Laparoscopic Adjustable Silicon Gastric Banding versus Sleeve Gastrectomy

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Abstract

Background and purpose: Obesity now forms one of the leading public health concerns globally. Several surgical options including sleeve gastrectomy exist for its treatment. Recently, laparoscopic gastric banding has been developed with the aim of providing a laparoscopically placed device that is safe and effective in generating substantial weight loss. The goal of this review is to compare the effectiveness and safety of laparoscopic adjustable silicon gastric banding (LASGB) and laparoscopic sleeve gastrectomy (LSG) in the treatment of morbid obesity by reviewing the methods of patient selection, operative time, conversion rate, complications, blood loss, postoperative morbidity and mortality, hospital stay, and quality of life.

Material and methods: A systematic literature search was performed using Highwire press, Springer link, Medline, Medscape and Google, and article bibliographies to identify relevant evidence. Included studies must have reported outcome data for more than 40 patients aged 20 years and above with a minimum of one 1-year follow-up. The operating time, complications, blood loss, hospital stay, morbidity and mortality, and quality of life were reviewed.

Results: The total number of patients enrolled was 4,519; the specific procedure totals were 3,714 for LAGB and 805 for LSG. The age range of the population studied was 13-79 years for LSG and 18-65 years for LAGB. The sex distribution had a male:female ratio of 1:4 for LAGB and 1:3 for LSG. The overall complication rate in this review varied from 1.7-11. 80% for LSG and 0.2-24% for LAGB.

Conclusion: Laparoscopic sleeve gastrectomy though, forms a safe surgical option for weight loss treatment particularly in the very-very-obese patients (BMI > 60 kg/m^2). LASGB gives satisfactory results and coupled with reversibility and low cost, it is an important tool in the long-term management of patients with morbid obesity.

Keywords: Laparoscopic adjustable silicon gastric banding, laparoscopic sleeve gastrectomy, bariatric surgery.

INTRODUCTION

The health and economic impact of obesity remain a global dilemma.[1-10] This has resulted in excallating research modalities to combate the disease. It has been shown that surgery provides a long-term solution to the problem of obesity by reducing mortality by 31.6% compared with nonoperative methods.[11] The advent of minimal access surgery has revolutionized patient acceptability and the physicians' dilemma. Laparoscopic adjustable silicone gastric banding (LASGB) and laparoscopic sleeve gastrectomy are emerging surgical procedures for the treatment of morbid obesity. Their main advantage is comparable reduction in complication rates.[12,13] Laparoscopic adjustable gastric banding (LAGB) was introduced in the early 1990s to serve as a minimally invasive, potentially safe, reversible and controllable method to achieve significant weight loss by using a gastric band incorporating an adjustable silicone balloon for open placement.

Laparoscopic sleeve gastrectomy (LSG) was introduced as a multipurpose restrictive procedure for obese patients.[14-17] It is now becoming more common as a single-stage operation for the treatment of morbid obesity. It however appears that the volume of gastric tissue excised greatly affects weight loss. Hence it is said that a removed gastric volume of < 500 cc might be a predictor of failure in treatment or early weight regain, though a safe and effective restrictive bariatric procedure.[16,17]

Both LASGB and LSG have their drawbacks and the current literature is scarce concerning which approach is superior. The goal of this review is to compare the effectiveness and safety of LASGB and LSG in the treatment of morbid obesity by reviewing the methods of patient selection, operative time, conversion rate, complications, blood loss, postoperative morbidity and mortality, hospital stay, and quality of life.

MATERIAL AND METHODS

A systematic literature search of articles published between January 1, 2000 and March 24, 2009 was performed using Highwire press, Springerlink, Medline and Google. Further articles were identified from the reference lists of retrieved literature. A meta-analysis was impossible because of inconsistencies in the various reports. A simple percentage was therefore used as recorded in the various articles.

ARTICLE INCLUSION CRITERIA

All patients must have been age more than 20 years at the time of surgery. The study must have appeared in a peer-reviewed

journal as an English language article. The study must have presented a universally accepted procedure in a specialized laparoscopic institution with statistical case analysis and reported data on more than 40 patients. For weight or BMI data, only data at least one year after surgery were considered. No minimum follow-up for other outcomes was considered. For quality-of-life outcomes, the study should have measured quality of life before and after surgery. Data on comparative studies where only included if values on LASGB and LSG were clearly indicated and randomized. In cases of multiple reports from the same surgical center, double-counting of patients was avoided by including data and outcomes that were based on the largest number of patients and still meeting the other inclusion criteria.

