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Research Article

The Place Bariatric Surgery and Multidisciplinary Team in the Treatment of Obesity in Adolescent Patients

Sorin Cimpean[1*], Dario Raglione[1], Benjamin Cadiere[1], Guy Bernard Cadiere[1] Gloire à Dieu Byabene[2]

[1]Digestive Surgery Department, Saint Pierre University Hospital, Brussels, Belgium

[2]Panzi Hospital, Congo

[*]**Corresponding author:** Sorin Cimpean, Digestive Surgery Department, Saint Pierre University Hospital, Rue Haute 322, 1000, Brussels, Belgium

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Abstract

Background: Earlier development of overweight and obesity represents an increased risk factor for development of comorbidities. Adolescent bariatric surgery is a sensitive and controversial topic in medical, social, psychological point of views.

Materials and Methods: We performed a literature review on PubMed, Cochrane, Medline and Google Scholar database to identify the publications who concerns bariatric surgery in adolescents and the multidisciplinary team management of obesity at young age.

Discussion: Obesity at young age has more that heath consequences. At this age, adolescents are concerned not only about the long term health impact of obesity but particularly about the aesthetic aspect, social image, their social relations and their integration in society or in a group of friends. The follow up should be by performed a multidisciplinary team composed by surgeon, paediatrician, mental health professionals, general practitioner and the family as a complementary support. Negative points associated with bariatric surgery in adolescence, besides includes micronutrient deficiencies are also reoperation. The surgery must be well weighed before posing the operative indication.

Conclusion: Bariatric surgery has emerged as the most effective short-term weight loss strategy for adults with severe obesity, but its role in adolescents is still being defined. A good selection of the patients and a close follow are indispensable for a good postoperative result, and the operative indication must be more conservative than for the adults.

Background

The puberty and young adulthood are high-risk times for abnormal weight gain. Weight gain during early adolescence carries with it higher-risk for adult morbidity. The increase in the prevalence of overweight and obesity worldwide is called by the World Health Organization (WHO) and International Association for the Study of Obesity (IASO) as "a crisis in public health". This phenomena is increasing in young generation (1,2). Therefore, earlier development of overweight and obesity represents an increased risk factor for premature metabolic and/or cardiovascular diseases in later life like premature mortality, coronary heart disease, obstructive sleep apnoea, hypertension, dyslipidaemia, and type 2 diabetes mellitus (5-7). The puberty and young adulthood are high-risk times for abnormal weight gain. Weight gain during early adolescence carries with it higher-risk for adult morbidity. The adolescent is also victim of the social stigmatization because of the obesity. Bariatric surgery for severe obesity is presents a clear benefit in term of weight loss and comorbidities reduction. Long-term results are not well-known or not very clear. The postoperative complications or nutritional perturbation in adolescents can be potentially dangerous for the future development of the adult. The teenager can confront big challenges, behavioural and psychological, specific for this period of transition before being an adult. The primary concern for bariatric surgery at young age is an increased risk for perioperative morbidity and mortality as every surgery and some techniques are irreversible. These patients tend to have more associated systemic comorbidities. In that period of life the personality and the habits are not well defined and the adolescent doesn't have his total responsibility. Lack of evidence on

the safety of bariatric surgery in the young has led some third-party payers and Medicare to deny bariatric surgery coverage to patients under the age of 20 years.

Adolescent bariatric surgery is a sensitive and controversial topic in medical, social, psychological point of views. The aim of this study was to analyse contemporary outcomes of bariatric surgery in the young and to compare them to previous data from elderly patients, to define some criteria before the indication of the surgery, to choose the technique that can be used for the patient. To evaluate the surgical, psychological and social outcomes after bariatric surgery in adolescent. Is the surgical approach in obese adolescents a real alternative to the lifestyle changes and dietary measures or just an unnecessary luxury? Does it have a positive long-term effect on a young body? When should the team indicate the surgery? What should be the approach in the multidisciplinary follow up after bariatric surgery? We will try to answer those questions and to find some light on the bariatric surgery in adolescents' field.

Material and Methods

A literature research was performed on databases like PubMed, Cochrane, Medline and Google Scholar, to identify the publication who concerns bariatric surgery in adolescents. The publications that were selected were studies, reviews of literature and meta-analysis after 2010. The studies with a follow up less than 1 month, were not included and also the case reports were not considered. The keywords of literature research were: obesity in adolescent, bariatric surgery complication, follow-up, preoperative assessment, multidisciplinary team. Priority on the discussion and consideration had the studies on adolescent patients who underwent bariatric surgery and we focused on the studies completed by meta-analysis or reviews findings.

