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Laparoscopic vertical sleeve gastrectomy significantly improves short term weight loss as compared to laparoscopic adjustable gastric band placement in morbidly obese adolescent patients

Felipe E. Pedroso [a], Jeffery Gander [a,b], Pilyung Stephen Oh [a], Jeffrey L. Zitsman [a,*]

[a] New York Presbyterian Morgan Stanley Children's Hospital, Columbia University Medical Center, Department of General Surgery, Division of Pediatric Surgery, Center for Adolescent Bariatric Surgery
[b] University of Virginia Health System, Department of Surgery, Division of Pediatric Surgery

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ABSTRACT

Background: Bariatric surgery has shown to be an effective weight loss treatment in morbidly obese adolescents. We compared outcomes of laparoscopic adjustable gastric band (LAGB) to laparoscopic vertical sleeve gastrectomy (VSG).
Methods: A single institution, retrospective evaluation of a prospectively collected database of LAGB and VSG patients.
Results: 174 morbidly obese patients underwent bariatric surgery at our institution between 2006 and 2013. 137 patients underwent LAGB and 37 underwent VSG. There were no significant differences between LAGB vs. VSG groups on day of surgery for age, gender, ethnicity, weight, and BMI. At 24-month follow up, patients who underwent VSG vs. LAGB displayed significantly greater percent excess weight loss (70.9 ± 20.7 vs. 35.5 ± 28.6, P = 0.004) and percent preoperative BMI loss (32.3 ± 11.0 vs. 16.4 ± 12.7, P = 0.004). Both VSG and LAGB significantly improved levels of HDL, HgA1c, and fasting glucose. LAGB patients had more complications than VSG patients.
Conclusion: Bariatric surgery is an effective treatment strategy in morbidly obese adolescents who have failed medical management. VSG results in greater short term weight and BMI loss when compared to LAGB. Longer follow up with more patients will be required to confirm the long term safety and efficacy of VSG in adolescent patients.

Obesity has become pandemic, and costs for the treatment of obesity related co-morbidities have dramatically increased worldwide. Coincidentally, the incidence of childhood obesity has risen, and with evidence demonstrating that many obese children ultimately become obese adults, effective weight loss strategies at an early age are essential [1,2]. The medical management of obesity has repeatedly been shown to be ineffective at reducing overall weight and sustaining weight loss in adults and children [3,4]. Bariatric surgery has been utilized as a treatment strategy in morbidly obese adults resulting in consistent and sustained weight loss and an overall reduction in obesity related co-morbidities [5,6]. NIH guidelines recommend bariatric surgery for severely obese adult patients with BMI > 40 or BMI > 35 with coexisting co-morbidities [7]. The use of bariatric surgery in adolescents (12–18 years of age) remains controversial, however, recent results have shown bariatric surgery in combination with medical therapies to be a safe and effective tool for the treatment of adolescent obesity. NIH guidelines for bariatric surgery have now been expanded to include adolescent patients [7].

Bariatric surgery performed in adolescent patients has shown promising short term results [8]. Laparoscopic adjustable gastric banding (LAGB), an accepted weight loss tool in adults, has been evaluated in adolescents. Our group and others have found LAGB to be an effective weight loss tool in adolescent patients [9–17]. Presently in the United States, LAGB remains an investigational device in adolescent patients thereby precluding its expanded use. Laparoscopic vertical sleeve gastrectomy (VSG) has been shown in adults to be more effective than LAGB at reducing postoperative weight, sustaining weight loss, and reducing the rates of obesity related co-morbidities [5,18,19]. VSG has now been instituted by our group and others for the treatment of severely obese adolescents. Moreover, several recent reports (mainly small case series) have shown VSG to be safe and successful at reducing weight, BMI, and the rates of obesity related co-morbidities in adolescents [20–25]. In an attempt to evaluate the safety and efficacy of VSG as compared to LAGB in adolescent patients, we have compared these two treatments strategies in adolescents for the first time. We hypothesized that VSG would not only be a safer procedure with lower complication rates, but also a more effective surgical tool in reducing overall weight, sustaining weight loss, and improving seromarkers associated with obese adolescent patients.

