Obesity Surgery (2019) 29:2739–2744
https://doi.org/10.1007/s11695-019-03908-2

ORIGINAL CONTRIBUTIONS

A 5-Year Follow-up in Children and Adolescents Undergoing One-Anastomosis Gastric Bypass (OAGB) at a European IFSO Excellence Center (EAC-BS)

Miguel A. Carbajo[1] · Gilberto Gonzalez-Ramirez[1] · Jose Maria Jimenez[1] · Enrique Luque-de-Leon[1] · Javier Ortiz-de-Solorzano[1] · Maria Jose Castro[1] · Jaime Ruiz-Tovar[1]

Published online: 2 May 2019

Abstract

Background The children and adolescent population with obesity has increased worldwide, both in developing areas and in developed countries. Consequently, the prevalence of morbid obesity among this population has also increased, leading to an exponential growth of bariatric approaches in this population. Many surgeons fear eventual nutritional sequelae after malabsorptive approaches and prefer restrictive or mixed procedures.

Methods A retrospective review of all the morbidly obese patients between 13 and 19 years, undergoing a one-anastomosis gastric bypass (OAGB) as bariatric procedure between 2004 and 2012, was performed.

Results A total of 39 patients were included, 8 males (20.5%) and 31 females (79.5%), with a mean age of 17.8 ± 2 years (range 13–19 years). Mean preoperative weight was 114.3 ± 20.4 kg and mean BMI 42.2 ± 5.9 kg/m^2. Preoperative comorbidities include only type 2 diabetes mellitus (T2DM) in 7.9% of the patients, hypertension in 10.3%, and dyslipidemia in 23.1%. Five years after surgery, mean BMI was 25.9 ± 5.3 kg/m^2 and total weight loss 32.1 ± 15.7%. Remission rate of T2DM, hypertension and dyslipidemia was 100%. All the patients received multivitamin and vitamin D supplementation. Anemia secondary to iron deficiency occurred in one female, requiring intravenous iron supplementation during 1 year and later on oral supplementation.

Conclusions OAGB is a valid alternative for long-term weight loss and remission of comorbidities in childhood and adolescence. No cases of malnutrition or growth disorders were observed.

Keywords Childhood · Adolescence · Obesity · OAGB · Malabsorptive procedures · Long-term follow-up

Background

The children and adolescent population with obesity has significantly increased all over the world, both in developing areas and in developed economies. According to the World Health Organization data obtained from different studies, obesity rate has multiplied tenfold in the last decade [1]. Specifically in Spain, the prevalence of obesity in children and adolescents ranges between 18 and 20% [2]. Thus, the prevalence of morbid obesity has also consequently increased and bariatric surgery is actually considered a usual therapeutic weapon among these patients [3, 4].

In the literature, the most common bariatric surgical procedures performed for adolescent patients are adjustable lap-band and Roux-en-Y gastric bypass (RYGB); however, sleeve gastrectomy has become more popular in recent years, though there is no evidence in long-term results [3–5]. One-anastomosis gastric bypass (OAGB) has demonstrated to be a safe, effective, and long-lasting procedure for weight loss and the remission of obesity-related comorbidities in the adult life [6, 7].

Many surgeons fear the nutritional sequelae after malabsorptive procedures, which might affect the normal growth of children and adolescents, and therefore prefer to opt for restrictive or mixed procedures in these patients [3–5]. However, a previous study has demonstrated that malabsoroptive procedures, such as duodenal switch, are safe

✉ Jaime Ruiz-Tovar
jruiztovar@gmail.com

[1] Centre of Excellence for the Study and Treatment of Obesity and Diabetes, Calle Estacion, No. 12, 1, 47004 Valladolid, Spain

procedures in adolescents, observing age-appropriate neurological and physical development in all the cases [8].

The aim of this study was to analyze the results obtained in our children and adolescent series undergoing OAGB.

Patients and Methods

A retrospective review of all the morbidly obese patients between 13 and 19 years undergoing an OAGB as bariatric procedure between 2004 and 2012 at an IFSO Center of Excellence was performed. Patients lost to follow-up were excluded.