Discussions

Obesity is a worldwide health problem. In the last years a new concern is rising in term of prevalence of obesity in childhood and adolescence. Obesity in children and adolescents is defined as a BMI-for-age/sex ≥95th percentile but < 120% of the 95th percentile and "severe obesity" is BMI-for-age/sex ≥ 120% of the 95th percentile [1]. 170 million children are currently with overweight globally. In US children, the prevalence passed from 6% in 1980 to 18.5% in 2016. In European countries the obesity of this group of age is also increasing. The obesity is associated with low-income families, with important quantitative but less qualitative intake of food [2]. There are also social factors that influence this type of food like the persuasive effect of commercials and social media influence. Risk factors for obesity are recognized as are carbohydrate oxidation rate that is independent of the volume of the carbohydrates intake, insulin resistance, glycaemic profile and the morphologic type of the patient [3]. Globally the obesity increase the risk for hypertension, dyslipidaemia, insulin resistance and type 2 diabetes, Non-alcoholic fatty liver disease (NASH), and orthopaedic disorders but also depression, anxiety, binge- or loss-of-control eating [4].

Why metabolic surgery in adolescents?

Obesity at young age has more that heath consequences. It is in discussion the wellbeing of a teenager who have the life before and a future to build. At this age the adolescents are concerned about the aesthetic aspect, social image, their social relations and their integration in society or in a group of friends, more that the long term health impact. 50% to 77% of obese adolescents will became obese adults and this will result in an increasing risk of developing dangerous health conditions related to obesity. The risk increases to 80% if just one parent is obese, and a familial context exists [5]. In a society where the 90-60-90 image is still the beauty standard the self-image is heavily conditioned by this picture. A study on 33 patients from 1981 to 2002 from National Institutes of Health Bariatric Surgery concluded can be performed safely in severely obese adolescents and in most instances, a long-lasting weight loss but the most important will ameliorate the self-image and social relationships of the young [6]. This is quite logic, the bullying at school is usually focused on this obese teenagers or they can be seen differently by their colleagues and marginalised. Sport activities are more limited and problematic for this adolescents and this can contribute to the social exclusion. Obese adolescents can have more difficulties in finding a job or a partner. Obesity also can increase the risk of infertility due to the hormonal effect of the fatty tissue [7]. Matheson, et al. in a literature review also report beneficial social, emotional and menstrual effects of weight loss from gastric bypass surgery in a morbidly obese teenager [8]. Bariatric surgery in adolescent patients is effective in helping patients who qualify for surgery BMI ≥ 35 kg/m2 with major comorbidities or BMI ≥ 40 kg/m2 with other comorbidities associated with long-term risk [9]. Generally the benefits of the bariatric surgery outweigh the risks for the carefully selected patient in an experienced medical centre [10]. Bariatric surgery does not seem to produce cognitive impairments or developmental delays. Bariatric surgery is a safe and an effective treatment option but it poses mostly ethical challenges, despite the low complication rates. The challenge is to change the mentality of the society and the social acceptance for the metabolic surgery at young age and to adapt to this ''fast food'' generation problems [11].

What are the psychological particularities at young age?

The surgeon must be aware in bariatric surgery consultation. The adolescent is more fragile and priorities and mentality of the teenagers is very particular. The influence of the society, the social media, and the marginalization of these patients surely have an influence on their moral and their good psychological status health. Parks et al. in a social media analysis on 13 (3 male,

10 female) identified social media as a powerful tool for social support for lifestyle change. Also, motivators for lifestyle changes included family support, personal goals, and non-scale victories [12]. Depression could have a negative influence on the motivation of following a nutritional program and lifestyle changes. There is some cases of suicide reported [13]. The problem of bullying and victimization is of actuality for the obese adolescents, which can be a serious issue in the mental health development of the teenager. An increased risk for suicide after surgery might be problematic and the follow-up for moderate to severe depression or history of suicidal behaviours must be very rigorous and multidisciplinary [14]. In a study in 5 academic medical centres on suicidal thoughts and behaviours in adolescents who underwent bariatric surgery indicates that surgery not modifies the risk of suicide in the first 4 postoperative years. The risk of suicide present before the surgery persisted. Despite the positive effects on the body image, social confirmation and family support can change or ameliorate this negative psychological status [15]. Some authors do not have the same findings. Järvholm et al. in a non-randomized study comparing 81 adolescents with ages between 13-18 who underwent Roux-en-Y gastric bypass surgery, and 80 patient from a control group who received conventional treatment reveals that bariatric surgery will not make the teenagers more vulnerable but the long-term mental health follow up is very important [16].

