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Research Article

Feasibility of Laparoscopic Management of Hiatal Hernia and/or Gastroesophageal Reflux Disease with Laparoscopic Sleeve Gastrectomy or Greater Curvature Plication in Morbidly Obese Patients

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Abstract

Gastro Esophageal Reflux Disease (GERD) presents at high incidence in morbidly obese patients. Laproscopic Sleeve Gastrectomy (LSG) has gained popularity as a definitive bariatric surgical procedure. Laparoscopic Greater Curvature Plication (LGCP) is a new bariatric restrictive procedure. The purpose was to compare between laparoscopic crural repair only with sleeve gastrectomy and laparoscopic Nissen fundoplication with greater curvature plication for management of GERD and/or hiatal hernia in morbidly obese patients. From August, 2013 to July, 2015, 40 morbidly obese patients with hiatal hernia and/or GERD underwent laparoscopic sleeve gastrectomy (Group A) or laparoscopic greater curvature Plication (Group B). After a mean follow-up of 14.1 month, median BMI fallen to 35 in group A and to 37.95 kg m^{-2} in group B. There was significant increase of operative time in group B when compared to group A (148±19.01 vs 100.75±12.27 min, respectively). On the other hand, the time to resume oral feeding was significantly shorter in group B (25±1.45 vs. 29±1.45 h). In addition, there was significant decrease of GERD symptoms in group B (0.0% vs. 20.0%). However, six patients in group B complaining postoperatively of gastric bloating (subside gradually during follow up period) and nine patients complaining of dysphagia (resolved with medical treatment). In group A, two patients complaining of dysphagia (disappear spontaneously during the follow up period) and recurrence of GERD symptoms reported in four patients (treated with minimal dose of PPI). Preoperatively, there were two patients of group A, who had moderate HH, which became mild postoperatively and no recurrence in group B. Nissen fundoplication with greater curvature plication requires a longer operative time. However, it had extra benefits such as, no alteration of body physiology, low complication rates, low cost, creation of high pressure zone with fundal wrap of Nissen fundoplication and no recurrence was recorded. Laparoscopic nissen fundoplication with greater curvature plication appears to have better results on GERD and/or hiatus hernia when compared to laparoscopic crural repair with sleeve gastrectomy, although it had long operative time.

Key words: Laparoscopic sleeve gastrectomy, greater curvature plication, hiatal hernia, gastroesophageal reflux disease

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Obesity is considered as worldwide epidemic. The World Health Organization (WHO) estimated in 2008, that more than 500 million adults are clinically obese (BMI>30%) worldwide (WHO., 2012). Obesity-related comorbidities include Type 2 Diabetes Mellitus (T2DM), hypertension, coronary artery disease, dyslipidemia, cancer and GERD (Visscher and Seidell, 2001). There is high incidence of gastroesophageal reflux disease (GERD) with obesity and may be present in half of obese patients with surgical indication. In the non-obese population, the incidence of GERD is 15-20% and barrett's esophagus is 1-2%. In obese, it ranges from 22-70 and 7-30%, respectively. Thus, obesity is a risk factor in the pathogenesis of reflux. There are structural changes that caused by bariatric interventions affect the motor functions of the organs involved (Nassif *et al*., 2014).

Laparoscopic Sleeve Gastrectomy (LSG) have a good role in producing weight loss and improving T2DM (Gill *et al*., 2010); however, evidence of LSG's effect on GERD is inconsistent (Chiu *et al*., 2011).

The GERD definition according to Montreal classification is a condition that develops, when reflux of stomach contents in the esophagus causes troublesome symptoms or complications. The GERD associated symptoms include heartburn, regurgitation, dysphagia, chronic cough and laryngitis. Exposure to acid for long periods within the esophagus can lead to histopathologic and structural changes such as peptic stricture and Barrett's esophagus (Moraes-Filho *et al*., 2002). There is no gold standard for diagnosis of GERD, so its diagnosis is imprecise (Moayyedi and Talley, 2006). Published practice guidelines recently state that, a diagnosis of GERD can be established in the setting of typical symptoms (Katz *et al*., 2013). With absence of gold standard in GERD diagnosis, evaluation of GERD includes multiple modalities including 24 h esophageal pH monitoring, esophageal manometry, endoscopy and symptom reporting. There are some studies assessing GERD, use symptom reporting as a primary endpoint, though others focus on the importance of more objective measures such as esophageal pH monitoring (Avidan *et al*., 2002). After many years of experience, laparoscopic antireflux surgery (LARS) is considered the gold standard for treatment of GERD and/or HH (Soricelli *et al*., 2010).

