 54 persons (range 36-76).

Discussion

Micronutrient supplements

Nutritional deficiencies including vitamin and mineral deficiencies are the most common complications after bariatric surgery [5]. The reasons for nutritional deficiency is multifactorial, including previous deficit, decreased intake, alteration in absorption or the presence of complications like stenosis, poor adherence to supplementation, alcohol consumption or drugs. The members of this clinical consensus agreed that evaluation of the nutritional status of minerals and micronutrients for preventive supplementation using polyvitamin preparation should be done in all patients undergoing bariatric surgery (Table 2) [6–9]. The details of clinical practical recommendations on micronutrient supplements after bariatric surgery is given in Table 2 along with the degree of recommendation and evidence.

Table 1 Level of evidence according to Centre for Evidence Based Medicine (CEBM) from Oxford

Recommendation degree	Level of Evidence	Type of study
A	1a	Randomized control trial (RCT) systematic review (homogeneous among them).
	1b	Individual RCT (with a narrow confidence interval).
	1c	Clinical practice (all of them or none).
B	2a	Systematic revision of the cohort studies (homogeneous).
	2b	Cohort individual Studies / individual RCT of low quality Outcomes research.
	2c	Ecological studies.
	3a	Systematic review of cases and controls (homogeneous).
	3b	Individual study of cases and controls.
C	4	Set of cases, cohort /cases studies and controls of low quality
D	5	Expert opinion based on no systematic revision of results or on pathophysiologic design

Thiamine Clinical deficiency of thiamine has been observed in patients with impaired food intake or persistent vomiting in the post-surgical period [5]. It is recommended that all patients receive thiamine supplementation as part of the multivitamin complex.

Iron Iron deficiency and iron deficiency anaemia are very frequent after bariatric surgery (35-50% and 20-30% respectively), especially in women of child bearing age [10]. It is predisposed by the reduced iron intake, alterations in gastric pH, decreased absorption and increased blood loss (e.g. menstruation) [11]. Iron should be included in the polyvitamin preparation in the recommended dosage (Table 2).

Folic acid The prevalence of folic acid deficiency after bariatric surgery is variable. A systematic review of the literature has shown an increase in the prevalence of folate deficiency

Table 2 List of recommendations for micronutrient supplements in post-bariatric management

S/No	Recommendation	Level of evidence and degree of recommendation *
1	The nutritional status of minerals and micronutrients should be evaluated in all patients, before and periodically after bariatric surgery (BS).	2b, B
2	Preventive supplementation with minerals and micronutrients should be followed in all patients undergoing bariatric surgery, adapted to the surgical technique, patient's clinical characteristics. All possible micronutrient deficiencies must be treated specifically.	2b, C
3	Polyvitamin that provides vitamins and trace elements should be advised in all patients undergoing bariatric surgery.	2b, B
4	Thiamine supplementation should be followed in all patients after surgery. In patients with poor oral tolerance or who require nutritional support, thiamine should be administered at high doses (50-100 mg / day).	3b, C
5	Oral iron supplementation should be followed BS, adapted to the type of surgery and the patient's clinical characteristics.	2a, B
6	Folic acid supplementation should be followed at a dose of 400 mg / day, as part of the polyvitamin supplement.	2a, B
7	All patients should be supplemented with vitamin B12. Intramuscular administration (1000mcg / 1-3 months) is the most recommended regimen, although the oral route (> 350-500 mcg / day) can also be effective.	2a, B
8	A calcium intake of 1200-1500 mg/day should be administered (2000 mg / day after DBPD-DS), in the form of food or supplements.	2b, B
9	The nutritional status of vitamin D should be evaluated in all patients and the dose of Vitamin D necessary to maintain plasma levels above 30 ng/ml should be administered.	1b, B
10	The nutritional status should be evaluated and vitamin A supplementation should be followed. Evaluation of vitamins E and K, should be done in patients undergoing techniques with a significant malabsorptive component.	2b, C
11	Evaluation of the nutritional status of zinc and copper (and selenium if available) should be done and a preventive supplementation should be followed	2b, C
12	Micronutrient supplementation should not be discontinued after BS	5, D

after bariatric surgery [12]. Folic acid supplementation was recommended as part of the polyvitamin supplement.

