International Journal of Surgery 12 (2014) 504–508

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.journal-surgery.net

Original research

Long term predictors of success after laparoscopic sleeve gastrectomy

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ARTICLE INFO

Article history:
Received 26 September 2013
Received in revised form
8 January 2014
Accepted 15 February 2014
Available online 18 February 2014

Keywords:
Morbid obesity
Bougie size
Gastrectomy
Leak

ABSTRACT

Background: To evaluate early, mid and long term efficacy of laparoscopic sleeve gastrectomy as a definitive management of morbid obesity and to study factors that may predict its success.
Materials and methods: A retrospective study was conducted by reviewing the database of patients who underwent LSG as a definitive bariatric procedure, from April 2005 to March 2013. Univariate and multivariate analysis were performed.
Results: 1395 patients were included in this study. Mean age was 33 years and women:men ratio was 74:26. The mean preoperative BMI was 46 kg/m^2. Operative time was 113 ± 29 min. Reinforcement of staple line was done only in 447 (32%) cases. 11 (0.79%) cases developed postoperative leak, with total number of complications 72 (5.1%) and 0% mortality. Percentage of excess weight loss (%EWL) was 42%, 53%, 61%, 73%, 67%, 61%, 59% and 57% at 6 months, 1–7 years. Remission of diabetes (DM), hypertension (HTN) and hyperlipidaemia (HLP) occurred 69%, 54% and 43% respectively. 56 (4%) patients underwent revision surgery, for insufficient weight loss ($n = 37$) and severe reflux symptoms ($n = 19$). Mean follow up was 76 ± 19 (range: 6–103) months. Smaller bougie size and leaving smaller antrum were associated with significant %EWL. Bougie ≤36F remained significant in multivariate analysis.
Conclusion: This study supports safety, effectiveness and durability of LSG as a sole definitive bariatric procedure. Smaller bougie size and shorter distance from pylorus were associated with significant %EWL.

1. Introduction

Laparoscopic sleeve gastrectomy (LSG) was first used as 1st stage of two staged bariatric surgery for those with high surgical risk severely obese patients (BMI ≥ 60 kg/m^2). In the past few years, on the basis of several studies, LSG is becoming a sole bariatric procedure due to its effectiveness on weight loss and co-morbidities resolution [1–4].

LSG is a restrictive procedure in which up to 80% of the stomach is vertically resected leaving a gastric tube or conduit preserving the vagi and pylorus. LSG is proved to have a weight loss effect within the range between gastric banding and bypass surgery. Moreover, it is a simple procedure with low morbidities and negligible long term nutritional deficiencies [5,6]. We conducted this retrospective study to review our experience with application of LSG as a definitive procedure for morbidly obese patients.

2. Materials and methods

Our study is a retrospective multi-center study through reviewing the database of the morbidly obese patients admitted at our institutions, (Jahra Hospital-Kuwait, King Faisal Hospital- KSA, and Mansoura University Hospital- Egypt) who underwent LSG as a definitive bariatric procedure from April 2005 through March 2013.

Patients with age 18–65 years, BMI >40, or >35 with co-morbidities after failure of many dietetic regimen, acceptable levels of surgical risk, a clear understanding of the surgery and its impact on patient's life were included in the study after having an informed signed consent. We excluded patients with prohibitive surgical risk, indications of lack of compliance with perioperative regimen, uncontrolled alcohol or drug abuse, uncontrolled depression or other mental disorders, and lack of family support or significant discord within the family about the planned surgery.

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http://dx.doi.org/10.1016/j.ijsu.2014.02.008
1743-9191/

Each patient underwent a complete history and physical examination to assess the co-morbidities. Diagnostic workup includes gastroscopy, abdominal ultrosonography, X-ray chest film, electrocardiogram, complete blood count, coagulation profile, thyroid profile, electrolytes, blood urea nitrogen (BUN), creatinine, and evaluations of liver functions and lipid levels. Consultation with cardiologists, pulmonologists and anesthetists was done. Patients received one injection of 1st generation cephalosporin during induction and deep vein thrombosis prophylaxis (DVT) in the form of enoxaparin and elastic stockings.

3. Surgical technique

The greater curve was devascularized using Harmonic scalpel or LigaSure devices going up to angle of Hiss. Distance proximal from the pylorous to the 1st staple firing was formally measured by a ruler or a length of suture, (2–4 cm in 586 and 5–7 cm in 809 patients). A conduit of stomach was tailored over ≤36 Fr bougie in 837 and ≥44 Fr bougie in 558 cases, using endo GIA linear staplers starting with 1–2 green cartridges at the antrum and 2–4 blue ones at the body and the fundus.

At the early stage of study, the staple line was reinforced (447 cases) to prevent leakage and bleeding. Running stitch reinforcement was used in 307 cases starting from gastroesophageal junction downward and bovine pericardium (Peri-strips Dry [PSD]) reinforcement was used in 140 cases. In the remaining cases we stopped using reinforcement. Integrity of the staple line was checked intraoperatively by injecting a methylene blue before going to remove the bougie. Redivac drain (in 319 cases) was left behind at the left hypochondrial space after retrieval of the resected part that was sent for histopathology. All ≥10 mm port openings were closed routinely using polyglycolic acid suture 1 for sheath closure then the port sites were infiltrated with marcaine after skin closure. All patients were operated by operative teams who are experienced in laparoscopic bariatric surgery. All operations were completed laparoscopically.

