The Impact of Pyloric Pouch Size (3 cm and 6 cm) in Sleeve Gastrectomy on Postoperative Reflux and Vomiting

MOHAMED A. EL-MASRY, M.D.; MUHAMMAD EL-MARZOUKY, M.D. and YEHIA FAYEZ, M.Sc.
The Department of General Surgery, Faculty of Medicine, Cairo University

Abstract

Some evidence has shown that sleeve gastrectomy and similar procedures can be complicated by significant post-operative reflux symptoms. With an intact pylorus, severely restricted stomach capacity, and physiologically disrupted motility possibly creating stasis, one would expect that LSG would not be likely to relieve heartburn reflux symptoms, as does LRYGB.

Aim of Work: The aim of this study is to find out the impact of resecting the stomach 3cm from the pylorus versus 6cm regarding vomiting and reflux symptoms by randomly selecting the patients presenting to our department with morbid obesity and BMI >40 in Kasr Al-Ainy between January 2013 and March 2014.

Methods: This was a randomly selected prospective study carried out on morbidly obese patients presented to Kasr El-Aini Teaching Hospital during the period from January 2013 to March 2014, where sixty patients underwent sleeve gastrectomy. These patients grouped into two groups according to the starting point of resection of the stomach; Group (A) started 3cm from the pylorus towards the gastro-esophageal junction and Group (B) 6cm from the pylorus. The decision to do 3cm resection or 6cm resection randomly selected. These patients followed over a period of 6 months for post-operative nausea; vomiting and reflux symptoms where the assessment of the reflux was based mainly on the symptoms given by the patient.

Results: There was no statistical difference between both groups (6cm and 3cm) regarding post-operative reflux, where most of patients (61.7%) didn’t suffer reflux symptom versus (38.3%) who suffered from reflux where most of them had already pre-operative nausea; vomiting and reflux symptoms where the assessment of the reflux was based mainly on the symptoms given by the patient.

Conclusion: The 3cm group (Group A) were >14 times at a higher risk to have minor complications in the form of nausea, vomiting and reflux compared to 6cm group (Group B).

Key Words: Sleeve gastrectomy – Morbid obesity – Bariatric surgery – Reflux.

Correspondence to: Dr. Mohamed A. El-Masry, The Department of General Surgery, Faculty of Medicine, Cairo University

Introduction

LAPAROSCOPIC Sleeve Gastrectomy (LSG) is gaining popularity as a primary, staged and revisional operation for its proven safety and simplicity, as well as short-term and mid-term efficacy.

Sleeve Gastrectomy (SG) was initially conceived and first described as a restrictive component of the Bilio-Pancreatic Diversion (BPD) and duodenal switch procedure in 1988 by Hess [1] and Marceau [2] at times when bariatric surgery was conducted via laparotomy (open surgery). LSG was performed as a first step procedure in high-risk patients, to be followed by a second-step LRYGBP [3] or laparoscopic BPD [4].

Post-operative reflux symptoms is a notable side effect of sleeve gastrectomy [5]. Particularly because preoperative reflux symptoms and esophageal dysmotility are associated with morbid obesity [6]. With an intact pylorus, severely restricted stomach capacity, and physiologically disrupted motility possibly creating stasis [7], one would expect that LSG would not be likely to relieve heartburn reflux symptoms, as does LRYGB [8]. Laparoscopic sleeve gastrectomy proposed to have an adverse effect on the function of the lower esophageal sphincter due to disruption of the phreno-esophageal membrane and gastric resection at the angle of his predisposing the patient to postoperative reflux symptoms [9].

Impaired gastric emptying may be a possible explanation for reflux complication. Himpens [10] and Weiner [11] evaluated the incidence of reflux, and found that it increases during the first postoperative year, but disappears thereafter. The Melissas’s study [7] reported an increase in the gastric clearance times, while Bernstine et al., cited no change in gastric emptying rates at 3 months after the operation [12].
Patients and Methods

This was a randomly selected prospective study carried out on morbidly obese patients presented to Kasr El-Aini Teaching Hospital during the period from January 2013 to March 2014, where sixty patients underwent sleeve gastrectomy. These patients grouped into two groups according to the starting point of resection of the stomach; Group (A) started 3cm from the pylorus towards the gastro-esophageal junction and Group (B) 6cm from the pylorus. The decision to do 3cm resection or 6cm resection randomly selected. These patients were followed over a period of 6 months for post-operative nausea; vomiting and reflux symptoms and their weight loss.

