



Systematization of Nutritional Care In Endoscopic Treatment for Obesity

Maria Paula Carlini Cambi¹ · Giorgio A. P. Baretta¹ · Maurício Spagnol² · Roberto Zilio³ · Carina Rossoni^{3,4} 

Published online: 8 January 2019

© Springer Science+Business Media, LLC, part of Springer Nature 2019

Abstract

Purpose Propose the systematization of nutritional care in the endoscopic treatment of obesity.

Method This is a bibliographical review, since the initial proposal was a systematic review. This method became unfeasible due to the inexistence of studies that address this theme. Thus, a bibliographic survey was carried out, considering the endoscopic treatment as a restrictive treatment, as well as the information referring to case reports and multicentric studies.

Results Nutrition participation involves nutritional assessment and diagnosis, dietary planning pertinent to the adequate evolution of food consistency, as well as the use of food supplements compatible with the Gastric Sleeve due to food restriction. The Bariatric Plate Model (BPM) can be useful in the nutritional education of the patient after gastric endosuture, associated with water consumption and the performance of scheduled physical exercise, as well as periodic monitoring with the multiprofessional team.

Conclusions Specialized nutritional care is necessary, through a protocol of nutritional assistance defined after gastric endosuture, in order to achieve long-term weight loss and maintenance goals. The BPM can be an excellent form of nutritional education, observing protein intake as a macronutrient base.

Keywords Obesity · Nutritional education · Gastric sleeve · Gastric endosuture · Intra-gastric balloon · Recurrence of weight · Bariatric plate model

Introduction

Obesity is a chronic and inflammatory disease that requires continuous treatment to control its comorbidities such as cardiovascular diseases, musculoskeletal disorders, and type II diabetes [1].

The criteria for diagnosis and treatment of obesity are very well set and presented in the Brazilian Guidelines [2]. In morbid obesity, the most effective treatment is bariatric and metabolic surgery. However, for individuals with obesity grades I and II, there is a gap for these patients when clinical and

pharmacological treatments fail or have reached their level [3]. Given this context, new treatments for obesity are proposed. Among them, the gastric endosuture, which is an endoscopic treatment that decreases the size of the stomach through numerous plications made by the bariatric endoscopist. It is irreversible, but made in a way that does not prevent future bariatric surgery procedure. It can reduce 15 to 20% of the weight on average. The patient is released on the same day of the procedure with the relevant nutritional guidance [4]. The weight loss achieved by the current endoscopic procedure, although not proportional to surgical therapy, may allow filling of

✉ Maria Paula Carlini Cambi
mpcarlini@hotmail.com

Giorgio A. P. Baretta
giorgio.baretta@gmail.com

Maurício Spagnol
mspagnol@gmail.com

Roberto Zilio
rzilio@hotmail.com

Carina Rossoni
carina.rossoni@unoesc.edu.br

¹ Clinic Dr Giorgio Baretta, Street Alameda Princesa Izabel, 2559 - Bigorilho, Curitiba, PR 80730-080, Brazil

² University Community of the Region of Chapecó, Unoesc, Bondage Anjo da Guarda, 295-D, Efapi, Chapecó, SC 89802-120, Brazil

³ University of Western Santa Catarina, Unoesc, Street Getúlio Vargas, 2125 - Flor da Serra, Joaçaba, SC 89600-000, Brazil

⁴ Postgraduate Program in Biosciences and Health, Unoesc, Street Getúlio Vargas, 2125 - Flor da Serra, Joaçaba, SC, Brazil

this treatment gap, perhaps the most reasonable in patients with in the BMI range from 30 to 35 kg/m². What is unique in this endoscopic procedure is that it can be conveniently replicated along a patient's journey in managing obesity. This endoluminal procedure allows the convenient revision, triggered by the weight gain and, more importantly, by the increase of the accommodation of the meal volume, which may suggest a break in the plicature [5, 6]. This is an important concept to consider. These 6-month pilot results, coupled with the existing safety profile of endoscopic sleeve gastroplasty, suggest that this procedure can serve as an early bariatric intervention, allowing physicians to treat their obese patients in a safe and less invasive manner, which may allow treatment of a larger segment of the obese population [4].

