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Original Article

Initial Experience of Laparoscopic Crural Closure in the Management of Hiatal Hernia in Obese Patients Undergoing Sleeve Gastrectomy

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Abstract

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Background: Laparoscopic Sleeve Gastrectomy [LSG] has made a revolution in the surgical treatment of obese patients, but only a few studies evaluated the concomitant repair of Hiatus Hernia [HH] during LSG, in obese patients with HH.

Aim: This study aimed to evaluate the safety and effectiveness of combined LSG with Crural repair in obese patients with HH.

Methods: This is a prospective study that was applied to 20 obese patients who underwent LSG with a crural repair. Preoperative data collected included personal, medical, and surgical history, clinical and endoscopic examination, intraoperative time and difficulties, postoperative data included hospital stay, postoperative complication, body mass index [BMI], and endoscopic evaluation.

Results: The mean age of the patients was 42.4±5.4 years old. The majority of the patients were females [70%] and only 30% were males. The mean of their BMI was 44.6±4.69 Kg/m². There was a statistically significant reduction in preoperative BMI measures [44.6±4.5766 kg/m²] 6 months postoperatively measures [33.95±3.499 kg/m²] [P value < 0 .0001]. The simultaneous crural repair in the treatment of morbid obesity associated with HH led to symptomatic relief of GERD in 75% of the patients. Only one patient [5%] developed a recurrence of HH in endoscopic evaluation. There were no recorded intraoperative or postoperative complications, and all patients' quality of life was enhanced.

Conclusion: Combined LSG with a crural repair is one of the most accepted procedures in the management of obese patients with HH with a high degree of safety and effectiveness.

Keywords: Obesity; Sleeve Gastrectomy; Crural; Body Mass Index.



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INTRODUCTION

Laparoscopic sleeve gastrectomy [LSG] is considered one of the most ideal bariatric procedures because it is a simple and straightforward surgical technique without any digestive anastomosis or intestinal bypass. Also, LSG is considered a physiologic procedure as the digestive tract continuity is respected. For these reasons, LSG is currently the most-performed bariatric procedure in many countries [1].

Hiatal hernia [HH] is a frequent condition in obese patients. The reported rate of HH in obese patients was 5 - 50%. The main issue of HH in patients undergoing sleeve gastrectomy [SG] is the association between gastroesophageal reflux disease [GERD] and HH. HH and GERD are the more common and interrelated problems in the obese population compared with the non-obese. Many patients presenting for consideration of bariatric surgery are asymptomatic even in the presence of HH [2].

Besides several factors contributing to the development of both HH and GERD; esophageal shortening secondary to chronic GERD led to HH [3]. They also found that the lower esophageal sphincter [LES] and crural diaphragm, which normally constitute the esophageal gastric junction high-pressure zone, were more frequently distanced from each other developing HH [4].

LSG has gained increasing popularity in the surgical treatment of obese patients, but current data on its effect on GERD are still controversial [5]. In addition, there are only a few studies investigating the effect of the concomitant repair of HH during LSG on GERD which despite some methodological limitations, suggests an improvement in symptoms [6].

AIM OF THE WORK

The aim of this study was to evaluate the safety and effectiveness of combined laparoscopic SG with crural repair in obese patients with hiatus hernia.

METHODS

This is a prospective study applied to 20 obese patients who underwent LSG in the general surgery department, faculty of medicine, Al-Azhar University Hospitals from 2018 to 2020. This study received approval from the ethical committee.

Before the surgery, all patients were asked to sign informed consent for participation.

The study included obese patients' candidate for LSG with age ≥ 18 and ≤ 70 years, body mass index [BMI] ≥ 35 and ≤ 60 m² with HH grade 1 and 2 with or without reflux. Patients who had previous open surgery or proven functional esophageal motility disorders were excluded from the study.

Preoperative assessment by taking history, clinical examination, review investigation, explaining the procedure and modalities, risks, complications, lifestyle modification, and starting a well-established doctor-patient relationship. Preoperative investigations included complete blood count [CBC], PT, INR, SGPT, SGOT, albumin, urea, creatinine level, free T3, free T4, TSH level, serum Cortisol level

[9am, 9pm], hepatitis marker [B, C] and fasting blood sugar, postprandial blood Sugar, HgA1c.

