IMPACT OF RESTRICTIVE BARIATRIC SURGERY ON DEPRESSION

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ABSTRACT

**OBJECTIVE:** Morbid obesity is one of the major health problems, there are many operations performed to resolve this problem. The current studies revealed that no one of them can be considered the gold standard operation. The aim of this study: was to compare laparoscopic sleeve gastrectomy with greater curvature plication for management of morbid obesity, with special emphasis on depression. **Methodology:** Between January 2012 and June 2014, thirty adult patients were included in this study, which was carried out in New Dameitza University Hospital. They were randomly divided into two equal groups. **Group A** underwent laparoscopic sleeve gastrectomy (LSG), while **Group B** underwent laparoscopic greater curvature plication (LGCP). Patients data, operative time, complications, percentage of excess weight loss (EWL %), and level of depression were documented. The mean follow up time was 19.56 months (range 6-29 months). **Results:** No statistical difference between the two groups as regard, postoperative oral feeding and hospital stay. The operative time was longer for gastric plication group. The EWL% was more or less similar in the two groups. Vomiting was occurred more with plication group, hemorrhage and leak noticed only with sleeve gastrectomy. Depression with variant degrees and loss of hunger feeling were more with sleeve gastrectomy. **Conclusion:** Sleeve gastrectomy and greater curvature plication were having more or less similar results. The extra benefits for greater curvature plication
are its safety, feasibility, effectiveness for excess weight loss (EWL) %, low complication rates, cost efficiency and its reversibility. The role of Ghrelin hormone which decreased after sleeve gastrectomy, must be kept in mind, due to its role as antidepressant, cardio-protective, and anti-proliferative for breast cancer. Long-term results and more studies are needed to determine the ideal operation for each patient.

Key words: Sleeve gastrectomy, greater curvature plication, depression.

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INTRODUCTION

Morbid obesity is affecting a large number of people worldwide and when clinical treatment does not achieve the expected results, bariatric surgery becomes the last resource (Cosmin and Vlad, 2011). Historically, many types of restrictive procedures have been performed to achieve weight loss (Buchwald and Buchwald, 2002). Most of these have been abandoned owing to poor long-term weight loss, food intolerance, or severe gastroesophageal reflux. These gastroplastic procedures were designed to partition the proximal stomach horizontally or vertically, with a small outlet to achieve gastric restriction. Vertical banded gastroplasty, in particular, has resulted in poor long-term outcomes, and a high percentage of vertical banded gastroplasty patients have required revision to Roux-en-Y gastric bypass to alleviate intolerable reflux symptoms and dysphagia or to achieve weight again (Balsiger et al., 2000). Laparoscopic sleeve gastrectomy (LSG), also known as longitudinal or vertical gastrectomy, is a relatively new and effective surgical option for the management of morbid obesity. It was initially introduced in 1990 as an alternative to distal gastrectomy with the duodenal switch procedure to reduce the rate of complications (Frezza, 2007). Sleeve gastrectomy was first performed laparoscopically by Ren and colleagues (Ren et al., 2000). At the
time, LSG was considered a first-stage operation in high-risk patients before biliopancreatic diversion or Roux-en-Y gastric bypass (Regan et al., 2003). Laparoscopic sleeve gastrectomy was subsequently found to be effective as a single procedure for the treatment of morbid obesity. Although LSG functions as a restrictive procedure; it may also cause early satiety by removing the ghrelin-producing portion of the stomach (Gumbs et al., 2007).

Laparoscopic greater curvature plication (LGCP) is a new bariatric restrictive procedure that avoids the complications linked with the permanent implant of an adjustable gastric ring (esophageal laceration, gastric erosion), also minimizing the possibility of leaks associated with sleeve gastrectomy. Also known as gastric imbrication and total vertical sleeve plication, the procedure consists of reducing the gastric volume by placing at least two rows of non-absorbable sutures on the greater gastric curvature. LGCP was first described in 2007 (Talebpour and Amoli, 2007). Trials were initiated in the USA in 2009 and the first paper was published in 2010 (Ramos et al., 2010).