Preoperative Evaluation

A multidisciplinary team performed a combined medical, nutritional, psychological, and endocrinological workup to evaluate potential surgical candidates. A dietician established a diet consisting in a total daily energy intake of 1000 kcal. A weight loss of at least 10% of the patient's weight (20% of patient's weight in patients with superobesity) was considered an indispensable condition to undergo the bariatric approach, whose benefit has been demonstrated in a previous study of our group [9].

Patients received information about possible perioperative complications and necessary postoperative nutritional supplementation.

Surgical Technique

All procedures were performed laparoscopically. Surgical technique of OAGB was performed as previously described by Carbajo et al. [10]. The total bowel length was determined; the biliopancreatic limb length was 60% of the total bowel length, and the common limb length was 40% of the total bowel length.

Follow-up

All the patients were followed up by the surgeon and endocrinologist at 3, 6, 9, 12, 18, and 24 months and later on yearly. During the follow-up, anthropometric parameters and comorbidity resolution were evaluated. All the patients completed a 5-year follow-up.

Medical treatment, such as antidiabetic, antihypertensive, and hypolipemiant drugs, was adjusted according to the current needs of the patient. The nutritional status of the patients was evaluated by the endocrinologist with analytical blood tests. Multivitamin tablets (Elevit, Bayer, Germany), 2 tablets/day, and vitamin D (Hidroferol 266 UI, Faes Pharma, Spain), 1 blister/week, were uniformly prescribed. According to the analytical determinations, specific vitamin or mineral deficiencies were specifically supplemented.

Remission of Comorbidities

Remission of type 2 diabetes mellitus (T2DM) was defined as plasma fasting glucose levels below 110 mg/dl and glycated hemoglobin (HbA1c) below 6.5% in the absence of hypoglycemic treatment. Remission of hypertension (HT) was defined as blood pressure below 135/85 mm hg in the absence of antihypertensive treatment; remission of dyslipidemia (DL) was defined as fasting plasma triglycerides below 200 mg/dl, total cholesterol below 200 mg/dl, and high-density lipoprotein cholesterol over 40 mg/dl in the absence of pharmacological therapy.

Postoperative endoscopy was not routinely performed, only in those patients with persistence or new onset of reflux symptoms.

Variables

Analyzed variables included age, gender, preoperative obesity-related comorbidities, weight, BMI, postoperative complications, mortality, and hospital stay. During the follow-up, at 1, 2, and 5 years, anthropometric measurements, remission of comorbidities, and nutritional deficiencies were assessed.

Statistics

Statistical analysis was performed with the informatic program SPSS 20.0 for Windows. Quantitative variables following Gaussian distribution were defined by mean and range. Qualitative variables were defined by number of cases and percentage.

Patients over 18 years old signed a written informed consent form, before undergoing the surgery. In those patients under 18 years old, informed consent form was signed by the patients and their parents or legal guardians, according to the Spanish law.

Results

A total of 39 patients were included, 8 males (20.5%) and 31 females (79.5%), with a mean age of 17.8 ± 2 years (range 13–19 years). Eighteen patients were under 18 years old and 21 were 18 or 19 years old at the time of surgery. Mean weight

was 114.3 ± 20.4 kg, mean height 154 ± 11.6 cm, and mean BMI 48.2 ± 5.7 kg/m^2. Preoperative comorbidities are described in Table 1.

All the patients underwent an OAGB with a mean biliopancreatic limb of 260.5 ± 29.6 cm (range 200–320 cm) and a mean common limb of 227.1 ± 16.8 cm (range 200–250 cm). There were no postoperative complications, and hospital stay was 1 day in all the cases.

One year after surgery, mean weight was 65.9 ± 13.7 kg, mean height 158.6 ± 13.4 cm, mean BMI 26.2 ± 3.9 kg/m^2, and total weight loss 42.3 ± 12.3%. Remission rates of T2DM, hypertension, and dyslipidemia were 100%.