Preoperative imaging included abdominopelvic ultrasound, chest X-ray, ECG, Echo, and duplex lower limb vessels. A preoperative upper GI endoscope was done for assessment of the gastric wall, assessment of the hiatus, and detection of hiatus hernia.

Preoperative preparation:

The patient was ordered to have a low carbohydrate diet for 3-5 days before surgery, a proton pump inhibitor for 5 days before surgery, and Clexan 12 hours before surgery to approximate the dose according to weight 1mg/kg as prophylactic dose.

Surgical Procedure:

The patients, under general anesthesia, were positioned in the inverse Trendelenburg position, tilted up 30°. After induction of the pneumoperitoneum by verus needle, five trocars [one 15 mm, two 10-12 mm, and two 5 mm trocars] or [two 10-12 mm and three 5 mm trocars] were placed. The vascular supply of the gastric greater curvature was divided starting 3-4 cm from the pylorus and proceeding upward until the angle of His, using a LigaSure™ vessel sealing device [Valleylab™, Boulder, CO, USA], or by mean of Harmonic vessel sealing device or by mean of Enseal vessel sealing device.

The dissection of the hiatal crura was performed from the left, taking care to preserve the hepatic branch of the vagus. The gastroesophageal fat pad was completely dissected and reduced within the abdomen [Figure 1A,B]. The diameter of the hernia orifice was estimated by taking the opening jaws of the clinch clamp as a reference [Tyco Healthcare ©, Gosport, Hampshire, UK]. The hiatal crura defect was repaired with two or three interrupted nonabsorbable sutures between the right and the left diaphragmatic pillars [Figure 1C, D]. Then, LSG was created by a linear stapler. A 36-Fr calibrating bougie was strictly positioned against the lesser curve then the stomach was cut using the stapler preserving a curvature with a wide area at the incisura [Figure 2A] and preservation of the angle of His [Figure 2B], to obtain a 60-80-ml gastric pouch. An intraoperative dye test with methylene blue was performed.

One drain was placed [Figure 2A]: Preservation of widening of the junction between vertical limb and horizontal limb [wide tube at crow's foot].

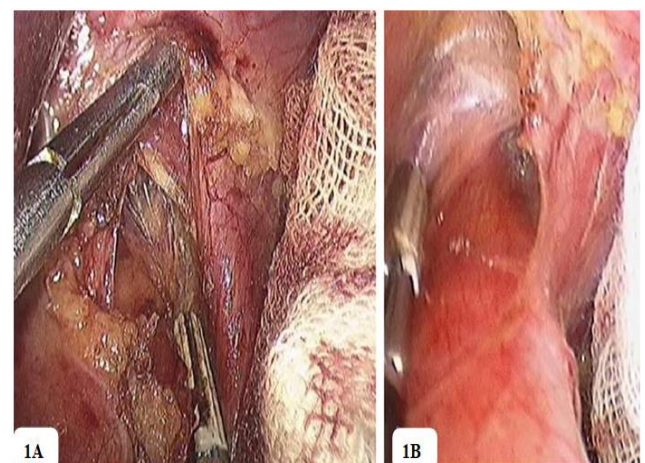


Figure [1] A) Dissection of the hiatal crura and esophagus, B) to have an apart in the abdomen.

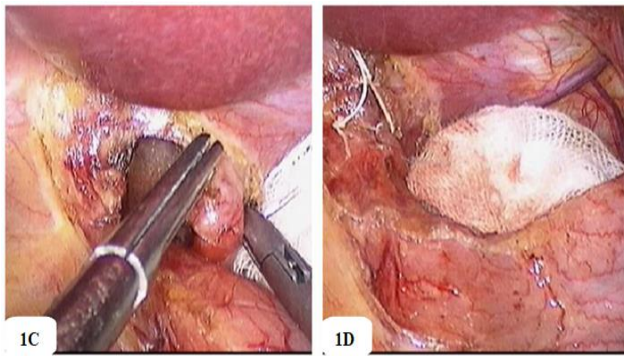


Figure [1] C, D]: Closure of the diaphragmatic crura by non-absorbable sutures [anterior repair].

