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IMPACT OF CONCOMITANT LAPAROSCOPIC SLEEVE GASTRECTOMY AND CRURAL CLOSURE IN INCIDENTALLY DISCOVERED WIDE HIATUS IN MORBIDLY OBESE PATIENTS

By

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ABSTRACT

Background: Vertical gastrectomy or gastric sleeve has gained popularity among surgeons, due to its lower technical complexity and good results. However, there are conflicting results regarding the gastroesophageal reflux (GERD) after the sleeve. Several studies suggest an increase in the severity of reflux symptoms and "de novo" or a new appearance after surgery, among other reasons, due to a decrease in gastric emptying, an increase in intragastric pressure, a decrease in residual stomach distensibility and a weakening of the lower esophageal sphincter (IAS). On the other side, the hiatal hernia (HH) is closely related to the presence of GERD.

Objective: To analyze the symptoms of GERD and use of anti-reflux medications in morbidly obese patients undergoing concomitant crural closure with laparoscopic sleeve gastrectomy for morbid obesity.

Patients and methods: This prospective study was done in the surgery department, at Al-Azhar university hospitals in the period between October 2019 and October 2021. Thirty morbidly obese patients were included in this study. All patients were operated upon for laparoscopic sleeve gastrectomy, in patients with wide hiatal opening, simultaneous crural closure was done. Follow up of all patients for at least 6 months postoperative including history and endoscopy.

Results: There were highly statistically significant reduction BMI (kg/m2) and weight (kg) in 6 months and 12 months compared to preoperative. There was statistically significant improved in hyperlipidemia in postoperative compared to preoperative with p-value ($p<0.05$), while it was improved in type 2 diabetes mellitus and hypertension but insignificant, with p-value ($p>0.05$). There was statistically significant decrease GERD in postoperative compared to preoperative, with p-value ($p<0.05$ S).

Regarding complications, intraoperative tear of the splenic capsule occurred with bleeding. This was controlled laparoscopically with argon laser. Regarding complications directly related to sleeve gasterectomy, there was no leaks, no strictures, no gastrointestinal bleeding, and no perioperative deaths. There were no conversions to an open procedure.

Conclusion: Sleeve gastrectomy with concomitant crural repair and stitching of the crura of diaphragm is considered a feasible and safe technique providing good results in management of GERD symptoms for obese patients with reflux symptoms and hiatus hernia.

Keywords: Laparoscopic Sleeve Gastrectomy, Crural Closure Incidentally Discovered Wide Hiatus, Morbidly Obese.

INTRODUCTION

Obesity is a global health problem that requires a multidisciplinary treatment including specialists in mental health, medicine and surgery. It leads to a significant increase in morbidity and mortality and consequently reducing quality of life. It is estimated with body mass index (BMI) and obesity among adults is defined as BMI ≥ 30 *(Avena and and Wang, 2011)*.

Obesity is associated with multiple comorbidities including diabetes mellitus, hypertension, obstructive sleep apnoea and gastro- oesophageal reflux disease (GERD). Hiatal hernia (HH) and GERD are closely related. Obesity is known to be an independent risk factor for the development of both GERD and HH *(Soricelli et al., 2010)*.

HH is present in about 37%–50% of morbidly obese patients undergoing bariatric surgery *(He et al., 2013)*. While 50% – 70% of the patients undergoing this surgery have symptomatic reflux *(Frigg et al., 2010)*.

In adults with morbid obesity, bariatric surgery produces greater weight loss and weight loss maintenance than that produced by standard care or conventional medical treatment. The surgical treatment of obesity and metabolic disorders require a multidisciplinary approach with a team that includes surgeons, physicians, psychiatrists, dieticians, counselors, and others, as needed *(Padwal et al., 2011)*.

Laparoscopic anti-reflux surgery (especially laparoscopic Nissan fundoplication) with hiatal hernia repair (HHR) is generally the best management for refractory or structural GERD. Meanwhile, in morbidly obese patients with HH and/or GERD symptoms, the feasibility and effect of doing the anti-reflux surgery along with a bariatric surgery is still under-observation as anti-reflux surgeries mainly depend upon the wrap formation using the gastric fundus which is removed or excluded in different bariatric surgeries. Laparoscopic Roux-en-Y bypass with or without crural closure is the bestknown operation to improve GERD and HH *(Salvador-Sanchis et al., 2010)*.

