CE 2.5 Contact Hours

Development of an Algorithm for Adolescent Bariatric Surgery

Nichole B. Roller, RN, DNP-S

Abstract: Childhood obesity has become a national epidemic, and children are diagnosed with obesity-related comorbidities, which were once only associated with adults. Despite current interventions, children continue to exude poor diet and physical activity outcomes. The algorithm developed and described here was in congruence with a regional healthcare facility mission and goals. The final product is an adolescent weight management algorithm to include bariatric surgery for select adolescents who meet the criteria. A literature review was conducted by searching databases EBSCO, CINAHL, Bing, Google Scholar, and Academic Search Premier. The algorithm was developed by reviewing current literature and evidence on adolescent bariatric surgery. Experts in the field of adolescent bariatric surgery were contacted to evaluate the proposed algorithm. The development of an adolescent bariatric surgery program poses many challenges as it remains a relatively new process. The screening that adolescents undergo before surgery is extensive and takes several months to complete. The algorithm may be helpful in the development of an adolescent bariatric surgery program and in the primary care setting as it can guide providers in the adolescent weight management process. The algorithm and the recommendations may be used as a starting point for program development and adolescent weight management, but the ultimate decision on which adolescents have surgery should be based on expert medical and surgical personnel judgment of adolescent obesity specialists.

KEY WORDS: adolescent, obesity, management, bariatric surgery

BACKGROUND

According to the Centers for Disease Control and Prevention (CDC), the number of overweight and obese children has tripled in the past 30 years (CDC, 2013). Nationally, 18% of children between 6 and 11 years old and 18% of children between 12 and 19 years old are obese, whereas in 1980, only 7% of children in these age ranges were determined to be obese. Childhood obesity has become a national epidemic and, if not reversed, is estimated that, by 2030, 50.1% of adults and 30% of children and adolescents will be classified as obese (Montoya & Lobo, 2011).

The consequences of obesity affect children physically, psychologically, and socially. However, the potential impact of the physical consequences could be chronic and eventually fatal if left untreated. Healthcare costs related to treating children for obesity-related problems have increased more than threefold in the past 2 decades (Shaya, Fores, Gbarayor, & Wang, 2008). Obesity has known detrimental effects on a child's psychological state of mind. According to the CDC, obese children are at an increased risk for depression and social stigmatization (CDC, 2013). "Studies have shown a relationship between childhood obesity, lowered self-esteem, discrimination, stigmatization, and peer rejection particularly in educational settings" (Shaya et al., 2008). Research conducted by Puhl and Heuer (2009) confirms that individuals who are obese face stigmatization because of their weight in many aspects of their life. These individuals may face discrimination by healthcare workers who have the perception that obese patients are noncompliant with weight loss treatment and often assume that patients lack the motivation to make necessary changes for weight loss. Puhl and Heuer's research indicates that the fact that a portion of healthcare professionals who do not have confidence in prescribing weight loss plans in obese individuals and believe treatment for weight loss when the individual is obese is pointless. In addition, Puhl and Heuer document that those adolescents who are obese face stigmatization by educators in primary school through college and, because of their weight, are less likely to continue with their education than those students of normal weight (Puhl & Heuer, 2009).

Children and adolescents face many barriers in the prevention and treatment of obesity, including obstacles at home, in school, and in the environment. Over the years, intervention programs have focused on the school setting, but children continue to exude poor diet and physical activity outcomes. In the article "School-Based Obesity Interventions: A Literature Review," the authors state that "…there is a lack of understanding of the sustainability and efficacy of different types of interventions across the board" (Shaya et al., 2008). Obesity in children cannot be prevented or treated if changes are not made at home, in school, and throughout the community.

Because of the current obesity trends, an increasing number of adolescents may be in need of bariatric

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surgery, either gastric bypass, adjustable gastric band (AGB), or gastric sleeve procedure. However, many adult bariatric surgery programs do not have a protocol as adolescent bariatric surgery has been viewed as unwarranted. An algorithm for adolescent bariatric surgery will be a useful tool in assisting bariatric centers in instituting practice guidelines and surgery protocols. In addition, many primary care providers are unsure of how to treat obesity in children and adolescents. The developed algorithm will provide them with instructions from the initial assessment of the individual and to the last phase, which is the evaluation for bariatric surgery and follow-up care after surgery.