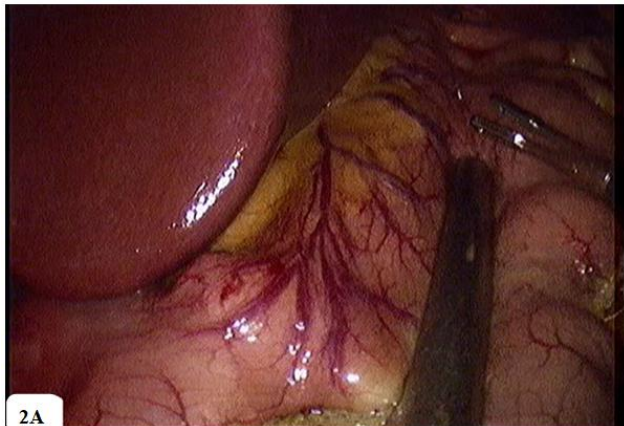


Figure [2A]: Preservation of widening of the junction between vertical limb and horizontal limb [wide tube at crow's foot].

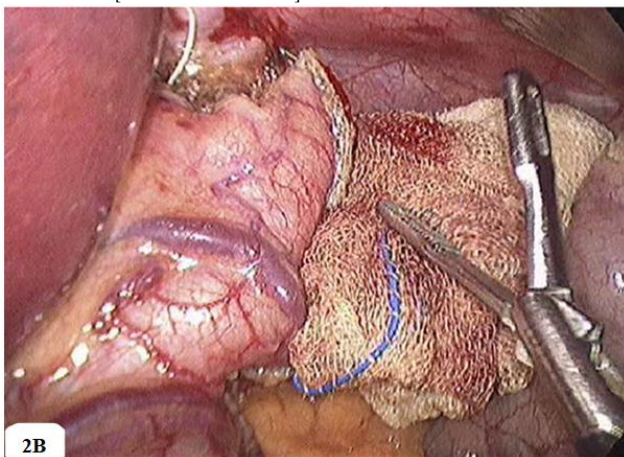


Figure [2B]: Preservation of the gastro-esophageal angle [angle of His].

Post-operative evaluation:

Day zero follow-up: nil per oral during the first 12 hours after surgery. Assessment of vital signs every 4 hours, drain, and urine output. The patients started clear liquid fluids after 12 from the surgery. Discharge 24 hours postoperative and after extraction of the drain.

The first-month follow-up: Every 10 days the patients come to the clinic to make sure that he/she follows instructions [dietitian-medication], assessment of the general condition and vital signs to exclude any complication neither from SG nor hiatus hernia repair [Fever, tachycardia, tachypnea, abdominal pain, and shortness of breath] and for assessment of weight loss [BMI measurement]. Start a thick liquid diet from day 11 to day 20 and A soft [mashed] diet from day 21 to day 30. From 2nd to 6th month follow up: the patients come to the clinic every month to assess symptomatic relief, resolution of

comorbidities such as Diabetes [by fasting blood glucose, or HbA1C after 3 months], and Hypertension [record of blood pressure measures], interruption of anti-reflux medication, X-ray evidence [Gastrograffin meal] of HH recurrence in non-responding complaining patients, endoscopic evidence of HH recurrence in non-responding, complaining patients, and quality of life according to the degree of weight loss [BMI measurement], resolution of gastrointestinal symptoms [GERD, Nausea, vomiting and epigastric pain] and resolution of comorbidities.

Statistical Analysis:

Data were collected and entered into the computer using SPSS [Statistical Package for Social Science] program for statistical analysis, [IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.]. Data were submitted as numerical or categorical, accordingly. Quantitative data were shown using mean, SD, and range. The qualitative data were expressed via frequency and percentage. The Chi-square test was used for measuring the association between qualitative variables. Fisher exact test was used for 2x2 qualitative variables when more than 25% of the cells have an expected count of less than 5. McNemar's test was used to compare two proportions that are related to each other. Student t-test was used to compare the mean and SD of 2 sets of quantitative normally distributed data, while Mann Whitney test was used when this data is not normally distributed. Pearson's correlation was used to study the correlation between two variables having normally distributed data, while Spearman's correlation was used when this data is not normally distributed. P-value was considered of statistical significance if it was < 0.05.

