Ulus Cerrahi Derg 2016; 32: 18-22
DOI: 10.5152/UCD.2015.2991

Comparison of laparoscopic sleeve gastrectomy and laparoscopic gastric plication: One year follow-up results

Şükrü Salih Toprak[1], Yücel Gültekin[2], Ahmet Okuş[3]

ABSTRACT

Objective: Various different surgical methods are used for obesity surgery. Among them, laparoscopic sleeve gastrectomy (LSG) and laparoscopic gastric plication (LGP) have been both successfully performed in recent years. In this study, we compared the treatment results of patients who underwent LGP, a method that was introduced later consisting of plication of gastric greater curvature to achieve volume reduction, with results of patients who underwent LSG.

Material and Methods: We analyzed data on morbid obese patients who underwent bariatric surgery with either LSG or LPG in Konya Beyhekim Hospital between 2009 and 2012. Demographic features including age and sex, preoperative blood biochemistry, body mass index (BMI) before and after operation, duration of hospital stay, morbidity, mortality and complications were analyzed.

Results: Fifty-five patients who were operated for obesity between 2009 and 2012 were included in the study. 29 patients underwent LGP, and 26 patients LSG. The BMI in the LGP and LSG groups was 41.4±3 kg/m^2 and 42.0±3.1 kg/m^2, respectively. There was no significant difference between two groups in terms of BMI. Two groups were also similar in terms of age and gender. In the LGP group, one patient had postoperative necrosis of the suture line. One patient in the LSG group was re-operated due to bleeding. Another patient in this group had leakage at the suture line. Postoperative BMI assessment of groups revealed significantly lower BMI levels in the LSG group. Length of hospital stay was significantly shorter in the LGP group. There was no significant difference in complication rates between two groups.

Conclusion: In this study, we obtained similar results in patients who were treated with LGP or LSG. Moreover, LSG was more efficient in decreasing BMI in morbid obesity surgery when compared to LGP. However, duration of hospital stay was significantly shorter in LGP group. We concluded that both methods could be effectively and safely used in the surgical management of morbid obesity.

Keywords: Obesity, sleeve, plication, laparoscopic

INTRODUCTION

Obesity is generally defined as a body mass index of 30 kg/m^2 and morbid obesity as being over 40 kg/m^2. Obesity emerged as a serious health problem in recent years due to the rise of the welfare in the society and malnutrition issues related to the modern lifestyle. Approximately 1.7 billion people worldwide suffer from obesity related serious health problems. The incidence of morbid obesity is reported as 3-5% in Western societies. Obesity has a mortality rate of approximately 0.1% in developed countries and leads to major healthcare cost. Morbid obesity related mortality often appears to be due to cardiovascular causes (1-4).

Bariatric procedures that have been implemented since the 1950s improved with both experience and technique over the years. With the introduction of laparoscopy to the surgical agenda in the 1990s, minimally invasive surgical technology began to be applied in bariatric surgery. Malabsortive methods, restrictive methods or their combinations are being applied for the surgical treatment of obesity. Gastric banding and laparoscopic sleeve gastrectomy (LSG) are two popular restrictive methods that have been applied to the present day for the surgical treatment of morbid obesity. In recent years, laparoscopic gastric plication (LGP) was introduced as another restrictive method in bariatric surgery. In this study, we aimed to compare LSG that is commonly used in the surgical treatment of morbid obesity with the recently introduced and popularized LGP (5-7).

MATERIAL AND METHODS

All patients who underwent LSG or LGP due to morbid obesity at Beyhekim Konya Hospital General Surgery Clinics by a single surgeon between the years 2009-2012 were retrospectively analyzed. Age, sex, and BMI on admission were evaluated. Preoperative levels of fasting blood glucose, aspartate aminotransferase (AST), alanine aminotransferase (ALT), triglycerides, cholesterol, and blood pressure were determined to investigate the presence of metabolic problems. The length of hospital stay was determined for both groups. All patients who underwent surgery were included.