METHOD

The algorithm was designed for a regional healthcare facility in North Dakota because the organization lacked a program protocol for adolescent bariatric surgery. The literature review of childhood and adolescent obesity was taken into consideration when designing the algorithm as well as meeting with the organizations' eating disorders unit and bariatric surgery staff.

The committee of the regional healthcare facility desired an algorithm be developed to include initial assessment of an obese adolescent, conservative weight loss methods, pharmacological weight loss options, and bariatric surgery with a time frame for each step. Team members were also interested in screening criteria needed preoperatively, contraindications for surgery, risks of the surgery, necessary team members, types of bariatric surgery used in adolescents, and follow-up care. Through research, it was noted that the American Society for Metabolic and Bariatric Surgery (ASMBS) has made recommendations on bariatric surgery for weight loss in morbidly obese adolescents who have failed previous weight loss attempts; however, the best practice guidelines the ASMBS released did not propose a guide for program development (Michalsky, Reichard, et al., 2011). Because of the need for guidance in program development, the committee requested an algorithm be developed to assist in the process.

Design an Algorithm

The information included in the algorithm is based on current evidence, staff input, and the recommended process for weight loss as instructed by a national pediatric specialist and completed using current and available research. There are several requirements adolescents must meet, and one must undergo an extensive screening process before an individual is considered for bariatric surgery.

Assess and Diagnose

The first step is to assess for obesity by obtaining height and weight to determine the body mass index (BMI) percentile. Normal weight is less than the 85th percentile, overweight is 85th–95th percentile, obese is greater than the 95th percentile, and severe obesity is greater than the 120th percentile (Klish, 2014).

Adolescents with a normal BMI percentile should be instructed to continue with healthy behaviors, and providers should observe for rapid weight gain (Institute for Clinical Systems Improvement, 2013). Overweight individuals should be given educational materials on lifestyle changes, such as diet and exercise, and encouraged to schedule a follow-up appointment with their primary care provider in 4 weeks. Follow-up visits should include weight, blood pressure measurement, and patient and family reinforcement on diet and exercise. Providers may refer an individual to organized weight loss program if follow-up visits prove to be successful (Klish, 2014). Individuals who are not successful with losing weight may consider a reevaluation of changes that have been made and changes still needing to occur. Weight loss goals for the first 6 months depend on the degree of obesity and the severity of the comorbid conditions present. Lifestyle changes made by the adolescent should be monitored for at least 6 months before moving to more intense therapy (Institute for Clinical Systems Improvement, 2013). Adolescents with a BMI percentile indicating severe obesity are at risk for comorbidities, and orders to evaluate fasting blood sugar, alanine aminotransferase, and lipids can be placed by the primary care provider, and then, they can proceed to the next phase of the algorithm (Klish, 2014; Figure 1 depicts Phase 1 of algorithm).

Educate and Change Encouragement

After a diagnosis of obesity or severe obesity is given, the provider offers medically supervised weight loss treatment. The next step of the algorithm relies on the patient's and family's motivation to make necessary changes. If the patient and family are motivated to make changes, then the provider incorporates education on nutrition, increased physical activity, behavior modification, and family counseling. Follow-up visits should be every 4 weeks for 6 or more months. Depending on the progress and weight lost, the adolescents should continue with the lifestyle changes and follow-up with their primary care provider as needed (Institute for Clinical Systems Improvement, 2013). Goals should be assessed; if they are not achieved but the individual remains motivated, then the next step is to make a referral to an endocrinologist at an adolescent weight loss center to discuss initiation of pharmacological therapy. Pharmacological therapy may be considered if the individual is obese with comorbidities or is