The intragastric balloon (IGB), which is a silicone device that is introduced into the stomach by endoscopy and inflated with methylene blue, can be used in two different versions: one lasting 6 months with the same volume and one with duration of 12 months with possibility of reinsufflation during the course of the year. The description of about 90% of patients with balloon is pain sensitivity, as well as nausea and vomiting in the first 2 days after the placement of the IGB [5–8].

Periodic nutritional monitoring for the treatment of obesity, whether clinical, endoscopic, or surgical, is essential for satisfactory long-term results. This care is necessary for food education and for monitoring nutritional status in special situations of nutrient deficiencies, gestation, advanced age/elderliness, prevention of weight relapse and all other conditions involving the operated patient [7].

The purpose of this research is to propose the systematization of nutritional care in the endoscopic treatment: gastric endosuture and intragastric balloon.

Method

This is a literature review, since the initial proposal was a systematic review. This method became unfeasible due to

the inexistence of studies that address this theme. Thus, a bibliographic survey has been performed considering endoscopic treatment as a restrictive treatment, as well as information regarding case reports and multicenter studies.

Development

Gastric Endosuture

Gastric endosuture is a less invasive endoscopic procedure than the traditional gastric sleeve and aims to plicate the gastric curve. The patient is anesthetized with orotracheal intubation and an Over StitchTM flexible endoscopic suture system is used, from Apollo Endosurgery Inc., Austin, TX, USA, which is created in a double channel of the endoscope, placed through the esophageal tube (US Endoscopy, Mentor, OH, USA), with insufflation of carbon dioxide gas [9]. This procedure reduces the gastric lumen within the tubular configuration, with increased modification of the curvature by the suture line that is made distal and proximal. Each suture consists of several points in the anterior and posterior part of the stomach. They are not continuous lines and may form a slit along the plicature. This cleft does not bring clinical complications.

Indication criteria for this procedure: patients with a body mass index (BMI) above 30 who could not maintain weight loss with another method, such as clinical treatment, diet, physical exercises, and medications; patients with BMI above 30 who do not have bariatric or non-bariatric surgery conditions; patients who failed treatment with gastric balloons; and patients who want a more effective treatment to support long-term weight loss than gastric balloon, regain weight after gastric sleeve or gastric bypass (wide pouches and dilated anastomoses) [5, 6, 8].



Gastric endosuture is an effective form of weight loss, but for long-term results, food quality should be prioritized, as the volumetric capacity of the stomach is reduced and requires nutritious foods to supply it. There is a natural change in the food profile of the operated person with decreased intake of sweets in general (highly palatable and energetic), and increase in the consumption of hyperproteic foods [10]. The day-to-day operation of the surgery should be simplified with a more easily understandable way of composing the daily meals. Therefore, the need to demonstrate through the composition of BPM (Bariatric Plate Model), how to plan your plate from the first meal to the last of the day and how important are the nutrients in the choices that the patient will make [11, 12].

Intragastric Balloon (IBG)

IBG is an endoscopic method for the treatment of obesity, indicated for BMI > 27 kg/m². Caloric restriction is important in this process, but behavioral changes are the determining factor for better results [7]. IBG aids in weight loss during the period of its stay in the stomach, providing satiety and gastric fullness. The IBG can be inflated with a volume from 600 to 700 ml, according to the person's stomach anatomy [5, 7].

Nutritional Treatment for Endoscopic Procedures in the Treatment of Obesity

Nutritional Assessment

Multidisciplinary attention is of utmost importance for all treatments involving obesity including gastric endosuture. The first contact with the nutritionist should be with the accomplishment of a complete anamnesis that involves objective and subjective

parameters of analysis. The intent is to identify patients at increased risk of presenting complications and to monitor the efficacy of dietary intervention (Table 1).

Nutritional Diagnosis

Detect and treat specific previous nutritional deficiencies that are common in the obese patient such as iron deficiency anemia, megaloblastic anemia, and water-soluble vitamin deficiency such as C are a purpose of this assessment. After thorough examination of all objective and subjective methods, we can conclude about the nutritional diagnosis, the degree of obesity, the nutritional condition of food acquisition and preparation and its ability to modify eating habits and thus elaborate the treatment plan [16].

Dietary Planning

After undergoing treatment, the patient will be released on the same day and will follow the feeding evolution at home (Tables 2 and 3).

Nutritional Monitoring

Gastric Endosuture The monitoring of nutritional status should occur quarterly in the first year and, thereafter, one to two times per year. At each visit, the evolution of body weight, records of daily food intake, digestive tract function, and biochemical tests should be evaluated [13–15].