[1]Clinic of General Surgery, Konya Beyhekim State Hospital, Konya, Turkey
[2]Department of Intensive Care, Hacettepe University School of Medicine, Ankara, Turkey
[3]Department of General Surgery, Konya Mevlana University School of Medicine, Konya, Turkey

Address for Correspondence
Yücel Gültekin
e-mail: drycl68@hotmail.com

Received: 20.11.2014
Accepted: 26.12.2014
Available Online Date: 18.08.2015

Available online at
www.ulusalcerrahidergisi.org

Indications for operation were specified as patients with BMI 35 kg/m^2 and above along with medical problems such as hypertension, diabetes mellitus and sleep apnea, and patients with BMI of 40 kg/m^2 and above. All of our patients have previously tried diet, medical treatment and did not get satisfactory results from lifestyle changes, behavior modification and other conservative methods, and have failed to lose sufficient weight.

Surgery was performed under general anesthesia in patients who underwent LSG. An intra-abdominal pressure of 12 mm-Hg was created. 10 mm trocars were placed in the subxiphoid, umbilical and the right subcostal-midclavicular line (for liver retraction), a 12 mm port in the left subcostal-midclavicular line (for stapler introduction), and a 5 mm trocar in the left subcostal-midaxillary line. The greater curvature was mobilized from the gastric fundus, down to 4-6 cm from the pylorus by using Covidien® LigaSure. Then with 42F bougie guidance, the stomach was resected vertically including the fundus, 4-6 cm from the pylorus. Hemostatic sutures were placed when required. A silicon drain was placed in the abdomen in all patients. Liquid foods were introduced on the postoperative 3rd -4th days.

In patients who underwent the other surgical method, LGP was performed under general anesthesia with an intra-abdominal pressure of 12 mm-Hg. 10 mm trocars were placed in the umbilicus, the left subcostal-midclavicular line and the right subcostal-midclavicular line (for liver retraction), 5 mm trocars in the subxiphoid and left subcostal-midaxillary line. The greater curvature was mobilized until the gastric fundus, 4-6 cm from the pylorus by using Covidien® LigaSure. With guidance of a 42F bougie, interrupted 1.0-26 mm silk sutures were placed from the pylorus to the fundus. The suture distances were set to be 2.5 cm and inward plication of the stomach was performed through the greater curvature. A silicone abdominal drain was placed when required. Liquid foods were started on postoperative day 2.

Wound infection, nausea and vomiting lasting for less than a week, atelectasis, hemorrhage treated with conservative approach, and non-life-threatening complications improving by medical treatment were considered as minor complications. Intra-abdominal abscess, intestinal leakage, bleeding requiring transfusion, pneumonia, acute respiratory distress syndrome, nausea and vomiting lasting longer than a week were considered as major complications. All patients were observed in the surgical intensive care unit on the first postoperative day. All patients operated by both techniques were evaluated in the first, sixth, and twelfth month and their follow-up data, particularly BMI, were recorded.

Statistical Analysis

Statistical Package for the Social Sciences (SPSS) for Windows 15 (SPSS® Inc., Chicago, IL, USA) was used for data analysis. Descriptive statistical analysis was performed. The Student t test was used to assess the difference between the groups. $p < 0.05$ was considered to be significant.

RESULTS

All 55 patients who underwent these operations were included in the study. Our study group consisted of 44 men and 11 women. The mean age was found to be 34.8±10.7 years.

Table 1. Groups according to age-gender and BMI

	Age (Mean±SD)	Gender Male	Female	BMI (kg/m^2) (Mean±SD)
Group 1 (n=29)	35.5±11.2	23	6	41.4±3.0
Group 2 (n=26)	33.9±10.4	21	5	42.0±3.1
P value	0.581	0.763		0.482

SD: standard deviation; BMI: body mass index

Table 2. Preoperative biochemical parameters and arterial systolic blood pressure value