Patient inclusion criteria:
These patients should fulfill certain criteria for choice:
1- Patients who have BMIs of 40kg/m$^2$ or more, or between 35kg/m$^2$ and 40kg/m$^2$ with other significant obesity related co-morbidities that could be improved if they lost weight.
2- Patients commit to the need for follow-up.

Patient exclusion criteria:
3- Patients with previous abdominal surgeries.
4- Patients with psychiatric problems.
5- Severe cardiopulmonary disease or other serious organic disease making the subject a high-risk surgical candidate, uncontrolled hypertension, and portal hypertension.
6- Pregnancy or lactation at surgery.
7- Drug or alcohol abuse.
8- Previous malabsorptive or restrictive procedures performed for the treatment of obesity.

Pre-operative preparation:
All patients underwent a standard evaluation preoperatively. Blood tests requested in the form of complete blood picture, fasting blood sugar, clinical chemistries (serum albumin, ALT, AST, GGT, Urea, and Creatinine) and prothrombin time and concentration. Abdominal ultrasonography, chest X-ray, pulmonary function tests, ECG and echocardiography performed preoperatively. Patients informed about the nature of the research, and each patient understood and agreed to the procedure (informed consent). One to two weeks pre-operatively the patients asked to consume very low caloric diet.

Procedure:
Dissection of greater curvature started flush to the greater curvature using Ligasure® (Covidien) or Harmonic scalpel® (Ethicon Endo-Surgery) until the gastro-esophageal junction and releasing the posterior adhesions between the stomach and the pancreas. It was important to continue the dissection up to the left crus of diaphragm, dividing the gastrophrenic ligament and making the gastric fundus completely free. Marking of the distance from the pyloric ring to the starting point of resection done; where a calibrated string used to determine the starting point of resection from the pyloric ring at the greater curvature of the stomach either 3cm or 6cm, as shown in Figs. (1,2). The decision to do 3cm resection or 6cm resection randomly selected.

In order to excise, then a 36 Fr bougie was inserted till the pylorus then the stapler introduced through the right operator port with a green cartridge then the following blue cartridges introduced through the left operator port. A grasper then used to close the pylorus and methylene blue injected under pressure to test for leakage. Finally, a drain placed and the resected removed through the left 12mm working port.

Fig. (1): Sleeve gastrectomy with starting point 3cm pre-pyloric distance.

Fig. (2): Sleeve gastrectomy with starting point 6cm pre-pyloric distance.
**Post-operative measures:**

In day one, gastrografin study was performed to exclude leakage then the drain was removed and the patient was discharged on liquid diet for three weeks followed by pureed foods for another three weeks then soft diet for two weeks, then regular diet afterwards. All patients were discharged on vitamin B12 vial every month for one year, calcium tablets twice daily for one year; PPI for the first three months and multi-vitamins for one year.

All patients were examined monthly during the first six months for BMI changes and post-operative complications mainly (nausea, vomiting and reflux) where nausea and vomiting categorized by a scoring system called PONV impact scale (13) (post-operative nausea and vomiting scoring system), as shown in (Table 1).

<table>
<thead>
<tr>
<th>Vomiting frequency</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>Once</td>
<td>1</td>
</tr>
<tr>
<td>Twice</td>
<td>2</td>
</tr>
<tr>
<td>Three or more times</td>
<td>3</td>
</tr>
</tbody>
</table>

Feeling of nausea (an unsettled feeling in the stomach and slight urge to vomit)? If yes, has your feeling of nausea interfered with activities of daily living, such as being able to get out of bed, being able to move about freely in bed, being able to walk normally, or eating and drinking?, as shown in (Table 2).

On the other hand regarding the reflux it was assessed based on the symptoms taken from the patient pre and post-operatively.

<table>
<thead>
<tr>
<th>Nausea frequency</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td>0</td>
</tr>
<tr>
<td>Sometimes</td>
<td>1</td>
</tr>
<tr>
<td>Often or most of the time</td>
<td>2</td>
</tr>
<tr>
<td>All of the time</td>
<td>3</td>
</tr>
</tbody>
</table>

**Statistical methods:**

The data coded and entered using the statistical package SPSS version 15. The data summarized using number and percentage for qualitative values. Statistical differences between groups tested using Chi Square test for qualitative variables. Logistic regression analysis done to test for significant predictors of postoperative complications. p-values less than or equal to 0.05 were considered statistically significant.