Vitamin B12 Vitamin B12 deficiency is frequent after BS (26-70%) [13], especially after gastric bypass procedures (RYGB) [14]. Intramuscular administration of vitamin B12, is the most recommended regimen compared to oral supplementation due to decreased availability of intrinsic factor (IF) post-bariatric surgery [15, 16].

Calcium Gastric resection, exclusion of the first tracts of the small intestine and steatorrhea decrease the absorption of calcium after bariatric surgery [16]. Dietary intake is insufficient to meet the recommendations [6, 10]. A supplemental calcium intake of 1200-1500 mg/day after bariatric surgery is recommended [7–9].

Vitamin D Vitamin D deficiency is common and occurs frequently after RYGB and especially after DBP [17, 21]. In general, a minimum of 2000-3000 IU/day and higher doses (up to 50,000 IU per week) in DBP5 is recommended [9].

Vitamin A Vitamin A deficiency is usually observed after malabsorptive techniques, such as DBP or DS [5], reaching an incidence of 60% [7] and may have clinical consequences. Deficiencies of vitamin E and vitamin K after DBP and DS have also been described, usually asymptomatic [18, 19].

Other micronutrients The deficiency of zinc and copper is frequent after malabsorptive bariatric surgery (DBP) [22], and it is usually asymptomatic. Supplementation with zinc decreases the absorption of copper. Selenium deficiency after bariatric surgery has also been described [23, 25–27, 29].

There are no studies that have specifically evaluated how long it is necessary to maintain systematic preventive supplementation after the different bariatric surgery techniques or if it is possible to suspend it in a safe manner [20, 24].

Diet

It is recommended to introduce a liquid diet at hospital (protein supply between 40-60 g/day) discharge for 1-2 weeks followed by crushed or semi-soft diet for 2 weeks (Level of evidence 4, grade of recommendation C). Progress should be made with in 6-8 small doses of crushed diet based on purees (120-150 ml) distributed throughout the day [28]. This progressive diet aims for the patient to adapt to the capacity of the new gastric reservoir, without experiencing digestive discomfort. The patients can start with a solid diet that provides between 60-120 g of protein/day to maintain lean mass during weight loss from 4 weeks post-surgery to prevent protein malnutrition [30–35] (Table 3).

Monitoring and cadence of visits

During the first months of the postoperative period, a relatively frequent follow-up is recommended with the multidisciplinary team (Table 4). Early endocrinological follow-up should be necessary in case of comorbidities such as diabetes, hypertension or dyslipidemia. In the long term, the primary health care team can play an important role in the adequate assignment to substitution treatment, and in the assessment of patients who have left the follow-up [35–37] (Table 4).

Weight management through exercise and analytics for monitoring the patients

Recent evidence from exercise interventions following bariatric surgery suggests that exercise may provide further improvements in metabolic health, compared to surgery induced weight loss alone (Table 5). Patients should incorporate moderate aerobic physical activity that includes a minimum of 150 minutes per week. Patients undergoing surgery for obesity, depending on the technique used, require different investigations periodically (Degree of Recommendation, 4C). The detailed recommendation for the investigations is given in [40–42] Table 5.

Withdrawal of co-morbidity medication

Obesity-related co-morbidities usually improve following bariatric surgery, requiring frequent modifications in medications.

Diabetes mellitus (DM) In the first six months post-surgery, glycemic control should be closely evaluated to reduce drugs for diabetes (Level of evidence 5 grade of recommendation D). It is recommended to avoid the drugs that cause hypoglycemia (Metformin, DPP4 inhibitors, GLP-1 analogues, SGLT-2 inhibitors). Patients who are on insulin before surgery should be evaluated for a possible reduction of the dose after surgery [38, 39].

Arterial hypertension (HT) High blood pressure (HBP) is a common comorbidity in patients with obesity. Clinical guidelines advise that first-line pharmacological treatment for hypertension should include a renin-angiotensin-inhibiting drug (angiotensin receptor blocker or ACEI). Clinical follow-up is needed in the immediate postoperative period, as blood pressure decreases from the first few days after surgery and treatment should be modified or suspended if needed. In the medium and long term, it is necessary to re-evaluate the patient, especially with other vascular risk factors (Level of evidence 3 grade of recommendation C) [46, 47].