Two years after surgery, mean weight was 66 ± 10.7 kg, mean height 162.4 ± 14.1 cm, mean BMI 25 ± 5.1 kg/m^2, and total weight loss 42.3 ± 9.6%. Remission rates of T2DM, hypertension, and dyslipidemia were 100%.

Five years after surgery, mean weight was 70 ± 14.3 kg, mean height 164.3 ± 13.9 cm, mean BMI 25.9 ± 5.3 kg/m^2, and total weight loss 38.8 ± 12.7%. Remission rates of T2DM, hypertension, and dyslipidemia were 100%. The evolution of weight loss is described in Table 2.

One female patient presented severe anemia secondary to iron deficiency, requiring intravenous supplementation during 1 year and later on oral supplementation. The rest of the patients received daily multivitamin supplementation and vitamin D 266 UI weekly and remained under periodical analytical controls. There were no cases of protein malnutrition among this series of patients.

During the follow-up, there were no cases of persistence or new onset on reflux symptoms.

Discussion

Obesity in childhood is associated with most of the physical and psychosocial conditions observed in obese adults [11]. Obese children and adolescents are destined to become obese adults [12]. Adolescents with morbid obesity are at elevated risk of developing adult comorbidities, including type 2 diabetes, sleep apnea–hypopnea syndrome, hypertension, joint problems, nonalcoholic fatty liver disease [13], reduced quality of life [10], and negative self-esteem, that may persist into adulthood [14]. Despite massive healthcare initiatives, including lifestyle changes, increase in physical activity, and dietary modifications, which are the first steps for the treatment of obesity, nonoperative therapy for morbid obesity has produced poor results [15, 16]. For these patients, bariatric surgery may provide the only practical alternative for achieving a healthy weight and to avoid the development of physical and psychological consequences of obesity [17, 18].

Table 1 Preoperative comorbidities

T2DM	7.9%
Hypertension	10.3%
Dyslipidemia	23.1%
Arthropaties	30.8%
Sleep apnea/hypopnea syndrome	38.5%
Gastroesophageal reflux disease	23.1%
Liver steatosis	38.5%

The IFSO position statement of 2016 about bariatric surgery in children and adolescents indicates that in the absence of changes of lifestyle, children with obesity may suffer a reduction of life expectancy between 10 and 20 years and are at risk to develop serious health problems at 40–60 years of age [19]. Thus, bariatric surgery is an effective procedure in patients under 18 years of age with obesity. However, there is still little evidence about the safety and long-term benefits of these procedures among children and adolescents. Woolford et al. [20] conducted a survey on pediatricians and concluded that half of them would never refer obese adolescents for bariatric surgery. They argue that patients should be at least 18 years old in order to be considered for bariatric surgery. The reasons for this reluctance are the uncertainty about the long-term consequences of bariatric surgery, such as growth limitations or nutritional disorders [21]. In relation with this fear, for a time it was considered that only restrictive procedures were the most adequate to avoid generating an aggregate disorder in the growth of these patients [22]. Mixed procedures, like RYGB, with low malabsorptive component, are increasingly performed [21–23]. However, most authors agree that there is a lack of long-term results.

A Spanish multisociety expert panel assessment concluded that morbid obesity in adolescents requires a stronger, intensive, and more aggressive treatment than in adults. In this regard, surgery should occupy a more prominent role given its excellent results in terms of weight loss and ability to correct comorbidities, which are easier to reverse at early stages [24]. Malabsorptive techniques can also be probably indicated in children and adolescents, aiming to reduce the incidence of long-term weight regain and recurrence of comorbidities reported for restrictive techniques [25] and even for RYGB [26]. The bowel of children and adolescents has an enormous capacity of absorption and adaptation. Given the long-term expectation of life in these patients, a malabsorptive procedure would be more suitable for this population. OAGB is a malabsorptive procedure that has exponentially increased in the last decade. It is associated with very low complications, mortality, readmissions, and reoperation rates and shows excellent short- and long-term benefits of weight loss and resolution of comorbidities in adult population. In the OAGB technique, as described by Carbajo et al. [10], the total bowel length is determined. After its assessment, the appropriate length of the limbs is calculated to obtain a significant weight loss, but warranting enough bowel length for absorption to

