Comparison Study of Gastric Emptying after Performing Sleeve Gastrectomy with Two Different Techniques

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Abstract  Sleeve gastrectomy (SG) has become the primary surgical modality of treatment for obesity. This operation could be associated with motor gastric dysfunction and abnormal gastric emptying. The purpose of this prospective study is to present a comparison study of gastric emptying to solids after performing sleeve gastrectomy with two different techniques using scintigraphy. Prospectively; 26 morbidly obese patients were submitted for laparoscopic SG. Group A: 15 patients had sleeve gastrectomy started 7 cm from the pylorus and then vertical gastrectomy along a 40 French size tube. Group B: 11 patients have the sleeve started at 4 cm from the pylorus and then vertical gastrectomy along a 40 french size gastric tube. Gastric emptying of solids was measured by scintigraphic technique. Results of gastric emptying after SG is variable according to point of starting sleeve gastrectomy from the pylorus. At 4 cm it is associated with delayed emptying in 73% of patients and at 7 cm it is associated with accelerated emptying for solids in 87% of patients. These results should be considered to select the appropriate technique according to gender and preoperative foregut condition.

Keywords: sleeve gastrectomy, gastric dysfunction, gastric emptying scintigraphy


1. Introduction

All over the world, the prevalence of obesity and obesity related diseases are inclining to an alarming figure in which a lot of research is performed in order to understand and control this pandemic. Bariatric procedures were involved in the management of morbidly obese patient and its associated metabolic diseases [1]. Over two decades sleeve gastrectomy evolved from part of duodenal switch procedure to a first step bariatric procedure. Hence it succeeded to be a sole procedure in the management of morbid obesity and its associated metabolic diseases [2]. This operation involves removal of up to 80% of the stomach, which could be associated with motor gastric dysfunction due to the resection of gastric pacemaker. Normally, gastric emptying is a slow process that takes place at a very slow pace guided by blood glucose levels as well as enteric nervous signaling and gastrointestinal peptide hormones [3]. It is believed that after sleeve gastrectomy multiple neurohormonal changed occur. The purpose of the present study is to evaluate and compare gastric emptying of the antrum after having it resected at 4 cm in one group and 7cm from the pylorus in the other group.

2. Methodology

26 morbidly obese patients (6 males, 20 females) were prospectively involved in the study. All patients were candidate for laparoscopic sleeve gastrectomy. Patient's demographic characteristics are shown on Table 1.

<table>
<thead>
<tr>
<th>Table 1. Demography of patients</th>
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<tr>
<td>Total no. of patients</td>
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<tr>
<td>Male:Female</td>
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<tr>
<td>Mean Age</td>
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<td>Weight Range</td>
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<td>BMI Range</td>
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Patients' selection was done preoperatively. All Patients with hypothyroidism, diabetes mellitus, cholelithiasis, significant gastro- esophageal reflux disease and patients on antidepressants were excluded from the study to avoid the presence of preoperative general emptying disorder preoperatively. The preparatory work up included complete blood count, liver function tests, renal function tests, chest x ray, endocrinological profile (thyroid and adrenal function) and abdominal ultrasound to rule out cholelithiasis, Patients were divided into two groups. Group A: Fifteen patients were chosen to have LSG with the vertical resection point at 7 cm from the pylorus. In this group the mean age was 34, mean initial BMI was 42 kg/m². In group B, ( Vertical resection at 4cm from the pylorus) eleven patients had the vertical resection starting point at 4 cm from the pylorus. In this group the mean age was 28, mean initial BMI was 42kg/m².
2.1. Operative Procedure

Under general anesthesia, pneumoperitoneum was created using CO₂ up to a pressure of 15 mmHg. Five trocars were inserted.

Using 10 mm ligasure (Covidian endosurgery), the lesser sac was entered, and then the gastro colic ligament and short gastric vessels were opened up to the level and angle of His. Insertion of a 40-Fr orogastric tube into the stomach down to the pylorus, while in the other group were started the vertical resection point at 4 cm from the pylorus. After that sleeve gastrectomy was performed using laparoscopic linear stapler (Echilon 60 mm – Ethicon Endosurgery) reinforced with Perstrips (Synovis Surgical Innovations). The staple line was then covered with glue (Glubran – GEM). The resected stomach was then extracted out. We close only the trocar sites where the stomach was extracted throughout.

2.2. Gastric Emptying Scintigraphy

Twenty six patients underwent gastric emptying scintigraphy after three months of surgery. All patients had consumed Tin Colloids Tc 99m– labeled as solid boiled egg meal without any complication. Gastric emptying scan was performed in the morning after an overnight fast. The meal was consumed in 5 minutes. Scintigraphic imaging was obtained with gamma camera system (Philips-Forte).

In group B, the results were as follow: In eight patients (72.7 %), the gastric emptying study revealed much slower gastric emptying in comparison to group A, ranging from 45 minutes to 128 minutes with an average of 91.5 min as in Figure 2. The mean gastric emptying time was 54 min. The mean BMI dropped down to 35kg/m² and then to 30 kg/m² and three and six months respectively. Among these, 6 patients (54.5%) developed significant nausea probably related to the slow emptying process. It was noticed that all of them were females. Initially we tried Metoclopramide and Domperidone with minimal resolution of symptom but successfully managed with Meclizine or Ondansetron. Another interesting point was appetite, which was less group B in comparison to group A, which led to less frequent meal intake, however the weight loss difference between the two groups was statistically insignificant at three and six month postoperatively as shown in tables below.

