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SURGERY FOR OBESITY AND RELATED DISEASES

ASMBS guidelines

ASMBS pediatric committee best practice guidelines

Marc Michalsky, M.D., F.A.C.S., F.A.A.P.[a,*], Kirk Reichard, M.D., F.A.C.S., F.A.A.P.[b], Thomas Inge, M.D., F.A.C.S., F.A.A.P.[c], Janey Pratt, M.D., F.A.C.S.[d], Carine Lenders, M.D., F.A.A.P.[e]

[a]*Chair, American Society for Metabolic and Bariatric Surgery Pediatric Committee, Gainesville, Florida*
[b]*Co-Chair, American Society for Metabolic and Bariatric Surgery Pediatric Committee, Gainesville, Florida*
[c]*Immediate Past Chair, American Society for Metabolic and Bariatric Surgery Pediatric Committee, Gainesville, Florida*
[d]*Committee Member, American Society for Metabolic and Bariatric Surgery Pediatric Committee, Gainesville, Florida*
[e]*Department of Pediatrics, Boston Medical Center, Boston, Massachusetts*

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The prevalence of obesity among children and adolescents is rapidly increasing and is associated with substantial co-morbid disease states [1,2]. At present, a mounting body of evidence supports the use of modern surgical weight loss procedures for carefully selected, extremely obese adolescents [3]. Scientific evidence demonstrating the high propensity of severely obese adolescents to become severely obese adults [1] and the greater associated risk among adults with "juvenile-onset" obesity (i.e., obese adults who became obese during childhood; approximately 25%) [4–7] combined with the evidence demonstrating improvement in obesity-related co-morbid diseases after weight loss induced by bariatric surgery [8–10] support the concept of "early" intervention in carefully selected adolescents patients [11]. Although current evidence is not sufficiently robust to allow a precise discrimination or recommendations among specific bariatric procedures, an increasing body of data demonstrating evidence of safety and efficacy exists for 2 of the more commonly performed bariatric procedures for this age group (i.e., Roux-en-Y gastric bypass [RYGB] and adjustable gastric band [AGB]) [12–15].

The American Society for Metabolic and Bariatric Surgery Pediatric Committee acknowledges a recent and authoritative literature review and deliberation by a multidisciplinary group of experts assembled by the Betsy Lehman Center for Patient Safety and Medical Error Reduction. The previously published report of this collaborative [16], titled "Best Practice Updates for Pediatric/Adolescent Weight Loss Surgery" have been abstracted and supplemented with more recent publications, including a systematic review and meta-analysis [17], for the present position statement. The specific areas reviewed included prevention of early obesity-related mortality and morbidity, the criteria for patient selection, and the long-term outcomes of adolescent bariatric surgery.

Co-morbidities

Type 2 diabetes mellitus

A steep increase in the prevalence of type 2 diabetes is occurring worldwide, in parallel with the increasing rate of obesity in children and adolescents [18]. Type 2 diabetes is widely considered a chronic, progressive disease [19,20], and, among children and adolescents, it is associated with an increased risk of hypertension, dyslipidemia, and nonalcoholic fatty liver disease. In contrast to the significant challenges encountered in achieving adequate glycemic control with medical and behavioral approaches in this age group [21], recent data suggest that diabetes can go into complete remission in adolescents who undergo RYGB [22]. Thus, established type 2 diabetes is a strong indication for bariatric surgery in morbidly obese adolescents.

Obstructive sleep apnea

Up to 20% of children and adolescents with obesity have moderate to severe obstructive sleep apnea. Approximately 15% have central sleep apnea, which is often associated with episodes of severe oxygen desaturation during sleep

*Correspondence: Marc P. Michalsky, M.D., F.A.C.S., F.A.A.P., Department of Pediatric Surgery, Center for Healthy Weight and Nutrition, Nationwide Children's Hospital, Ohio State University College of Medicine, 700 Children's Drive, Suite ED379, Columbus, OH 43205.
E-mail: marc.michalsky@nationwidechildrens.org

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(<85%) [23]. With the prevalence of obstructive sleep apnea even greater among adolescents presenting for bariatric surgery, recent data have demonstrated substantial improvement and/or resolution after bariatric surgery in adolescents consistent with the outcomes in adults. Thus, moderate or severe obstructive sleep apnea (e.g., apnea-hypopnea index >15) is a strong indication for early bariatric surgery in adolescents.