RESULTS

A total of 703 articles where found. Twelve articles met the inclusion criteria (Table 1). Five investigated LASGB. Six investigated LSG. Only one prospective randomized study was found comparing laparoscopic gastric banding and laparoscopic sleeve gastrectomy. The total number of patients enrolled was 4,519; the specific procedure totals were 3,714 for LASGB and 805 for LSG. The age range of the population studied was 13-79 years for LSG and 18-65 years for LASGB. The sex distribution had a male : female ratio of 1:4 for LASGB and 1:3 for LSG. Two of the reports are from the United States, two from Germany, three from France, one from Belgium, one from the UK, one from South Korea, one from Australia, and one from Switzerland.

PATIENT SELECTION

In a prospective randomized study between laparoscopic gastric banding and laparoscopic sleeve gastrectomy, Himpens et al studied 80 patients with a mean age of 36 (20-61) years for LASGB (83% women) and 40 (22-65) years for LSG (77% women).[18] Nocca et al studied 163 patients (68% women) with an average age of 41.57 years who underwent LSG.[19] Turker et al studied LSG patients with a mean age of 42 (13-79) years and Weiner R et al studied 984 LASGB patients with a mean age of 37.9 (18-65) years.[12,17] Other studies in the LASGB and LSG group had patients with similar age group.[18-22]

MEAN BODY MASS INDEX

The mean BMI in both study groups were similar. Himpens worked on patients with a mean BMI of 37 (30-47) for LASGB and 39 (30-53) for LSG (Not significant).[18] Uglioni reported on 70 patients with a mean BMI of 46 (35-61) kg/m^2 in SLG study group in an attempt to find out the early and midterm results of laparoscopic sleeve gastrectomy (LSG) as an isolated primary and secondary operation after failed gastric banding.[22] Similarly, Nocca et al reported on LSG patients whose indications for this procedure in their study, were morbid obese [body mass index (BMI) > 40 kg/m^2] or severe obese patients (BMI > 35 kg/m^2) with severe comorbidities (diabetes, sleep apnea, hypertension) together with high-volume eating disorders and super-obese patients (BMI > 50 kg/m^2).[19] Fuks et al reported on the data of 135 consecutive patients undergoing LSG between July 2004 and October 2007 prospectively. In this study, LSG was indicated only for weight reduction with a body mass index (BMI) > 40 or > 35 kg/m^2 associated with severe comorbidity.[23] Their aim was to evaluate the efficacy of LSG procedure on weight loss, and short-term outcome. Preoperative mean body weight was 120.7 kg and mean body mass index (BMI) was 44.3 kg/m^2 in the study of Zinzindohoue et al.[21]

OPERATIVE TIME, HOSPITAL STAY AND MORTALITY

Only three of the 12 articles reported the details of the operative time. Two of these were in the LSG and one in the LASGB group. Fuks et al reported a mean operating time of 103 minutes

Table 1: Results of articles studied

Study	*Date of surgery*	*LASGB*	*LSG*	*No receiving surgery*	*Mean age*	*Mean BMI*
Weiner et al[20]	1994-2002	Yes	–	984	Not indicated	46.8 ± 7.2
Weiner et al[17]	Not reported	–	Yes	120	Not indicated	Not indicated
Nocca et al[19]	2003-2006	–	Yes	163	41.57	45.9
Tucker et al[12]	2004-2007	–	Yes	147	42 (13-79)	43.4
Himpens et al[18]	Jan-Dec 2002	Yes	Yes	80	LAGB 36 (20-61) LSG 40 (22-65)	37 (30-47) 39 (30-53)
Fuks et al[23]	July 2004-Oct 2007	–	Yes	135	40 (18-65)	48.8 (37-72)
Chevallier et al[24]	1996-2003	Yes	–	1,000	40.4 (16.3-66.3)	44.3
Zinzindohoue et al[106]	April 1997-June 2001	Yes	–	500	40.4	44.3
Singhal et al[13]	April 2003-June 2007	Yes	–	1140	Not indicated	44.3 (35-88)
Sang Moon Han[26]	Jan 2003- May 2004	–	Yes	130	Not indicated	Not indicated
Uglioni et al[22]	May 2004-Oct 2007	–	Yes	70	43 (21-65)	46 (35-61)
Dixon et al[25]	Not indicated	Yes	–	50	Not indicated	Not indicated