In 1988, LSG was developed as the initial procedure in a staged approach to patients with morbid obesity (Hess and Hess, 1998). After that it was described as an isolated procedure in 1993 by Johnston *et al*. (2003). A minimal invasive alternative developed in 1999 (Gumbs *et al*., 2007). Since then, LSG has gained popularity as a definitive bariatric surgical procedure (Colquitt *et al*., 2009). Hiatal Hernia Repair with LSG has been recently proposed for the management of HH in morbid obese patients (Bernante *et al*., 2008). There is a controversy regarding the effect of LSG on GERD. The current literature can be divided into two categories: those that demonstrate an increase in GERD prevalence after LSG and those that demonstrate a decrease in GERD prevalence after LSG (Laffin *et al*., 2013). Laparoscopic Greater Curvature Plication (LGCP) is considered a new bariatric restrictive procedure that can avoids the complications associated with the permanent implant of an adjustable gastric banding, also minimizing the possibility of leaks associated with sleeve gastrectomy. The procedure consists of reducing the gastric volume by placing at least two rows of non-absorbable sutures on the gastric greater curvature. The LGCP was first described in 2007 (Talebpour and Amoli, 2007).

The present study designed to compare between laparoscopic crural repair only with sleeve gastrectomy and laparoscopic nissen fundoplication with greater curvature plication for management of GERD and/or hiatal hernia in morbidly obese patients.

MATERIALS AND METHODS

From August, 2013 to July, 2015, 40 morbidly obese patients with hiatus hernia and/or Gastroesophageal reflux disease (GERD) were underwent laparoscopic crural repair with sleeve gastrectomy or laparoscopic Nissen fundoplication with greater curvature plication. This study was carried out in New Dameitta University Hospital.

Inclusion criteria: The inclusion criteria were morbidly obese patients (BMI 40-55%), non-sweet eaters, without endocrinal disturbances, with failed other measures to lose weight, with no previous upper GIT surgery, patients with hiatus hernia and/or GERD.

Exclusion criteria: The Exclusion criteria were morbidly obese patients with no reflux symptoms or hiatus hernia on preoperative studies, sweet eaters, patients with psychological troubles and patients with previous upper GIT surgeries.

Laparoscopic crural repair with LSG was done for 20 patients (Group A) and laparoscopic Nissen fundoplication with GCP for 20 patients (group B). All patients underwent a preoperative work-up including history and physical examination, routine laboratory investigations, ECG, chest radiography, pulmonary function tests, abdomina

ultrasonography, upper GIT endoscopy, barium swallow (if indicated) and psychiatric evaluation. Prophylactic antibiotic and anticoagulant injection were taken routinely preoperative. An informed consent was given by all patients.

Surgical procedure: Under general anesthesia, all patients were positioned in reverse trendelenburg position, tilted up 30°. The camera man stands to the patient's right side, the assistant to the left side. The surgeon stands between the legs to operate in the French position. After induction of the pneumoperitoneum, five ports (one 10 mm optical port above the umbilicus, two 12 mm ports in the mid clavicular line in both sides above the level of the umbilicus, one 5 mm port below the xiphisternum for liver retraction and one 5 mm port in the left anterior axillary line) were placed (Fig. 1) (French and Khaitan, 2006). The vascular supply of the gastric greater curvature was divided starting 4-6 cm from the pylorus and proceeding upward until of his angle, by means of vessel sealing device.