Table 3 List of recommendations for dietary supplements following bariatric surgery

S/No	Recommendation	Level of evidence and degree of recommendation
1	Liquid diet should be introduced at hospital discharge for 1-2 weeks.	4, C
2	Progress should be made with a crushed or semi-soft diet for 2 weeks.	4, C
3	Solid diet should be introduced after 4 weeks of surgery that provides between 60-120 g of protein/day to maintain lean mass during weight loss.	2a, B

Dyslipidemia Improvements in serum lipid levels after bariatric surgery are multifactorial in nature (absorption, dietary pattern) and not only attributable to weight loss. Lipid-lowering medications should not be withdrawn unless clearly indicated, considered unnecessary or impossible due to gastrointestinal symptoms and patient's risk history prior to surgery (for example, ischemic heart disease or type 2 diabetes mellitus) [43].

Evaluation and treatment of frequent gastrointestinal symptoms

Vomiting Vomiting is one of the main complications after bariatric surgery. In many cases, they translate dietary transgressions of the patients, but they can also be due to the surgical techniques performed [116]. In all cases, it is necessary to have imaging tests for evaluation and the most important evaluations are esophagogastric transit and upper digestive endoscopy (Table 6).

Abdominal pain Abdominal pain may occur after ingestion in those patients who do not adapt to the necessary changes in their eating habits after the modification of the anatomy. It is necessary to rule out other causes and influence on correct eating habits in the patient [44, 45] (Table 6).

Cholelithiasis The incidence of cholelithiasis in the operated obese patient ranges from 30-53%, and is related to rapid weight loss [48–52, 94] (Table 6). The hypomotility of the gall bladder and the supersaturation of cholesterol in the bile, induce the increase of its incidence. Ursodeoxycholic is a secondary bile acid that reduces the saturation of cholesterol in the bile, especially in obese patients. Multiple studies have shown that the administration of Ursodeoxycholic during rapid weight loss, either after surgery or with a very low calorie diet, significantly reduces the appearance of cholelithiasis [48–53, 59]. Ursodeoxycholic prophylaxis should be indicated in patients without cholelithiasis as a prophylaxis (Table 6).

Marginal ulcer or anastomotic mouth Marginal ulcer is a specific complication of the techniques with gastro-jejunal/ileal anastomosis. The use of PPI / Anti-H2 is recommended for the prophylaxis of marginal ulcer during the first post-operative year in biliopancreatic diversion (BPD), and in the RYGB between 3-6 months, especially in those patients with associated risks [54, 96–99, 105] (Table 6).

Internal hernia It can manifest itself as a pattern of intermittent abdominal pain or acute obstruction, frequently associated with significant weight loss. Early laparoscopy is suggested in case of confirmation or explorer if there is a high clinical suspicion not confirmed in the imaging tests [56–59] (Table 6).

Erosion or migration / gastric band slip In gastric band patients with epigastralgia, associated or not with vomiting, migration should be ruled out, as well as its erosion in the gastric cavity. Recommended treatment is to deflate and to remove the band by laparoscopic / endoscopic approach, scheduled or urgent depending on the patient's condition [63, 69] (Table 6).

Table 4 List of recommendations for monitoring and cadence of visits

S/No	Recommendation	Level of evidence and degree of recommendation
1	Follow-up should be done with the multidisciplinary team (Surgeon, endocrinologist, nutritionist) at 10 -15 days of discharge, a month, and then 3, 6, 12, 18 and 24 months after the intervention, to continue later every year. Early endocrinological follow-up should be necessary in case of comorbidities such as diabetes, hypertension or dyslipidemia.	4, C
2	Nutritional follow-up should be more frequent in case of difficulty in the progression of the successive phases of the diet, in case of intolerance to some foods, or to improve the adequate speed of intake or chewing.	4, C

Table 5 List of recommendations on weight management through exercise and analytics for monitoring the patients

S/No	Recommendation	Level of evidence and degree of recommendation
1	Patients should incorporate moderate aerobic physical activity that includes a minimum of 150 minutes per week, although preferably 300 minutes per week should be achieved.	5, D
2	The following tests should be done in BPGYR, GV and DBP / CD: Glucose, creatinine, sodium, potassium, Complete blood count, ferritin, vitamin B12 and folic acid, Calcium, 25 (OH) -vitamin D3, PTH and alkaline phosphatase, Albumin, prealbumin and transferrin. Biochemical liver: GOT, GPT, GGT, Lipidic profile: total cholesterol, HDL, LDL and triglycerides, Zinc, and magnesium.	4, C
3	These tests should be done pre-bariatric surgery, and should be followed up in the 1st year (months 1, 3, 6 and 12 months), 2nd year (every 6 months), and subsequently every 12 months.	4, C