Adolescence is a period of life where the follow up can be challenging. Lainas et al. in a retrospective study on 84 patients who underwent laparoscopic sleeve gastrectomy and 2 years of follow up found that despite the good results of the surgery, adolescents have a higher risk of follow-up interruption than adults, because of increased mobility (educational or employment). The adolescents are more susceptible to the mood changes, who are specifics to this age [17].

What are the particularities of preoperative assessment?

The key for the success of bariatric surgery and even more important for the bariatric surgery in adolescents is a good selection of the patients. Despite the good results of the surgery, the intervention is not riskless and the choice for surgery must be well weighted. As for the adults, the surgery must be the B plan and to be considered if the dietary measures and lifestyle changes fail. Medical therapy include exercise, diet, psychological behaviour modification, and even pharmacotherapy [18]. If the indication is posed to easy, than problems of compliance, mostly during the follow up should not surprise the surgeon. Compliance from both patient and family with the pre-operative and post-operative plan is essential for the outcome. Collaboration between the families and the surgical team is essential and consist in communicate also to the parents the risks of surgery but also the long-term benefits on health [19]. Dietary restriction and generally the compliance of the patient to the nutritional program is the real challenge of for obesity treatment but is only rarely successful for morbidly obese patients. If for the adults the difficulty of losing weight following a diet and a sport program, for the adolescents who have additional factors specific to the age and important psychosocial pressure. The influence of the family and the support of the parents and their help is very important [20].

Multidisciplinary team should include the paediatrician, who can help for an appropriate selection of the patients for the surgery. The pedopsychatrist and the nutritionist in collaboration with the surgeon and the parents should well identify the causes of the obesity. The preoperative assessment must be exhaustive and concern psychosocial evaluations, to evaluate the psychiatric symptoms, and the psychopathological conditions [21]. The most common comorbid psychological conditions appear to be depression, anxiety, ADHD, and disordered eating like binge eating or purging behaviours along with substance use abuse should be evaluated and referred for treatment before going to the surgery [22].

What is the weight loss?

There is many studies on the effects of the bariatric surgery on the weight loss for the adults. For the adolescents, the weight loss is comparable to the adults. This is an important feature and can justify the surgical approach. Inge, et al. study the health effects between two groups of patients who underwent Roux-en-Y gastric bypass. The comparison was performed on 161 patients from 2006 to 2012 and 396 patients from 2006 to 2009. Adolescents and adults who underwent gastric bypass had similar weight loss at 5 years after surgery but adolescents had remission of diabetes and hypertension more than adults [23]. Is not surprising that the weight loss is similar, because the same mechanisms are involved in the weight loss, at all ages. Another retrospective study from Maffazioli, et al. on 46 adolescent patients between 16-21 years who underwent RYGB (24 patients) or SG (22 patients) between 2012 and 2014 found that percentage of excess BMI lost and percentage of total body weight loss reduction did not differ between the two groups. For this study the follow up of 1-6 months cannot be considered satisfying but gives an idea of similarity between the two groups of adolescents and adults [24]. Without a doubt bariatric surgery is superior to medical treatment for long-term weight loss. The problem is the sustainability of the weight loss. 5-30% patients either lose little weight regaining weight in the long term and here the problem of follow up and the good operative indication came in discussion [25].

What is the effect of the surgery on comorbidities?

The benefits on the comorbidities reduction, considered as the primary reason of bariatric surgery, are well documented by different studies. Obesity will increase the risk of the teenager later for premature mortality, coronary heart disease, obstructive

sleep apnoea, hypertension, dyslipidaemia, and type 2 diabetes mellitus. Diabetes even well controlled at long course can have important negative health effects divided into micro vascular and macrovascular. Microvascular complications include neuropathy, nephropathy, and retinopathy, while macro vascular complications consist of cardiovascular disease, stroke, and peripheral artery disease [26]. Based on the long-term data from the Teen-LABS, FABS 5+, and AMOS studies, the metabolic surgery for diabetic adolescent patients revealed that the diabetes is more aggressive in adolescents than in adults and the risk of failure of oral anti-hyperglycaemic medication is higher [27]. The positive effect of the bariatric surgery on diabetes is no doubt despite the risk of postoperative complications related to the surgery and nutritional deficiencies. Surgery performed at this age will increase the possibility of complete remission OD diabetes for this patients [28]. The idea of better outcomes who are in influenced by the earlier surgery is justified by Stanford et al. in a retrospective cohort study that compare the short and long-term outcomes of surgery in adolescents and adults who have undergone a RYGB or SG in 76 adolescent and 74 adult subjects with severe obesity concluded that adolescents compared to adults better results weight loss and resolution of type 2 diabetes and hypertension [29]. A meta-analysis of 49 studies with 3007 adolescents patients were included bariatric surgery in leads to similar outcome in weight loss reduction, glycaemic levels for diabetic patients and lipid control to adults [30]. The positive effect of bariatric surgery for severely obese adolescent on diabetes or hypertension, can justify the early surgical intervention. For the adolescents as for the adults, bariatric surgery results in significant improvement in insulin resistance, but also in liver steatosis, inflammation, and fibrosis [31].