After division of the gastrohepatic omentum, distal esophagus and gastroesophageal junction were mobilized to get a 4 cm tension free intra-abdominal esophagus. Posterior crural repair was performed with two or three interrupted 2-0 non-absorbable sutures (Fig. 2).

Group A: For Group A, sleeve gastrectomy was performed using a linear stapler with two sequential green load firings for the antrum, followed by three or four sequential blue cartridges for the remaining gastric body and fundus. The stapler was applied alongside a 36-Fr calibrating bougie strictly positioned against the lesser curve; the final appearance of stomach like a tube as shown in Fig. 3. Intraoperative methylene blue dye test was routinely performed. One drain was placed, extraction of excised part of stomach and finally port sites closed with sutures.

Group B: For Group B, after crural repair and devascularization of greater curvature of stomach as before, the esophagus retracted anteriorly, visualization of the fundus from behind the right side of the esophagus. The left hand grasps the fundus and pulls it around to the right side. The fundus should come around easily and stay in place without tension. The esophagus should essentially be invaginated into the fundus with the fundoplication facing the patient's right side. A "shoe shine" maneuver can be performed to ensure that the proper portion of the fundus was brought around. The fundoplication is secured by placing three 2-0 non-absorbable sutures in simple fashion to create a 2 cm loose floppy nissen (Fig. 4). Gastric plication was created by plicating the greater curvature; applying a first row of seromuscular, non-absorbable 0 interrupted sutures, so that it was far away from gastric acid. The distance between the sutures varied between 1.0 and 1.5 cm. This was reinforced by a second row of non-absorbable running 0 sutures, to strengthen the plication and prevent herniation between the sutures. Plication was started at the top of gastric fundal wrap and carried down