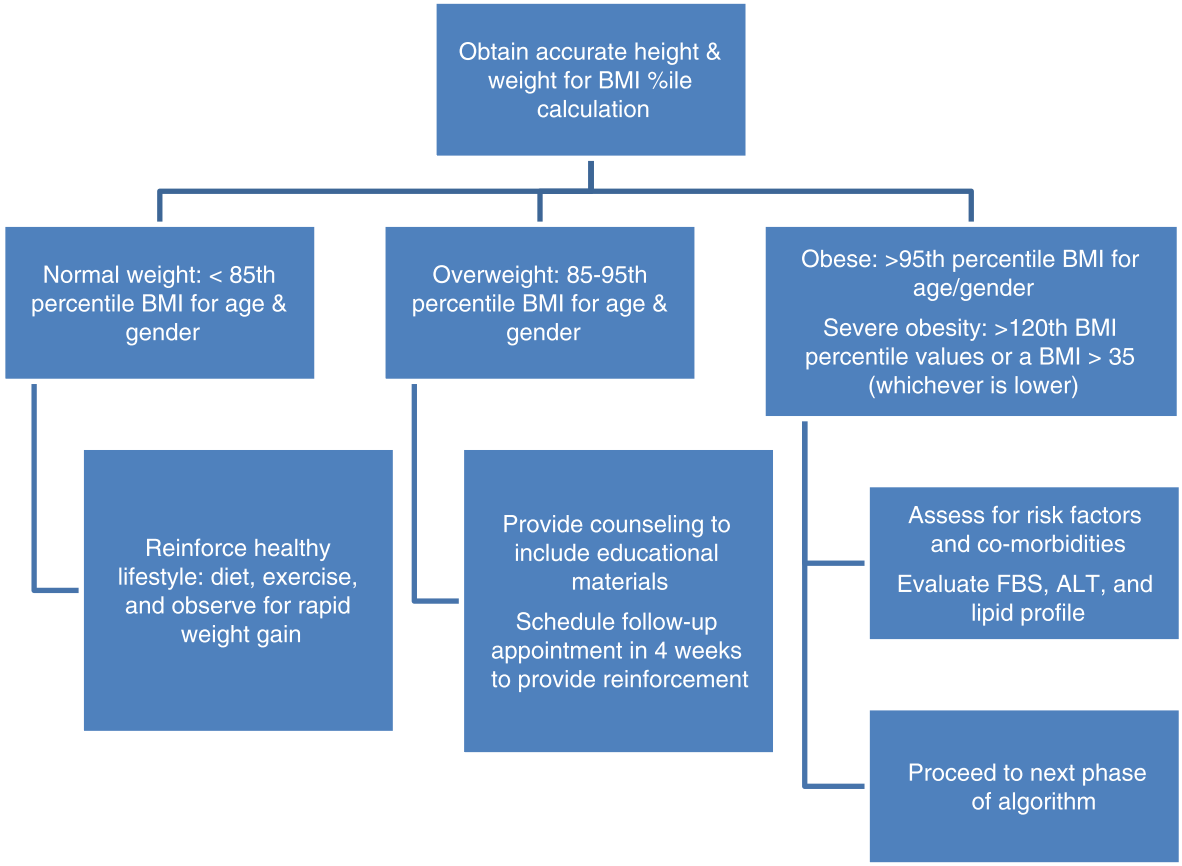

FIGURE 1. Assess and diagnose.

severely obese with a BMI > 99th percentile (Institute for Clinical Systems Improvement, 2013).

Currently orlistat, metformin, and phentermine are medications indicated for use in adolescents for weight loss. Orlistat decreases the absorption of fatty acids by 30% in people who ingest a 30% fat diet. Side effects of this medication are abdominal cramping, flatus, and oily bowel movements. However, with continued use, the side effects decrease. Orlistat may interfere with absorption of fat-soluble vitamins. To prevent vitamin deficiencies, a daily multivitamin containing Vitamins A, D, E, and K should be taken (Iughetti, China, Berri, & Predieri, 2010). Orlistat may be used in individuals aged 12 years or older (Spear et al., 2007). Metformin is an oral antihyperglycemic agent. As a treatment option for pediatric obesity, the medication is safe and shown to induce minimal weight loss after 6–12 months of use. Despite marginal weight loss, metformin has multiple cardiac and metabolic benefits (Kelly et al., 2013). There is no correlation of weight loss and dose of metformin prescribed; however, best results have been obtained by prescribing 1000 mg daily (Brufani et al., 2013). Potential side effects of this medication are diarrhea, bloating, stomach pain, gas, indigestion, constipation, metallic taste in the mouth, heartburn, flushing, nail changes, muscle pain, chest pain, and rash (National Institutes of Health, 2014). Phentermine is a stimulant and appetite suppressant and approved for use in adolescents who are 16 years old and/or older. This medication should not be used for more than 12 months (Institute for Clinical Systems Improvement, 2013). Common side effects from this medication include dry mouth, unpleasant taste, diarrhea, and vomiting. Serious side effects can include increased blood pressure, heart palpitations, restlessness, dizziness, tremor, insomnia, shortness of breath, chest pain, lower extremity edema, and difficulty performing physical exercise an individual is normally able to perform (National Institutes of Health, 2013). Effectiveness of these medications may be reduced after 6 months to 1 year of use, and regaining weight after discontinuation is common. If after 6 or more months of treatment and goals have not been achieved, then it may be necessary to continue to the next phase of the algorithm if the adolescent and family are