The process of food re-education for the patient who undergoes the gastric endosuture is fundamental and must be started from the first consultation with the nutritionist. The Bariatric Plate Model (BPM) is a simple form of nutritional guidance because it aims at the greater goal of the patient, which is their understanding of the reality of daily consumption. BPM is a simple tool to demonstrate to the patient the

Table 1 Nutritional assessment parameters for endoscopic treatment

Subjective methods	Objective methods
<p>Clinical history: body weight, changes in food intake, presence or absence of gastrointestinal symptoms such as nausea, vomiting, diarrhea and constipation. Parity, previous surgeries and their evolution. Use of various medications that may interfere with the absorption of nutrients and contraceptives. History of weight gain, previous treatments performed for obesity. Family history of obesity and associated comorbidities. Use of continuous medications.</p> <p>Social history: who buys food and prepares it at home, how is the work and family routine that can interfere with adherence to treatment. Presence/use or not of alcohol and substances such as tobacco and illicit drugs.</p> <p>Dietary history: 24-h food register to know the food routine, fractionation, place of meals, water intake and other liquids.</p>	<p>Physical examination:</p> <ul style="list-style-type: none"> • Anthropometry: weight, height, body mass index, abdominal circumference, percentage of body weight reduction. • Electric bioimpedance: it determines the body compartments and the percentage of fat free mass, aqueous mass, fat mass and their corporal distribution. <p>Laboratory tests: hematocrit, hemoglobin, total lymphocytes, pre-albumin; transferrin, lipid metabolism (total cholesterol and fractions), renal function (urea and creatinine), hepatic function (oxaloacetic and pyruvic transaminases), hydro (B and C complex) and lipid (KADE) soluble vitamins, minerals such as iron, ionized calcium, magnesium, glycemic metabolism (fasting glycemia and glycyated hemoglobin).</p>

Reference: adapted from: Aills L et al., Mechanick JI et al., and Busetto L et al. [13–15]

Table 2 Dietary planning after gastric endosuture

After gastric endosuture

Phase 1: 15 days, liquid feeding

Characteristic: hypocaloric (500 to 700 Kcal) and hyperproteic (60 to 80 g of protein per day).

Purpose: resting of the gastro intestinal tract and internal cicatrization.

Phase 2: 02 days, paste feeding

Characteristic: hypocaloric (700 to 900 Kcal) and hyperproteic (60 to 80 g of protein per day).

Purpose: resting of the gastro intestinal tract and internal cicatrization. Beginning the use of nutritional supplements.

Phase 3: 15 days, mild feeding

Characteristic: hypocaloric (700 to 900 Kcal) and hyperproteic (60 to 80 g of protein per day).

Purpose: chewing training, inclusion of new foods.

Phase 4: from this point, feeding in normal consistency

Characteristic: hypocaloric (1000 to 1200 Kcal) and hyperproteic (60 to 80 mg of protein per day), 45% of carbohydrates and 30% of lipids.

Purpose: promote healthy weight loss and maintenance of weight eliminated in the long run.

:Reference adapted from: Aills L et al., Mechanick JI et al., and Busetto L et al. [13–15]

consumption of macronutrients and micronutrients and their daily distribution in the meals, in order to favor their weight loss and the maintenance of their nutritional status in the long run [12].

