# Bariatric Surgery in Adolescence

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***Background/Purpose:*** Surgical treatment for morbid obesity is relatively contraindicated in patients less than 18 years of age. However, on some occasions, there is extreme obesity in this age group that does not respond to nonsurgical treatment. The aim of this study was to evaluate the surgical management of severe morbid obesity in adolescents.

***Methods:*** During a 4-year period, the authors assessed 11 adolescent patients with severe morbid obesity. All patients underwent extensive preoperative evaluation including thorough psychological evaluation together with their families. Laparoscopic adjustable gastric banding (LAGB) was performed in all patients. Patients underwent follow-up for a mean of 23 months.

***Results:*** The mean age of the 11 children in this study was 15.7 years (range, 11 to 17 years). Associated conditions included heart failure and pulmonary hypertension in one patient, amenorrhea in 2 patients, and gallstones in 1 patient. Mean preoperative body mass index (BMI) was 46.4 kg/m$^2$ (range, 38 to 56.6). There were no operative complications. Over a mean follow-up period of 23 months (range, 6 to 36 months), the mean BMI dropped from 46.6 to 32.1 kg/m$^2$ with marked improvement in medical conditions and general psychologic well being. No late complications developed in any patient.

***Conclusions:*** Children are routinely excluded from bariatric surgery programs because of the difficulties involved in psychologically and cognitively preparing this population for surgery. However, extreme morbid obesity rarely responds to nonsurgical therapy for any extended period. This select population will benefit from bariatric surgery if an effort is made to properly prepare patients, together with their families, for the postoperative change in lifestyle and body image.


INDEX WORDS: Morbid obesity, surgery, adolescents.

MORBID OBESITY in youth is a growing problem in the western world. Up to 22% of children have a body mass index above the 85th percentile.[1,2] Obesity in adults is associated with significant health risks and increased early mortality,[3] and obese children often become obese adults.[4] In addition, obese children themselves suffer from significant morbidity, both psychological and physical, with an increased incidence of type II diabetes mellitus, hypercholesterolemia, and poor body image.[5]

Weight loss in adolescents has been shown to decrease the risk factors for coronary disease.[6] Also, decreasing obesity-related mortality in adults depends on early weight loss while still in adolescence, and the sooner the better.[4]

Despite the benefits of weight loss in the severely obese adolescent population, bariatric surgery has been discouraged because of the difficulty in preparing these patients for the change in lifestyle as well as the extended follow-up and compliance necessary for success. In addition, the nutritional complications that may arise after this type of surgery are unknown and may influence growth and sexual maturation.

Nonoperative treatment for obesity is notoriously ineffective in the longterm[7] and thus the severely obese adolescent, although difficult to treat, would be expected to benefit from bariatric surgery if properly prepared and supported throughout the pre- and postoperative periods. This study retrospectively evaluates the success of bariatric surgery in 11 severely obese adolescents in whom nonoperative management had failed.

## MATERIALS AND METHODS

Eleven adolescents aged 11 to 17 years, were studied. Eight patients were girls and 3 were boys. The mean BMI was 46.6 kg/m$^2$ (range, 38 to 56.6), and all patients fulfilled the National Institutes of Health (NIH) criteria for morbid obesity. The patients were treated and underwent follow-up in a multidisciplinary center dedicated to the treatment of obesity. The center includes staff from the departments of surgery, medicine, pediatrics, nutrition, psychology, social services, endocrinology, imaging, and plastic surgery.

Before referral to our center, the adolescents had been under the care of a dietitian for at least 1 year and had failed to reduce weight despite a low calorie diet of about 800 Kcal/d. No patients were treated medically because the efficiency of these drugs in adults is still not proven, and the long-term effect in children is unknown.[8] In addition, 3 patients had had their jaws wireclamped, and 2 patients had been

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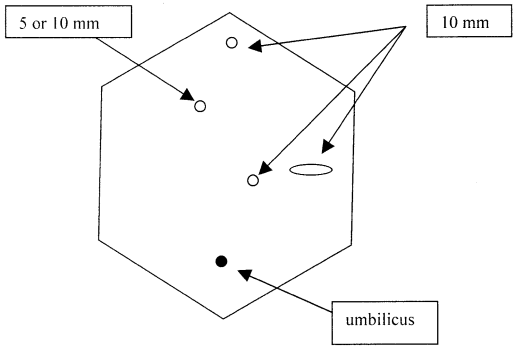


**Fig 1. Trocar sites.**

hospitalized for protracted fasting of 3 to 6 months. However, all were unsuccessful at reducing and maintaining weight loss.