Group		Mean	SD (±)
Group 1	FBG (mg/dL)	105.3	19.1
Group 2		103.5	19.5
Group 1	AST (U/L)	32.1	7.1
Group 2		31.6	3.6
Group 1	ALT (U/L)	33.6	6.5
Group 2		32.4	4.4
Group 1	Triglycerid (mg/dL)	216.6	35.7
Group 2		217.7	29.0
Group 1	Cholesterol (mg/dL)	214.6	30.5
Group 2		216.6	27.1
Group 1	Blood pressure (mm-Hg)	135.0	16.4
Group 2		131.7	15.6

FBG: fasting blood glucose; AST: aspartate aminotransferase; ALT: alanine aminotransferase; SD standard deviation

The mean body mass index of all patients was 41.7±3.0. The 29 patients with LGP constituted Group 1, and the 26 patients with LSG were called Group 2. There were 23 males and 6 females in Group 1. The mean age of Group 1 was 35±11.2 years. There were 21 male and 5 female patients in Group 2, with a mean age of 33.9±10.9 years. There was no statistically significant difference between the two groups in terms of mean age (p=0.581) and gender (p=0.763). The preoperative BMIs were 41.4±3.0 and 42.0±3.1 in Group 1 and Group 2, respectively. There was no statistically significant difference in terms of BMI between the groups (p=0.482) (Table 1).

Preoperative levels of fasting blood sugar, AST, ALT, triglycerides, cholesterol, systolic arterial blood pressure values were determined (Table 2), and they were similar between the two groups. All patients underwent preoperative upper gastrointestinal endoscopy procedure, and there were no abnormalities to either change operation plan or avoid operations. The length of hospital stay was 3.2±0.5 in Group 1 patients, and was 5.5±0.8 days in Group 2. The duration of hospitalization was found to be significantly less in favor of Group 1 ($p<0.001$). One patient in Group 2 was re-operated on the second postoperative day for bleeding, and hemostasis was achieved. Another patient in Group 2 developed a leak in the suture line on the fifth postoperative day and underwent subtotal gastrectomy. In the same group (Group 2), there was leak in the suture line in a second patient that was treated with hospitaliza-

Table 3. Comparison of LGP and LSG complications

	Number of patients	Bleeding (reoperation for hemostasis) subtotal gastrectomy	Suture line leak or necrosis (conservative management)	Suture line leak or necrosis	Minor nausea-vomiting	Mortality
LGP	29	None	1	None	5	None
LSG	26	1	1	1	None	None

LGP: laparoscopic gastric plication; LSG: laparoscopic sleeve gastrectomy

Table 4. Comparison of length of hospital stay and BMI in Group 1 and 2

	Group 1	Group 2	p value
Length of hospital stay	3.2±0.5	5.5±0.8	<0.001
1. month (BMI) (kg/m^2)	36.3±2.3	37.0±2.3	0.249
6. month (BMI) (kg/m^2)	30.7±1.9	29.7±1.9	0.072
12. month (BMI) (kg/m^2)	27.3±2.0	26.0±1.8	0.020

BMI: body mass index

tion and conservative management. A patient in Group 1 developed necrosis of the suture line on the fifth day and underwent subtotal gastrectomy. Also in this group (Group 1), minor complications such as nausea and vomiting for less than a week was detected in five patients. These complications resolved with hospitalization and medical treatment (Table 3).

The BMI of patients in Group 1 and 2 were assessed on the first, six and twelfth postoperative months. The mean BMI in Group 1 was found as 36.3±2.3, 30.7±1.9, 27.3±2.0, respectively. In Group 2, the mean BMI was 37.0±2.3, 29.7±1.9 and 26.0±1.8, respectively. There were no significant changes in BMI decrease between Group 1 and Group 2 in the first and sixth months, while the decrease was statistically significant in favor of LSG in the twelfth month (p=0.02) (Table 4).

DISCUSSION

Although the main etiologic factor is still controversial, genetics and environmental factors play a common role in the etiology of morbid obesity. One of the most common fatal complications of morbid obesity is sleep apnea, and medical treatment does not usually offer cure. Other major problems emerging in morbid obese patients can be listed as hypertension, dyslipidemia, diabetes and diabetes-related coronary disease, gastroesophageal reflux disease, degenerative arthritis and menstrual disorders in women (2, 8-10).