Systematic image tests in asymptomatic illness

Esophago gastro duodenoscopy (EGD) or computerized tomography (CT) During postoperative follow-up, EGD or computerized tomography CT is usually used for the early diagnosis of complications in the initial post-operative days. In cases of weight regain, an imaging test help in diagnosis, such as a redundant fundus in a SG or a reservoir or dilated anastomosis in a RYGB. Therefore, the performance of imaging tests during the postoperative period should be reserved only for cases of clinical suspicion of complications (pain, vomiting, gastroesophageal reflux) and in cases of weight regain or insufficient weight loss [60–62, 70, 71] (Table 7).

Table 6 List of recommendations for evaluation and treatment of frequent gastrointestinal symptoms

S/No	Recommendation	Level of evidence and degree of recommendation
1	Imaging tests are recommended to study vomiting in all cases, important studies are esophagogastric transit and upper upper gastrointestinal endoscopy. Depending on the surgical technique, the complications to be ruled out vary and their approach also.	5, D
2	Abdominal pain may occur after ingestion in those patients who do not adapt to the necessary changes in their eating habits after the modification of the anatomy. Both in the BPGL and in the GTL an excessive intake or in a short interval of time, can cause pain. It is recommended to rule out other causes and influence on correct eating habits in the patient.	5, D
3	Prophylaxis with Ursodeoxycholic Acid at a daily dose of at least 600 mg / day reduces the formation of biliary lithiasis after bariatric surgery, as well as the need for cholecystectomy. The cost-effectiveness of this measure is yet to be determined	1a, A
4	The incidence of cholelithiasis in the operated obese patient ranges from 30-53%, and is related to rapid weight loss. 7-10% require cholecystectomy due to biliary pathology, mainly biliary colic and cholecystitis. Diagnosed by history and abdominal ultrasound and treated by laparoscopic cholecystectomy.	2a, B
5	Marginal ulcer is a specific complication of the techniques with gastro-jejunal / ileal anastomosis. In the BPG the incidence varies between 0.8-16%. The etiopathogeny is multifactorial: reservoir size, NSAIDs, tobacco, DM and Helicobacter pylori.	2a, B
6	The use of PPI / Anti-H2 is recommended for the prophylaxis of marginal ulcer during the first postoperative year in BPD, and in the BPG between 3-6 months, especially in those patients with associated risk factors	3a, C
7	The diagnosis of marginal ulcer is made by endoscopy and the treatment is to eliminate the possible risk factors (eradicate HP if +) and initiate intensive treatment with proton pump inhibitors (PPI, associated or not with sucralfate). There is a risk of perforation, and in cases of recurrent or intractable ulcers, surgery is necessary.	2a, B
8	Internal hernia may manifest as intermittent abdominal pain or acute obstruction, frequently associated with significant weight loss.	1a, A
9	For the diagnosis of internal hernia, there must be a high clinical suspicion and the recommended imaging study is CT.	3b, C
10	The recommended treatment is early laparoscopy in case of confirmation or explorer if there is a high clinical suspicion not confirmed in the imaging tests.	2c, C
11	In gastric band patients with epigastralgia, associated or not with vomiting, migration should be ruled out, as well as its erosion in the gastric cavity. The diagnosis is made by simple abdominal radiography, esophago-gastro-duodenal transit, CT with oral contrast and upper digestive endoscopy. The treatment is to deflate and remove the band by laparoscopic / endoscopic approach, scheduled or urgent depending on the patient's condition.	2b, B

Postoperative endoscopy Endoscopy can be a feasible and safe option for management of postoperative complications. At present, endoscopy is not recommended in asymptomatic patients and is reserved for cases with complications as a diagnostic and therapeutic tool in the anastomotic leak **(Level of evidence 3A, grade of recommendation B)** [72–79]**.**

Body composition and bone mineral density

The study of body composition to evaluate weight loss is useful to know to what extent it has occurred in terms of fat mass (% FAT) or fat-free mass (% FFM), although its use has not been standardized in daily clinical practice (Table 7). Bariatric and metabolic surgery is associated with decrease in bone mineral density leading to increased risk of fractures. Bone mineral density should be assessed in the case of known osteoporosis prior to surgery, and annual assessment is recommended in patients with high risk factors, like postmenopausal women [64–68, 80–82] (Table 7).

