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Original article

Body composition changes in adolescents after laparoscopic sleeve gastrectomy

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Abstract

Background: Sleeve gastrectomy (SG) is a commonly used bariatric procedure in severely obese adolescents. Weight loss after SG is associated with marked changes in body composition, but factors associated with such changes have not yet been described in adolescents.

Objective: To identify factors associated with changes in body weight and composition in adolescents 1 year after SG.

Setting: University Hospital, Tel Hashomer, Israel.

Methods: Age, sex, weight, height, preoperative body mass index (BMI), and body fat percent measured by bioimpedance were collected in 25 adolescents (16 males, 9 females, age 16.6 ± 1.5 yr) before and 1 year after SG. Obesity-related complications, preoperative weight loss, and physical activity after surgery were also recorded. Repeated-measures analyses of variance and linear mixed model analyses were performed.

Results: One year after SG, weight decreased by 32%, fat mass by 55%, and fat-free mass by 9% from baseline. Male participants lost significantly more weight than female participants, with larger decreases in fat mass (–65% versus –41%, $P < .001$) and body fat percent (–48% versus –21%, $P < .001$). The amount of physical activity at 1-year follow-up was also associated with larger reductions in body fat percent in both genders. Age or baseline BMI, fat mass, and fat-free mass were not associated with changes in BMI or body composition.

Conclusion: Among obese adolescents 1 year after SG, the only modifiable factor associated with larger decreases in body fat percent was physical activity. Larger studies are needed to formally identify other possible predictors of body composition changes after SG. (Surg Obes Relat Dis 2015;▮:00–00.)

Keywords: Bariatric; Surgery; Fat; Fat percent; Youth

Bariatric surgery is a therapeutic option for severely obese adolescents [1], with a favorable short-term complication profile [2,3]. Laparoscopic sleeve gastrectomy (SG) is gaining popularity as the bariatric procedure of choice in obese adolescents because it has been found to produce significant weight loss [1,3–6] with concomitant significant reductions in the prevalence of obesity-associated comorbidities in this age group [3,7].

Significant weight loss is associated with marked changes in body composition, with large reductions in body fat percent, fat mass, and fat-free mass [8]. In 1 systematic review, the median loss of fat-free mass described after bariatric procedures in adults ranged from 31% after

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Roux-en-Y gastric bypass to 18% after laparoscopic adjustable gastric banding [8]. In general, a larger weight loss is associated with a larger reduction of fat-free mass after bariatric surgery in adults [9]. The loss of fat-free mass is mostly the result of reduced muscle mass, which is the major contributor to the decreased resting energy expenditure commonly seen after bariatric surgery [10]. Understanding tissue composition changes after bariatric surgery may assist in maintaining long-term weight loss success.

There are scarce data available on predictors of weight loss after bariatric surgery in youth. In a recent study of several types of bariatric procedures in 345 adolescents and young adults, males were found to have a larger body mass index (BMI) reduction than females [3]. Similar BMI reductions were seen in younger (<18 yr) versus older (≥ 18 yr) patients in that study, yet further analysis was not described in this aspect. Data on SG specifically, or on body composition changes, were also not described. Taken together, a significant research gap exists because nearly all available data on this topic emanate from studies in adults, and after bariatric procedures that are currently less common in adolescents. There are presently no data on body composition changes in adolescents who underwent SG. Furthermore, no published study to date had identified factors that contribute to the magnitude of weight loss and body composition changes in adolescents after SG.

The aim of this study was to identify factors that are associated with changes in body weight and composition in adolescents after SG. We hypothesized that age, sex, preoperative BMI, fat mass and fat-free mass, presurgical weight loss, and physical activity may be associated with the degree of weight loss and of body composition changes in youth after SG. The information obtained from this pilot study could be used in designing larger and more rigorous research projects.

Methods

Study design and setting

This was a cohort study that included all severely obese adolescents who underwent SG at the Edmond and Lily Safra Children's Hospital, Sheba Medical Center, Tel Hashomer, Israel, from March 2011 until December 2013. Participants were routinely monitored after surgery by the pediatric bariatric surgeon, pediatric bariatric dietician, mental health staff, pediatric endocrinologist, and sports and exercise medicine specialist according to clinical needs. All underwent a 1-year postoperative follow-up visit.

Participants

All adolescents in this study fulfilled the criteria for bariatric surgery set forth by the Israeli Ministry of Health in 2009 [11]. These guidelines state that adolescents be considered for bariatric surgery if chronologic age is >13 years, bone age is >15 years for males and >13 years for females; BMI is >50 kg/m^2 (or >45 kg/m^2 at age >16 yr) with mild complications (e.g., hypertension, dyslipidemia, significant disturbance of everyday activities or psychosocial functioning) or >40 kg/m^2 with severe obesity complications (diabetes mellitus, steatohepatitis, severe obstructive sleep apnea, or idiopathic intracranial hypertension). Candidates for surgery should have participated in an organized weight reduction program for at least 6 months and should have undergone a psychiatric evaluation that examined the readiness, competence, and commitment of both adolescent and family.

Study outcomes and definitions

The primary objective of this study was to identify factors associated with changes in weight and body fat percentage in adolescents 1 year after undergoing SG. Hypertension, dyslipidemia, and impaired glucose tolerance were defined according to the guidelines set forth by the Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents [12]. Sleep apnea was diagnosed using polysomnography with an apnea-hypopnea index cutoff of 5 events/hr. Pseudotumor cerebri was defined by presence of an elevated opening cerebrospinal fluid pressure >25 cm H_2O and a normal brain magnetic resonance imaging; these tests were performed after a personal history of headache and findings consistent with papilledema on ophthalmologic examination.

Data collection

Data abstracted for the purpose of this study from the medical charts were participant age, sex, weight, height, and body fat percent before surgery and 1 year after it; prevalence of obesity complications at surgery; preoperative weight changes in the 1–2 months before surgery; and physical activity habits 1 year after surgery. The study protocol was approved by the Institutional Review Board of Sheba Medical Center, Tel Hashomer, Israel, and conducted according to the standards of the 1964 Declaration of Helsinki and its later amendments.

Obesity was defined as having a BMI $\geq$ 95th percentile for sex and age according to the United States Centers for Disease Control and Prevention (CDC) reference curves, and overweight was defined as having a BMI $\geq$ 85th percentile for sex and age, as recommended by the Israeli guidelines for pediatric obesity prevention and treatment [13]. Severe obesity was defined as having a BMI $\geq$ 120% of the 95th percentile or ≥ 35 kg/m^2, whichever was lower [14]. Excess weight (EW) was calculated as the amount of weight the child has above the 85th percentile of BMI for age and sex [15], because this is the cutoff point that precisely defines him or her as being overweight [13]. The