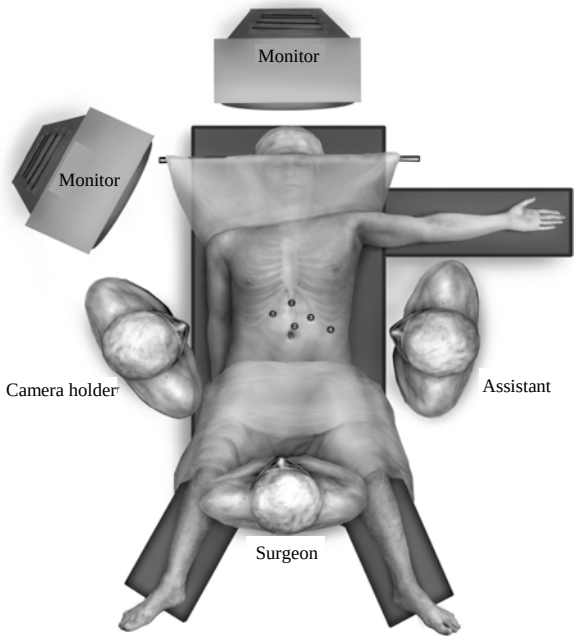

Fig. 1: Port placement/room setup

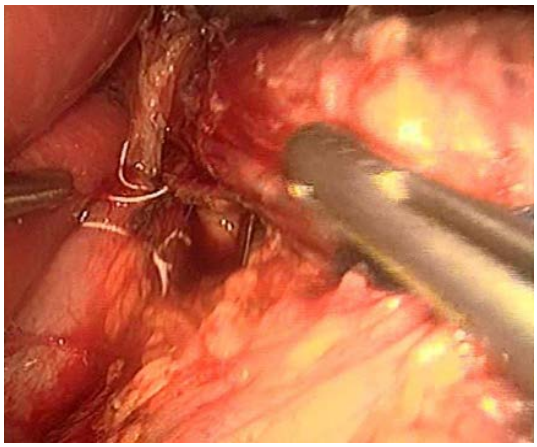

Fig. 2: Crural repair

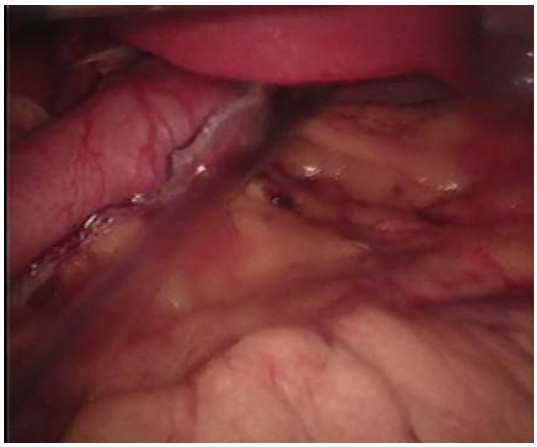

Fig. 3: Final appearance of stomach after sleeve gastrectomy

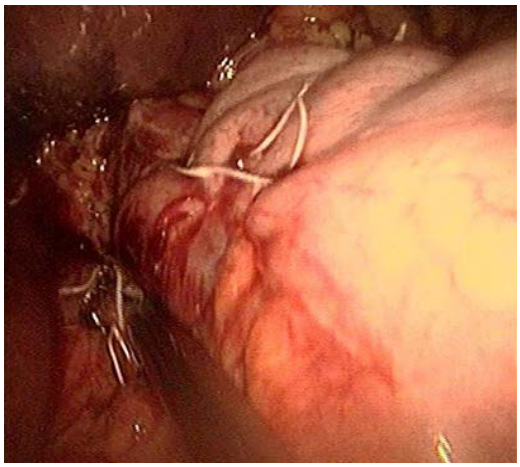

Fig. 4: Final appearance of crural repair with Nissen fundoplication

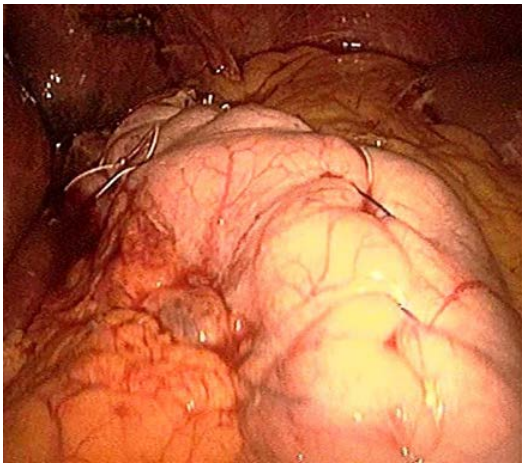

Fig. 5: Final appearance after Nessin Fundoplication with GCP

to 4 cm from the pylorus. The technique was similar to that of Schellekens *et al.* (2012), invagination of three sections of gastric wall, by taking four bites, two posterior and two anterior to the greater curvature. The final shape of stomach was like a sleeve gastrectomy, but slightly larger (Fig. 5). One drain was placed and finally port sites closed with sutures.

Statistical analysis: The collected data were analyzed using statistical package for social science (SPSS), version 16 (SPSS Inc., IL, Chicago), running on IBM-compatible computer. Quantitative data expressed as mean±standard deviation, while, categorical variables were expressed as frequency and percent. Independent samples student's t test was used for comparison between two means, while Chi square test was used to compare between two categorical variables. p-value<0.05 was considered significant.

RESULTS

Forty patients complaining of morbid obesity with hiatal hernia and/or GERD were divided into two groups; (A) underwent laparoscopic crural repair with sleeve gastrectomy and (B) underwent Laparoscopic Nissen fundoplication with greater curvature plication in New Damietta University Hospital from August, 2013 to July, 2015.

In this study, 31 patients (77.5%) were females and 9 (22.5%) were males; their age ranged from 18-50 years old with mean age of 36.1 years; the mean BMI was 44.58 kg m^{-2}. Female patients were 15 (75%) in group A and 16 (80%) in group B. The mean age of group A was 38.2 years and 33.95 years for group B. The mean BMI was 45.05% for group A and 44.10% for group B (Table 1). All patients complain of GERD symptoms and eleven patients with Hiatus hernia, five in group A and six in group B. All cases were completed laparoscopically. The median operative time was 100.75 min (range 80-120 min) for group A and 148 min (range120-180 min) for group B. Oral feeding was resumed following a mean duration of 29 h for group A and 25 h for group B. Postoperative mortality was nil, there was vomiting in two patients (10%) of group A and four patients (20%) in group B, this vomiting was managed with PPI and antiemetic. There was recurrence of GERD symptoms in four patients (20%) of group A, which subsided with minimal dose of PPI and no one in group B. There were nine patients (45%) from group B complaining of dysphagia postoperative, which resolved with motility regulator drugs; while in group A, there were two patients (10%) complaining of dysphagia, which disappear during the follow up period (Table 2).