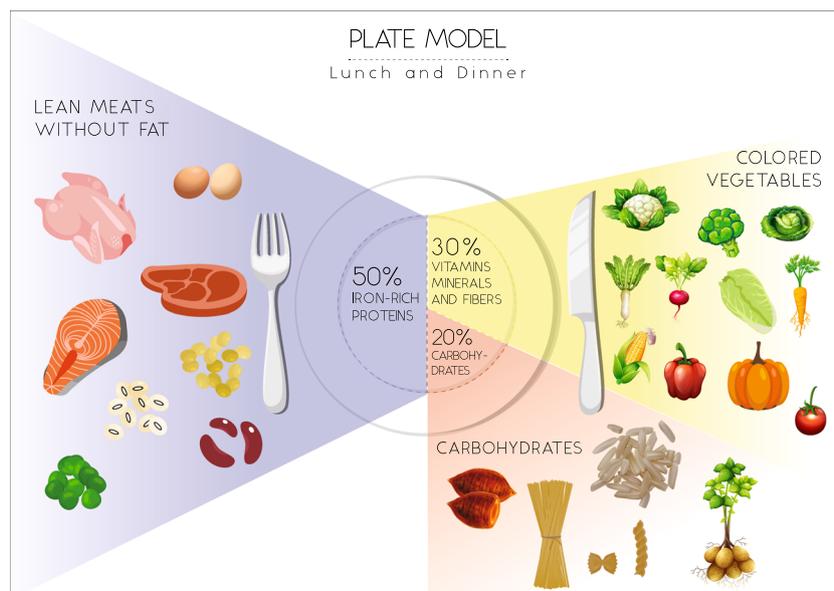
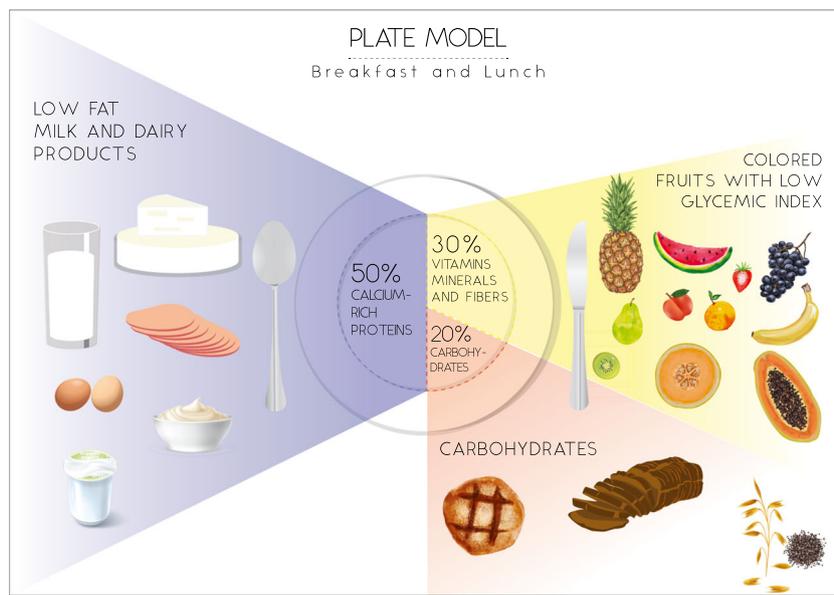


Table 3 Dietary planning after intragastric balloon (IGB)

Before and after IGB

Phase 1: the day before the placement of the IGB, liquid feeding

Feature: hypocaloric (500 to 700 Kcal) and hyperproteic (50 to 60 g of protein per day).

Purpose: preparation of the gastrointestinal tract

Phase 2: 02 days, restricted liquid feeding

Feature: hypocaloric (500 to 700 Kcal) and hyperproteic (50 to 60 g of proteins per day).

Purpose: rest of the gastrointestinal tract. Beginning of the use of nutritional supplements in powders: multivitamin, whey protein and prebiotics.

Phase 3: 08 days, liquid feeding

Feature: hypocaloric (500 to 700 Kcal) and hyperproteic (50 to 60 g of protein per day).

Purpose: rest of the gastrointestinal tract and adaptation to IGB.

Phase 4: 02 days, paste feeding

Feature: hypocaloric (700 to 900 Kcal) and hyperproteic (50 to 60 g of protein per day).

Purpose: Adaptive brief transition to new food consistency.

Phase 5: 05 days, mild feeding

Feature: hypocaloric (700 to 900 Kcal) and hyperproteic (50 to 60 g of protein per day).

Purpose: para treinamento da mastigação e inclusão de novos alimentos.

Phase 6: from this on, feeding in normal consistency

Feature: hypocaloric (1000 to 1200 Kcal) and hyperproteic (50 to 60 mg of protein per), 50% of carbohydrates and 30% of lipids.

Purpose: promote healthy weight loss and maintenance of weight eliminated in the long run.

Reference: Intragastric Ballon System Orbera^R [17]

The priority is for the group of proteins. For the breakfast plate or snacks, one should prioritize sources of calcium-rich proteins like milk and dairy products. Start the day with skimmed milk, cottage-type cheeses, ricotta or Minas cheese, and sugar-free yogurts. The use of yogurts is excellent for maintaining the consumption of natural probiotics, responsible for the rebalancing of intestinal bacteria and protection against intestinal dysbiosis. Iron-rich protein food sources should be used in separate meals such as lunch and dinner, calcium-rich meals such as breakfast, and snacks to promote the absorption of these micronutrients [12].