(range, 30-550) for LSG.[23] This report was similar to that of Turker et al whose mean operating time was 60 minutes (58-190) in a retrospective study of 148 post LSG patients in the United States between 2004 and 2007 with the view to finding out if LSG could be a one-stage primary restrictive procedure.[12] The only LASGB study that gave details of operative time was that of Zinzindohoue et al that reported a mean operative time of 105 minutes in 500 patients who underwent laparoscopic surgery for morbid obesity between 1997 and 2001 with application of an adjustable gastric band in order to evaluate the early and late morbidity of laparoscopic adjustable gastric banding for morbid obesity and to assess the efficacy of this procedure.[21]

Four of the articles studied documented the duration of hospital stay postsurgery. The average hospital stay for patients who underwent LSG was 2.7 (2-25) days but one patient who had gastric fistula stayed for 47 days.[12,23] The mean stay for LASGB patients was 2.7 (0-30) days.[13,21] Five of the articles reviewed reported on mortalities in their studies. The overall mortality rate following LSG was 0-0.8%[12,19,20,22] while that of LASGB was 0%.[21]

Blood loss, Complications, Conversion to Open Surgery and Reoperation

The overall complication rate in this review varied from 1.7-11.80%[12,19,22] for LSG and 0.2-24% for LAGB.[12,17,19,20,22,24,25] The highest reported complication rate following LASGB was due to slippage of the adjustable band while the highest rate following LSG was secondary to esophageal reflux symptoms.[22,24] The other complications reported in the LSG studies include early leak (1.7%),[17] gastric fistula (1.7-5.1%).[13,14,19,26] Gastric prolapse (20%), incisional hernia (0.6%), reconnection of catheter (0.6%) and wound infection (4%) were also reported as complications resulting from LASGB.[21,25] Other life-threatening complications reported by Chevallier et al and accounting for 1.2% of their study population of 1,000 LASGB patients include gastric perforation (0.4%), acute respiratory distress (0.2%), pulmonary embolism (0.2%), migration (0.3%), and gastric necrosis (0.1%).[24] Chevallier et al in this 7-year study, had 11.1% of their patients undergoing an abdominal reoperation for perforation (0.2%), band slippage (0.78%), migration (0.3%), gastric necrosis (0.1%), esophageal dilatation (0.2%), incisional hernias (0.4%) and port problems (0.21%). Similar conversion and reoperation rates were reported by Zinzindohoue et al.[21] In their study, twelve patients (2.4%) were converted to open surgery and a patient reoperation rate of 10.4% was reported as a result of abdominal complications. There were no reports of conversions in the LSG group but reoperation rates ranged from 4.9-11.4%.[12,19] Tucker et al reported a mean blood loss of 60 ml (range, 0-300 ml) for LSG.[12]

Effect of Surgical Procedure on Weight, BMI, Diabetes and Quality of Life

The study of Nocca et al on LSG showed a percentage of excessive body weight loss of 59.45% at 1 year and 61.52% at 2 years.[19] No statistical difference was noticed in weight loss between obese and extreme obese patients in this study.[19] In a related retrospective study of 130 patients between 2003 and 2004, Han et al reported a median weight loss of 24.6 ±10.0 kg and 83.3 ±28.3% while decrease in BMI was 9.2 ±3.7 kg/m^2 .[13] A reduction of BMI from *44.3 to 34.2, 32.8 and 31.9 at 1, 2 and 3 years with a mean percent excess weight loss (%EWL) of 42.8%, 52% and 54.8% respectively were similarly reported by* Zinzindohoue et al in the LASGB study group.[21] Similar results were reported by Singhal et al in 2008 in a study population of 1,140 who had gone through LASGB.[13] This study showed an excess percent BMI loss at 1, 2 and years of *38.3%, 43.7%, and 58.9%*.[13] Excess percent BMI loss was persistent for 8 years in the only study where patients were followed up for this duration of time.[20] *The* BMI dropped from 46.8 to 32.3 kg/m^2 over the 8 years period. The observations in loss of weight and BMI were similar in the LSG group. A drop in the BMI after 1 year of 65% (9-127%), after 2 years 63% (13-123%), and after 3 years 60% (9-111%) was observed by Uglioni et al.[22] Similarly, Han reported that at 12 months after LSG, the BMI decrease was 9.2 ±3.7 kg/m^2, and median weight loss was 24.6 ±10.0 kg.[26]