Preoperatively, there were two patients (40%) of group A, who had moderate HH, which became mild postoperatively and no recurrence in group B as demonstrated with upper gastrointestinal tract endoscopy which was done after one month after surgery. There were six patients (30%) of group B complaining postoperatively of gastric bloating, which subside gradually during follow up period. After a mean follow-up of 14.1 month (5-24 month), median BMI has fallen to 35 kg m^{-2} in group A and to 37.95 kg m^{-2} in group B (Table 2).

DISCUSSION

Obesity is a key risk factor for GERD, the increasing incidence of obesity has coincided with an increasing prevalence of GERD (Hampel *et al.*, 2005). The relation between obesity and GERD is thought to be due to an increase in intragastric pressure with external compression by

Table 1: Comparison between groups A and B as regard to age, gender and BMI

Variables	Group A	Group B	Test	p-value (NS)
Age	38.2±9.58 years	33.95±8.62 years	1.47	0.15
Gender				
Female	15 (75%)	16 (80%)	0.14	0.71
Male	5 (25%)	4 (20%)		
BMI	45.05±2.96	44.10±2.48	1.09	0.27

BMI: Body mass index, NS: Non-significant

Table 2: Comparison between groups A and B as regard to peri-operative data

Variables	Group A	Group B	Test	p-value
Pre-operative				-
GERD	20 (100%)	20 (100%)	a	0.72(NS)
HH	5 (25%)	6 (30%)	0.12	
Operative time	100.75±12.27 min	148±19.01 min	9.33	<0.001*
Post-operative				
Oral feeding	29±1.45 h	25±1.45 h	8.71	<0.001*
Mortality	0	0	a	-
Vomiting	2 (10%)	4 (20%)	0.78	0.37 (NS)
Gastric bloating	0	6 (30%)	7.05	0.008*
Dysphagia	2 (10%)	9 (45%)	6.14	0.013*
GERD symptoms recurrence	4 (20%)	0	4.44	0.035*
HH recurrence	2 (40%)	0	2.10	0.14 (NS)
Median BMI	35.0±2.99 kg m^{-2}	37.95±2.06 kg m^{-2}	3.63	0.001*

HH: Hiatus hernia, GERD: Gastroesophageal reflux disease, BMI: Body mass index, a: No statistics can be computed because the variable is constant, *statistically significant, NS: Non-significant

surrounding adipose tissue, this leads to frequent relaxation of the lower esophageal sphincter and hence, the occurrence of acid refluxes (Tai *et al*., 2010). For management of GERD among obese patients, weight reduction often is recommended (De Groot *et al*., 2009).

Although, the underlying mechanisms causing the occurrence of GERD after LSG are not clear, the involvement of the Lower Esophageal Sphincter (LES) might play an important role. As a part of LSG, the resection at the angle of His and partial sectioning of the sling fibers, may impair the function of the LES after LSG. Braghetto *et al*. (2010) reported that a decrease in LES pressure was found in 17 of 20 patients after LSG. Also, by using multislice computed tomography to evaluate anatomical changes after LSG, Baumann *et al*. (2011) concluded that 10 of 27 patients had migration of the proximal sleeve above the level of the hiatal opening after LSG, indicative of a hiatal herniation of the sleeve.

Increased weight was associated with both esophageal acid exposure and mechanical dysfunction of the LES as demonstrated with Ayazi *et al*. (2009). Wu *et al*. (2007) found an association between obesity and frequency of transient lower esophageal sphincter relaxation.