All patients underwent thorough psychological evaluation preoperatively. Patients together with their families were counseled about the lifestyle change that would be necessary as a result of surgery. Postoperative emotional support was provided for patients and their families in addition to the appropriate physical follow-up.

Evaluation preoperatively included studies of lung function and endocrine function, abdominal ultrasound scan, and barium swallow. Glucose levels were measured and were within normal limits in all 11 patients. Insulin and HbA1C were not measured, nor was a glucose tolerance test performed before surgery. Cholesterol and triglycerides were measured routinely preoperatively in each patient.

Preoperative evaluation did not include routine cardiac or lung function tests unless clinically indicated as was the case in 1 patient who was known to suffer from heart failure and pulmonary hypertension.

All patients underwent the same surgical procedure: laparoscopic adjustable gastric banding (LAGB). The decision as to the type of bariatric surgical procedure was made to ensure minimal morbidity while still achieving satisfactory postoperative results. In addition, this procedure is completely reversible as opposed to any other acceptable surgical alternative. One patient had gallstones, and her gallbladder was removed during the same surgical procedure.

The procedure was performed under general anesthesia as described previously.[9] Briefly, patients are placed under general anesthetic, and a nasogastric tube is placed to drain the stomach. The patient is placed in the lithotomy and steep anti-Trendelenburg position. Three 10-mm trocars and a 5-mm trocar are used routinely (Fig 1) unless a large fan liver retractor is needed, in which case the 5-mm trocar is replaced by a 10-mm trocar. The surgeon stands between the patient's legs and the assistant is placed on the left, holding the liver retractor and operating the camera. Dissection is performed very close to the stomach beginning on the lesser curvature to avoid entrance into the lesser sac and staying within the adhesions behind the stomach, until the posterior fundus is reached. The fundus is then pulled medially, and a small window is opened at the angle of His, above the spleen. An adjustable silicone gastric band (Bioenterics, Carpeneria, USA) is placed 2 cm below the gastroesophageal junction to create a small gastric pouch with a volume of about 15 mL. The inner part of the band is a sleeve connected to a subcutaneous port located superficially in the left abdominal wall, enabling later adjustments of the band diameter.

Patients were observed for 24 hours postoperatively and then were discharged after an additional meeting with a dietician. One patient remained under observation for an additional 24 hours because of severe preoperative comorbid disease.

## RESULTS

The mean age of 11 children entered in the study was 15.7 years (range, 11 to 17 years) with a mean preoperative BMI of 46.6 kg/m$^2$ (range, 38 to 56.6). One patient suffered from heart failure and pulmonary hypertension. Two additional patients had amenorrhea and another had gallstones. Three patients suffered from recurrent boils, 2 from skin rashes, and another 7 from stretch marks. The most common complaint of patients before surgery was offensive body odor and unpleasant appearance, both of which embarrassed the patients.

No patient suffered perioperative complications, and there were no late complications during the follow-up period. None of the patients had cholelithiasis during the follow-up period. Abdominal ultrasound scan was done 6 months postoperatively in all patients.

Patients underwent follow-up for a mean of 23 months (6 to 36 months). During this period, the mean BMI fell to 32.1 kg/m$^2$ (Fig 2) with a marked improvement in all associated medical conditions. The 2 patients with high triglyceride levels before surgery, had normal levels after weight reduction; however, cholesterol levels remained elevated in the patient with abnormal preoperative levels. There was one patient who was very ill with debilitating heart failure and pulmonary hypertension requiring repeated hospitalizations. This patient did very well after surgery and was able to return to school without being hospitalized since surgery and now sleeps without the need of continuous positive airway pressure (CPAP). In addition, all the adolescents reported an improvement in overall well being; they were more physically active, more socially involved with their peers and reported feeling happier than before surgery.