Protein supplementation is fundamental. For meeting the daily nutritional needs after gastric endosuture, the use of Whey Protein is necessary. The use of powdered supplements should start as early as the first day of liquid feeding and remain throughout life. Ideal to use a hydrolyzed, lactose-free, gluten-free, and sucrose-free formula for easing the use adhesion. The powder can be diluted in water (better absorbed) or in skimmed milk [18].

A third part of the plate (30%) should be occupied by the group of vitamins, minerals, and fibers, represented by fruits and vegetables in general. They are fibrous foods that require chewing. It is important to vary the colors from day to day to strengthen the immune system, regenerate the skin and regulate metabolism. Moderation is the watchword. Excess vitamins and minerals can be dangerous. Some vitamins, like D, we get through sun exposure and pyridoxine (B6) and biotin are released by intestinal bacteria [16]. Biotin is very important in preventing alopecia [19].

The most important and most discussed nutrients are vitamins A, D, B₁₂, calcium, and iron. A multivitamin with at least 2/3 of the nutrients reaching 100% of the RDAs can meet the daily needs of vitamins, always coupled with a sufficient food intake [13–15, 19].

Vitamin B₁₂ (or cyanocobalamin) is present only in foods of animal origin, usually rich in proteins such as meats, milk, and their derivatives. Its lack is a risk to the nervous system,

because it can cause forgetfulness, irritability, difficulty concentrating, and tingling in the hands and feet. Even if the patient consumes these foods, this vitamin should be monitored and prescribed throughout the life, either oral, intramuscular, or sublingual [13–15, 19].

Vitamin D or cholecalciferol is important for weight maintenance and for bone metabolism. Their food sources are limited in milk and dairy products, eggs, and liver. Its biggest source is sunlight, so the patient is advised to sunbathe daily, preferably without sunscreen for 15 mins. Synthetic supplementation is a routine in both preoperative and postoperative periods, averaging 3000 IU per day [20].

The remaining third of the plate would consist of carbohydrates, which are energy foods, important for day to day. The choice in this group is low glycemic index. Whole carbohydrates with breads, rice, grains, pasta, and cereals tend to decrease the absorption of sugars and fats, which favors cardiovascular health, besides promoting better satiety power [21].

Lipids Lipids are chemical compounds insoluble in water. They are important macronutrients to provide essential fatty acids. Suggested sources are canola and olive oil. The use of canola oil is encouraged because it is safe for humans, as well as for its positive effects on variables such as reduction of tumor cell growth, elevated antioxidant capacity, increased insulin sensitivity, and glucose tolerance as well as reduction of total triacylglycerol and LDL cholesterol reduction [22]. It also adds to the prevention of alopecia in operated patients. Olive oil, a common lipid source in the Mediterranean diet, rich in oleic acid, a monounsaturated fatty acid (ω 9), which is present in concentrations higher than 50% in olive oil. Moderate consumption of walnuts and nuts that are rich in monounsaturated and polyunsaturated fatty acids. Cashew nuts have an anacardic acid that may also be beneficial in avoiding cavities [22].

Nutrient	Supplementation indicated
Proteins	60 to 80 g per day or 1 to 1.5 g/kg of ideal weight per day. Whey Protein hydrolyzate is encouraged—one scoop per day with an average of 25 g of protein.
Vitamin B1 (thiamine)	Oral, 12 mg per day. Preferably 50 mg coming from the B complex
Vitamin B12 (cobalamin)	Oral, 350 to 500 µg per day
Intramuscular parenteral, 1000 µg per month	
Folate (folic acid)	Oral, 400–800 µg per day
Women willing to gestate, 800–1000 µg per day	
Iron	Oral, 18 mg per day
Women of reproductive age who menstruate, 45 to 60 mg per day	
Note: separate doses of calcium supplements, foods rich in phytates and polyphenols. Integrate use with ascorbic acid.	
Vitamin D ₃	Oral, 3000 UI per day until the levels of 25 (OH) D are above 30 ng/ml
Calcium	Oral, 1200–1500 mg per day
Calcium carbonate, along with meals	
Calcium citrate, around or not to meals	
Vitamins A, E, and K	Oral: Vitamin A, 5000 to 10,000 UI per day Vitamin E, 15 mg per day Vitamin K, 300 µg per day
Zinc	Polyvitamin, containing 100% of RDA 8–11 mg per day

Reference: [13–15, 19]

Intragastric Balloon Monitoring of nutritional status occurs monthly during the period in which the intragastric balloon remains. At each visit, the evolution of body weight, daily food intake, digestive tract function, and biochemical tests should be evaluated [18, 20, 22].