Anxiety and depression associated with migraine may contribute to increased food intake by affecting appetite regulators. The gut hormone ghrelin is an important modulator of energy intake (Castañeda et al., 2010). It has been reported that circulating ghrelin level increase not only in response to energy insufficiency but also in response to acute and chronic stress. Moreover, increasing ghrelin levels produce anxiolytic and antidepressant-like responses. Chronic stress causes elevated ghrelin level, and the effects of depression and anxiety are minimized when ghrelin level rise (Schellekens et al., 2012).

**PATIENTS AND METHODS**

Between January, 2012 and June, 2014, 30 adult patients were included in this study, which was carried out in New Dameitta University Hospital. They were randomly divided into two equal groups. Group A underwent LSG, while group B underwent LGCP. Data were collected through routine follow-up at 1,
3, 6, 12, and 24 months postoperative. Patients data, operative time, complications, percentage of excess weight loss (EWL %), and psychological changes were compared.

**Inclusion criteria included:** Fit patients for surgery, 18-50 years old, had a body mass index (BMI) of 40-50 kg/m² and absence of significant psychopathology that could limit their ability to understand the procedure and comply with the medical, surgical, and/or behavioral recommendations.

**Exclusion criteria included:** Pregnancy or lactation, drug and/or alcohol abuse, previous malabsorptive or restrictive procedures performed for the treatment of obesity, severe cardiopulmonary disease, uncontrolled hypertension, cirrhosis and major (severe) depression.

All patients received intravenous antibiotics, subcutaneous anticoagulant and lower limb compression with elastic bandages preoperatively.

As regard operative details for group (A); Patients were placed in an anti-Trendlenburg position, French position (operator between legs) and two assistants one each side of the patient, under general anesthesia; the abdomen was insufflated with CO₂, five-ports were inserted into peritoneal cavity; one 10mm optical port above the umbilicus, two 12 mm operating ports in the mid-clavicular lines on both sides, two 5mm assistant ports in the right and left hypochondria. A liver retractor was used to support the liver. The pylorus is identified, and an area approximately 4 cm from the pylorus is chosen to begin coagulating and transecting the greater curvature vessels with a Harmonic Scalpel (figure 1). The greater curvature of the stomach is mobilized to the angle of His, with particular attention paid to mobilizing the entire fundus to the left crus of diaphragm. Resectioning of the antrum was started tangentially from the right lateral port using a stapler with a green load, A 34-French bougie is passed and positioned in the distal antrum, the body and fundus of the stomach is achieved using blue or gold loads to the angle of His. Extraction of bougie
and insertion of Ryle tube was done. Clips or over-sew the staple line were used for hemostasis (figure 2). Competence of staple line was tested with injection of methylene blue through the Ryle tube. Extraction of excised part of stomach (figure 3). Drain was inserted and port sites closed with sutures.

![Figure (1): Coagulation and transection of greater curvature vessels with a Harmonic Scalpel.](image1)

![Figure (2): Final shape of stomach after sleeve gastrectomy with clips over the staple line for hemostasis.](image2)

![Figure (3): The excised part of stomach after extraction.](image3)

As regard operative details for group (B); under general anesthesia, the abdomen was insufflated with CO₂, five-ports were inserted into peritoneal cavity; one 10mm optical port above the umbilicus, one 10mm operating port in the right midclavicular line, one 5mm operating port in the left midclavicular line, two 5mm assistant ports in the right and left hypochondriac. The same steps
as group (A) till mobilization of greater curvature of stomach, then 34-French bougie is passed and positioned in the distal antrum.

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, interrupted sutures provide better calibration, better control of the tension applied on the stomach and better alignment. 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 2 cm from the gastroesophageal junction and carried down to 4cm from the pylorus. The technique was similar to that of Talebpour et al., 2012, invagination of three sections of gastric wall illustrated schematically in figure (4), in order to have three sections (AB, BC and CD), it was obviously needed to have four separation points of A, B, C and D (which represent the locations of suture bites). There would be four bites at each transverse level; two (A and B) in anterior and two (C and D) in posterior gastric wall.

The final shape of stomach was like a sleeve gastrectomy, but slightly larger (figure 5). No need for competency test or drains, finally port sites closed with sutures.