RESULTS

The present study was conducted on 20 patients of both sexes presenting with morbid obesity and reflux disease, either symptomatic patients or asymptomatic [Endoscopic & Manometric], and underwent LSG and anti-reflux procedure [crural repair].

The mean age of the patients was 42.4±5.4 years old. The majority of the patients were females [70%] and only 30% were males. The mean of their BMI was 44.6±4.69 Kg/m². 15% of the patients had diabetes, 15% had hypertension, and 5% of the patients had combined diabetes and hypertension. 5% of our patients were smokers. GERD symptoms like heartburn related to meals worse at night or being flat, regurgitation of food or sour liquid, and sensation of a lump in the throat was present in 70% of patients. 11 [55%] had a preoperative diagnosis of HH by the endoscope.

The operative time ranged from 75–100 minutes with a mean of 88.2±6.9 minutes. The intra-operative assessment was done for the hiatus hernia by double action grasper to assess the widest line between the crura if it < or > 3cm after complete dissection of the hiatus. 11 patients [55%] had HH measured < 3 cm and 9 patients [45%] had HH measured > 3cm.

In comparing the pre-operative diagnosis of HH by the endoscope and the intra-operative diagnosis. We found a statistically significant difference between both diagnoses [P < 0.05] as the preoperative endoscopy revealed that 12 patients had HH and 8 patients were free, while intra-operatively none of the patients was free of HH [Table 1].

Regarding the effect of intra-Operative assessment of HH on operative Time, there was no significant difference in the operative time regarding the intra-operative assessment of HH either <3cm [89.55±6.105 min] or >3cm [86.67±7.906 min] [P>0.05]. In addition, there was no significant correlation between the operative time and the age of the patients, BMI, or the intraoperative assessment of HH [P >0.05].

While assessing the weight loss and reduction of BMI at 6 months postoperatively, there was a statistically significant reduction in pre-operative BMI measures [44.6±4.5766 kg/m2] and the 6 months postoperatively measures [33.95±3.499 kg/m2] [P-value<0.0001] table [2]. In addition; the simultaneous crural repair in the treatment of morbid obesity associated with HH led to symptomatic relief of GERD in 75% of the patients. Postoperatively, all patients expressed satisfaction. Significant improvement in GERD symptoms was noticed postoperatively [P<0.05]. Pre-operative there were 14 patients suffering from GERD symptoms while post-operatively they were only 5. Besides that, 75% of patients stopped

the anti-reflux medication postoperatively while only 25% continued medication, although there was no statistically significant association between a history of GERD and interruption of anti-reflux medications [P=0.91]. Symptomatic relief and interruption of medication were noticed in all patients with co-morbidities. The post-operative X-ray evidence of HH recurrence among patients showed that 4 patients [20%] developed recurrence in x-ray, which needed to be followed by endoscopic evaluation later. The endoscopic evaluation revealed that only one patient [5%] developed recurrence in endoscopic evaluation, while the other 3 patients were found to have weak diaphragmatic crura not recurrent HH [Table 3].

On recording intra-operative and post-operative complications, fortunately, there was no recorded intra-operative or post-operative complications. All patients' quality of life was enhanced by assessing the quality of life according to the degree of weight loss [BMI measurement], resolution of gastrointestinal symptoms, and resolution of comorbidities.

Table [1]: Association between pre-operative diagnosis of HH by the endoscope and intra-operative diagnosis

	Pre-operative diagnosis by the endoscope	Intraoperative diagnosis	Fisher Exact test	P-value
Hiatus Hernia	12	8	0.0332	< 0.05
No HH	8	0		

Table [2]: Assessment of Weight loss and reduction of BMI at 6 months postoperatively.