Some limitations of SG in morbidly obese patients with GERD is the development of postoperative high-pressure gastric tube along with loss of gastroesophageal junction complex (stapled), which is usually attributed to GERD symptoms. However, the incidence of de novo GERD and the effect of SG on patients with preexisting GERD remain controversial. Some authors have reported resolution of GERD following SG, whereas others noted a high incidence of de novo GERD and worsening of previously existing GERD-related symptoms following SG *(Salvador-Sanchis et al., 2010)*.

Few studies have addressed the effect of LSG with crural closure on GERD in morbidly obese patients having HH, and still the results of these studies are conflicting *(Aridi et al., 2017)*.

The aim of the present study was to analyze the symptoms of GERD and use of anti-reflux medications in morbidly obese patients undergoing concomitant crural closure with laparoscopic sleeve gastrectomy for morbid obesity.

PATIENTS AND METHODS

This prospective study was done in the surgery department, at Al-Azhar university hospitals in the period between October 2019 and October 2021. Thirty morbidly obese patients were included in this study.

All patients were operated upon for laparoscopic sleeve gastrectomy, in patients with wide hiatal opening, simultaneous crural closure was done. Follow up of all patients for at least 6 months postoperative including history and endoscopy.

Inclusion criteria: Age range (17~ 55) years, BMI more than 35 with co-morbidity, failure of non-surgical treatment, and absence of endocrinal diseases or psychological disorders.

Exclusion criteria: Age less than 17 years or more than 55 years, BMI less than 35 without comorbidity, presence of endocrinal or psychological disorders, and unfit patients.

All patients were subjected to:

1. Full history and clinical examination.
2. Laboratory investigations for preoperative evaluation including CBC, PT, liver and kidney functions, and hormonal profile (FBS, T3, T4, TSH, Serum Cortisol).
3. Radiological investigations including chest X-ray, pelvi-abdominal ultrasound, CT may be ordered in selected patients.
4. Evaluation of the cardiac and respiratory condition in the form of ECG, Echocardiogram, and respiratory functions.
5. Oesophago-Gastro-Duodenoscopy (OGD).

Surgery:

All the patients had LSG along with crural repair in the same sitting under general anesthesia and under complete aseptic conditions, and operative time was recorded. Operations were carried out under general anesthesia, with endotracheal intubation. Patients had a liquid diet 24 h before surgery and a minimum of 8 h of nothing by mouth (NPO) before surgery.

Full clinical preoperative evaluation (personal and medical) as well as full laboratory investigations (as full blood count, liver function tests, kidney function tests, liver enzymes, thyroid function, T3, T4, TSH and lipid profile).

Prophylactic anticoagulant medications were given to all patients in the form of subcutaneous Clexane® 0.5 unit/Kg/24. An ICU bed was reserved for all patients the night of operation with the decision of transfer left to the postoperative recovery assessment.

Foley catheter for urine output Monitoring.

Prophylactic Antibiotics e.g. 3rd generation cephalosporins.

Statistical analysis:

Recorded data were analyzed using the statistical package for social sciences, version 23.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage. Data were

explored for normality using Kolmogorov-Smirnov and Shapiro-Wilk Test. Paired sample t-test of significance was used when comparing between related sample. Chi-square (x2) test of significance was used in order to compare proportions between qualitative parameters. The confidence interval was set to 95% and the margin of error accepted was set to 5%. P value < 0.05 was considered significant.

RESULTS

From the 30 studied participants, 12 were males (40%) and 18 were females (60%). The ages were in the range from 17–55 years old, with a mean age of 36.17±6.92. The body mass index (BMI) mean was 49.50±15.46 kg/m2 (range 36–56). Mean weight was 129.01±32.83 Kg (Range: 111–165) and mean height was 1.67±0.60 (Range: 1.39–1.82) **(Table 1)**.

Table (1): Distribution of demographic data and anthropometric measurements among study group

Demographic data	**Number (%)**	
Sex: Females Males	 18 (60%) 12 (40%)	
	Mean±SD	**Range**
Age (years)	36.17±6.92	17–55
Anthropometric measurements: Body weight (kg) Height (m) BMI (kg/m2)	 129.01±32.83 1.67±0.60 49.50±15.46	 111–165 1.39–1.82 36–56

There were highly statistically significant reduction BMI (kg/m2) and weight (kg) in 6 months and 12 months compared to preoperative **(Table 2)**.