* Corresponding author at: Morgan Stanley Children's Hospital/New York Presbyterian Hospital, CHN Room 212, 3959 Broadway, New York, NY, 100032. Tel.: +1 2123428585; fax: +1 2123059270.
E-mail address: Jlz2@CUMC.Columbia.edu (J.L. Zitsman).

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1. Methods

This study was approved by the Institutional Review Board of Columbia University Medical Center and the Morgan Stanley Children's Hospital. All patients were treated at this one institution. The LAGB and VSG registries of the Center for Adolescent Bariatric Surgery have been prospectively developed since 2006, and all data were confirmed by a review of the medical records, clinic visits, and operative reports. All surgeries were performed by a single surgeon at the same tertiary institution. An investigational device exception from the FDA was obtained for the use of the adjustable gastric band in adolescent patients.

All patients were screened by phone for height and weight prior to initial meeting with the pediatric surgeon. All patients completed a screening questionnaire (medical history, family history, psychological history, and history of any prior weight loss attempts) and were instructed to write a statement describing why they wished to undergo bariatric surgery.

Preoperatively, patients were scheduled to visit with a pediatric endocrinologist, nutritionist, psychologist, and exercise specialist. Baseline laboratory panels were obtained (hematological, blood chemistries, liver function, lipid panels, fasting glucose, and C-reactive protein). Preoperatively, patients underwent monthly meetings with the nutritionist, the nurse practitioner, and the surgeon. Each patient was instructed to maintain an exercise log. Patient status was discussed at weekly team meetings and surgery was offered to patients with a documented failed weight loss despite compliance with recommended eating behavior and exercise changes for a minimum of 6 months. Preoperatively, informed consent was obtained from both patient and one parent. Between July 2010 and April 2011 patients were given a choice between LAGB and VSG, following April 2011 we recommended VSG, however we offered LAGB as another surgical option for patients 18 years and older. A protein-sparing liquid diet was started 2 weeks preoperatively.

At surgery all patients received a preoperative antibiotic, and 5000 U of subcutaneous heparin. Sequential compression device stockings were placed on each lower extremity. Nathanson liver retractors were used in all cases. Laparoscopic adjustable gastric band was performed using the LapBand® Systems (Allergan Inc, Irvine, CA) via a 4 port method, which has been previously described by Ren and Fielding [26]. Laparoscopic vertical sleeve gastrectomy was also performed via a 4 port technique. A sleeve gastrectomy of the greater curvature of the stomach from 6 cm proximal from the pylorus to the angle of His was performed over a 40Fr bougie with a linear stapler and reinforced with Seamguard ® (W.L. Gore and Associates Inc.). Staple line bleeding was controlled with monopolar cautery or clips. Upper endoscopy was utilized for intragastric evaluation of the staple line and stomach was insufflated to evaluate for staple line leak.

On postoperative day 1 the first 75 LAGB patients and all VSG patients underwent a gastrografin contrast swallow study, and if negative for stricture or leak, patients were started on a bariatric clear liquid diet. Later LAGB patients had an upright abdominal radiograph to check for band and port positions. At the first postoperative appointment the diet was advanced to a bariatric pureed diet for two weeks, followed by foods as tolerated with continued nutritionist consultation throughout. All patients were seen postoperatively at 2 weeks, and then every month until 3 months, at 6 months, followed by every 6 months out to 2 years, then yearly. LAGB patients were encouraged to return for adjustments whenever necessary and all were performed by the surgeon.