The process of dietary re-education is slow and progressive and starts, from the first consultation, with the orientation of the food groups through the Plate Model (PM), a method similar to that used in patients with chronic diseases such as dyslipidemias and cardiovascular diseases proposed in 1990 [15]. There is a suggestion for using half the plate with vitamins and minerals, one third with proteins, and another third of the plate of carbohydrates, especially the whole grains.

The guidance on water intake is strengthened to favor IGB hygiene. It is indicated 30 ml per kilogram of ideal weight per day. Other behavioral guidelines are pertinent such as food fractionation, exhaustive chewing, and follow-up of individualized food planning with closed menus established according to family routine or food substitution lists to provide flexibility in daily food choices. The process should be monitored monthly and, if necessary, strategies should be modified to facilitate weight elimination [5–8, 21].

Nutritional Supplements

The use of nutritional supplements is mandatory after gastric endosuture and, if necessary, after IGB and requires periodic metabolic control to analyze the need for each specific nutrient. A multivitamin should cover 100% of the RDA.

Water Consumption

Water is fuel for various reactions of the body and plays a key role for intestinal, cerebral, pulmonary, renal, and cardiologic functioning. With a consumption of 30 ml/kg of ideal weight per day, it is possible to avoid the formation of gallstones and kidney stones [15].

Physical Activity

The practice of daily physical activity is encouraged from the 15th day after gastric endosuture and as soon as the patient feels good after the IGB. A physical educator should plan and guide the proper exercise for each patient. The major goal should be the preservation and recovery of lean mass and elimination of fat mass. Given this, there is a greater chance of long-term weight maintenance [24].

The weight loss achieved by the current endoscopic procedure, although not proportional to surgical therapy, may allow filling of this treatment gap, perhaps the most reasonable in patients within the BMI range from 30 to 35 kg/m². What is unique in this endoscopic procedure is that it can be repeated conveniently along a patient's journey in managing obesity. This endoluminal procedure allows the convenient revision, triggered by the weight gain and, more importantly, by the increase of the accommodation of the meal volume, which may suggest a break in the plicature [5, 6]. This is an important concept to consider. These 6-month pilot results, together with the existing

safety profile of the sleeve gastropasty, suggest that this procedure can serve as an early bariatric intervention, allowing physicians to treat their obese patients in a safer and less invasive manner, thus allowing treatment of a larger segment of the obese populations [4].

For IGB, the mean weight loss is 15% of the excess weight. There may be variations in this context, especially when dietary and behavioral measures are not adhered to according to protocol [21].

We also highlight the need for the development of prospective studies in the field of nutrition in the endoscopic treatment of obesity.

Final Considerations

Specialized nutritional care is necessary, through a protocol of nutritional assistance defined after gastric endosuture, in order to achieve long-term weight loss and maintenance goals. The BPM can be an excellent form of nutritional education, reserving protein intake as a macronutrient base.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Statement This article does not contain any studies with human participants or animals performed by any of the authors. Informed consent statement does not apply.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