Currently, there are both medical and surgical options for the treatment of morbid obesity. Diet, lifestyle changes, intragastric balloon implementation, methods such as drugs that reduce appetite and disrupt absorption are being tested for the medical treatment of morbid obesity. Prior to surgery, a trial of medical treatment is widely accepted, despite its limited success (5, 11-13).

Surgical treatment of morbid obesity has been proven to provide long-term weight loss, and to improve morbid obesity related serious co-morbidities as well as quality of life. Many of these problems associated with morbid obesity either completely disappear or decrease with weight loss. The improvement with bariatric surgery in diabetes is reported as 76.8%, in hypertension as 61.7%, in hyperlipidemia as 83.6%, and in sleep apnea as 70.0% (2, 8-10).

Surgical treatment is recommended for patients with a BMI ≥40 kg/m^2 or with BMI ≥35 kg/m^2 along with co-morbidities when other treatment options fail (NIH Consensus 1991). Among the surgical treatment methods used are gastric and intestinal bypass, biliopancreatic diversion, band gastroplasty, sleeve gastrectomy and gastric plication. A 10-15% increase in patient survival is reported after a successful surgery. The implementation of morbid obesity surgery in experienced centers appears to have an approximately 1-2% mortality rate (7, 14-19). Surgery for morbid obesity is improving every day. The issue on which surgical method is more effective is still controversial. Therefore, our study aimed to identify the efficacy of LGP and LSG in the surgical treatment of morbid obesity and to reveal their superiority over each other.

There are numerous studies on LGP and LSG in the literature. Felberbauer et al. (20) applied LSG in 126 patients with an average follow-up of 19.1 months, and they detected more than 50% excess weight loss (EWL) in 64% of patients. However, in 7% of patients the EWL was below 25%. In their study, the only major complication was a staple line leak in one patient. Felberbauer et al. (20) stated that the effect of LSG was not clear in patients with morbid obesity, due to inadequate results obtained in 7% of patients. Noun et al (21) performed LSG on 122 obese patients between 2010-2012, and they reported a decrease in BMI from 33.2±2.5 kg/m^2 to 24.7±2 kg/m^2 by the twelfth month. They identified severe staple line leakage in 1.3% of patients, mild staple line leakage in 0.5%, and mortality in 0.1%. They stated that the LSG method is a successful and safe method. In the LSG group in our study, one patient developed a serious leak in the staple line, and another was re-operated for bleeding. There was no mortality in our patients. The BMI of our patients showed a steady decrease during postoperative follow-up at one, six and twelve months. In the LSG group, a reduction was detected from 42±3.1 kg/m^2 to 26.0±1.8 kg/m^2 on the 12th month. The BMI reduction in the LSG group was found to be successful in terms of surgical treatment of morbid obesity (21-23).

Atlas et al. (24) applied LGP to 44 patients in 2011-2012. The EWL was found to be approximately 50.7% on twelve months, and they concluded that LGP is a successful method in terms of weight loss in patients with morbid obesity. However, in the same study, nausea and vomiting was detected within the first ten days in 79.5% of patients, and 25% of patients had to be re-hospitalized for refractory nausea and vomiting. Therefore, they emphasized the incidence of nausea and vomiting and

associated readmissions as drawbacks of this method. In the present study, we evaluated BMI postoperatively in the LGP group. The initial BMI of 41.4±3.0 kg/m^2 was identified to be 27.3±2.0 kg/m^2 on the twelfth month. The results were satisfactory and consistent with the literature in terms of weight loss (13, 18, 25). The postoperative nausea and vomiting in our LGP patients was less frequent than that reported by Atlas et al (24). Only five of 29 patients (17.2%) had nausea and vomiting in our series. These symptoms resolved with medical methods or short-term hospitalization.