Nonalcoholic fatty liver disease and nonalcoholic steatohepatitis

Approximately 38% of obese children and adolescents have steatosis compared with 5% of lean subjects, and about 9% have nonalcoholic steatohepatitis (NASH) compared with 1% of the lean population [24]. Although the risk factors for the progression of steatosis and NASH to frank cirrhosis are not fully understood, recent data have demonstrated a decrease in the degree of steatosis and inflammatory markers in most patients and regression in hepatic fibrosis after bariatric surgery in some patients [25,26]. Therefore, NASH should be considered as a strong indication for early bariatric surgery in adolescent patient compared with steatosis alone.

Pseudotumor cerebri

Bariatric surgery is considered the long-term procedure of choice among adults with pseudotumor cerebri [27,28]. Just as observed in adults, the symptoms of pseudotumor cerebri improve several months after bariatric surgery in adolescents [29,30]. Thus, pseudotumor cerebri is a strong indication for bariatric surgery in morbidly obese adolescents.

Cardiovascular disease risks

Although our understanding of cardiovascular disease (CVD) risk factors in association with childhood obesity continues to evolve, current data have shown an increased incidence of left ventricular hypertrophy in young adults (age 20–38 yr) as a consequence of juvenile-onset obesity [31]. In addition, researchers have reported that skinfold thickness and blood pressure measured in childhood and adolescence is associated with diminished carotid artery elasticity in adulthood [32]. These factors likely predict the long-term risk of CVD; however, evidence of short-term morbidity from these risk factors is lacking. Although weight loss after bariatric surgery has been shown to improve several CVD risk factors in adults [33], more robust analysis pertaining to baseline disease and the longitudinal effects in the adolescent population undergoing weight loss surgery is required. Thus, CVD risk factors are less strong indications for early bariatric intervention in adolescents.

Predictors of metabolic syndrome

Bariatric surgery can result in improvement of the metabolic and inflammatory parameters of the metabolic syndrome, including hyperinsulinemia, insulin resistance, and abnormal lipid metabolism [33]. Although evidence suggests that certain parameters associated with childhood obesity are linked to the development of the metabolic syndrome in adulthood, the diagnosis of the metabolic syndrome in this age group is ill-defined and not well standardized [34]. Therefore, a diagnosis of the metabolic syndrome in obese adolescents is a relative indication for bariatric surgery.

Quality of life

Research has clearly shown that obesity has a negative effect on quality of life in adolescents [35–39]. Several recent studies have also shown significant improvement in postoperative quality of life after RYGB and AGB in adolescents similar to the improvements seen in adult cohorts [12,40–42]. Therefore, bariatric surgery might have important benefits to the emotional health and quality of life in extremely overweight adolescents.

Depression

Many obese adolescents seeking weight management treatment present with signs of clinical depression [39,43–45]. Available data, however, indicate that the presence of depression before bariatric surgery does not adversely affect the rate of anticipated weight loss after bariatric surgery [46]. Current data demonstrate that depression improves markedly in adolescents after bariatric surgery [47]. Thus, depression is not an exclusion criterion for bariatric surgery. However, suicide can be a risk after bariatric surgery in adults [48], and it is important that adolescents with preoperative depression be monitored for recurrence of depression postoperatively.

Eating disorders

Binge eating and self-induced purging occur in 5–30% of obese adolescents seeking bariatric surgery. The presence of such eating disturbances before bariatric surgery does not appear to affect weight loss outcome after bariatric surgery in adult cohorts, at least in the short term. Therefore, although not studied specifically in adolescents seeking bariatric surgery, the presence of eating disturbances is not an exclusion criterion. If an eating disorder is identified, treatment should be initiated and the patient should be considered stable before bariatric surgery.

Patient selection

Recent evidence has demonstrated increased metabolic risks associated with a greater body mass index (BMI) for age, especially ≥99th BMI percentile compared with lesser

grades of obesity [1]. Because the average BMI increases with increasing age, a naturally more conservative approach for the younger patients can be achieved by using a fixed BMI cutoff point. Because all adolescent boys and most adolescent girls <18 years old with a BMI of 35 kg/m^2 are greater than the 99th BMI percentile [1], the BMI thresholds used for adult selection criterion appear to be appropriate for adolescents, with some modification with regard to associated co-morbid disease thresholds. As recently recommended, the selection criteria for adolescents being considered for a bariatric procedure should include a BMI of ≥35 kg/m^2 with major co-morbidities (i.e., type 2 diabetes mellitus, moderate to severe sleep apnea [apnea-hypopnea index >15], pseudotumor cerebri, or severe NASH) or a BMI of ≥40 kg/m^2 with other co-morbidities (e.g., hypertension, insulin resistance, glucose intolerance, substantially impaired quality of life or activities of daily living, dyslipidemia, sleep apnea with apnea-hypopnea index >5) [16]. The associated risk/benefit analysis should also include the consideration of the potential long-term health risks of untreated or inadequately treated obesity for the individual candidate.