Weight in kilograms and height for both LAGB and VSG patients were measured at all visits. Analyses and comparisons were made at different time points including preoperatively, 6, 12, 18, and 24 months. Mean, standard deviation, median, and range weights (kg) and BMI (kg/m^2) were calculated for each time point for both groups. Preoperative body weight was measured at the visit 2 weeks prior to surgery before the protein-sparing diet was begun. Excess body weight was calculated by subtracting preoperative body weight by body weight for age, gender and height at the 85th percentile using CDC growth charts [27]. Percent Excess Weight Loss (%EWL) was defined as [(preoperative weight − follow up weight)/(preoperative weight − weight corresponding to the 85th percentile for patients age, gender and height) × 100]. Percent preop BMI loss was defined as [(1 − (follow up BMI/preop BMI)) × 100]. Seromarkers associated with obesity including: total triglycerides, total cholesterol, High Density Lipoprotein (HDL), Low Density Lipoprotein (LDL), Hemoglobin gA1c (HgA1c), fasting glucose and C-Reactive Protein (CRP) were all measured preoperatively and at all time points.

In order to evaluate the effect of gender on weight and BMI loss by operation (LAGB and VSG), patients were stratified by gender and comparisons of weight and BMI loss by LAGB vs. VSG were made. To evaluate for significant differences between weight and BMI loss in males and females for each procedure type, patients were stratified by type of procedure and comparisons of males and females were made. All analyses included percent excess weight loss and percent preoperative BMI.

Linear regression analysis was performed evaluating the effect of LAGB and VSG in trends of seromarkers associated with obesity including: total triglycerides, total cholesterol, HDL, LDL, HgA1c, fasting glucose, and CRP. For each seromarker, slope, y-intercept at day 0 (representing preoperative levels), R square, and p-value for each slope were reported. Comparisons in trends between LABG and VSG were made for all seromarkers.

Statistical analysis was performed with SPSS version 18.0 (PASW) released July 30, 2009 (IBM Corporation, Somers NY) and Graphpad Prism Version 5.0 was used for other statistical analysis and figures. Fisher's exact T-test was used for categorical variables and analysis of variance was used for comparing weights at different time points between LAGB and VSG patients. Statistical significance was defined as $P < 0.05$.

2. Results

2.1. Patient and group demographics

A total of 137 laparoscopic adjustable gastric bands (LAGBs) were placed from February 2006 to April 2011. Mean age for LAGB patients was 16.9 ± 1.2 and more females (94/137) underwent the procedure than males (43/137). Follow up data were available at 6, 12, 18, and 24 months for 137, 126, 111, 81, and 80 patients respectively in the LAGB group and in the VSG group follow up data were available at 6, 12, 18, and 24 months for 31, 21, 7, and 6 patients respectively. 37 laparoscopic vertical sleeve gastrectomies (VSGs) were performed from June 2010 to August 2013 with mean age of 17.3 ± 1.82 with more females (27/37) than males (10/37). No significant differences in age ($P = 0.12$), gender ($P = 0.69$), ethnicity ($P = 0.07$), or preoperative weight (kg) (136.1 ± 26.9, 138.2 ± 25.4, $P = 0.68$) were noted between LAGB and VSG patients (Table 1). Nine LAGB patients who had more than regained their preoperative weights (average weight gain of 14.9 kg), were converted to a VSG and included in the analysis. No significant difference between LAGB and VSG patients was observed in preoperative excess weight (kg) (65.1 ± 24.2, 66.7 ± 22.1, $P = 0.73$), or preoperative BMI (kg/m^2) (48.3 ± 8.3 vs. 50.1 ± 9.4, $P = 0.26$). Operative times were available for all 37 VSG patients and 113 LAGB patients and VSG patients had longer operative times than LAGB patients (144.1 ± 55.1 vs. 112.3. 25.7, $P < 0.0001$). However, when excluding the 9 reoperative patients who underwent conversions from LAGB to VSG, no significant difference in operative time between LAGB and VSG was observed (112.3 ± 25.7 vs. 114.8 ± 18.2, $P = 0.60$). No significant differences between LABG and VSG were present for all preoperative studied seromarkers associated with obesity (Total triglycerides, total cholesterol, HDL, LDL, Fasting glucose, HgA1c, and CRP, all $P > 0.05$), except that VSG patients exhibited a significantly greater fasting glucose (90 ± 13.8 vs. 85.9 ± 7.7, $P = 0.02$). (Table 1)