Table (2): BMI and weight reduction on the follow up period

		Mean±SD	**Mean Diff.**	**Change%**	**p-value**
BMI (kg/m2)	Preoperative	49.50±15.46			
	6 months	34.14±14.66	-15.36	-31.03	<0.001
	12 months	27.11±13.75	-22.39	-45.23	<0.001
Weight (kg)	Preoperative	129.01±32.83			
	6 months	97.49±16.87	-31.52	-24.43	<0.001
	12 months	89.16±10.24	-39.85	-30.89	<0.001

There was statistically significant improved in hyperlipidemia in postoperative compared to preoperative with p-value ($p<0.05$), while it was improved in type 2 diabetes mellitus and hypertension but insignificant, with p-value ($p>0.05$) **(Table 3)**.

Table (3): Comparison between pre-operative and post-operative shows resolution of co-morbidities most patients, including hypertension; type 2 diabetes mellitus, and hyperlipidemia

Co-morbidity	Pre-Operative		Post-Operative		P-value
	No.	%	No.	%	
Hyperlipidemia	18	60.0%	10/18	55.6%	0.040
Type 2 diabetes mellitus	12	40.0%	6/12	50.0%	0.094
Hypertension	9	30.0%	4/9	44.4%	0.119

Evaluation of patients preoperatively by full history and examination was done. Questions regarding eating behavior, and GERD symptoms were assessed using GERD-Health Related Quality of Life (HRQL) questionnaire. Nine patients (30%) of the thirty patients were suffering from symptoms of (GERD). Eight patients (88.8%) from 9 GERD were identified to have HH intra-operatively. The presence of HH was confirmed intraoperatively and underwent LSG with crural closure after good dissection of the diaphragmatic crura. The sleeve was created in the standard fashion over a 36-F bougie starting at 3–6 cm from pylorus. Hiatal crural defect was repaired with two or three interrupted non-absorbable sutures between the right and left crura.

Gastroesophageal reflux disease (GERD) was diagnosed by patient symptoms and upper GI endoscopy. This was done on preoperative basis. Postoperatively, symptomatic patients were re-evaluated by GI endoscopy on 12month periods. Table below shows development of gastroesophageal reflux postoperatively.

There was statistically significant decrease GERD in postoperative compared to preoperative, with p-value ($p<0.05$ S) **(Table 4)**.

Table (4): Gastroesophageal reflux postoperatively state postoperatively

GERD	Pre-Operative		Post-Operative		p-value
	No.	%	No.	%	
Yes	9	30%	2	6.7%	0.045
No	21	70%	28	93.3%	

Eight patients were identified to have HH intra-operatively. The presence of HH was confirmed intraoperatively and underwent LSG with crural closure after good dissection of the diaphragmatic crura. The sleeve was created in the standard fashion over a 36-F bougie starting at 3–6 cm from pylorus. Hiatal crural defect was repaired with two or three interrupted non-absorbable sutures between the right and left crura.

Table (5): Discovered HH intra-operatively

Discovered HH intra-operatively	No.	%
Yes	8	26.7%
No	22	73.3%

Symptoms of GERD were evaluated via written questionnaire post operatively. This involved Heartburn, Regurgitation, Epigastric or chest pain, Epigastric fullness, Dysphagia and CoughTable below shows these syptoms.

All those patients (3 symptomatic patients) were treated with PPIs after diagnosis of GERD. On 12 month follow up symptomatic improvement occurred in 1/3 (33.3%) improved symptomatically. 2 patients (66.7%) still not completely improved.

Regarding complications, intraoperative tear of the splenic capsule occurred with bleeding. This was controlled laparoscopically with argon laser. Regarding complications directly related to sleeve gasterectomy, there was no leaks, no strictures, no gastrointestinal bleeding, and no perioperative deaths. There were no conversions to an open procedure.

Table (6): Symptoms and Treatment of GERD postoperatively (n=3)

		No.	%
Symptoms	Regurgitation	3	100%
	Heartburn	3	100%
	Epigastric fullness	3	100%
	Epigastric or chest pain	2	66.7%
	Dysphagia	1	33.3%
Treatment	Improvement of symptoms	1	33.3%
	Continious on PPIs	2	66.7%

DISCUSSION

This prospective non-comparative clinical study was carried out on 30 patients. They were assessed by multidisciplinary (MDT) team to assess their psychological and nutritional status and other aspects.

In this study there were 18 females (60%) and 12 males (40 %). Patients' ages ranged from 17– 55 years old, with a mean age of 40.

In this study, initial weight was 129.0 kg/m2, 6months postoperatively it was 97.49 kg/m2, 12 months postoperatively it reaches 89.16 kg/m2 and on 6 months postoperatively it was decreased to 93.8 kg/m2 finally.