Non-Alcoholic Fatty Liver Disease (NAFLD) is characterized by excessive hepatic fat accumulation (steatosis) in the absence of significant alcohol consumption, occurring with or without hepatic inflammation and fibrosis. NAFLD is the most prevalent form of chronic liver disease, affecting 10%–20% of the general paediatric population. The concern is the potential to become the leading cause of liver pathology, liver failure and indication for liver transplantation [32]. Obese adolescent have an increased risk for this pathology and 38% of obese children have excess fat deposition in the liver in which approximately 9% progress to Non-Alcoholic Steatohepatitis. (NASH) which is the most severe form of hepatic steatosis and can progress to cirrhosis [33]. AMOS study on 81 obese adolescent patients who underwent RYGB confirms the significant weight loss, frequent resolution of cardio metabolic comorbidity, and improvement in quality of life into the long term in adolescents with severe obesity [34].

Metabolic surgery have also a positive impact in the adolescents on the obstructive sleep apnoea (OSA) as for the adults. This is an important finding because OSA is associated with cognitive deficits as well as metabolic and cardiovascular morbidity, the potential positive impact of the surgery on obese adolescents cannot be minimised. This idea is sustained by Kalra, et al. in a retrospective review where identifies a resolution or significant reduction in OSA severity in the adolescent patients who underwent bariatric surgery [35]. Pseudotumor cerebri or idiopathic intracranial hypertension can be predominantly in overweight or obese adults correlated with hyperandrogenism was associated with an earlier age of onset of pseudotumor cerebri syndrome. Bariatric surgery and consecutive weight loss have a positive effect in either adult or adolescent obese patients [36].

What are the drawbacks?

Bariatric surgery is not recommended for pregnant or breast-feeding adolescents, if the patient presents cognitive disabilities, serious psychiatric or psychological disorder, Prader-Willi syndrome of hyperphagic conditions. These pathologies will interference with the compliance of the postoperative nutritional program, and will increase the risk of postoperative complication and failure [37]. Inge, et al. in multidisciplinary study state that the indications for operation should be more conservative than for the adults because the adolescents usually did not performed all the attempts to change the lifestyle or dietary measures and are more predisposed to the negative effects of the surgery. Also the postoperative compliance might lower that for the adults [38]. ASMBS paediatric metabolic and bariatric surgery guidelines 2018, suggests the possibility of an increase alcohol use after the surgery, especially when co-morbidities exist. Adolescents are more likely to stop taking nutritional supplements and a close follow-up with vitamin level monitoring is strongly recommended [39]. Nutritional deficiencies over 5 years, are greater after RYGB, particularly for iron and B12 deficiency and allowed by inadequate supplement intake, weight regain, black race and pregnancy [40]. Negative points associated with RYGB in adolescence, besides includes micronutrient deficiencies are also reoperation. The surgery must be well weighed before posing in operative indication [41].

Weight loss commonly reaches a plateau after 12 to 18 months in many patients. It must be kept in mind and well explained to the patient and to the family, that a surgical intervention do not guarantees the weight loss lifelong if the dietary measures are not respected and the possibility of weight regain exist. Up to 14% to 30% of adult patients regain much if not all of the initial weight lost over time. It seems that the adolescents will regain some weight after 5 to 10 years postoperatively [42].

What to expect in term of postoperative complications?

Postoperative specific complications after bariatric surgery include anastomotic leak, bleeding, anastomotic strictures, and nutritional deficiencies. Lamoshi et al. systematic review on the adolescent bariatric surgery report total complications (early and late), 15.8% of LSG of patients and 22.1% of RYGB patients [43]

Humayon, et al. 2005-2014 on bariatric surgery in adolescents study was observed in adolescents versus adults bariatric surgery procedures and lower complication risk and shorter length of stay than adults [44]. Teen-LABS, AMOS, Saudi Arabia and the Germany Obesity Registry studies in 750 adolescents operated by bariatric surgery compared to an incidence of 0.08-0.31 in adult studies report that postoperative complications and the incidence of reoperations appeared to be higher adolescent with 13-17% requiring reoperations as compared to 6-7% in adult [45] (Table 1).