Postoperative Period

After sleeve gastrectomy, routine postoperative radiological studies were done on day one, mainly to rule out early leakage. After gastric plication, no routine postoperative radiological studies were done. Upper gastrointestinal endoscopy was done when needed to rule out stricture. For first two weeks liquids were permitted, and then semi-solids for two weeks, well grinded solid foods were started after that. Psychological assessment was done peri-operative for all patients.
Depression was assessed with Hamilton Depression (HAM-D) scale (Hamilton, 1960). HAM-D scale is a 17 item questionnaire, and was administered by a psychiatrist during a face to face interview. The minimum score is 0 and the maximum score is 53 points. Each item on the questionnaire is scored on a 3 or 5 point scale, depending on the item, and the total score is compared to the corresponding descriptor. A score of zero represents an absence of the depressive symptom being measured, a score of one indicates doubt concerning the presence of the symptom, a score of two indicates mild symptoms, a score of three indicates moderate symptoms, and a score of four represents the presence of severe symptoms. The remaining eight items are scored on a three-point scale, from zero to two, with zero representing absence of symptom, one indicating doubt that the symptom is present, and two representing clear presence of symptoms. Assessment time is estimated at 20 minutes. Scores from 0 to 7 is considered normal (no depression); scores from 7 to 17 were mild and 18 to 24 was moderate depression.

Figure (4): Transverse section of plicated stomach (Talebpour et al., 2012)

Figure (5): The final shape of stomach after greater curvature plication.
RESULTS

The mean follow up time was 19.56 months (range 6-29 months). The mean patient age was 33.8 years (range 18-50 years). There were 22 females (73.3%) and 8 males (26.7%). The mean BMI for all patients 46kg/m², the mean EWL% was 64% for group A and 58.8% for group B (table 1).

Table (1): Personal characteristics of studied cases

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group A</th>
<th>Group B</th>
<th>Total</th>
<th>Test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>31.66±9.48</td>
<td>35.93±9.58</td>
<td>33.80±9.61</td>
<td>1.22</td>
<td>0.23(NS)</td>
</tr>
<tr>
<td>Female gender</td>
<td>12 (80.0%)</td>
<td>10 (66.7%)</td>
<td>22 (73.3%)</td>
<td>0.68</td>
<td>0.41(NS)</td>
</tr>
<tr>
<td>BMI</td>
<td>45.73±1.38</td>
<td>46.26±1.70</td>
<td>46.0±1.55</td>
<td>0.93</td>
<td>0.35(NS)</td>
</tr>
</tbody>
</table>

NS= non-significant

The operative time was of a mean 114 minutes for group A and 139 minutes for group B. Oral feeding was resumed following a mean duration of 29 hours for group A and 25 hours for group B. Mean hospital stay was 3.5 days for group A and 3.2 days for group B.

As regard postoperative complications, vomiting occurred in 4 patients (26.6%) of group A and 12 patients (80%) of group B. One patient (6.6%) of group A suffered from hemorrhage, which managed with reoperation and hemostasis was done with clips and over-sew sutures, no one of group B suffered from hemorrhage. Minute leak was occurred in one patient (6.6%) of group A, which managed conservatively, there was no leak in group B. Loss of hunger feeling was reported in 11 patients (73.3%) of group A and in 4 patients (26.7%) of group B. Depression was noticed preoperatively with variant degrees in 9 patients (60.0%) of group A and in 10 patients (6.6%) of group B (66.7%). Postoperatively, depression in group A was reported in 7 cases (46.7%) (4 mild, 3 moderate) and 3 cases (20.0%) in group B (2 mild and 1 moderate). There was no significant difference between both groups as regard preoperative depression while postoperatively, there was significant decrease of depression in group B.
when compared to group A. In addition, the decrease in depression was significant in group B when comparing postoperative to preoperative values (table 2).