Our reported weight loss results are matched with other published data

(Bohdjalian et al., 2010, Deitel et al., 2011, Strain et al., 2011 and Sarela et al., 2012). BMI reduction on the follow up period was 34.14 kg/m2 after 6 months on follow up. Initial BMI was 50.7 kg/m2, 12 months postoperatively it was 27.11kg/m2.

In contrast, some reports as *Himpens et al. (2010)* reported a small reduction in BMI on follow up to be 8.7 (kg/m2). While reduction was not reported in *(Santoro, 2010)*.

There was remarkable resolution of comorbidities in most patients, including hypertension, type 2 diabetes mellitus, and hyperlipidemia.

Gastroesophageal reflux disease (GERD) was diagnosed by patient symptoms and upper GI endoscopy. This was done on preoperative basis.

Postoperatively, symptomatic patients (only two) werere-evaluated by GI endoscopy on 2, 4 and 6 month periods.

In our study, Symptoms of GERD were evaluated via written questionnaire post operatively. This involved Heartburn, Regurgitation, Epigastric or chest pain, Epigastric fullness, Dysphagia and Cough.

Gagner et al. (2016) reported that as for SG, it can promote the development or worsening of GERD symptoms, so that the preoperative diagnosis of GERD and/or HH might represent a contraindication to SG.

In contrary, a study by *Himpens et al. (2011)* showed that the 'de novo' appearance of GERD occurred in 21.8% of patients 1 year after surgery. However, 3 years later, GERD was present in only 3.1% because of the restoration of the angle of His. Furthermore, 75% of patients affected by reflux symptoms before surgery noted its disappearance 1 and 3 years after surgery.

More precisely, regarding exclusively reflux symptoms after sleeve gastrectomy, the rate is variable ranging from 2.8% to 13% *(Nocca et al., 2010* and *Crookes, 2011)*.

Some authors proved that 'de novo' GERD symptoms developed in 22.9% of their patients undergoing SG alone compared with 0% of patients undergoing SG plus HHR *(Soricelli et al., 2010)*.

In our study, symptomatic GERD was present in 9(30%) patients, and HH was diagnosed in eight patients intraoperatively. The mean follow-up was 6 months, and GERD remission occurred in 7 (77.7%) patients, confirmed by upper gastrointestinal endoscopy. In the remaining two (22.2%) patients, ant reflux medications were continued, with complete control of symptoms after about 6 months.

We tried to increase the anti-reflux measures by repairing of HH and keeping the gastroesophageal junction in intra-abdominal position by intracorporeal stitching between right and left crus of the diaphragm.

We tried to prove that HHR is not just crural approximation but aimed to get good esophageal dissection and mobilization to restore intra-abdominal esophagus. The gastroesophageal junction is a complex anatomic structure that is closely linked to proper functioning of the antacid barrier. Effacement of angle of His, loss of diaphragmatic support, and migration of intra-abdominal esophagus

into negative pressure chest area are some factors that contribute to disruption of the gastroesophageal junction anatomy that functions as ant acid barrier. So, we aimed at restoration of most of these protective mechanisms to ensure proper HHR in concomitant with sleeve gastrectomy and improvement of GERD symptoms postoperatively.

In our study, GERD symptoms were markedly improved confirmed by 6-month upper gastrointestinal endoscopy (77.7%). This finding is matched with *(Himpens et al., 2010)*. Who noted that of the patients with pre-existing GERD, 75% had had resolution?

The results of this study support the recommendation to repair the hiatal hernia, during the realization of a gastric sleeve.

The majority of patients in whom the hernia was left intact developed GERD. By leaving the hiatal hernia intact, the mistake of incompletely resecting the fundus can be made, and two phenomena can explain the development of GERD as a consequence of this. First, a larger surface area of remaining gastric mucosa increases acid production due to a greater number of parietal cells. Second, the remaining stomach acquires the shape of an hourglass, which determines that the food remains longer in the proximal stomach, reducing gastric transit and favoring reflux. On the other hand, the presence of a hiatal hernia may favor the esophago gastric junction migrating to the thorax. *Baumann et al. (2011)*, followed 27 patients with gastric sleeve, using multislice computed tomography, finding that the migration of the line of staples to the thorax is related to the presence of gastroesophageal reflux.

Most studies similar to this one shows an improvement in GERD when the hernia is repaired *(Mahawar et al., 2015)*. With the exception of the randomized controlled study conducted by *Snyder et al. (2016)*. Showed no difference between repairing or not the HH.