Pros	Cons
50% to 77% of obese adolescents/ became obese adults	Risk of postoperative complications/reoperations
Bullying/Social marginalization	Nutritional deficiencies
Difficulties for sport activities	Non-compliance to follow-up
Difficulties to finding a job or a partner	Suicide/increased risk of alcohol or drug abuse
Risk of infertility	Efficiency of contraception / risk of pregnancy
Depression	
Surgery superior to medical treatment for weight loss	
Benefits on the comorbidities reduction	

Table 1: Advantages and disadvantages of the bariatric surgery in the treatment of obesity in adolescents.

What are the particularities of the postoperative follow up?

Success after bariatric procedures requires significant behavioural changes that are dependent on the patient's ability to successfully implement lifestyle changes [46]. White, et al. in a prospective study on 18 adolescents who underwent SG and 11 patients RYGB with a follow up of 4 years remarked the challenges of the follow-up that was inconsistent and difficult [47]. Dobritoiu et al in retrospectively study on 64 adolescent patients who underwent SG or RYGB between 2013 and November 2019 with a follow up of 3 years found that the surgical treatment is safe and effective and propose prophylactic doses of Ursodezoxicolic acid for 6 months postoperatively for the prevention of the gallbladder lithiasis [48].

The follow up should be by performed a multidisciplinary team composed by surgeon, paediatrician, mental health professionals, general practitioner and the family as a complementary support. It can also need the presence of an endocrinologist, a cardiologist and a pneumologist if the patient has comorbidities. There is not only the adolescent who is responsible for the good result, but also all the members of the team, but all the efforts are conditioned by the compliance of the patient. For this reason a correct evaluation before the surgery is so important (Figure 1).

There are special considerations?

Negative outcomes of bariatric surgery reported in adolescents can include the presence of risk of suicide and increased risk of alcohol or drug abuse [49] Vilallonga et al. in retrospective study of prospectively study on 28 adolescents treated by RYGB with follow-up between 2.4 and 10.2 found that the bariatric surgery in teens is safe with positive effects on weight loss, comorbidities and satisfaction degree but special attention must be on the effects of the efficacity of the conventional contraception and risk of pregnancy [50].

There is a place for the new technologies?

There is a number of new bariatric procedures and devices that show promise in their applicability to paediatric patients with obesity. These procedures are constituted by laparoscopic gastric plication, endoscopic sleeve gastroplasty, intragastric single or two balloons systems, duodenal-jejunal bypass sleeve liner, aspirated gastrostomies [51]. But further studies are necessaries to prove their efficacity in the field of bariatric surgery and especially their applicability in the obese teenagers.