motivated. Providers continue to educate adolescents and families who are not currently motivated to make changes on risks of obesity and related comorbidities. A follow-up appointment is made periodically to asses for patient and family motivation in making lifestyle changes (Institute for Clinical Systems Improvement, 2013; Figure 2 depicts algorithm for education and change encouragement).

Bariatric Surgical Screening

The first step of this phase of the algorithm is to determine if the adolescent meets the criteria for bariatric surgery. Evaluation is performed by a multidisciplinary team at a facility specializing in adolescent bariatric surgery. The facility must have staff and administration personnel dedicated to the excellence of care provided to the adolescent population. Staff members must be able to provide compassionate care to severely obese adolescents and understand the medical and psychosocial comorbidities associated with the disease. Staff must be skilled at providing preoperative and postoperative care of patients undergoing bariatric surgery. The facility where surgery will take place must have an age-appropriate intensive care unit staffed with a physician skilled in advanced cardiac life support and available 24 hours per day. In addition, the organization offering adolescent bariatric surgery is required to have specialized bariatric equipment designed for the care of patients who are morbidly obese. The medical director of this program must be a pediatric expert to "evaluate and manage the developmentally unique aspects of pediatric patients and their families" (Michalsky, Kramer, et al., 2011, p. 67). During the course of evaluation and treatment, bariatric surgery team members should