Measurement and definition of weight loss

To define the changes in weight loss, it is proposed to use the percentage of excess weight loss (PEPP, also called percentage of overweight lost or PSPP): PEPP = [(initial weight-current weight) / (initial weight-ideal weight)] x 100. The weight loss should also be able to be expressed as a change in the BMI, taking as reference BMI of 25 Kg / m2. The percentage of excess BMI lost (also called Percentage Excess BMI Lost,% EBMIL) is calculated by the formula: **% EBMIL = [(Initial BMI - Current BMI) / (Initial BMI - 25)] x 100 (Grade of recommendation: C-D).**

In relation to weight recovery or weight gain after treatment for obesity, there is no unanimity. From an empirical point of view in the treatment of obesity if a loss between 5-10% is considered significant to change the expression of comorbidities. It may be a good approximation in many patients to predict an insufficient weight loss, although there is no consensus regarding the validity of these formulations in different populations. Insufficient loss is considered if 50% of the excess weight lost (% EWL) is not reached, according to most publications on the subject. Regarding weight gain, there is no agreement or unanimity of criteria in publications. There is no agreement or unanimity of criteria in the publications regarding this topic [83–93] **(level of evidence 5, grade of recommendation D).**

Motives for revisional surgery

Revision surgery following bariatric surgery can be technically challenging, but it can offer the patient a wide variety of solutions for the treatment of weight reoccurrence and complications after primary operations. Few studies suggest revisions after bariatric surgery, for treating persistent obesity, comorbidities, and complications. [100–103, 106–108, 110, 114] **(Level of evidence 4, grade of recommendation C).**

Table 7 List of recommendations for performing systematic image tests in asymptomatic illness, body composition technique, bone mineral density technique, and postoperative endoscopy

S/No	Recommendation	Level of evidence and degree of recommendation
1	The routine use of imaging tests like CT, EGD, endoscopy in the postoperative patient with favorable evolution is not recommended. They are recommended in case of clinical suspicion of complication.	5, D
2	At present, endoscopy is not recommended in asymptomatic patients in the postoperative period. The role of endoscopy is reserved for cases with complications as a diagnostic and therapeutic tool in the anastomotic leak.	3a, B
3	The study of body composition to assess the loss of weight is useful to know to what extent it has occurred at the expense of fat mass (% FAT) or fat-free mass (% FFM), although its use has not been standardized in daily clinical practice.	2b, B
4	The most accurate methods (DEXA, air displacement plethysmography or hydrostatic weight) are expensive and reserved for clinical trials.	2, B
5	Bioelectrical impedance (BIA) is an inexpensive way to measure changes in body composition, but may give imprecise results, so the results obtained should be taken with caution.	3-4, C
6	The determination of body composition is not a necessary or mandatory exploration in the follow-up of patients undergoing bariatric surgery, so it is not routinely recommended. If done, it is recommended at 3, 6 and 12 months after surgery.	4, D
7	Bone mineral density is recommended in case of known osteoporosis prior to surgery, in patients with risk factors for osteoporosis, and in postmenopausal women. This is especially important in case of malabsorptive techniques. For patients in follow-up after restrictive techniques, the recommendations to perform a bone densitometry would be similar to the general population. If indicated, it is recommended to perform it annually after surgery, and in case of a decrease in bone mineral density, to propose specific treatment.	3a, B

Table 8 List of recommendations for motives for revisional surgery

S/No	Recommendation	Level of evidence and degree of recommendation
1	The causes for corrective surgery should be investigated in the patient during follow-up and should be subsidiary of surgical management.	4, C
2	It is recommended that after failed restrictive procedures, the review is recommended only in cases of complications and not in cases with adequate weight loss at the time of failure.	4, C
3	Severe malabsorption with malnutrition, mainly by malabsorptive procedures (biliopancreatic diversion, duodenal crossing, jejuno-ileal bypass) is an important cause of revision surgery.	4, C
4	The treatment of acute or chronic complications after obesity surgery should be according to a multidisciplinary management, and in reference centers where complications can be treated.	4, C

The revision surgery could be classified as conversion, inversion, and corrective surgery [104]. The conversion surgery that would be defined in converting an obesity surgery procedure into another procedure. Examples of conversion interventions include transforming an adjustable gastric band into a vertical gastrectomy or gastric bypass, a vertical gastrectomy to a gastric bypass. The inversion surgery is defined as the procedure that restores normal anatomy like the conversion of a Roux-en-Y gastric bypass to a normal anatomy [85].