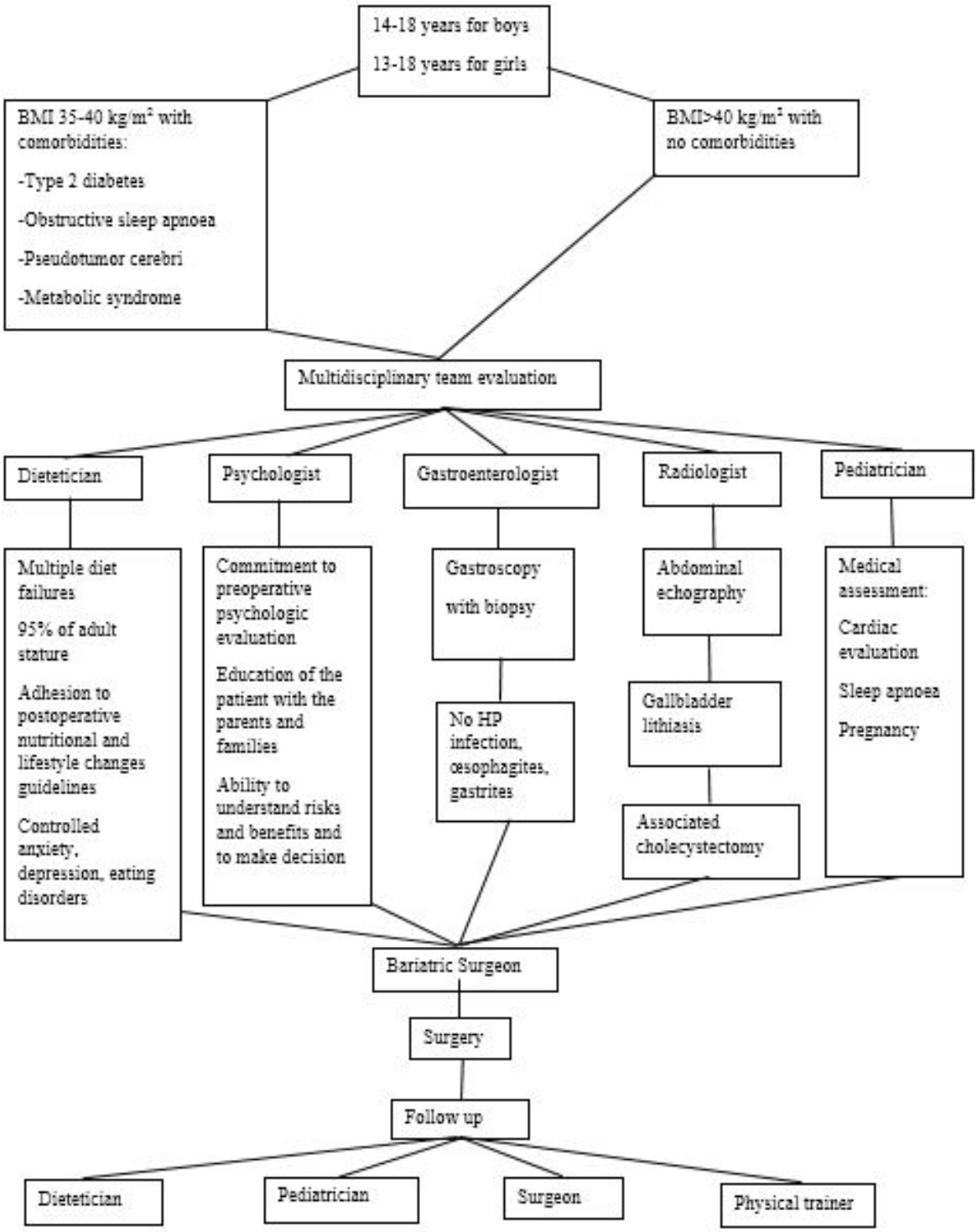

Figure 1: The Multidisciplinary Bariatric Team Management of Obese Adolescents.

Conclusion

Bariatric surgery has emerged as the most effective short-term weight loss strategy for adults with severe obesity, but its role in adolescents is still being defined. Nowadays, metabolic surgery is validated by the studies as an effective treatment of severe obesity in adolescents. A good selection of the patients and a close follow up are indispensable for a good postoperative result, and the operative indication must be more conservative than for the adults.