Table (2): Operative, postoperative data and depression of studied cases

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group A</th>
<th>Group B</th>
<th>Total</th>
<th>Test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative time</td>
<td>114.0±22.61</td>
<td>139.0±19.65</td>
<td>126.50±24.39</td>
<td>3.23</td>
<td>0.003*</td>
</tr>
<tr>
<td>Resume oral feeding</td>
<td>29.0±1.60</td>
<td>25.0±1.41</td>
<td>27.0±2.51</td>
<td>7.24</td>
<td>0.001*</td>
</tr>
<tr>
<td>Hospital stay</td>
<td>3.53±0.74</td>
<td>3.20±0.41</td>
<td>3.36±0.61</td>
<td>1.51</td>
<td>0.14(NS)</td>
</tr>
<tr>
<td>Follow up (months)</td>
<td>21.73±6.63</td>
<td>17.40±6.72</td>
<td>19.56±6.92</td>
<td>1.77</td>
<td>0.08(NS)</td>
</tr>
<tr>
<td>EWL%</td>
<td>64.0±0.85</td>
<td>58.8±0.77</td>
<td>61.40±2.76</td>
<td>17.5</td>
<td>0.001*</td>
</tr>
<tr>
<td>Complications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vomiting</td>
<td>4(26.7%)</td>
<td>12(80.0%)</td>
<td>16(53.3%)</td>
<td>8.57</td>
<td>0.003*</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>1 (6.7%)</td>
<td>0(0.0%)</td>
<td>1(3.3%)</td>
<td>1.03</td>
<td>0.31(NS)</td>
</tr>
<tr>
<td>Minute leak</td>
<td>1(6.7%)</td>
<td>0(0.0%)</td>
<td>1(3.3%)</td>
<td>1.03</td>
<td>0.31(NS)</td>
</tr>
<tr>
<td>Loss of hunger feeling</td>
<td>11 (73.3%)</td>
<td>4(26.7%)</td>
<td>15(50.0%)</td>
<td>6.53</td>
<td>0.011*</td>
</tr>
<tr>
<td>Preoperative Depression</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>3(20.0%)</td>
<td>4 (26.7%)</td>
<td>7(23.3%)</td>
<td>0.23</td>
<td>0.89(NS)</td>
</tr>
<tr>
<td>Postoperative depression</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>4(26.7%)</td>
<td>2(13.3%)</td>
<td>6(20.0%)</td>
<td>7.80</td>
<td>0.017*</td>
</tr>
<tr>
<td>Moderate</td>
<td>3(20.0%)</td>
<td>1(6.7%)</td>
<td>4(13.3%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* = significant; NS= non-significant

**DISCUSSION**

Morbid obesity is one of the major health problems of the 21st century. Formally recognized by the WHO as a global epidemic in 1997, it was estimated that in 2008, 1.5 billion adults, 20 and older, were overweight. Of these, over 200 million men and nearly 300 million women were obese, with higher rates among women than men ([Center for disease control [CDC], 2012](https://www.cdc.gov/)).

As the most effective means for excess weight loss available, bariatric surgery has been growing continuously, with more and more patients opting for surgical treatment of their condition, new operations and techniques being developed, and new instruments being produced ([Brody, 2004](https://www.brody.org/)).

LSG is an innovative procedure for the management of obesity. It was originally developed as a first-stage bariatric procedure to reduce surgical risk in high-risk patients through the induction of dramatic weight loss. Advantages of
LSG include: technical efficiency, lack of an intestinal anastomosis, normal intestinal absorption, no risk of internal hernias, no implantation of a foreign body, pylorus preservation (prevents dumping syndrome), and finally LSG may be considered the most appropriate option in extremely obese patients.

Concerns remain however, regarding the risks and important major complications associated with LSG including staple line leak (1.17%), post-operative hemorrhage (3.57%), and the irreversibility of LSG (Cottam et al., 2006).

A new technique was presented, initially named total vertical gastric plication, and better known today as laparoscopic greater curvature plication. Developed in Iran by Dr Talebpour as a cheap alternative to Laparoscopic Sleeve Gastrectomy, it appears to be gaining ground as its theoretical advantages of technical simplicity and low complication rate are of major importance (Talebpour and Amoli, 2007).

Laparoscopic Sleeve Gastrectomy (LSG) has been in many ways the Holy Grail of Bariatric Surgery. A relatively simple technique, with short operating time, few complications, and very good results in Excess Weight Loss; LGCP is being proposed as a different way to reproduce the same results with even fewer complications according to the Third International Summit on the status of LSG (Deitel et al., 2011).

Human studies on ghrelin and stress suggest the coordinating role of ghrelin on behavioral response to stress by modulating energy intake. In one study, patients suffering from major depression had lower plasma ghrelin levels and antidepressant effects were reported following ghrelin administration (Barim et al., 2009).