79 (5.6%) patients had concomitant cholecystectomy for symptomatic gall bladder stones, and 59 patients had hiatoplasty for hiatus hernia (stitching both diaphragmatic crura by means of 2 or 3 non-absorbable stitches leaving at least 1 cm space for the esophagus with a bougie inside to avoid postoperative dysphagia), and 56 patients with umbilical hernia had suture repair by the conventional approach.

On the 1st postoperative day (POD), leakage was further checked by gastrograffin meal study, then patients were encouraged to start oral fluid for 4 days and progress to semi-solid for further 3 weeks then solid foods were allowed after the 4th week, according to the dietician instructions. Anticoagulant was continued while staying in hospital and at home for 2 weeks till he/she is full ambulant. Patients were discharged if they were going well and advised to take multivitamins and proton pump inhibitor for one month and when needed thereafter.

The 1st follow up visit was one week later to check wounds and any complications. Multivitamins and calcium supplementations were prescribed for all patients. Ursidiol 300 mg twice daily was prescribed as a gall stone prophylaxis for 6 months to patients with intact bladder. Next follow up visits were scheduled every 3 months in the 1st year, every 6 months in the 2nd year, and yearly thereafter. Laboratory investigations for protein, mineral and vitamin deficiency was done yearly. Mean follow up duration was 76 ± 19 (range: 6–103) months.

Patients' data were collected into a data sheet for statistical purpose including clinical, radiologic, laboratory, operative and postoperative findings.

3.1. Statistical analysis

The statistical analysis of the data in this study was done using the SPSS version 10. For continuous variables, descriptive statistics were calculated and were reported as mean ± SD. Categorical variables were described using frequency distributions. The Student's *t*- test for paired samples was used to detect differences in the means of numerical variables, Chi-square test or Fisher's exact test (when necessary) was used for qualitative variables. *P* values >0.05 were considered to be significant. Significant variables were entered into a logistic regression model to determine independent significant variables. They were expressed as odds ratios (OR) with their 95% CI.

4. Results

1419 patients underwent LSG as a definitive bariatric procedure at our institutes. 1395 patients were included in this study as 24 patients were lost for follow up. 1395 (100%) patients were followed up for 6 months, 1339 (96%) patients for 1 year, 1156 (83%) for 2 years, 1089 (78%) patients for 3 years, 983 (70%) patients for 4 years, 859 (62%) patients for 5 years, 731 (53) patients for 6 year, 519 (37%) patients for 7 years, and 307 (22%) patients for 8 years (Fig. 1). Mean age was 33 ± 7 (range: 18–65) years and women:men ratio was 74:26. BMI was 46 ± 9 (range: 40–70) kg/m^2, with mean body weight 109 ± 25 (range: 100–178) kg. Diabetes mellitus (DM) was found in 41%, hypertension (HTN) in 57%, obstructive sleep apnea syndrome (OSAS) in 22% cases, degenerative joint disease (DJD) in 32%, and hyperlipidemia (HLP) in 43% patients. All operations were completed laparoscopically with mean operative time 113 ± 29 (range: 79–139) minutes. Time to resume oral intake was1.7 ± 0.8 (range: 0.9–2.9) days, and hospital stay was 3.9 ± 1.7 (2.1–25) days (Table 1).

Co-morbidities were assessed every follow up visit and improvement was considered if the dosage of medication were reduced or patient needed fewer drugs to control his/her disease. Resolution of disease was considered if patient is no longer requiring medication. At 3 years, DM, HTN, OSAS, DJD, and HLP were remitted in 69%, 54%, 51%, 61% and 43% respectively.

5. Intraoperative complications

Bleeding from short gastric vessels at the upper pole of spleen occurred in 3 patients that was solved laparoscopically and spleen was preserved. 35 patients had bleeding at the staple line that was controlled sufficiently by endo-clips or reinforcing stitches. One patient had left liver lobe injury during introduction of the

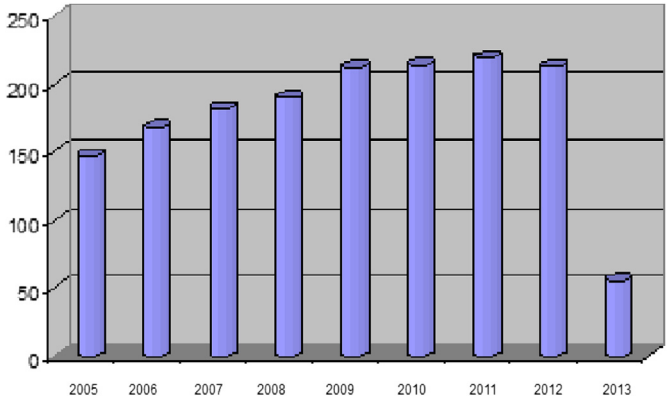

Fig. 1. 1395 patients from April 2005 through March 2013.