Team member qualifications

No empirical evidence is available supporting the establishment and use of a multidisciplinary team for adults or adolescents undergoing bariatric surgery; however, this approach is rational and is currently well established as the standard of care [49–51]. The recommendations for specific elements designed to maximize a multidisciplinary approach might require institution variation depending on the specific institutional resource logistics. An example of the rudimentary components includes the following team members.

1. Surgeon (should be an experienced bariatric surgeon)
2. Pediatric specialist (this could be a pediatrician with a specialty in endocrinology, gastroenterology, nutrition, and/or adolescence, or an internist or family practitioner with training in adolescent medicine)
3. Registered dietitian (experience in treating obesity and working with children and families); experience with adults undergoing bariatric surgery is preferable but not mandatory
4. Mental health specialist (psychiatrist, psychologist, or other qualified and independently licensed mental health specialist with specialty training in pediatric, adolescent, and family treatment and experience in treating eating disorders and obesity); in addition, the practitioner should have experience evaluating patients and families for bariatric surgery.
5. Coordinator (registered nurse, social worker, or one of the other team members who has the responsibility of coordinating the care for each child or adolescent and ensuring compliance and follow-up)
6. Exercise physiologist, physical therapist, or other individual specially trained to provide safe physical activity prescriptions to morbidly obese adolescents

Risks and outcomes

Patients with a greater BMI and more serious medical illness are at increased risk of complications after bariatric surgery. Providing access to bariatric surgery earlier in life when the disease burden and severity is lower might decrease the operative risk, morbidity, and mortality. Additionally, earlier surgical intervention alters the natural course of many obesity-related co-morbidities that otherwise would put the patient at risk of long-term complications and early mortality.

Psychosocial risks

The psychosocial outcomes after bariatric surgery have not been adequately studied, particularly in adolescents. Although current short-term data show improvement in depression, eating disturbances, and quality of life after weight loss induced by bariatric surgery [47,52], the long-term results have not been well studied.

Nutritional risks

Noncompliance with medical regimens is particularly common among adolescents with chronic illnesses [53]. Therefore, adolescents undergoing bariatric surgery should be carefully assessed for their ability to comply with the medical regimens and follow-up care [54,55]. Consistent attendance and compliance with medical interventions is an important measure of whether a patient and family are likely to comply with care postoperatively. Low levels of iron, vitamin B_{12}, vitamin D, and calcium are common problems after RYGB [55]. Adolescents also could be at particular risk of thiamine deficiency [56]. Adolescence is a critical period for bone mass accumulation, with ≤50% of adult total bone mass achieved during this period; calcium and vitamin D are vital for the accrual of optimal bone mineral in the developing skeleton [57,58].

Pregnancy risks

No studies have examined the outcomes of pregnancy after bariatric surgery in the adolescent population; however, a recent investigation has reported a twofold increase in pregnancy in adolescent bariatric patients [59]. This finding suggests that the risk of pregnancy in adolescents undergoing bariatric surgery might be increased. All female adolescents should be informed about increased fertility after weight loss and that pregnancy during the first 18 months after bariatric surgery has possible risks. These patients should be counseled to avoid pregnancy during this period and offered contraception. For patients who become

pregnant in the years after bariatric surgery, data have shown that the risks of pregnancy (i.e., eclampsia, gestational diabetes) are significantly reduced after surgically induced weight loss [60].

Informed consent

The process of informed consent in the adolescent who is referred for bariatric surgery is associated with certain medical, legal, and ethical issues [61]. It is important for the care team, patient, and family to recognize and consider the specific risks of bariatric surgery, particularly those relevant to the younger patient, as a part of a carefully considered risk/benefit decision. The key facts to recognize and consider are (1) most adolescent obesity tracks into adulthood, with the risk factors for adult obesity increasing with age, greater BMI, and parental obesity [1]; (2) bariatric surgery is far more effective than behavior modification and/or family-based therapy, which, in turn, is generally more effective than unsupervised diet and exercise [62]; and (3) some dieting behaviors and untreated obesity can carry a risk of morbidity and mortality—these are generally long-term risks and must be weighed against the operative mortality and morbidity associated with bariatric surgery. Knowledge and understanding of these issues by the patient and family should be formally assessed as a part of the informed consent process.