All patients received vitamin supplements after surgery and were followed up closely for deficiencies. Four girls required additional iron supplements for iron deficiency anemia. Menstruation began in the 2 girls suffering from amenorrhea before surgery.

Complications of the subcutaneous port are not seen

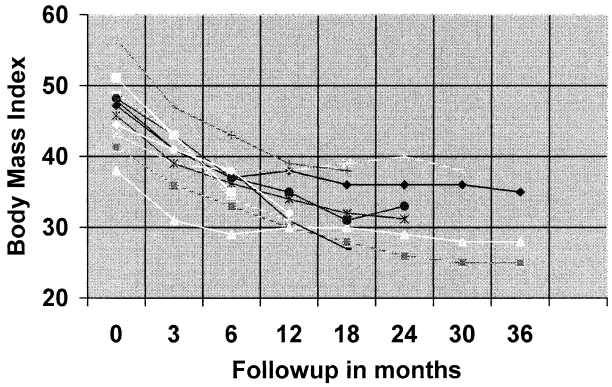


**Fig 2. Body mass index over time in 11 adolescent patients.**

often in our experience with this procedure, unlike ports used in chemotherapy or for hyperalimentation. In this group of patients also, no port complication developed.

All patients adjusted well to the dietary limitations imposed by surgery, and no patient was admitted during the follow-up period for complications owing to poor compliance with dietary instructions.

## DISCUSSION

Obesity in the adult population is a well-known risk factor for several diseases, including a substantial increase in cardiovascular disease, type II diabetes mellitus, chronic obstructive pulmonary disease, and arthropathy. This has been shown to be true also in the adolescent population. As obese children grow up to become adolescents, the low-risk profile of childhood is replaced with higher blood pressure, higher levels of LDL cholesterol and lower levels of HDL cholesterol, and increased risk of type II diabetes mellitus.[10] Coronary atherosclerosis is more likely to be present in young adults with excess adipose tissue independent of other risk factors.[11] Adolescent obesity has been associated with other significant illnesses including colorectal cancer, gout, and arthritis.[12] Moreover, social stigmatization and poor self-image are especially difficult issues for teenagers and have been clearly shown to be exacerbated by obesity.[13,14]

Conservative treatment of obesity is ineffective, and up to 90% of people will return to their original weight.[7] The serious morbidity in obese children warrants an aggressive approach; however, pharmacologic treatments are to be avoided in this group because of their possible irreversible side-effects.[8] Psychological and behavioral therapy alone cannot be expected to help, and thus this well-defined group of severely obese adolescents may benefit only from the addition of surgical treatment.[15]

A recent review of treatment for obesity in adolescents[16] examined the place of bariatric surgery and overall recommended a very cautious approach, concluding that "gastric bypass remains a last resort option for severely obese adolescents," although it was the only treatment option that actually worked. Although it is true that jejunoileal bypass (mostly abandoned as an operative procedure in obesity) and gastric bypass are effective treatments for morbid obesity, they are not without complications.[17,18] The procedure used in this study, LAGB, is distinctly different from other operative procedures for morbid obesity, because there are no anastomoses, no bypass of functional bowel, and the operation is completely reversible. Our experience with this procedure has shown that patients are successful in maintaining weight loss with minimal serious complications.[9]

This study was not designed to compare different procedures in bariatric surgery in this population. All patients had the same operation—LAGB. Laparoscopic-assisted gastric banding may be the ideal operation for the adolescent population precisely because the gastric banding is easily and completely reversible as well as providing great flexibility in a population that obviously is volatile with changing physical and dietary needs. In addition, because this procedure depends on the compliance of the patient, and thus, successful behavior modification, we postulate that this procedure may enable some patients to maintain a normal weight as adults without the need for banding.

Our data indicate that bariatric surgery in the adolescent population is a safe and effective treatment for morbid obesity at least in the short term. Moreover, most of our patients were followed up for a minimum of 2 years, and some to 3 years, with consistent maintenance of weight loss. Longer follow-up is needed to evaluate the complications, improvement in comorbidities, and long-term maintenance of weight loss.

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