Table 2 Evolution of weight, height, BMI, and total weight loss at 1, 2, and 5 years after surgery

	Weight (kg)	Height (cm)	BMI (kg/m^2)	Excess weight loss (%)	Total weight loss (%)
Preoperative	114.3 ± 20.4	154 ± 11.6	48.2 ± 5.7		
3 months post	90.6 ± 17.1	154.7 ± 11.5	37.9 ± 4.9	43.6 ± 14.7	20.7 ± 9.8
6 months post	79.7 ± 15.6	155.9 ± 11.5	32.8 ± 4.4	64.9 ± 15.2	31.1 ± 10.6
9 months post	71.2 ± 14.9	157.4 ± 12.4	28.7 ± 4.2	82.4 ± 17.5	37.7 ± 11.1
1 year post	65.9 ± 13.7	158.6 ± 13.4	26.2 ± 3.9	94.3 ± 18	42.3 ± 12.3
18 months post	65.5 ± 12.6	160.6 ± 13.9	25.4 ± 4.8	98.9 ± 17.9	42.7 ± 10.7
2 years post	66 ± 11.7	162.4 ± 14.1	25 ± 5.1	100 ± 17.6	42.3 ± 9.6
3 years post	67.1 ± 12.3	163.1 ± 13.5	25.2 ± 5.4	98.9 ± 18.1	41.3 ± 11.2
5 years post	70 ± 14.3	164.3 ± 13.9	25.9 ± 5.3	94.7 ± 17.9	38.8 ± 12.7

avoid secondary malnutrition disorders. In our series, mean BMI 5 years after surgery was 25.9 kg/m^2 with a total weight loss of 38.8% and remission of comorbidities in 100% of the cases. Notwithstanding, the main concern after malabsortive procedures are nutritional deficiencies. In our study, there were no cases of malnutrition. One patient presented microcytic anemia, but the rest remained asymptomatic and without any other deficiencies, taking only multivitamin and vitamin D supplements. A recently published study of our group, comparing OAGB with RYGB and SG in adult patients, showed that weight loss and remission of comorbidities was significantly higher after OAGB, when compared with the other techniques. However, the nutritional deficiencies were comparable between OAGB and RYGB, and slightly greater than SG, referring specifically to iron and folates [27]. In this study, iron deficiency could be observed in up to 25% of the cases, despite routine daily multivitamin and mineral supplement intake. Most of these cases do not develop microcytic anemia, and the iron deficiency is usually managed with specific iron oral supplementation. Only those cases refractory to the oral treatment must be treated with parenteral iron solutions. Iron deficiencies are frequent after procedures bypassing the duodenum, which is the main site for iron absorption. Moreover, the gastric resection reduces the gastric acid secretion, which is responsible for the conversion of iron to ferrous salts that are absorbed [28]. Our previous study has demonstrated that iron deficiencies were significantly lower after sleeve gastrectomy than after Roux-en-Y gastric bypass or OAGB [27].

Few studies have reported long-term follow-up after bariatric surgery in adolescents. A Swedish nationwide study, involving adolescents undergoing RYGB, showed a mean BMI of 32 kg/m^2 5 years after surgery and up to 72% of patients with nutritional deficiencies [23]. A recently published meta-analysis of morbidly obese adolescents, undergoing mainly RYGB, adjustable gastric banding and sleeve gastrectomy, and with a minimum of 3 years follow-up, revealed mean BMI 3 years after surgery ranging from 27.3 to 40.5 kg/m^2. Despite the improvement in anthropometric data was significantly better after RYGB than after restrictive procedures, they observed a weight regain in those patients with follow-up longer than 5 years. Diabetes mellitus was the only comorbidity with a significant long-term improvement [29].

