



The Relationship of Gastric Reflux and Scintigraphy Following Sleeve Gastrectomy

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Abstract

Aim and Scope: Laparoscopic Sleeve Gastrectomy (LSG) technique has been the most commonly used surgical treatment approach in the treatment of obesity in recent years. However, there is no consensus among surgeons regarding whether the antrum should be preserved or not. On the other hand, post-meal intolerance (nausea, vomiting, etc.) that develops in patients after surgery seriously affects the quality of life. We investigated the relationship between the antrum resection margin and postoperative symptoms. We also examined the findings of Gastric Emptying Scintigraphy (GES) such as Gastroesophageal Reflux (GER) and gastric emptying half-time.

Materials and Methods: Patients who underwent LSG between January 2017 and December 2018 were included in this prospective study. Study participants were divided into Antrum Resection (AR) and Antrum Preservation (AP) groups based on the antral resection margin lengths. Gastric emptying half-time for liquids was assessed by GES postoperatively. Quantitative analysis was performed for calculating gastric emptying half-time and visual analysis was undertaken for evaluation of the presence of GER. The patients were classified as symptomatic and asymptomatic according to the presence of nausea and vomiting. Also, patients were classified according to GER findings in GES. On the other hand, GES findings were compared with a control group of 20 people who received GES for other reasons.

Results: A total of 60 patients (49 females, 11 males; mean age: 40.3 ± 20.1) included. 35 patients had an antral resection margin of 2 cm (antrum resection-AR group) while 25 patients had an antral resection margin of 4 cm (antrum preservation-AP group) from the pylorus. The mean result of gastric emptying half-time was calculated as 27.63 ± 10.98 min which was shorter than the result of the control group (54.35 ± 24.31 min). The difference was statistically significant ($p=0.0001$). However, no difference was found between the two different surgical techniques in terms of postoperative symptoms, gastric emptying half-time, and development of GER.

Discussion: In conclusion, the duration of gastric emptying for liquid in patients who underwent LSG surgery decreases. Postoperative symptoms such as nausea, vomiting, and presence of GER, seem to be related neither to the LSG techniques nor the duration of liquid gastric emptying half-time.

Keywords: Sleeve gastrectomy; Gastric emptying; Scintigraphy; Reflux; Symptom

Introduction

The increasing prevalence of morbid obesity has led to a worldwide increase in bariatric techniques [1]. Different bariatric techniques cause different outcomes in terms of weight loss and reduction in obesity-related comorbidities [2]. Laparoscopic Sleeve Gastrectomy (LSG) is among the most popular techniques and it is based on the principle of resecting approximately 80% of the stomach with the guidance of a bougie placed into the stomach orogastrically and reforming the stomach into a tube shape [3].

Because it is a relatively straightforward procedure with relatively low postoperative morbidity and mortality rates resulting in an average of 60% weight loss in total body weight, LSG has gained popularity in the surgical treatment of obesity [4,5]. However, there is still debate regarding its indications and procedure. One of the controversial issues is the ideal distance between the gastric resection line and the pylorus (i.e., antrum resection vs. antrum preservation). Authors who

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suggest leaving more than 4 cm distance base this recommendation on the assumption that this approach results in fewer postoperative complications such as proximal leakage since the antrum and motor function of the stomach are both spared [6]. On the other hand, leaving less than 4 cm (i.e. 2 cm) between the gastric resection line and the pylorus is considered more effective in reducing BMI [7].

Although LSG has proven effective in providing long-term weight loss, the postprandial symptoms associated with this procedure can impair the quality of patients' life [8]. Abnormal gastric emptying may also be associated with GER [9].

In light of these conflicting results, we designed this study to investigate the impact of the extent of antral resection on postoperative complications of nausea-vomiting and GER, and the duration of gastric emptying.

Materials and Methods

Patients

A total of 60 obese (BMI>40 or >35 kg/m²) patients (49 females, 11 males, age range: 20 to 65 years, mean 40.3 years) who underwent LSG surgery between January 2017 and December 2018 were included. The symptoms and findings of GES were prospectively evaluated in the postoperative period (mean: 10 months, range: 3 to 12 months after surgery) in Selcuk University Medical Faculty Department of Nuclear Medicine. All patients were operated on by the same surgeon. There is an ongoing debate around the world regarding the two techniques, and to the best of our knowledge, there is no source to recommend which technique should be applied to which patient. Therefore, the technique to be applied for LSG was left to the surgeon's preference. Patients who have a 4 cm (AP group) or 2 cm (AR group) distance from the pylorus to the surgical border were noted using the hospital information system and recorded surgery compact discs. Gastric resection started 2 cm or 4 cm above the pylorus, up proximally to the gastro-esophageal junction. The patients were classified as symptomatic and asymptomatic according to the presence of nausea and vomiting. Also, patients were classified according to GER findings in GES. There was also a control group that included 20 patients undergoing GES for other reasons.