CONCLUSION

Sleeve gastrectomy with concomitant crural repair and stitching of the crura of diaphragm is considered a feasible and safe technique providing good results in management of GERD symptoms for obese patients with reflux symptoms and hiatus hernia.

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تأثير عملية تكميم المعده بالمنظار الجراحى بالتزامن مع غلق فتحة الحجاب الحاجز فى الفتحة العريضة المكتشفة مصادفة فى مرضى البدانة المفرطة

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خلفيـــة البحـــث: إكتســبت عمليــة تكمــيم المعــدة أو تكمــيم المعــدة العمــودي شــعبية بــين الجــراحين، بســبب قلــة تعقيــدها التقنــي ونتائجهــا الجيــدة. ومــع ذلــك، هنــاك نتــائج متضــاربة فيمــا يتعلــق بالارتجــاع المعــدي المريئــي بعــد التكمــيم. تشــير العديــد مــن الدراســات إلــى زيــادة فــي شــدة أعــراض الارتجــاع أو ظهــور جديــد بعــد الجراحــة، مــن بــين أســباب أخــرى، بســبب انخفــاض إفــراغ المعــدة، وزيــادة الضــغط داخــل المعــدة، وانخفــاض قابليــة توســع المعــدة المتبقيــة وضــعف مــن العضــلة العاصــرة للمــريء الســفلية. علــى الجانــب الآخــر، فــإن الفتــق الحجــابي يــرتبط إرتباطًــا وثيقًــا بوجــود إرتــداد معدي مريئي.

الهــدف مــن البحــث: تحليــل أعــراض الارتجــاع المعــدي المريئــي واســتخدام الأدويــة المضــادة للارتجــاع فــي المرضــى الــذين يعــانون مــن الســمنة المفرطــة ويخضــعون لإغلاق الفخذ المصاحب مع تكميم المعدة بالمنظار من أجل السمنة المرضية.

المرضــى وطــرق البحــث: أجريــت هــذه الدراســة الاســتباقية فــي قســم الجراحــة بمستشــفيات جامعــة الأزهــر فــي الفتــرة مــا بــين أكتــوبر 2019 حتــي أكتــوبر 2021 ، وقــد تــم تضــمين 30 مريضــاً يعــانون مــن الســمنة المفرطــة فــي هــذه الدراســة. تــم إجــراء عمليــات جراحيــة لجميــع المرضــى مــن أجــل استئصــال المعــدة الكمــي بالمنظــار، وفــي المرضــى الــذين يعــانون مــن فتحــة الحجــاب الحــاجز الواســعة، تــم إجــراء إغــلاق مفصــلي فــي وقــت واحــد. متابعــة جميــع المرضــى لمــدة 6 أشــهر علــى الأقــل بعــد الجراحة بما في ذلك التاريخ والتنظير.

نتائج البحث: كان هناك إنخفاض ذو دلالة إحصائية عالية في مؤشر كتلة الجسم والوزن في 6 أشهر و 12 شهرًا مقارنةً قبل الجراحة. كان هناك تحسن معتد به إحصائيا في فرط شحميات الدم بعد الجراحة مقارنة مع قبل الجراحة، بينما تحسن في داء السكري من النوع 2 وارتفاع ضغط الدم ولكن غير معنوي. كان هناك إنخفاض معتد به إحصائيا في الجزر المعدي المريئي في فترة ما بعد الجراحة مقارنة مع قبل الجراحة.

فيما يتعلق بالمضاعفات، حدث تمزق أثناء العملية لكبسولة الطحال مع النزيف. تم التحكم في هذا بالمنظار باستخدام ليزر الأرجون. فيما يتعلق بالمضاعفات المرتبطة مباشرة بجراحة تكميم المعدة، لم يكن هناك تسريبات، ولا قيود، ولا نزيف معدي معوي، ولا وفيات حول الجراحة. لم تكن هناك تحويلات إلى إجراء مفتوح.

الاستنتاج: يعتبر تكميم المعدة مع ما يصاحب ذلك من إصلاح الفخذ وخياطة غشاء الحجاب الحاجز تقنية مجدية وآمنة توفر نتائج جيدة في إدارة أعراض الارتجاع المعدي المريئي للمرضى الذين يعانون من السمنة المفرطة مع أعراض الارتجاع وفتق الحجاب الحاجز.

الكلمات الدالة: تكميم المعدة بالمنظار، الفتحة العريضة المكتشفة مصادفة، البدانة المفرطة.