References

1. Srivastava G, Fox CK, Kelly AS, Jastreboff AM, Browne AF, et al. (2019) Clinical Considerations Regarding the Use of Obesity Pharmacotherapy in Adolescents with Obesity. Obesity (Silver Spring) 27: 190-204.
2. Blundell JE, Baker JL, Boyland E, Blaak E, Charzewska J, et al. (2017) Variations in the Prevalence of Obesity Among European Countries, and a Consideration of Possible Causes. Obes Facts 10: 25-37.
3. Papatheodorou K, Banach M, Bekiari E, Rizzo M, Edmonds M (2018) Complications of Diabetes J DiabetesRes 2017. J Diabetes Res 1-4.
4. Pratt JSA, Roque SS, Valera R, Czepiel KS, Tsao DD, et al. (2020) Stanford FC. Preoperative considerations for the pediatric patient undergoing metabolic and bariatric surgery. Semin Pediatr Surg 29: 150890.
5. Inge TH, Krebs NF, Garcia VF, Skelton JA, Guice KS, et al. (2004) Bariatric surgery for severely overweight adolescents: concerns and recommendations. Pediatric114: 217□223.
6. Sugerman HJ, Kellum JM, Sugerman EL, DeMaria EJ, Kennedy C, et al. (2003) Bariatric surgery for severely obese adolescents. Gastrointest Surg 7: 102-108.
7. Thenappan A, Nadler E (2019) Bariatric Surgery in Children: Indications, Types, and Outcomes. Curr Gastroenterol Rep 21: 24.
8. Jianchun Y (2014) Bariatric Surgery in Adolesencets : a multidisciplinary Approach. In: Huang C-K, éditeur. Essentials and Controversies in Bariatric Surgery.
9. Teelucksingh S, Dan D (2009) The results of gastric bypass surgery in a teenager. Br J DiabetesVasc Dis 9: 242-243.
10. Lambrinou C-P, Androutsos O, Karaglani E, Cardon G, Huys N, et al. (2020) Effective strategies for childhood obesity prevention via school based, family involved interventions: a critical review for the development of the Feel4Diabetes-study school based component. BMC EndocrDisord 20: 52.
11. Adams TD (2019) In Teens with Severe Obesity, Can Bariatric Surgery Wait until Adulthood? N Engl J Med 380: 2175-2177.
12. Parks EP, Finnerty DD, Panganiban J, Frasso R, Bishop-Gilyard C, et al. (2020) Perspectives of adolescents with severe obesity on social Media in Preparation for weight-loss surgery: a qualitative study. BMC Pediatr 20: 96.
13. Kelly AS, Marcus MD, Yanovski JA, Yanovski SZ, Osganian SK (2019) Working toward precision medicine approaches to treat severe obesity in adolescents: report of an NIH workshop. Int J Obes 42: 1834-1844.
14. Hsia DS, Fallon SC, Brandt ML (2012) Adolescent Bariatric Surgery. Arch Pediatr Adolesc Med 166: 757-766.
15. Ahn SM (2020) Current Issues in Bariatric Surgery for Adolescents with Severe Obesity: Durability, Complications, and Timing of Intervention. J ObesMetabSyndr 29: 4-11.
16. Jarvholm K, Bruze G, Peltonen M, Marcus C, Flodmark C-E, et al. (2020) 5-year mental health and eating pattern outcomes following bariatric surgery in adolescents: a prospective cohort study. Lancet Child Adolesc Health 4: 210-219.
17. Lainas P, De Filippo G, Di Giuro G, Mikhael R, Bougneres P, et al. (2020) Laparoscopic Sleeve Gastrectomy for Adolescents Under 18 Years Old with Severe Obesity. Obes Surg 30: 267-273.
18. Durkin N, Desai AP (2017) What Is the Evidence for Paediatric/Adolescent Bariatric Surgery? Curr Obes Rep 6: 278-285.
19. Burton ET, Mackey ER, Reynolds K, Cadieux A, Gaffka BJ, et al. (2020) Psychopathology and Adolescent Bariatric Surgery: A Topical Review to Support Psychologists in Assessment and Treatment Considerations. J Clin Psychol Med Settings 27: 235-246.
20. Stefater MA, Inge TH (2017) Bariatric Surgery for Adolescents with Type 2 Diabetes: an Emerging Therapeutic Strategy. Curr Diab Rep 17: 62.
21. Inge TH, Garcia V, Daniels S, Langford L, Kirk S, et al. (2004) A multidisciplinary approach to the adolescent bariatric surgical patient. J Pediatr Surg 39: 442-447.
22. Reddy SD, Sysko R, Mackey ER (2020) Mental health, loss of control eating, and cognitive functioning in adolescents undergoing bariatric surgery. Semin Pediatr Surg 29:150892.
23. Inge TH, Courcoulas AP, Jenkins TM, Michalsky MP, Brandt ML, et al. (2019) Five-Year Outcomes of Gastric Bypass in Adolescents as Compared with Adults. N Engl J Med 380: 2136-2145.
24. Maffazioli GD, Stanford FC, Campoverde Reyes KJ, Stanley TL, Singhal V, et al. (2016) Comparing Outcomes of Two Types of Bariatric Surgery in an Adolescent Obese Population: Roux-en-Y Gastric Bypass vs. Sleeve Gastrectomy. Frontiers in Pediatrics 4:78.
25. Beamish AJ, Olbers T (2019) Metabolic and bariatric surgery in adolescents. Nat Rev Gastroenterol Hepatol 16: 585-587.
26. Khattab A, Sperling MA (2019) Obesity in Adolescents and Youth: The Case for and against Bariatric Surgery. J Pediatr 207:18-22.
27. Wulkan ML, Durham MM (2005) Obesity in the United States: Is there a quick fix? Pros and cons of bariatric surgery from the pediatric perspective. Curr Gastroenterol Rep 7: 445-450.
28. Reinehr T (2018) Long-term effects of adolescent obesity: time to act. Nat Rev Endocrinol 14:183-188.
29. Stanford FC, Mushannen T, Cortez P, Campoverde Reyes KJ, Lee H, et al. (2020) Comparison of Short and Long-Term Outcomes of Metabolic and Bariatric Surgery in Adolescents and Adults. Front Endocrinol 11:157.
30. Qi L, Guo Y, Liu C-Q, Huang Z-P, Sheng Y, et al. (2017) Effects of bariatric surgery on glycemic and lipid metabolism, surgical complication and quality of life in adolescents with obesity: a systematic review and meta-analysis. Surg Obes Relat Dis 13: 2037-2055.