In a prospective single center study utilized hiatal hernia repair concurrently with LSG, there are 47.5% decrease in GERD prevalence postoperatively at 6 and 12 months (Daes *et al*., 2012). Soricelli *et al*. (2013) found that there is no *de novo* cases of GERD in any of the 97 patients undergoing LSG and hiatal hernia repair. The dissection involved in LSG can reduce any hiatal hernia via traction applied during routine dissection. This was evidenced by the fact that in Daes *et al*. (2012) of the 65 HH diagnosed preoperatively 31 had been reduced through the dissection associated with LSG at the time of operation. In the future, recognition and planned repair of hiatal hernia concurrently with LSG may be one of the major technical factors in reducing post-LSG GERD.

The aim of the surgical management of gastroesophageal reflux and/or HH, regardless of obese or non-obese patients is to restore the cardioesophageal competence (Fraser *et al*., 2001). In 1937, Rudolf Nissen in Istanbul performed a transpleural cardia resection and protected the anastomosis within a gastric fold, this was the first idea of fundoplication to prevent gastroesophageal reflux. The first fundoplication without resection was practiced in 1955, with a short publication appearing in 1956 (Nissen, 1956). Donahue *et al*. (1977) performed total wrap and validated by DeMeester *et al*. (1986). The technique includes full mobilization of the gastroesophageal junction and posterior fundus with division of the upper short gastric vessels and a crural repair (Donahue *et al*., 1977; DeMeester *et al*., 1986).

Laparoscopic antireflux surgery effectively decreased symptoms of gastroesophageal reflux disease and cured erosive esophagitis. Adverse effects postoperatively were usually mild and patient satisfaction was good (Kellokumpu *et al*., 2013).

The LGB at the beginning, seemed to be contraindicated in obese patients with HH, due to increased risk of band slippage or dysphagia and afterward has been proven by several authors that crural repair in addition to gastric banding does not increase the risk of slippage or dysphagia and significantly improves reflux symptoms, providing an increase in lower esophageal sphincter pressure (Gulkarov *et al*., 2008). The LSG however, is considered a safe and effective bariatric procedure and have results similar to those of LRYGBP and superior to LGB in terms of weight loss and a low rate of postoperative morbidity (Melissas *et al*., 2007).

The LSG with crural closure can represent a valuable option for the synchronous management of morbid obesity and HH, providing good outcomes in terms of weight loss and GERD symptoms control (Soricelli *et al*., 2010). Talebpour and Amoli (2007) have published the largest series to date using the laparoscopic GCP technique. They reported the results from 100 patients who had undergone GCP with a mean age of 32 years and a mean preoperative BMI of 47 kg m^{-2} (range 36-58). The mean% EWL loss at 1, 6, 12, 24, and 36 months was 21.4%, 54% (72 cases), 61% (56 cases), 60% (50 cases) and 57% (11 cases), respectively. The average follow-up was 18 months. The mean operative time was 98 min (range 70-152) and the mean hospital stay was 1.3 days (range 1-4). Nausea and vomiting were the most common complications. The reoperation rate was 2.6% in their series (1 suture line leak, 1 prepyloric perforation, 1 liver abscess and 1 kinking of the stomach requiring revision), with no late complications.

In our study, no statistical difference between the two groups as regard postoperative oral feeding. The operative time was longer for group B. The postoperative median BMI was less for group A. Vomiting, gastric bloating and dysphagia were occurred more with plication group, recurrence of GERD and H.H symptoms were noticed only with crural repair and sleeve gastrectomy.

CONCLUSION

Laparoscopic Nissen fundoplication with greater curvature plication appears to have better results on GERD and/or hiatus hernia when compared to laparoscopic crural repair only with sleeve gastrectomy in morbidly obese patients, although it had long operative time (which expected to be shorter with increased experience). Laparoscopic greater curvature plication had extra-benefits over laparoscopic sleeve gastrectomy such as, no alteration of body physiology, low complication rates, low cost, availability of creation of high pressure zone with fundal wrap of Nissen fundoplication, reversibility and no recurrence was recorded. Long term results and more studies are needed to determine the ideal operation for each patient.

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