The study was approved by the local ethics committee of Selcuk University Faculty of Medicine (meeting date: no: 44824) and a signed informed consent form was obtained from all the patients participating in the study.

Gastric emptying scintigraphy

GES was evaluated in the postoperative period (mean: 10 months, range: 3 to 12 months after surgery). All patients fasted for the scintigraphy overnight. Liquid phase study was performed after oral ingestion of 150 milliliters of milk labeled with 300 microcuries (μ ci) technetium 99m (^{99m}Tc) Diethylenetriaminepentaacetic Acid (DTPA). Images were taken when the patient was in the supine position and was collected using a gamma camera (Siemens E-Cam Signature, Germany) equipped with low energy high-resolution collimator. Dynamic images of 1 min were acquired for 90 min which was started as soon as the patient drinks the radiolabeled milk. Anterior and posterior images were obtained and geometric mean was taken into account in calculating the duration of gastric emptying. Processing included both visual and quantitative analysis for later of which, a region of interest was drawn around the stomach. After that, a time-activity curve was generated and half time of gastric emptying half-time was calculated. Images obtained from the anterior

view were taken into consideration for visual analysis which was used for the assessment of GER. Images obtained from the anterior view were used for visual analysis and GER assessment. Detection of gastric activity refluxing into the esophageal region was considered as an indicator of GER.

Statistical analysis

Statistical analysis was performed using SPSS 21.0 (SPSS Inc. Chicago, IL, USA). Demographic and perioperative data were compared using Student's t-test. For continuous variables, descriptive statistics were calculated and expressed as mean \pm standard deviation. Categorical variables were presented as numbers and percentages. The Mann-Whitney U test was performed to compare the groups in terms of gastric emptying half-time values and presence or absence of GER. The p-value was considered significant when it was less than 0.05.

Results

Of the 60 consecutive patients included in the study, 35 (58%) were in the AR group and 25 (42%) were in the AP group. Table 1 summarizes the patient's characteristics. The mean of the gastric emptying half-time of the study population was shorter than the mean result of the control group (28.1 \pm 10.927 and 54.35 \pm 24.31 min, respectively) and this difference was statistically significant (p=0.0001). The gastric emptying half-time in the AR and AP groups was calculated as 28.69 \pm 11.80 and 31.64 \pm 12.56, respectively, the difference was not statistically significant (p=0.669).

GER was observed in 28 of 60 patients (47%) and the remaining 32 patients (53%), there was not any evidence of GER. When we looked at their results of the gastric emptying half-time, in patients with GER it was found as 25.75 min, and in the ones without, half-time of gastric emptying was calculated as 25.03 min and the difference was not statistically significant (p=0.095). Table 2 represents the relationship between gastroesophageal reflux positive and negative patients with

Table 1: Patient's characteristics.

	N
Age	
Study Population	60
Control Group	20
Sex	
Male	11 (%18.33)
Female	49 (%81.67)
Operation Techniques	
Antrum Resection	35 (%58.33)
Antrum Preservation	25 (%41.67)

Table 2: The relationship between gastroesophageal reflux positive and negative patients with gastric emptying half-time, laparoscopic sleeve gastrectomy techniques, and symptoms.

	GER positive	GER negative
Numbers of patients	28	32
Gastric emptying half-time	25,75	25.03
Antrum resection group	20	15
Antrum preservation group	8	17
Symptomatic	14	18
Asymptomatic	15	13

Table 3: Comparison of symptomatic and asymptomatic patients with means of gastric emptying half-time, laparoscopic sleeve gastrectomy techniques, and GER symptoms.

	Symptomatic	Asymptomatic
Number of patients	32	28
Gastric emptying half-time	29,90	26,03
Antrum resection group	16	19
Antrum preservation group	16	9
GER positive	11	17
GER negative	21	11

Table 4: Comparison of laparoscopic sleeve gastrectomy techniques in terms of gastric emptying half time, GER (+)/(-) patients, and symptomatic-asymptomatic patients.

	Antrum Resection Group	Antrum Preservation Group
Patients	35	25
Gastric emptying half-time	28,69	31,64
GER (+)	20	8
GER (-)	15	17
Symptomatic	16	16
Asymptomatic	19	9

gastric emptying half-time, LSG techniques, and symptoms.