Marceau et al. [8] reported a series of 16 adolescents undergoing a duodenal switch with a mean follow-up period of 10.6 years (range 2–16 years). They showed a mean excess weight loss over 80%, with complete remission of comorbidities and normal age-appropriate neurodevelopment. However, two patients in their series presented postoperative complications, and one of them died in the postoperative course. Papadia et al. [30] described their experience with 76 adolescents undergoing a biliopancreatic diversion, with a mean follow-up of 11 years. They showed a mean excess weight loss of 78% at their longest follow-up, a complete remission of diabetes mellitus and dyslipidemia and a remission rate of hypertension over 92%. However, they reported a protein malnutrition rate of 14.5% and long-term mortality of 4%. Obviously, malabsorptive procedures obtain greater weight loss and improvement of comorbidities, but with a higher risk of malnutrition and sequelae [31].

OAGB is also a malabsorptive procedure, but in our series, there were no complications, weight loss was even better than that reported for duodenal switch and biliopancreatic diversion, and physical and neurological development was completely normal in all the cases, with heights within the normal range and many of them with university studies. Referring to the remission of comorbidities, it is certain that the remission rates of T2D, HT, and DL are 100%. However, it must be considered that the prevalence of preoperative comorbidities was low among the studied population. Therefore, our results of comorbidity remission must be interpreted with caution.

The patients analyzed in this study presented a gastroesophageal reflux disease (GERD) rate of 23.1%. After surgery, the GERD symptoms disappeared in these patients and there were no cases of new onset of biliary reflux symptoms. OAGB is considered by many authors a surgical treatment option for GERD [32]. However, there is still some debate about new onset of biliary reflux. The reported incidence of

biliary reflux by most series ranges from 0.7 to 2.8% [33, 34], but there are some studies reporting up to 10% rates [35]. We performed a modified OAGB with an antireflux suture, as previously described, obtaining a postoperative biliary reflux rate of 0.2% after 12 years follow-up [10]. Thus, it seems logical that there were no cases of biliary reflux among 39 patients.

Recent randomized studies have shown equivalent weight loss between sleeve gastrectomy (SG) and RYGB, despite the lack of an intestinal bypass in the first one [35]. The reason why SG had similar results to RYGB is that SG may provide a better restriction than RYGB, countervailing the malabsorptive mechanism of RYGB. In OAGB, there is also a mild restriction provided by the long sleeve tuve. However, weight loss is not only based on restriction and malabsorption. There are also metabolic mechanisms of weight loss. Exclusion of the duodenum from food stream may eliminate the physiologic response of duodenal gut hormone and related enzyme secretion (glucagon, cholecystokinin, and biliopancreatic enzymes). The rapid food transit to distal gut induces a surge of distal gut hormone (GLP-1 and PYY) release. This has been widely studied in RYGB and SG, but little is still known about OAGB [36, 37]. Another mechanism involved is the gut microbiota. Recent studies have shown that the gut microbiota of obese human beings is distinct from that of healthy weight individuals. The abundance of certain species changed significantly after SG and RYGB. It was also revealed that the abundance of certain microbes was significantly correlated with the body mass index, fasting blood glucose, and glycosylated hemoglobin. Similarly, there is a lack of evidence about changes in microbiota after OAGB [38]. Thus, future studies on OAGB should be focused on analyzing the metabolic hormonal effect of this technique and the changes in the microbioma and their correlation with weight loss and remission of comorbidities.

In our opinion, OAGB with total bowel length measure and, according to this, customizing the biliopancreatic and common limb lengths, is an effective and safe procedure for morbidly obese children and adolescents. However, further studies with longer follow-up periods must be conducted to confirm our results.

Conclusions

OAGB is a valid alternative for long-term weight loss and remission of comorbidities in childhood and adolescence. There are no cases of malnutrition and the scarce vitamin or mineral deficiencies can be controlled with specific supplementation, without affecting normal growth.

The measurement of the total bowel length is essential to perform a safe technique and to achieve adequate long-term results.

Compliance with Ethical Standards

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

Statement of Informed Consent Informed consent was obtained from all individual participants included in the study.

Statement of Human Rights All procedures performed in this study were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments.