**Results**

The patients’ ages ranged from 17 to 60 years old with a mean of 34.5 years. The majority of patients in this study were in the age group 21-40 (65%) with five patients (8.3%) below twenty years. The majority of candidates in this study (71.7%) were females. Most of the candidates in our study were married (60%) as compared to single (40%).

Fifty percent of patients in this study had BMI >50, 25% had BMI 40-45%, and 5% had BMI 35-40% with co-morbidities. The majority of patients in this study were bulky eater (76.7%) versus (23.3%) were sweet eater.

The majority of our patients (88.3%) satisfied from the procedure and its results without any privileges for any group (3cm or 6cm) and with the presence of minor complications, which had accepted, by most of them. Almost all of patients underwent this operation with either techniques (3cm or 6cm) showed marked reduction in their appetite (95%).

In this study, there was no major complications (e.g.; leakage, bleeding, pulmonary embolism or death). However, minor complications in the form of nausea, vomiting and reflux were more with 3cm group (96.6%) as compared to 6cm group (67.9%). There was a strong significant difference between both groups can be seen in the \( p \)-value in this table (0.003), as shown in [(Table 3), Fig. (3)].

<table>
<thead>
<tr>
<th></th>
<th>Group A 3cm</th>
<th>Group B 6cm</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor complications:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1 (3.1%)</td>
<td>9 (32.1%)</td>
<td>10 (16.7%)</td>
</tr>
<tr>
<td>Minor</td>
<td>31 (96.9%)</td>
<td>19 (67.9%)</td>
<td>50 (83.3%)</td>
</tr>
<tr>
<td>Total</td>
<td>32 (100.0%)</td>
<td>28 (100.0%)</td>
<td>60 (100.0%)</td>
</tr>
</tbody>
</table>
The Impact of Pyloric Pouch Size (3cm & 6cm) in Sleeve Gastrectomy

Complications in this study were totally minor (nausea, vomiting and reflux) and occurred in (83.3%) of patients with no age significance versus (16.7%) who developed no complications initial BMI had no influence on post-operative complications and this was evident from the near percent of patients in each BMI group. Diabetes mellitus, hypertension and chronic diseases had no influence on post-operative complications in either group (3cm and 6cm).

There was no statistically significant difference between both groups (6cm and 3cm) regarding post-operative reflux, where most of patients (61.7%) did not suffer reflux symptom versus (38.3%) who suffered from reflux where most of them had already pre-operative reflux symptoms. In addition, (43.8%) of patients in 3cm group suffered from reflux versus (32.1%) in 6cm group who suffered from reflux taking in consideration that the sample size is sixty patients so higher sample size may confirm this correlation, as shown in Fig. (4).

Ninety percent (90.6%) from the group 3cm suffered from repeated vomiting (twice or more daily) within the first six months compared to (60.7%) from 6cm group, which had a strong significant difference with p-value 0.021. On the other hand we find that (32.1 %) of patients in 6cm group developed no vomiting at six months versus (6.3%) of 3cm group, as shown in Fig. (5).

Sixty five percent (65%) of patients underwent sleeve in this study did not suffer from postoperative nausea without any significance between both groups (3cm and 6cm), with a \( p \)-value of 0.319. In contrast to (23.3%) who suffered from nausea most of the time at six months, as shown in Fig. (6).

In this study, diabetes mellitus had no influence on post-operative complications in either group (3cm and 6cm), as shown in (Table 4).
Table (4): Correlation between diabetes mellitus and presence of minor complications (nausea, vomiting and reflux).

<table>
<thead>
<tr>
<th>Minor complications</th>
<th>Diabetic</th>
<th>Not</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>0 (0%)</td>
<td>10</td>
<td>10 (16.7%)</td>
</tr>
<tr>
<td>Minor</td>
<td>6 (100.0%)</td>
<td>44</td>
<td>50 (83.3%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6 (100.0%)</td>
<td>54</td>
<td>60 (100.0%)</td>
</tr>
</tbody>
</table>

In this study, HTN had no influence on postoperative complications in either group (3cm and 6cm), as shown in (Table 5).