Problems arise when the adolescent and parents disagree about bariatric surgery. A gap often exists between the adolescent and parent perception regarding the effect of obesity on their lives [36,38,44]. Parents tend to endorse the negative medical and psychosocial effect that obesity is having on their children more strongly than the adolescent does. One must be extremely careful to recognize when overt or subtle coercion is responsible for a child's assent to surgery. Without an empirically valid method of assessing the capacity of an adolescent to make an informed decision about bariatric surgery, the clinical team must consider the adolescent's cognitive, social, and emotional development and support their independent role in the decision-making process [61].

Types of bariatric surgery

A review of the current data indicates that patient safety and weight loss outcomes for extremely obese adolescents undergoing bariatric surgery are comparable [63,64] or better than those seen in adults [12,14,15,40,62].

Gastric bypass

The use of RYGB for weight loss in the United States dates back to the 1960s for adults and the 1980s for adolescents [63,64]. Recent data focused on the application of RYGB in the adolescent population have demonstrated equivalent safely and efficacy compared with historic data derived from the adult population [62,65,66]. A meta-analysis that reviewed the outcomes of 6 RYGB studies, including 131 adolescent patients (mean BMI of 51.8 kg/m^2) reported a significant and sustained decrease in BMI after surgery [17]. Examination of these data demonstrated perioperative morbidity among adolescents undergoing RYGB that was similar in nature and severity to that of adult RYGB patients. Severe complications, such as anastomotic leak, sepsis, bleeding complications, and thromboembolic events, are rare but have been reported. No deaths have been reported in the perioperative period, with 3 long-term deaths reported (occurring 9 mo and 2 and 6 yr after RYGB) [62]. Substantial efforts should be made to achieve long-term follow-up after RYGB to limit the associate risks of micronutrient and vitamin deficiencies [56] and to maximize postoperative nutritional compliance [54]. This is particularly important in this patient population because adolescence is a period of increased growth and development and decreased compliance [64].

Adjustable gastric banding

A substantial number of reports on the use of AGB in adolescents have been published in the past several years [40,41,67–70] AGB offers an effective and attractive treatment option in carefully selected patients, because of its excellent safety profile and lower risk of postoperative vitamin deficiencies compared with RYGB and biliopancreatic diversion. Although AGB is not yet approved by the Food and Drug Administration for use in children <18 years old, its use has increased dramatically. One study demonstrated a sevenfold increase in the use of AGB for patients 13–20 years old from 2005 to 2007 [71].

A review of the published series by Pratt et al. [16] included >200 adolescents and demonstrated a substantial loss of excess body weight (37–63%) during the 6-month to 7-year follow-up period. No deaths occurred in these studies, and the complication rates were 6–10%. The reoperation rates, including band removal, were 8–10% [41,67,68]. A meta-analysis of 8 AGB studies reported data on 352 patients (mean BMI of 45.8 kg/m^2) [17]. That report documented significant and sustained weight loss and complications similar to those reported in adult AGB patients. Most complications were mechanical or device-related and not life-threatening, although many required reoperation. AGB has been shown to effectively reduce cardiovascular risk factors in adolescent patients. A study of 20 adolescent patients, aged 14–17 years, who underwent AGB demonstrated 41% excess weight loss and resolution of the metabolic syndrome in 82% of patients 18 months after surgery [72].

In a recent randomized controlled trial comparing lifestyle modification with AGB, O'Brien et al. [69] reported a significantly greater decrease in body weight (30% BMI reduction for the operative versus 3% for the nonoperative

treatment group) and improvement in health status and quality of life when comparing the longitudinal outcomes (2 yr) of the operative versus nonoperative study groups. Complications requiring reoperation, however, developed in more than one quarter of the adolescents undergoing AGB. Although these initial reports appear to be encouraging, more robust longitudinal data encompassing precise descriptions of changes in co-morbidities after AGB in adolescents are still lacking. Based on current data, AGB is more effective than behavioral interventions alone and results in significant weight loss when used as a part of a comprehensive weight loss program for adolescents. In the United State, the off-label use of the AGB in the pediatric population can occur with investigational device exemption from the Food and Drug Administration.

Other procedures

More recently, the number of sleeve gastrectomies being performed in the adolescent population is increasing owing to the low short-term complication rates reported for the adult population and the decreased risk of associated nutritional deficiencies. Although long-term adolescent outcomes data are required, the preliminary results from ongoing studies of adolescents undergoing sleeve gastrectomy appear to demonstrate excellent weight reduction, reversal of associated co-morbid diseases, and morbidity outcomes similar to those of the adult population.

Reports describing the outcomes related to biliopancreatic diversion and duodenal switch, exist but currently are not robust. Concerns regarding associated fat-soluble vitamin deficiencies and long-term protein malnutrition limit the ability to offer specific recommendations at present [73,74].

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Disclosures

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