References

1. Sjöström L. Review of the key results from the Swedish Obese Subjects (SOS) trial – a prospective controlled intervention study of bariatric surgery. *J Intern Med*. 2013;273:219–34.
2. Associação Brasileira para o Estudo da Obesidade e da Síndrome Metabólica. ABESO - Diretrizes Brasileiras de Obesidade 2016. 4 ed. São Paulo SP.
3. Gontrand López-Nava-Breviere, Inmaculada Bautista-Castaño, Juan Pedro Fernández-Corbelle and Marta Trell Endoscopic sleeve gastropasty (the Apollo method): a new approach to obesity management. *Rev Esp Enferm Dig (Madrid)* Vol. 108, No. 4, pp. 201–206, 2016.
4. Vargas EJ, Bazerbach F, Rizk M, et al. Transoral outlet reduction with full thickness endoscopic suturing for weight regain after gastric bypass: a large multicenter international experience and meta-analysis. *Surg Endosc*. 2018;32:252–9.
5. Lopez-Nava G et al. Factors predictive of success with endoscopic sleeve gastropasty. *Endosc Int Open*. 2016;04:E222–7.
6. Lopez-Nava, M P Galvão, Bautista-Castaño, J P Fernandez-Corbelle, M Trell, N Lopez. Gastroplastia sleeve endoscópica para tratamento da obesidade: dois anos de experiência. *Arq Bras Cir Dig* 2017; 30(1):18–20.
7. Yumuk V, Tsigos C, Fried M, et al. Obesity management task force of the European Association for the study of obesity: European guidelines for obesity management in adults. *Obes Facts*. 2015;8: 402–24.
8. Galvão-Neto MP, Eduardo Grecco E, Souza TF, et al. Gastroplastia vertical endoscópica – terapêutica minimamente invasiva para tratamento promário da obesidade. *ABCD Arq Bras Cir Dig*. 2016;29(Supl.1):95–7.
9. Apollo Endosurgery, Inc. Overstitch Flexible Endoscopic Suture System®. Available in: <https://apolloendo.com/overstitch/>. Accessed December 7, 2019
10. Moizé VL, PI-Sunyer X, Mochari H, et al. Nutritional Pyramid for Post-gastric Bypass Patients. *Obes Surg*. 2010;20:1133–41.
11. Camelon KM, Hådel K, Jämsén PT, et al. The Plate Model: a visual method of teaching meal planning. DAIS Project Group. *Diabetes Atherosclerosis Intervention Study*. *J Am Diet Assoc*. 1998;98(10): 1155–8.
12. Cambi MPC and Baretta GAP. Bariatric diet guide: plate model template for bariatric surgery patients. *ABCD*, 2018, 31(2).
13. Aills L, Blankenship J, Buffington C, Furtado M, Parrot J. ASMBS allied health nutritional guidelines for the surgical weight loss patient. *SOARD* 4 (2008) S73–S108.
14. Mechanick JI, Youdin A et al 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. *Obesity* 2013 21 (01): S1–27
15. Busetto L, Dicker D, Azran C, et al. Practical recommendations of the obesity management task force of the European Association for the Study of obesity for the post-bariatric surgery medical management. *Obes Facts*. 2017;10:597–632.
16. International Dietetics and Nutrition Terminology (IDNT) Reference Manual. Chicago, IL., Academy of Nutrition and Dietetics, 4a ed., 2013.
17. Apollo Endosurgery, Inc. A Intra-gastric Balloon System Orbera®. Available in: https://apolloendo.com/wp-content/uploads/2018/04/GRF-00520-00_R03.pdf. Accessed December 7, 2019.
18. Lopes Gomes D, Moehlecke M, Lopes Da Silva FB, et al. Whey protein supplementation enhances body fat and weight loss in women long after bariatric surgery: a randomized controlled trial. *Obes Surg*. 2017;27(2):424–31.
19. Trüeb RM. Serum Biotin Levels in Women Complaining of Hair Loss. *Int J Trichology*. 2016;8(2):73–7.
20. Parrott J, Frank L, Rabena R et al. American Society for Metabolic and Bariatric Surgery Integrated Health Nutritional Guidelines for the Surgical Weight Loss Patient 2016 Update: Micronutrients. *SOARD* (2017) 00–00.
21. Pellitero S, Martínez E, Puig R, et al. Evaluation of vitamin and trace element requirements after sleeve gastrectomy at long term. *Obes Surg*. 2017;27(7):1674–82.
22. Flores L, Moizé V, Pujol J, et al. Prospective study of individualized or high fixed doses of vitamin D supplementation after bariatric surgery. *Obes Surg*. 2015;25:470–6.
23. Lin L, Allemekinders H, Dansby A, et al. Evidence of health benefits of canola oil. *Nutr Rev*. 2013;71(6):370–385.
24. Delgado Floody P, Caamaño Navarrete F, Jerez Mayorga D, et al. Effects of a multidisciplinary program on morbid obese patients and patients with comorbidity who are likely to be candidates for bariatric surgery. *Nutr Hosp*. 2015;31(5): 2011–6.