Twenty patients (57%) in the AR group had GER and 15 patients had postoperative symptoms. The 8 patients (32%) and 15 (60%) in the AP group suffered postoperative GER and symptoms, respectively. The analysis performed to compare the presence of postoperative symptoms and GER in these two groups revealed no statistical difference ($p=0.165$, $p=0.109$, respectively).

While 28 patients (47%) were asymptomatic, 32 patients (53%) had complaints of postoperative nausea and vomiting. GER was observed in 40% of symptomatic and 54% of asymptomatic patients. When the analysis was performed to compare the mean of gastric emptying half-times of symptomatic and asymptomatic patients, no significance was shown (29.90 min vs. 26.03 min respectively, $p=0.241$). Similarly, the difference in presence of GER between symptomatic and asymptomatic patients was not found as statistically significant ($p=0.605$). Table 3 represents the comparison of symptomatic and asymptomatic patients with means of gastric emptying half-time, LSG techniques, and GER symptoms. Table 4 shows the comparison of LSG techniques in terms of gastric emptying half time, GER symptoms, and symptomatic-asymptomatic patients.

Discussion

Among bariatric surgery methods, LSG is the most effective method to ensure and maintain sufficient weight loss. The most important mechanism of LSG in weight loss is the volume of the residue stomach. To maintain the stomach's physiological emptying function, antral sparing is important. However, the residual gastric volume has not been standardized among surgeons, effects of different surgical approaches on food tolerance, change of gastric emptying duration, and their associations of postsurgical complaints have not been identified and conflicting results have been reported in the literature [10].

In our study, we investigated the gastric emptying duration for liquids in patients who underwent LSG with GES which is accepted

as the golden standard for the assessment of gastric motor function [11,12]. Although the solid phase is more sensitive in the assessment of the antrum, patients can show intolerance to solid foods in the first 3 months after the surgery.

Gastric emptying half-time for liquids was found as shorter than the mean result of the control group which was statistically significant in our study. Our results are concordant with the results of Braghetto et al. who showed an acceleration of gastric emptying for both solids and liquids after LSG [13]. Acceleration of gastric emptying for solids after sleeve gastrectomy was also reported by Melissas et al. [14]. On the contrary, Bernsteine et al. [15], evaluated the influence of sleeve gastrectomy on gastric emptying and suggested that LSG with antrum preservation has no effect on gastric emptying which emphasizes the role of antrum in gastric motor function. Although gastric emptying half-time was shorter in these patient groups compared to the control group, when we compared the GES results of the patients in the AP and AR groups, there was no difference.

Although Rubin et al. evaluated 120 patients who underwent LSG, in terms of postoperative early complications [16], did not find any severe complication and concluded that it is an efficient and safe procedure; following sleeve gastrectomy, symptoms such as postoperative nausea-vomiting, reflux can be frequently observed and can severely affect the patient's quality of life, particularly within the first year after the surgery. In our study, 32 of 60 patients were symptomatic and the difference of gastric emptying half-time between symptomatic and asymptomatic patients was not significant. Similarly, Burgerhart et al. [17] reported no significant correlation between gastric emptying half-time and severity of postoperative symptoms. Similarly, Abdallah et al. [18] investigated the effect of surgical distance to pylorus and concluded that more weight was lost as antral resection increased but there was no significant difference in terms of the complications. Keidar et al. [19] studied the presence of postoperative GER and gastric motility disorders in a large number of patients in two different centers and concluded that different surgical approaches such as the size of antral resection and bougie size were not effective in the development of this complication. In our study, no significant difference was demonstrated in terms of the presence of postoperative symptoms and GER between patients with 2 and 4 cm distance of surgical border to the pylorus. We were also unable to show a difference in gastric emptying durations between patients with GER and the ones without. We thought that acceleration in gastric emptying half-time for liquids after LSG may be secondary to modification in gastric functional anatomy, alteration of antrum-duodenal motor complex, or gastrointestinal hormonal modifications which were suggested by Braghetto et al. [13].

The unusual point of our study was evaluating gastric emptying duration and presence of GER in a single session by scintigraphy which is a noninvasive method compared to manometric techniques. Whereas the limitation was assessing the duration of liquid emptying time only. The effect of different surgical approaches on solid gastric emptying time could not be evaluated in our study because of observation of patient intolerance for solid foods.

Conclusion

Our study result suggests that gastric emptying half-time for liquids decreases after LSG. Most commonly seen postoperative symptoms of nausea-vomiting and the presence of GER seem to be related neither to the distance between the LSG techniques nor the

duration of liquid gastric emptying half-time.

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