3. Results

All 26 patients underwent LSG without complications. In group A (who had the vertical resection point at 7 cm from the pylorus), the results were as follow. In thirteen patients (86.6 %) there was clear rapid antral emptying ranging from 16 – 22 minutes (average of 19 min) as in Figure 1. two patients (13.3 %) had a gastric emptying at 29 and 34 minutes respectively. the mean time for gastric emptying was 20 minutes. Patients who were having rapid gastric emptying had the tendency to have more frequent small meals every 4-5 hours. Among this group only one patient (3.8 %) developed persistent heart burn that was managed with proton pump inhibitors. Patients were followed up for 6 months, the mean BMI dropped to 34 kg/m² and 29kg/m² at three and six months respectively.
4. Discussion

Laparoscopic sleeve gastrectomy emerged as a restrictive bariatric procedure but its ability to reduce weight extends beyond that through many different mechanisms as hormonal and possible gastric emptying role [4]. Laparoscopic sleeve gastrectomy has been practiced as a first stage surgical procedure for high risk, morbidly obese patients with a BMI of more than 50, however currently approved as sole bariatric procedure for patients with lower BMI. Many studies reported great success after sleeve gastrectomy with estimated weight loss from 51-83% at one year [5]. Gastric emptying is carefully regulated process, consisting of different mechanically defined phases. The gastric metabolic load as well as neural regulatory mechanism and hormonal influences cooperate in order to achieve a well balanced emptying of gastric contents into duodenum [6].

Normally gastric emptying of solids has a biphasic pattern. During the first phase [the lag phase], solid food particles are redistributed from the gastric fundus and broken down to a very tiny small particles of 1-2 mm which can pass out though the pylorus during the linear emptying phase [7] as in Figure 3. There is a clear difference between the emptying of liquids and solids from the stomach. Ingested liquids are rapidly distributed throughout the stomach. The emptying of non caloric liquid begins immediately with a half emptying time of 15-20 minutes [8].

After sleeve gastrectomy, gastric reservoir function is reduced significantly and may abolish because of the elimination of gastric receptive relaxation or accommodation, which both play a major role in the regulation of satiety. In our study, we studied the gastric emptying of solids after performing sleeve gastrectomy along a 40 French size gastric tube but with a group who had the antrum vertically resected at 7 cm from the pylorus, and the other group at 4 cm from the pylorus. As previously demonstrated the gastric emptying process is characterized by a lag or retention phase and an emptying phase.

In the solids emptying process, the lag phase or retention phase is shown as plateau and the emptying phase is characterized by a declining manner. As with other studies, the gastric emptying process starts with a decline without having the plateau which normally indicates the redistribution process of the meal. Having such a persistent decline may indicate absence of the lag phase after sleeve gastrectomy [9]. Normally the lag phase lasts between 30-60 minutes and the emptying phase lasts around 30 minutes. In our study we believe that there probably is no lag phase since the absence of fundus and body eliminate the distribution of food particles.
As shown with our study results, in group A: there was significant increase in emptying of solids with an average of 19 minutes and this rapid manner of emptying was also mentioned in previous studies. [10,11]. On the other hand, in group B; the study showed much slower emptying in most of patients with an average of 91.5 minutes.

Normally, the gastric pacemaker area is located at the upper part of the greater curvature, which generates a slow wave basal rhythm [pacesetter potential] with a frequency of three waves per minutes which also sets the maximum frequency of gastric contraction. The gastric slow waves are propagated in the aboral direction while the proximal gastric region remains silent without any spontaneous depolarization [12].

After sleeve gastrectomy with 7 cm vertical resection from the pylorus the neural innervations of the antrum remains almost intact as shown in Figure 4. That will preserve the contractility of the antrum which will lead to rapid emptying because of the lack the redistribution process due to the lack of the body and fundus of the stomach. On the other hand, vertical resection of the antrum at 4 cm from the pylorus abolished some of the neural innervations of the antrum which contributed to the slower emptying process in most of patients who were involved in the study. From the symptomatology standpoint, it was noticed that patients who had slow gastric emptying at 4 cm vertical resection from the pylorus, had frequent complaints of nausea, vomiting and poor appetite. In the other group, who had the antrum vertically resected at 7cm from the pylorus and who had rapid gastric emptying were complaining of dumping like symptoms manifested with headache and dizziness when eating highly concentrated sugar or fatty meals. This group of patients was also more liable to have frequent meals compared with the other group.

5. Conclusion

Sleeve gastrectomy is a restrictive bariatric procedure; however other additional physiological elements are involved which may have an additional element in the mechanism of weight loss after sleeve gastrectomy. Further double blinded randomized studies are needed to evaluate the neural and hormonal changes that occur after sleeve gastrectomy.

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Competing interests

The authors declare that they have no competing interests.

References