31. Armstrong SC, Bolling CF, Michalsky MP, Reichard KW (2019) Pediatric Metabolic and Bariatric Surgery: Evidence, Barriers, and Best Practices. Pediatrics 144: e20193223.

32. Black DD (2020) Impact of Bariatric Surgery on Adipose Tissue and Liver Inflammation in Adolescents with Nonalcoholic Steatohepatitis. J Pediatr 216: 7-9.

33. Temple J, Cordero P, Li J, Nguyen V, Oben J (2016) A Guide to Non-Alcoholic Fatty Liver Disease in Childhood and Adolescence. Int J Mol Sci 17: 947.

34. Olbers T, Beamish AJ, Gronowitz E, Flodmark C-E, Dahlgren J, et al. (2017) Laparoscopic Roux-en-Y gastric bypass in adolescents with severe obesity (AMOS): a prospective, 5-year, Swedish nationwide study. Lancet DiabetesEndocrinol 5:174-183.

35. Kalra M, Inge T, Garcia V, Daniels S, Lawson L, et al. (2005) Obstructive Sleep Apnea in Extremely Overweight Adolescents undergoing Bariatric Surgery. Obes Res 13:1175-1179.

36. Paley GL, Sheldon CA, Burrows EK, Chilutti MR, Liu GT, et al. (2015) Overweight and Obesity in Pediatric Secondary Pseudotumor Cerebri Syndrome. Am J Ophthalmol 159: 344-352.

37. Baur LA, Fitzgerald DA (2010) Recommendations for bariatric surgery in adolescents in Australia and New Zealand: Recommendations for bariatric surgery. J Paediatr Child Health 46: 704-707.

38. Matheson BE, Colborn D, Bohon C (2019) Bariatric Surgery in Children and Adolescents with Cognitive Impairment and/or Developmental Delay: Current Knowledge and Clinical Recommendations. ObesSurg 29: 4114-4126.

39. Pratt JSA, Browne A, Browne NT, Bruzoni M, Cohen M, et al. (2018) ASMBS pediatric metabolic and bariatric surgery guidelines, 2018. SurgObesRelat Dis 14: 882-901.

40. Fullmer MA, Abrams SH, Hrovat K, Mooney L, Scheimann AO, Hillman JB, et al. Nutritional Strategy for Adolescents Undergoing Bariatric Surgery: Report of a Working Group of the Nutrition Committee of NASPGHAN/NACHRI. J Pediatr Gastroenterol Nutr 54:125-135.

41. Xanthakos SA (2009) Nutritional Deficiencies in Obesity and After Bariatric Surgery. Pediatr Clin North Am 56: 1105-1121.

42. Wilson JA (2019) Gastric bypass in adolescents: should they have priority? J R Coll Physicians Edinb 49: 225-226.

43. Lamoshi A, Chernoguz A, Harmon CM, Helmrath M (2020) Complications of bariatric surgery in adolescents. Semin Pediatr Surg 29:150888.

44. Humayon S, Altieri MS, Yang J, Nie L, Spaniolas K, et al. (2019) Recent trends of bariatric surgery in adolescent population in the state of New York. SurgObesRelat Dis 15:1388-1393.

45. Pedroso FE, Angriman F, Endo A, Dasenbrock H, Storino A, et al. (2018) Weight loss after bariatric surgery in obese adolescents: a systematic review and meta-analysis. SurgObesRelat Dis 14: 413-22.

46. Zeller MH, Reiter-Purtill J, Jenkins TM, Kidwell KM, Bensman HE, et al. (2020) Suicidal thoughts and behaviors in adolescents who underwent bariatric surgery. Surg Obes Relat Dis 16: 568-580.

47. White B, Doyle J, Matschull K, Adamo M, Christie D, et al. (2017) Outcomes of fifty patients entering an adolescent bariatric surgery programme. Arch Dis Child 9.

48. Dobritoiu D, Buza M, Catanescu E, Copaescu C (2019) Excellent Short- and Medium-term Result of Bariatric Surgery in Adolescence. A Single Center Study. Chirurgia (Bucur) 114: 753-760.

49. Thakkar RK, Michalsky MP (2015) Update on bariatric surgery in adolescence: Curr Opin Pediatr 27: 370-376.

50. Vilallonga R, Himpens J, van de Vrande S (2016) Long-Term (7 Years) Follow-Up of Roux-en-Y Gastric Bypass on Obese Adolescent Patients (<18 Years). Obes Fact 9: 91-100.

51. Kang HS, DeAntonio J, Oiticica C, Lanning D, Browne A (2020) Novel and emerging devices and operations in the treatment of obesity in children and adolescents. Semin Pediatr Surg 29: 150881.