Table (5): Correlation between hypertension and presence of minor complications (nausea, vomiting and reflux).

<table>
<thead>
<tr>
<th>Minor complications</th>
<th>Hypertensive</th>
<th>Not</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>0 (0%)</td>
<td>10</td>
<td>10 (16.7%)</td>
</tr>
<tr>
<td>Minor</td>
<td>10 (100.0%)</td>
<td>40</td>
<td>50 (83.3%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>10 (100.0%)</td>
<td>50</td>
<td>60 (100.0%)</td>
</tr>
</tbody>
</table>

**Discussion**

The majority of patients in this study was in the age group 21-40 (65%) giving an idea about the age group seeking for this operation most were young adults and middle age. The majority of candidates in this study (71.7%) was females, which may be indicator of the main sex looking for this operation. Most of the candidates in our study were married (60%) as compared to single (40%) which indicates that the majority of patients looking for this kind of operation were mostly married females for functional and psychological elements. The majority of subjects in our study (55%) was working denoting which kind of patients look for this operation and the need of this group for the operation to improve their performance. Fifty percent of patients in this study had BMI >50, 25% had BMI 40-45%, and 5% had BMI 35-40% with co-morbidities denoting that the majority of patients did not look for this operation until they became morbidly obese.

Ninety percent of the patients in this study were not diabetic versus 10% only who are diabetic on oral hypoglycemic drugs with minimal improvement over the period of six months in the form of reduction of the doses of anti-hypertensive drugs.

In this study, we proved that the 3cm antral pouch group have higher rate of vomiting compared to 6cm group with fixed bougie size 36 Fr and that 3cm groups were >6 times at a higher risk to have vomiting >once compared to 6cm group where these results differed to some extent with Jacobs and co-workers [19] who reported that no statistically significant difference between 4 and 7cm antral pouch existed and agreed with that no difference between 46-Fr, 40-Fr, and 36-Fr bougie regarding excess body weight loss EBWL. But our results agreed with Jacobs and co-workers regarding excess body weight loss that there was no difference in the results of 6cm groups and 3cm antral pouch.

The majority of our patients (88.3%) were satisfied from the procedure and its results without any privileges for any group (3cm or 6cm) and with the presence of minor complications which were accepted by most of them. In addition, almost all of patients underwent this operation with either techniques (3cm or 6cm) showed marked reduction in their appetite (95%) without any privileges for any group.

Complications were graded according to the Clavien's classification system [15]. Grade I, a complication inducing any deviation from the normal postoperative course; Grade II, complications requiring pharmacologic treatment; Grade III, complications requiring operative, endoscopic, or radiologic intervention; Grade IV, life-threatening complications requiring intermediate or intensive care unit management; and Grade V, death of a patient [16]. In this study, there was no major complications (e.g.; leakage, bleeding, pulmonary embolism or death). Applying this grading in this study, we find that all complications belonged to Grade 1 and 2 in the form of nausea, vomiting and reflux symptoms, where all responded to medical treatment and one case only of severe vomiting that was re-admitted to the hospital for IV fluids infusion and discharged after two days. We found that 96.9% (31 patients) in 3cm group developed minor complications mostly reflux and vomiting and 67.9% (19 patients) in 6cm group denoting that minor complications as nausea vomiting and reflux were strongly significant ($p$-value was (0.003) to 3cm group and our results proved that 3cm groups were >14 times at a higher risk to have these complications compared to 6cm group.
Our results that proved that 61.7% (37 patients) in our study didn't develop reflux symptoms compared to 38.3% (23 patients) who developed exaggeration of already presenting reflux symptoms with no significance to 3cm and 6cm groups which agree with [16], who suggested that leaving the antral part behind is crucial for normal function of the retained stomach, but they themselves report reflux with a technique of resection that starts from 5-6cm proximal to pylorus. However, Andrei et al., [17] suggested that the extent of the resection of the antrum has no implication on the sleeve emptying. In this study, (43.8%) of patients in 3cm group suffered from reflux versus (32.1%) in 6cm group who suffered from reflux taking in consideration that the sample size is sixty patients so higher sample size may confirm this correlation.