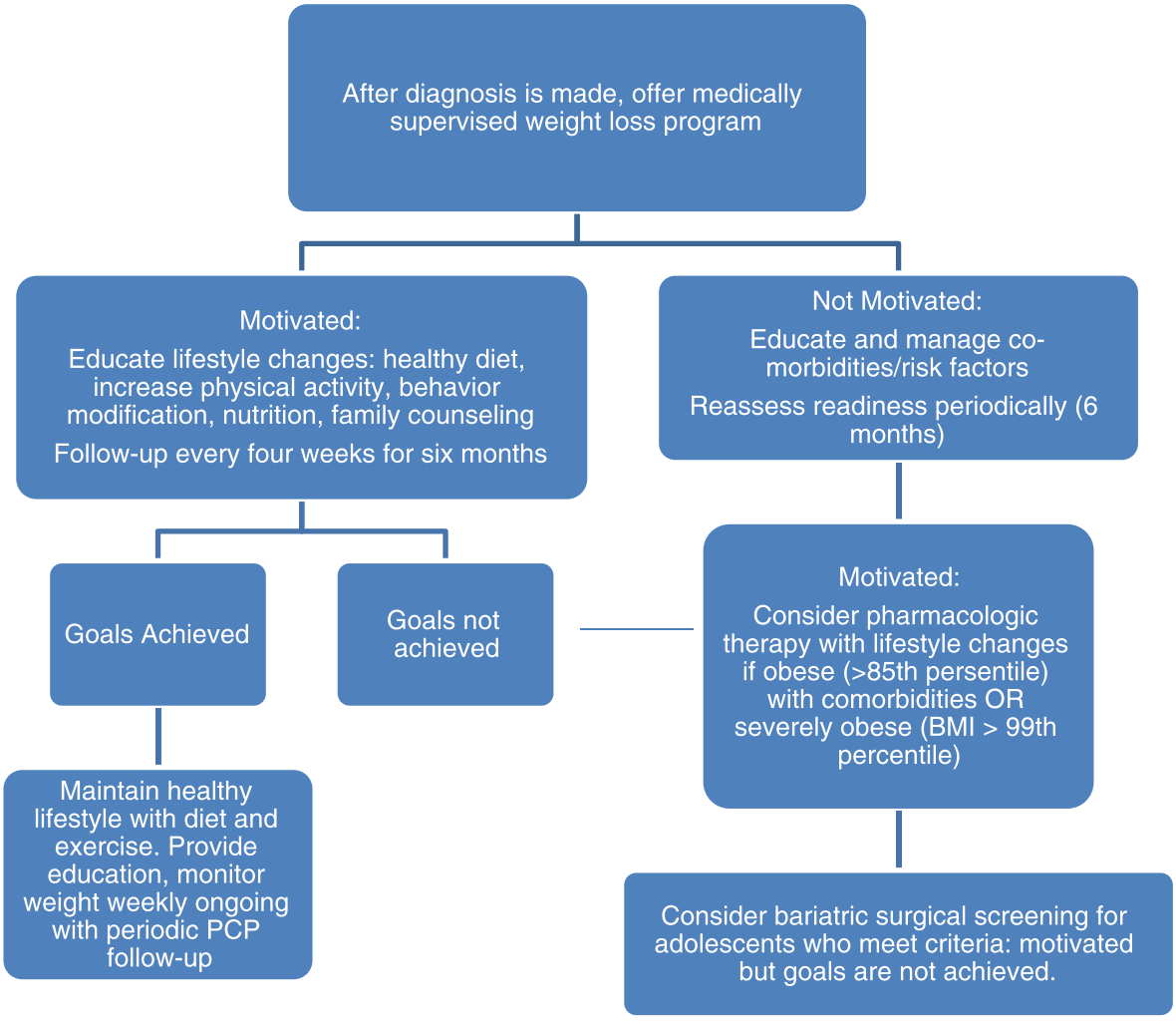

FIGURE 2. Algorithm for education and change encouragement.

keep the patients' primary provider informed of their medical status (Michalsky, Kramer, et al., 2011).

The ASMBS recommends facilities to have a multidisciplinary team in place for adolescents undergoing bariatric surgery (Michalsky, Reichard, et al., 2011). Disciplines chosen to be included in the team are based on each facility and the available resources. Below is a basic list of disciplines that can be combined to form a multidisciplinary team (Michalsky, Reichard, et al., 2011).

1. A surgeon who is skilled in bariatric surgery.
2. A pediatric specialist does not have to be a medical doctor or an expert in bariatric surgery.
3. A registered dietician who is skilled in caring for obese pediatric patients and their families.
4. A mental health specialist who has previous experience working with families, children, and adolescents. The mental health specialist should have a background in eating disorders and evaluating patients for bariatric surgery.
5. A team member willing to be a coordinator of care for the adolescent. This provider will encourage treatment adherence and follow-up appointments.
6. An exercise specialist to educate the adolescent on safe and effective activities for their individual obesity-related activity challenges.

The screening criteria adolescents need to meet to undergo bariatric surgery are extensive. Adolescents with a BMI greater than or equal to the 95th percentile with one or more serious obesity-related comorbidities or a BMI greater than or equal to the 99th percentile with less serious complications may be considered for bariatric surgery. If a patient presents for surgery with a BMI greater than 55 kg/m^2, a further weight reduction is recommended by some clinicians to occur before surgical intervention for the adolescent to achieve a nonobese stature after surgery (Inge & Kollar, 2011). The adolescent needs to have participated in 6 consecutive months of medically supervised weight loss attempts (Cleveland Clinic, 2011). Physical maturity needs to be attained before surgery and is determined by assessing bone age. Completing 95% of predicted adult stature based on bone age or having reached Tanner stage IV is a requisite (Xanthakos & Inge, 2014). Adolescents need to show commitment to comprehensive medical and psychological evaluations before and after surgery. All women are advised to avoid pregnancy for 12–18 months postoperatively and cannot be pregnant at the time of surgery. Adherence to nutritional guidelines postoperatively is necessary for weight loss success. The adolescent undergoing surgery will be required to provide assent before the surgical procedure (with their legal guardian providing consent), show mature decision making, and understand the risks/benefits of surgery. To achieve optimal outcomes, it is important that the individual has family support available preoperatively and postoperatively (Cleveland Clinic, 2011).

Before an adolescent undergoes bariatric surgery, potential medical causes of obesity need to be ruled out. Causes of obesity can be from medications or medical illness such as Cushing syndrome and Prader–Willi syndrome (Xanthakos & Inge, 2014). Contraindications may prevent the individual from having bariatric surgery and include substance abuse problem within the past year; medical, psychiatric, psychosocial, or cognitive condition preventing patient from abiding to postoperative dietary and medication regimens; impediment in their decision making ability; current or planned pregnancy within 18 months of procedure; and inability of the patient or parent to understand risks of surgical treatment and need for lifelong postoperative medical and nutritional management (Inge & Kollar, 2011).