Metabolic changes where also observed. Han et al reported that dyslipidemia resolved in 75% of their patients within 12 months, diabetes resolved in 100% of patients within 6 months of operation, and hypertension resolved in 92.9% and improved in 100% of the patients.[26] Joint pain resolved in 100% within 12 months. Weight loss plateaued at 12 months in the majority of patients.[26] *Comparative results were reported by Dixon and O'Brien who studied the* health outcomes of severely obese Type 2 diabetic subjects 1 year after laparoscopic adjustable gastric banding in 50 patients prospectively.[25] In their report, there was significant improvement in all measures of glucose metabolism. Remission of diabetes occurred in 64% of the patients, and major improvement of glucose control occurred in 26% of them; glucose metabolism was unchanged in 10%. HbA_{1c} was 7.8 ± 3.2% preoperatively and 6.2 ± 2.7% at 1 year ($P < 0.001$). Remission of diabetes was predicted by greater weight loss and a shorter history of diabetes (pseudo $r^2 = 0.44$, $P < 0.001$). Improvement in diabetes was related to increased insulin sensitivity and β-cell function. Weight loss was associated with significant improvements in fasting triglyceride level, HDL cholesterol level, hypertension, sleep, depression, appearance evaluation, and health-related quality of life.[25] Additionally, statistically significant improved health status and quality of life were registered for all groups studied under LSG by Weiner et al.[17] In a separate 8 years review of 984 LASGB patients, Weiner et al found 82% improvement in the quality of life.[20] This was similar to the findings of Zinzindohoue

et al in a study of 500 patients who underwent LASGB. They observed improved quality of life in obese patients and reported that half of the excess body weight can be effortlessly lost within 2 years.[21, 28]

DISCUSSION

Obesity is associated with several complications and comorbidities that lead to both physical and psychologic problems. Over 400 000 deaths are attributable to obesity in the United States alone each year, and obesity is identified as the second most common cause of death after smoking from modifiable behavioral risk factors.[6] Unfortunately, the conservative weight loss approach consisting of diet, exercise, and medication generally achieves only 5 to 10% reduction in body weight, and recidivism after such weight loss exceeds 90% within 5 years.[27,29] These disappointing results have triggered interest in bariatric surgery.[29] Bariatric surgical procedures are grouped fundamentally into restrictive procedures that limit caloric intake by downsizing the stomach's reservoir capacity and malabsorptive procedures thereby decreasing the length of the small intestine. Examples of restrictive procedures include laparoscopic adjustable gastric banding (LASGB) and sleeve gastroplasty (LSG).[30-33] In both cases a small gastric pouch is created, which then empties through a narrow outlet to the remainder of the stomach.

Bariatric surgery is fundamentally considered appropriate for adult patients with body mass index (BMI) greater than 40 or a BMI between 35 and 40 with an obesity-related comorbidity. These selection criteria were developed by the National Institutes of Health Consensus Development Panel in March 1991 and have since then been adopted by all major surgical and nonsurgical societies.[34] In the older patients with low morbidity and mortality, bariatric surgery can be safely performed.[35-37] In spite of an extensive bariatric surgery literature, there are several unanswered questions such as: what is the long-term impact of bariatric surgery on effective weight loss, what is the impact of bariatric surgery on obesity-related comorbidities such as diabetes, hyperlipidemia, hypertension, and obstructive sleep apnea on long-term basis? The most commonly used criterion for effective weight loss after bariatric surgery is the difference between actual weight and the ideal body weight for a given height. The estimation of ideal body weight can be obtained from the Metropolitan Life tables.[38]

Laparoscopic adjustable silicon gastric banding and laparoscopic sleeve gastrectomy have gained a lot of attention around the world. However, the role of LASGB and LSG for the management of obesity remains in doubt. Several studies have been conducted, some in favor and others not. The goal of this review was to ascertain if LASGB was superior to LSG, and if so what are the benefits and how it could be instituted more widely. There is also diversity in the quality of the randomized controlled trials. The main variable in these trials are the following parameters: number of patients, withdrawal of cases, exclusion of cases, blinding, intention to treat analysis, publication biasis, local practice variation, prophylactic antibiotics used and follow-up failure.

CONCLUSION

Laparoscopic sleeve gastrectomy though, forms a safe surgical option for weight loss treatment particularly in the very-very-obese patients (BMI > 60 kg/m^2). LASGB gives satisfactory results and coupled with reversibility and low cost, it is an important tool in the long-term management of patients with morbid obesity.

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