	Pre-Operative	Post-Operative 6 months	Paired t-test	P- Value
BMI	44.6 ± 4.576	33.95 ± 3.499	-29.795233	< 0.00001

Table [3]: Assessment of HH recurrence among patients.

	Pre-operative and operative diagnosis	Post-operative diagnosis	Fisher Exact test	P-value
Hiatus Hernia	20	0	0.0476	< 0.05
Recurrent HH	0	1		

DISCUSSION

Bariatric surgery is growing worldwide, and SG is the most frequently performed procedure [7]. LSG is associated with the development of GERD and frequent use of anti-reflux medications in the postoperative period. Worsening the GERD was attributed to the presence of HH and the increased intraluminal pressure due to stomach conversion to a straight tubular segment with a smaller capacity [8]. Thus, the indication of SG has been questioned in obese patients with HH and GERD. Current guidelines recommend concomitant HH repair during bariatric surgery when the defect is intraoperatively found, although the strength of the recommendation is weak [9].

Nonetheless, only a few studies have assessed the LSG with simultaneous crural repair in the treatment of morbid obesity associated with HH. Thus, the present study was conducted to assess

the efficacy and safety of LSG with simultaneous crural repair in the treatment of morbid obesity associated with HH.

The study was conducted on 20 patients of both sexes presenting with morbid obesity and reflux disease, either symptomatic patients or asymptomatic [Endoscopic & Manometric], and underwent LSG and anti-reflux procedure [crural repair].

The prevalence of obesity was generally higher in women than in men in all age groups, with sex differences being maximal between 50 and 65 years old [10]. In the present study, the patient's mean age was 42.4± 5.4 and 70% were females. In line with our findings,

Obese patients are at an increased risk for developing many medical problems, including insulin resistance and type 2 diabetes mellitus, hypertension, dyslipidemia, cardiovascular disease, stroke, sleep apnea, gall bladder disease, hyperuricemia, gout, and osteoarthritis [11].

In the present study, it was found that 15% of the patients had diabetes, 15% had hypertension, and 5% of the patients had combined diabetes and hypertension. Determining the prevalence of obesity and its associated comorbidities in patients actively managed at a US academic medical center was the goal of Pantalone and colleagues' research. The prevalence of type 2 diabetes mellitus and hypertension was 30.9% and 16.9%, respectively, in the BMI ≥ 40 categories [11].

Cross-sectional epidemiological studies have demonstrated a higher prevalence of GERD in obese individuals compared to non-obese [12].

In our cohort, the prevalence of GERD among morbidly obese patients was 70%. In agreement with our findings, Murray and colleagues examined the relationship between body mass and GERD in a large population-representative sample from the UK. 10 537 subjects in all, aged 20 to 59 years. Data about the frequency and severity of the dyspeptic symptoms and the anthropometric measurements of the provided subjects were taken. The prevalence of GERD among morbidly obese patients was 78.2% [13].

Morbidly obese patients commonly have GERD and associated hiatal hernias as obesity is a significant independent risk factor for GERD and hiatal hernia. The incidence of HH increases with BMI. As such, some surgeons routinely perform a concomitant HH repair during bariatric surgery [14].

In the present study, the preoperative endoscopic diagnosis of HH occurred in 60% only of the overall crural defects undergoing repair. To some extent, these results concede with a study of 181 patients with a mean BMI of 43 kg/m², based on the upper GI contrast study, the prevalence of HH was 37.0% and of GERD was 39.8% [14].

In the current study, the operative time ranged from 75-100 minutes with a mean of 88.2 \pm 6.9 minutes. The operative time wasn't influenced by the patient's age, BMI, or the intraoperative assessment of HH. These results concede with Soliman and his colleagues who reported that the mean operative time in a study on 20 patients was 95 minutes [range 65-125 min] [15].

Hiatus hernia prevalence in obese subjects undergoing bariatric surgeries may be underestimated and the preoperative diagnostic tests that exclude its presence may not be accurate. Furthermore, small hiatal defects can be underdiagnosed pre- and intraoperatively because of the presence of conspicuous gastroesophageal fat pads [6].