The next step of the screening process includes a variety of laboratory and radiographic tests. Further evaluation by specialists may be indicated given the testing results and postpone the adolescent as a candidate for surgery. Adolescents who are not candidates for surgery should follow up with their primary care provider periodically to continue with weight loss management as well as to reassess changes that may qualify them for surgery. Table 1 documents the recommended tests necessary before surgery (Cleveland Clinic, 2011; Inge et al., 2004; Inge & Kollar, 2011). The entire screening process may take several months to complete.

Choosing a weight loss procedure is the next step of the algorithm for an adolescent who has been cleared for bariatric surgery. Three main choices are available, the Roux-en-Y bypass (RYGB), gastric sleeve resection, and the AGB.

The RYGB procedure creates a small pouch out of the stomach, which decreases an individual's appetite. The "Y" portion of the procedure consists of dividing the small intestine (length determined by surgeon) and attaching the distal intestinal limb to the stomach to bypass the duodenum (Cleveland Clinic, 2011).

The AGB procedure consists of placing the AGB around the upper portion of the stomach, creating a small stomach pouch and larger lower pouch. The band can be tightened and loosened by injecting fluid into a port (under the skin), which is attached to a balloon within the ABG. Unlike RYGB, this procedure is completely reversible and is performed in patients aged 18 years and older (Inge & Kollar, 2011).

The third option for the adolescent is the sleeve gastrectomy. This procedure consists of removing a large portion of the fundus and curvature of the stomach, leaving behind a small, tubular stomach. The sleeve gastrectomy is seen by many as a safer surgical treatment

Table 1: Recommended Bariatric Surgery Screening

• Comprehensive history and physical examination	• Chemistry profile
• Waist circumference, height, weight, BMI	• Complete blood count
• Systolic and diastolic blood pressure	• Hemoglobin A1C
• Fasting lipid profile	• Psychological adjustment disorders
• Oral glucose tolerance test (elevated fasting blood sugar)	• Thyroid stimulating hormone
• Liver function tests	• Urinalysis
• Echocardiogram	• Pregnancy tests (female or beta HCG)
• Electrocardiogram (including exercise stress test if present prolonged QT)	• Polysomnography (sleep apnea symptoms)
• Chest radiograph	• Abdominal ultrasound (chronically elevated liver enzymes or gallstone concern)
• Urea breath test or endoscopy (excluding *Helicobacter pylori* infection if patient exhibits unexplained anemia or abdominal pain/ulcer history)	• Specialist evaluation (if preliminary results indicate need)
• Bone age (If there is a need to assess patient maturity as surgery causes rapid weight loss. Concern exists that this procedure may cause inhibition of structural growth if adolescent is not near anticipated adult height. Radiograph of hand and wrist can be completed to accurately determine achieved adult stature percentage.)	• Primary care provider documentation of continued weight loss attempts through lifestyle changes and medical use (Most insurance companies require documentation show at least 6 months of attempted weight loss regardless of weight loss or gain; some insurance companies will not cover surgical procedure if patient is less than 18 years old.)

BMI = body mass index. Sources: Cleveland Clinic, 2011; Inge & Kollar, 2011; Inge et al., 2004.

option for obesity as patients are less likely to have internal herniation and malabsorption problems (Lim, 2014). Another advantage of the sleeve gastrectomy is a decrease in ghrelin levels in the body for as long as 1 year. Ghrelin has an effect on appetite, and lower levels are associated with a decreased appetite (Adair & Ellsmere, 2014).

Before adolescents and their families can make a decision with the team's guidance, it is imperative that they understand risks and benefits of the procedures. Table 2 lists the risks of the three procedures most often used to treat adolescents with severe obesity. Figure 3 depicts bariatric surgical screening algorithm.