The corrective surgeries are those that correct a defect that has occurred or appeared secondary to the previous intervention, but without modifying the technique that has the patient with his anatomy. Correction reasons are the appearance of reflux after vertical gastrectomy or adjustable gastric band, the appearance of abdominal pain in the context of a gastric bypass carrier, the appearance of intestinal occlusion, the appearance of marginal ulcer or the appearance of gastro fistula, cholelithiasis in the follow-up, the appearance of trocar hernia or the midline, the closure of the mesenteric eyelets, and the repositioning of the porth-a-cath in the patient carrying an adjustable gastric band. These causes should be investigated in the patient during follow-up and should be subsidiary of surgical management [86–90, 95, 104] (Table 8).

Severe malabsorption with malnutrition, mainly by malabsorptive surgical procedures (is another cause of revision surgery. **(level of evidence 4, grade of recommendation C)** (Table 8). In general, bariatric revision surgery can be performed with minimal mortality, although significant morbidity [106, 109] (Table 8).

Gestation after bariatric surgery

In general, it is recommended that during the preconceptional period, adequate contraception must be maintained as oral contraceptives may be inefficient after bariatric surgery. It is recommended to avoid pregnancy during the first 12-18 months or at least until the correction of possible nutritional deficiencies. It is recommended to maintain the polyvitamin supplement prior to pregnancy and add specific supplementation with Folic acid and potassium iodide [16, 17, 111, 112] (Table 9).

Several studies have shown that pregnancy after bariatric surgery is safe and is associated with a lower risk of maternal and fetal complications, such as gestational diabetes (GD), preeclampsia and macrosomia as compared to the gestation

Table 9 List of recommendations for pregnancy after bariatric surgery

S/N	Recommendation	Level of evidence and degree of recommendation
1	It is recommended that follow-up and planning be carried out in patients with BS and with gestational desire to avoid possible complications.	2a, B
2	It is recommended to avoid pregnancy during the first 12-18 months after bariatric surgery or at least until the weight loss stabilizes and correction of possible nutritional deficiencies.	5, D
3	It is recommended to conduct a clinical and analytical follow-up protocol during pregnancy and lactation post BS.	5, D
4	It is recommended to evaluate the nutritional status and perform a micronutrient supplementation during pregnancy after BS to prevent the development of deficiencies.	4, C

of obese women not operated on. However, there is an increased risk of early fetal loss, small new-borns for gestational age, preterm delivery and internal hernia during pregnancy after bariatric surgery [1, 6]. Despite the risk of additional nutritional deficiency, breastfeeding is recommended with clinical and analytical follow-up (Table 9).

Quality of life monitoring test

Quality of life is influenced by digestive disorders caused from the techniques used in bariatric surgery (intolerance to food, diarrhoea), self-esteem, and the psychosocial impact of the intervention.

To evaluate the quality of life in obesity independently of surgery, it is recommended to use 'Quality of Life Questionnaire on Obesity-Lite' (Impact of Weight on Quality of Life-Lite, IWQOL-Lite). This tool is composed of 31 self-reported items, and evaluates five domains: physical state (11 items), self-esteem (7 items), sexual life (4 items), anxiety in public (5 items) and work (4 items). Each question is rated between 1 ("never true") and 5 ("always true"), and provides a global score and on each of the scales. Higher scores are associated with better quality of life. The use of tools like the Moorehead-Ardelt quality of life test or the Impact of Weight on Quality of Life-Lite (IWQOL) is routinely recommended in patients undergone bariatric surgery [113, 115] **(level of evidence 4, grade of recommendation D)**.

Conclusion

The design and incorporation of guidelines for the pre-and post-management of bariatric surgery has resulted in increase in the frequency of use of this surgical approach in the management of obesity. Although bariatric surgery is safe and effective but it sometimes leads to clinical complications and hence there is a constant need for the establishment of guidelines to manage the patients post surgically. Expertise and knowledge of the clinicians are required to convey suitable considerations to the post-bariatric patients. There should be extensive follow-up plans for the bariatric surgery patients.

Compliance with ethical standards

Conflict of Interest Statement All authors have no conflicts of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors and hence ethical approval and informed consent statement did not apply in the article.

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