References

1. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128·9 million children, adolescents, and adults. Lancet. 2017;390:2627–2642.
2. WHO European Database on Nutrition, Obesity and Physical Activity (NOPA). http://data.euro.who.int/nopa/. Accessed Dec 2018.
3. Carbajo MA, Vazquez-Pelcastre R, Aparicio-Ponce R, et al. 12 year old adolescent with super morbid obesity, treated with laparoscopic one anastomosis gastric bypass (LOAGB/BAGUA): a case report after 5-year follow-up. Nutr Hosp. 2015;31:2327–32.
4. Michalsky M, Reichard K, Inge T, et al. ASMBS pediatric committee best practice guidelines. Surg Obes Relat Dis. 2012;8:1–7.
5. Pratt JS, Lenders CM, Dionne EA, et al. Best practice updates for pediatric/adolescent weight loss surgery. Obesity (Silver Spring). 2009;17:901–10.
6. Carbajo MA, Garcia Caballero M, Toledano M, et al. One-anastomosis gastric bypass by laparoscopy: results of the first 209 patients. Obes Surg. 2005;15:398–404.
7. Lee WJ, Lin YH. Single-anastomosis gastric bypass (SAGB): appraisal of clinical evidence. Obes Surg. 2014;24:1749–56.
8. Marceau P, Marceau S, Biron S, et al. Long-term experience with duodenal switch in adolescents. Obes Surg. 2010;20:1609–16.
9. Carbajo MA, Castro MJ, Kleinfinger S, et al. Efectos de una dieta-formula normocalórica e hiperproteica (Vegestart complet®) vs dieta normal baja en calorias en pacientes con obesidad morbida como preparacion a cirugía bariátrica (bypass gástrico laparoscópico de una anastomosis): estudio prospectivo doble ciego aleatorizado. Nutr Hosp. 2010;25:939–48.
10. Carbajo MA, Luque de Leon E, Jimenez JM, et al. Laparoscopic one-anastomosis gastric bypass: technique, results and long-term follow-up in 1200 patients. Obes Surg. 2017;27:1153–67.
11. Vanhala M, Vanhala P, Kumpusalo E, et al. Relation between obesity from childhood to adulthood and the metabolic syndrome: population based study. Br Med J. 1998;317:319–20.
12. Laparoscopic vertical sleeve gastrectomy for adolescents with morbid obesity. In: McGuire MM, editor. Seminars in Pediatric Surgery Elsevier; 2014. p. 21–23.
13. Xanthakos S, Miles L, Bucuvalas J, et al. Histologic spectrum of nonalcoholic fatty liver disease in morbidly obese adolescents. Clin Gastroenterol Hepatol. 2006;4:226–32.
14. Schwimmer JB, Burwinkle TM, Varni JW. Health-related quality of life of severely obese children and adolescents. JAMA. 2003;289:1813–9.
15. Kolotkin RL, Crosby RD, Williams GR, et al. The relationship between health-related quality of life and weight loss. Obes Res. 2001;9:564–71.