Follow-Up Care

The last step of this phase is follow-up care. "Compliance with long-term post-operative follow-up care is critical for appropriate monitoring of weight-loss velocity and to provide anticipatory guidance and goal-setting for both patient and his or her family" (Michalsky, Kramer, et al., 2011, p. 69). Postoperatively, patients

Table 2: Short-Term Risks of Gastric Bypass Surgery

Roux-en-Y[a]	Adjustable Gastric Band (Age of 18 Years and Older)	Sleeve Gastrectomy
• Infection at point of incision	• Bleeding	• Bleeding
• Blood flow blockage in lungs	• Infection	• Stenosis
• Pulmonary embolism	• Band slippage	• Gastric leaks
• Stomach leak into other parts of body	• Band erosion into stomach	• GERD
• Loosened staples	• Stoma blockage	
• Narrowing link between stomach and intestines	• Esophageal or gastric pouch dilatation	
• Small bowel obstruction	• Severe nausea first month after surgery	
• Dumping syndrome (group of symptoms including nausea, bloating, vomiting, cramps, and diarrhea occurs when food moves through the body too quickly)		

Sources: Cleveland Clinic, 2011; Xanthakos & Inge, 2014; Adair & Ellsmere, 2014.

[a]Other risks include nausea, vomiting, sweating, faintness, general weakness, diarrhea, hiccups, bloating, hernia, ulcers, gallstones, nutritional deficiencies (iron, calcium, and other vitamins and minerals, which can lead to anemia or brittle bone disease osteoporosis if left untreated and death [always a possibility with surgery]).