Increasing evidence supports a functional role of ghrelin in myocardial growth associated with improved cardiac function. Also it had been detected in the aorta and myocardium, indicating that ghrelin may modulate cardiovascular
parameters. Recent evidence indicates that ghrelin inhibits apoptosis in cardiomyocytes and endothelial cells (Katugampola and Davenport, 2003).

These interesting data indicate that ghrelin administration may represent a new therapeutic approach in the management of chronic heart failure. Thus, the cardio-vascular activities of ghrelin suggest potential clinical uses of ghrelin. Theoretically, Ghrelin analogs might be used to protect from coronary ischemia and prevent the progression of dilated cardiomyopathy (James and John, 2004).

Cassoni et al. (2001) documented an antiproliferative effect of ghrelin in breast cancer cells. In their study, specific binding for ghrelin in human breast carcinomas and cell lines was observed. This entity of binding was independent of histologic type, stage, ER status, proliferative index of the tumor, or pre- or postmenopausal status of the patients, but it was directly related to grade of tumor differentiation.

In our study, no statistical difference between the two groups as regard, postoperative oral feeding and hospital stay. The operative time was longer for gastric plication group. The EWL% was more or less similar in the two groups. Vomiting was occurred more with plication group, hemorrhage and leak noticed only with sleeve gastrectomy.

Depression with variant degrees and loss of hunger feeling were more with sleeve gastrectomy. Bariatric surgery is a domain of complex interventions in high-risk patients. An ideal procedure does not exist and the key to successful treatment lies in a careful assessment of the individual risk jointly by the surgeon and the patient, as well as in providing intensive care and information before the operation and particularly in the long-term after a bariatric operation (Mohamed, 2012).

Sleeve gastrectomy and greater curvature plication were having more or less similar results. The extra benefits for greater curvature plication are its
safety, feasibility, effectivity for EWL%, low complication rates, cost efficiency and its reversibility. The role of Ghrelin hormone which decreased after sleeve gastrectomy, must be kept in mind, due to its role as antidepressant, cardio-protective, and anti-proliferative for breast cancer. Long-term results and more studies are needed to determine the ideal operation for each patient.
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تأثير جراحات السمنة التقيدية علي الاكتئاب

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صممت الدراسة الحالية بهدف التعرف على علاقة جراحات السمنة التقيدية (تكميم المعدة مقابل طي المعدة) في علاج السمنة المفرطة، وعلاقة ذلك بالاكتئاب. وقد أجريت الدراسة بين يناير 2012 ويونيو 2014. وقد اشتملت الدراسة على 100 لديهم سمرة مفرطة، تم اختيارهم بمستشفى دمياط الجامعي (جامعة الأزهر). وقد تم تقسيم المرضى إلى مجموعتين متساويتين العدد بصورة عشوائية طبقاً للبروتوكول الجراحي المتبغ. اشتملت الأولى على 50 حالة تم علاجهم بجراحة تكميم المعدة، والمجموعة الثانية تم إجراء الجراحة طبي المعدة. وقد تم تجميع المعلومات الشخصية، وقت الجراحة، المضاعفات، نسبة النقص من الوزن الزائد، ومستوي الاكتئاب قبل وبعد الجراحة. وقد كان متوسط وقت المتابعة 19.56 شهر (6-29 شهر). ولم توجد فروق ذات دلالة إحصائية بين المجموعتين بالنسبة للغذاء عن طريق الفم بعد الجراحة، ووقت المكث بالمستشفى، ونسبة النقص من الوزن الزائد. بينما حدث القيء لدى مجموعة طبي المعدة، وكان النزف والترسب أكثر لدى مجموعة تكميمي المعدة. وقد كان مستوي الاكتئاب بين مجموعتي الدراسة متقاربين ولم تكن هناك فروق ذات دلالة إحصائية، بينما بعد الجراحة كان هناك انخفاض يعتبره إحصائياً في مستوي الاكتئاب أقل مع جراحة طي المعدة. وهناك احتياج لدراسات مستقبلية لمتابعة أطول، لتحديد الجراحة المثلى لعلاج السمنة.