16. Cozacov Y, Roy M, Moon S, et al. Mid-term results of laparoscopic sleeve gastrectomy and roux-en-Y gastric bypass in adolescent patients. Obes Surg. 2014;24:747–52.
17. Alqahtani AR, Antonisamy B, Alamri H, et al. Laparoscopic sleeve gastrectomy in 108 obese children and adolescents aged 5 to 21 years. Ann Surg. 2012;256:266–73.
18. Inge TH, Krebs NF, Garcia VF, et al. Bariatric surgery for severely overweight adolescents: concerns and recommendations. Pediatrics. 2004;114:217–23.
19. De Luca M, Angrisani L, Himpens J, et al. Indications for surgery for obesity and weight-related diseases: position statements from the International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO). Obes Surg. 2016;26:1659–96.
20. Woolford SJ. To cut or not to cut: physicians' perspectives on referring adolescents for bariatric surgery. Obes Surg. 2010;20:937–42.
21. Karasko D. Weight loss in adolescents after bariatric surgery: a systematic review. J Pediatr Health Care. 2018;33:26–34. https://doi.org/10.1016/j.pedhc.2018.05.010.
22. Peña AS, Delko T, Couper R, et al. Laparoscopic adjustable gastric banding in Australian adolescents: should it be done? Obes Surg. 2017;27:1667–73.
23. Olbers T, Beamish AJ, Gronowitz E, et al. Laparoscopic Roux-en-Y gastric bypass in adolescents with severe obesity (AMOS): a prospective, 5-year, Swedish nationwide study. Lancet Diabetes Endocrinol. 2017;5:174–83.
24. Vilallonga R, Moreno Villares JM, Yeste Fernandez D, et al. Initial approach to childhood obesity in Spain. A multisociety expert panel assessment. Obes Surg. 2017;27:997–1006.
25. Melissas J, Stavroulakis K, Tzikoulis V, et al. Sleeve gastrectomy vs Roux-en-Y gastric bypass. Data from IFSO-European Chapter Center of Excellence Program. Obes Surg. 2017;27:847–55.
26. Higa K, Ho T, Tercero F, et al. Laparoscopic roux- en-Y gastric bypass: 10-year follow-up. Surg Obes Relat Dis. 2011;7:516–25.
27. Ruiz-Tovar J, Carbajo MA, González G, et al. Long-term follow-up after sleeve gastrectomy versus Roux-en-Y gastric bypass versus one-anastomosis gastric bypass: a prospective randomized comparative study of weight loss and remission of comorbidities. Surg Endosc. 2018;33:401–10. https://doi.org/10.1007/s00464-018-6307-9.
28. Mechanick JI, Youdim A, Jones DB, 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 of Metabolic & Bariatric Surgery. Surg Obes Relat Dis. 2013;9:159–91.
29. Shoar S, Mahmoudzadeh H, Naderan M, et al. Long-term outcome of bariatric surgery in morbidly obese adolescents: a systematic review and meta-analysis of 950 patients with a minimum of 3 years follow-up. Obes Surg. 2017;27:3110–7.
30. Papadia FS, Adami GF, Marinari GM, et al. Bariatric surgery in adolescents: a long-term follow-up study. Surg Obes Relat Dis. 2007;3:465–8.
31. Flores M, Vazquez R, Valdez JF, et al. Results of the OAGB in adolescents. In: Deitel M, editor. Essential of Mini-One anastomosis gastric bypass. Toronto: Springer; 2018. p. 273–84.
32. Sakran N. The question of bile gastro-esophageal reflux. In: Deitel M, editor. Essentials of Mini-One anastomosis gastric bypass. Cham: Springer; 2018. p. 143–51.
33. Kular KS, Manchanda N, Rutledge R. Analysis of the five-year outcomes of sleeve gastrectomy and mini gastric bypass: a report from the Indian sub-continent. Obes Surg. 2014;24:1724–8.
34. Chevallier JM, Arman GA, Guenzi M, et al. One thousand single anastomosis (omega loop) gastric bypasses to treat morbid obesity in a 7-year period: outcomes show few complications and good efficacy. Obes Surg. 2015;25:951–8.
35. Robert M, Espalieu P, Pelascini E, et al. Efficacy and safety of one anastomosis gastric bypass versus Roux-en-Y gastric bypass for obesity (YOMEGA): a multicentre, randomised, open-label, non-inferiority trial. Lancet. 2019;393:1299–309. https://doi.org/10.1016/S0140-6736(19)30475-1.
36. Peterli R, Wölnerhanssen BK, Peters T, et al. Effect of laparoscopic sleeve gastrectomy vs laparoscopic Roux-en-Y gastric bypass on weight loss in patients with morbid obesity: the SM-BOSS randomized clinical trial. JAMA. 2018;319:255–65.
37. Lee WJ, Chen CY, Chong K, et al. Changes in postprandial gut hormones after metabolic surgery: a comparison advances in bariatric/metabolic surgery of gastric bypass and sleeve gastrectomy. Surg Obes Relat Dis. 2011;7:683–90.
38. Wang FG, Bai RX, Yan WM, et al. Differential composition of gut microbiota among healthy volunteers, morbidly obese patients and post-bariatric surgery patients. Exp Ther Med. 2019;17:2268–78.