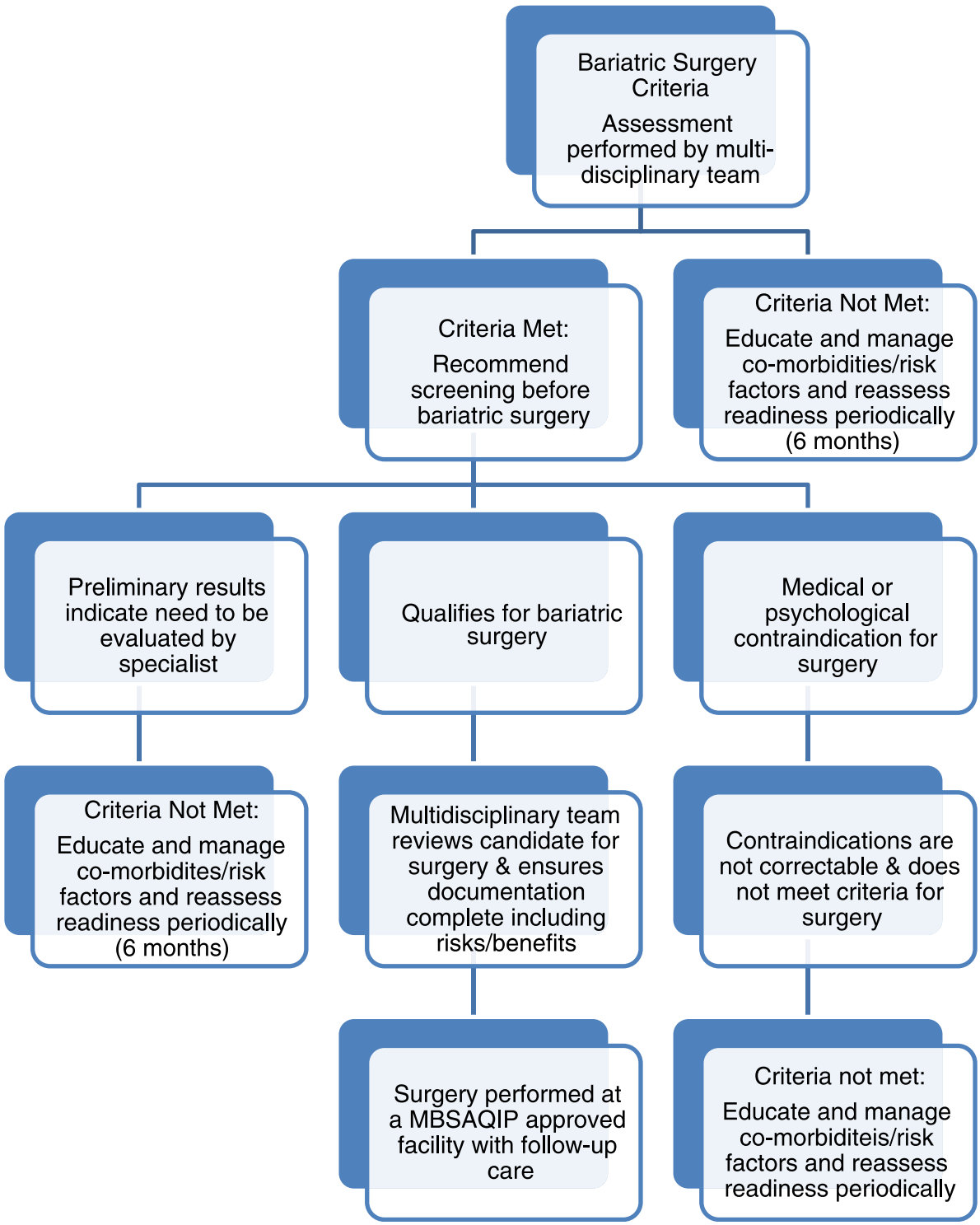

FIGURE 3. Bariatric surgical screening.

who have undergone gastric bypass or sleeve gastrectomy will be seen by the surgeon, psychologist, and dietician 2 weeks after surgery and then 1, 3, 6, 9, and 12 months postoperatively. Adolescents may have postprandial hypoglycemia after surgery, so questions pertaining to hypoglycemia need to be asked at each follow-up visit.

Patients who have the lap band procedure follow up every 4–6 weeks postoperatively for evaluation to have the AGB adjusted to restrict amount of food ingested and to help maintain satiety (Xanthakos & Inge, 2014).

After the first year, annual follow-up for all patients is recommended. More frequent evaluation is scheduled as clinically indicated, and AGB patients are seen PRN for AGB adjustments (Xanthakos & Inge, 2014). Laboratory checks are done at 3 and 12 months and yearly (Inge et al., 2004). Annual follow-up visits are recommended for monitoring of anthropometric measurements, nutritional status, residual comorbidities, and general health. CBC with differential, serum iron and ferritin, folate, B12, serum homocysteine, serum thiamine (B1), albumin, total protein, alkaline phosphatase, calcium, 25-hydroxy vitamin D, and parathyroid are assessed annually. RYGB patients may need to consume a variety of nutritional supplements to prevent potential nutritional complications (Xanthakos & Inge, 2014).

For RYGB patients, ursodiol and ranitidine are prescribed for the first 6 months (Inge et al., 2004). A daily multivitamin containing folate and iron (or a prenatal vitamin in women), 1200–1500 mg of calcium with 800–1000 international units of Vitamin D, and 1000 µg of oral vitamin B12 supplements or 1000-µg injection every month (patients with stable Vitamin B12 may receive one 3000-µg injection at their annual visit) are needed for the remainder of life of the patient who has had the RYGB procedure. Patients who had the lap band procedure need to take a daily multivitamin but, if iron deficiency occurs, should be prescribed with supplemental iron (Xanthakos & Inge, 2014).

RESULTS

The evaluation of the algorithm was based on the decision of the regional healthcare facility eating disorders unit to use the designed algorithm for the implementation of an adolescent bariatric surgery program. The information provided in the algorithm was recognized as being critical in identifying key information for program protocol per feedback from expert evaluations. The algorithm has been used by the regional healthcare facility in the development of an adolescent bariatric surgery program, and the final protocol created will contain essential portions of the algorithm. Despite the positive initial evaluations of the algorithm, it is important to note that the algorithm and recommendations provide a starting point for program development, but the ultimate decision on which adolescents have surgery is based on expert medical and surgical personnel judgment (Inge & Kollar, 2011).

CONCLUSION

Research indicates that bariatric surgery may be a necessary treatment (along with continued medical management support) for certain high-risk adolescents because the degree of postoperative weight loss leads to a reduction or elimination of life-threatening comorbid conditions. Clinical improvement of obesity-related comorbidities that adolescents achieve after bariatric surgery may outweigh potential bariatric surgical risks particularly because of the positive impact the bariatric procedure has on their body at a young age. However, if the bariatric procedure occurs after adolescents reach adulthood, the obesity-related medical problems that have occurred may be irreversible (Inge, Xanthakos, & Zeller, 2007).

Because of the limited data of the long-term effects of bariatric surgery on adolescents, recommendations have been made for institutions engaging in adolescent bariatric surgery to enroll their participants in a long-term outcome study. The National Institutes of Health has developed an ongoing investigation termed "Teen-Longitudinal Assessment of Bariatric Surgery." This study tracks information from adolescents who have had bariatric surgery, and information gained is used to guide the future of bariatric surgery in adolescents (Inge & Kollar, 2011).

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