Development of intense and persistent vomiting can lead to vitamin, mineral and protein deficiencies in a short period of time [18]. Wernicke's syndrome presents as confusion, nystagmus, ophthalmoplegia and ataxia. A confusional state with inattention, apathy, disorientation and memory loss may be present. The lower limbs may be affected with motor and sensory deficit [19]. In our study, ninety percent (90.6%) from the group 3cm suffered from repeated vomiting (twice or more daily) within the first six months compared to (60.7%) from 6cm group, which had a strong significant difference with p-value 0.021. On the other hand, we find that nine patients (32.1%) in 6cm group developed no vomiting at six months versus two patients (6.3%) in 3cm group.

In our study, sixty five percent (65%) of patients underwent sleeve in this study did not suffer from postoperative nausea without any significance between both groups (3cm and 6cm) with a p-value of 0.319. In contrast, to (23.3%) who suffered from nausea most of the time at six months.

Makarewicz et al., [20] stated that some patients were readmitted for dehydration and renal failure, both of which may possibly be related to the post-operative gastro-esophageal reflux disease; in this study 61.7% of patients developed no reflux symptoms while 82.7% developed vomiting more than once so vomiting is related to the size of antral pouch where the 3cm antral pouch group have higher rate of vomiting compared to 6cm group with fixed bougie size 36 Fr and that 3cm groups were >6 times at a higher risk to have vomiting more than once compared to 6cm group. Even Wernicke-Korsakoff syndrome has been reported after Sleeve Gastrectomy (SG) due to prolonged vomiting. Most authors report prescribing PPIs for different periods of time to the SG patients; in this study PPI were prescribed routinely for all patients for 3 months at least, where only one case was readmitted for severe vomiting and dehydration where she received IV fluids for 2 days and discharged after that.

Evangelos et al., [21] mentioned that reinforcement of the stapling line is a negative predictor for subsequent complications, while a high preoperative BMI, previous bariatric operation, and diabetes are positive predictors that contradict the results in this study that stated that DM, hypertension and other chronic diseases had no influence on development of any post-operative nausea, vomiting or reflux.

**Conclusion:**

Taking into consideration that 3cm groups (Group A) were >14 times at a higher risk to have minor complications in the form of reflux, nausea and vomiting compared to 6cm group (Group B) without any difference between both groups regarding BMI changes over a period of six months. The presence of these minor complications doesn't affect patients' satisfaction with the procedure. Where (88.3%) were satisfied from the procedure and its results.

**References**


ملخص العربي

اصبحت جراحة تكميم المعدة بالمنظار واسعة الشهرة كإجراء اولي او مرحلية او جراحة تصحيحية لجراحة سابقة، وذلك لما تستم به هذه الجراحة من الأمان والبساطة ونتائجها المذهلة على المدى القصير.

تم في هذه الدراسة عمل جراحة التكميم لستنين مريض حيث تم تقسيمهم بشكل عشوائي إلى مجموعتين المجموعة الأولى (أ) حيث بدأ التكميم من مسافة 2 سم من ممر進سات السداد والمجموعة الثانية (ب) حيث بدأ التكميم على مسافة 6 سم، وقد تم متابعة المرضى على مدار ستة أشهر من حيث مضاعفات ما بعد الجراحة وأهم الفجوات والنتائج المتوقعة في الوزن.

أخذا في الاعتبار أن غالبية المرضى (82%) يشعرون بدرجة عالية من الرضا من نتيجة الجراحة دون أي اضطرابات لاحقة المجموعتين (أ) او (ب) ووجود مضاعفات صغيرة مقبولة من معظم المرضى مع ان مجموعة (أ) اربعة عشر مرة أكثر عرضة لجميع المضاعفات الصفيرة من المجموعة (ب) دون أي فرق بين المجموعتين من ناحية فقدان الوزن الزائد.

ذا افتحت نتائج هذه الدراسة بداية التكميم من مسافة 6 سم من ممر진سات السداد للحصول على نتائج أفضل ومضاعفات أقل، ومن الجدير بالذكر أن هذه الدراسة أربعة مرضى (4/6) في المجموعة (أ) تم قد فقدوا أكثر من 80% من الوزن الزائد في ستة أشهر في مقابل مريض واحد (1/6) في المجموعة (ب) تم ونسبة فقد 80% من الوزن الزائد إذا كان الممكن من خلال المريض Méd نتائج أكثر دقة من ناحية فقد الوزن الزائد بين المجموعتين (أ) و(ب).

فمامة، مشير، سعيد، 2010.