This study showed that intra-operative assessment of HH revealed that 11 patients [55%] had HH measured <3cm, and 9 patients [45%] had HH measured >3cm. The intra-operative assessment was done for the hiatus hernia by double action grasper to assess the widest line between the crura if it < or >3cm after complete dissection of the hiatus. The Association between the pre-operative diagnosis of HH by the endoscope and the intra-operative diagnosis was statistically significant [P <0.05], so the examination of HH intraoperatively is a must for the exclusion of HH. Similar results were reported by Mohammed et al. [16], as they stated that surgeons may evaluate for the presence of HH on esophagogastroduodenoscopy [EGD]. However, preoperative endoscopic presence or absence of a significant HH does not always correlate with intraoperative findings.

Concerning the primary outcomes of the present study, the weight, and BMI significantly reduced 6 months postoperatively [P

<0.0001] [mean pre-operative weight was 44.6 \pm 4.576 kg/m² and mean post-operative weight was 33.95 \pm 3.499 kg/m²].

Simultaneous crural repair in the treatment of morbid obesity associated with HH led to significant relief of GERD symptoms in our patients. Pre-operative, there 14 patients suffer from GERD symptoms while post-operatively, only 5 still suffer from GERD symptoms. In addition, 75% of patients had stopped the anti-reflux medication postoperatively while only 25% continued on medication. All patients were satisfied postoperatively.

The successful repair mechanism may involve reducing the hiatus hernia size and the anterior plication of the band, which prevents the cephalic migration of the anterior stomach that creates LES incompetency.

Similar results were reported by Garg et al. who studied ten patients undergoing LSG, where five of them had GERD preoperatively with a mean pre-operative BMI; of 45.83 \pm 9.28 kg/m². After surgery, the mean weight loss at the time of follow-up was 38.19 \pm 12.60 kg, four patients [80%] showed complete resolution while one patient complained of persistent symptoms [17].

Symptomatic relief and interruption of medication were noticed in all patients with co-morbidities. In the same context, Attia, 2017 stated that improvement in health status and resolution of co-morbidities such as diabetes, hypertension, and dyslipidemia can be associated with LSG [18].

Recurrence of HH following laparoscopic repair was reported soon thereafter. Recurrence of hiatal herniation after surgical repair remains one of the challenges of surgery and plagued the specialty even when repairs were performed through open surgery [19].

In the present study, there were 4 patients [20%] who had evidence of recurrence in the x-ray, but when these patients underwent endoscopic evaluation later only one patient [5%] developed recurrence, while the other 15% was found to be weak diaphragmatic crura not recurrent HH. In Soliman and colleagues' study, HH recurrence was observed in two patients [10%] [15].

No cases of recurrence were reported by Soricelli et al. [6] and El Chaar et al. [20].

Regarding the safety of the procedure, no cases of mortality or postoperative complications were found in our cohort. It is believed that a formal and complete anterior, posterior, and mediastinal esophageal ensured appropriate HH repair, without tension and allow for adequate crural closure posterior to the esophagus at the index SG.

In agreement with our findings, Soricelli et al. [6] reported that the mortality was nil and no complications occurred. Similar results were obtained by Soliman et al. [15] and Samakar et al. [21].

The present series has indicated that HH repair associated with SG is feasible, with no postoperative complications related to the procedure with significant improvement of quality of life in all patients.

The approach to diaphragmatic pillars and the repair of crural defects could be performed easily from the left pillar before or after making gastric resection. In addition, comparing this approach, with

the right dissection approach of the hiatal area, allows better sparing of the anterior vascularization of the esophagogastric junction, whose impairment may be involved in the development of staple line leaks after the SG.

One of the main limitations of our study is that it was a single-center experience; therefore, its results couldn't be generalized to the general population. Another limitation was that the sample size of the present study was relatively small; the small sample size might have hindered the effect size from reaching the margin of statistical significance. In addition; the absence of a control group is another disadvantage that might have led to performance bias.

Conclusion: Combined LSG with a crural repair is one of the most accepted procedures in the management of obese patients with HH with a high degree of safety and effectiveness, providing good outcomes in the terms of weight loss and control of GERD symptoms.

Disclosure: None to be disclosed

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