In their 2013 study, Dijian et al. (26) compared LSG and LGP in 39 patients. The mean length of hospital stay was 4.2±1.9 days in the LGP, and 3.9±1.7 days in the LSG group. There was no significant difference between the groups in terms of length of hospital stays, while it was concluded that LSG method was more effective in terms of weight loss than LGP method based on BMI follow-up data on postoperative first, third, sixth months. Abdelbaki et al (27) have published a similar study carried out with 140 patients in 2014. They evaluated their treatment with EWL in the sixth and twelfth months. The twelfth month EWL values in the LGP and LSG groups were 52.1±15.1% and 68.1±15.8%, respectively, in favor of LSG. Therefore, they concluded that LSG was more efficient in the treatment of morbid obesity. They found the length of hospital stay to be longer in the LSG group. In our study comparing LGP and LSG, the reduction in BMI was significantly more in the LSG group in the twelfth month. However, there was no significant difference between the 2 groups in comparison of first and six-month BMI values. Length of hospital stay in LGP and LSG groups were 3.2±0.5, 5.5±0.8 days, respectively. In our study, the length of hospital stay was significantly less in the LGP group as compared to the LSG group, similar to Abdelbaki et al. (27).

The results obtained in our study are consistent with many studies in the literature. However, the low number of patients (55 patients), short follow-up period (12 months), and the retrospective nature are limitations of our study.

CONCLUSION

Laparoscopic gastric plication method is a new method that was popularized after LSG in the surgical treatment of morbid obesity. We found that LSG was more effective than LGP for the surgical treatment of morbid obesity. However, LGP is a good alternative in the surgical treatment of morbid obesity with shorter length of hospital stay, an easier technique and reversibility. New randomized trials with long-term follow-up are needed in order to obtain results that are more precise.

Ethics Committee Approval: Since it is a retrospective study, we did not apply for ethical committee approval.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - Ş.S.T., Y.G.; Design - Ş.S.T., Y.G.; Supervision - Y.G., A.O.; Funding - Y.G., A.O.; Materials - Ş.S.T., Y.G.; Data Collection and/or Processing - Ş.S.T., Y.G.; Analysis and/or Interpretation - Y.G., A.O.; Literature Review - Y.G.; Writer - Y.G.; Critical Review - Ş.S.T., Y.G., A.O.; Other - Ş.S.T., Y.G., A.O.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study has received no financial support.

REFERENCES

1. National institutes of health consensus development conference statement. Gastrointestinal surgery severe obesity. Am J Clin Nutr 1992; 55: 615-619.
2. Mokhad AH, Bowman BA, Ford ES. The continuing epidemic of obesity and diabetes in the United States JAMA 2012; 286: 1195-1200.
3. Mokhad AH, Serdula MK, Diketz WH, Bowman BA, Marks JS, Koplan JP. The spread of the obesity epidemic in the United States. 1991-1998. JAMA 1999; 282: 1519-1522. [CrossRef]
4. Adami HO, Trichopoulos D. Obesity and mortality from cancer. N Engl J Med 2003; 348: 1623-1624. [CrossRef]
5. Guimaraes M, Nora M, Ferreira T, Andrade S, Ribeiro AM, Oliveire V. Sleeve gastrectomy and gastric plication in the rat result in weight loss with different endocrine profiles. Obes Surg 2013; 23: 710-717. [CrossRef]
6. Schauer PR, Ikramuddin S. Laparoscopic surgery for morbid obesity. Obes Surg 2001; 81: 1145-1179. [CrossRef]
7. Frantzides CT, Zografakis JG, Welle SN. Bariatrik cerrahi. In: Sayek İ, editor. Temel Cerrahi. 4. baskı. Ankara Güneş Tıp Kitabevleri 2013; 1333-1341.
8. Collier A. Bariatric surgery and diabetes. Indian J Endocrinol Metab 2012; 16: 230-232.
9. Maes HH, Neale MC, Eaves LJ. Genetic and environmental factors in relative body weight and human adiposity. Behav Genet 1997; 27: 325-351. [CrossRef]
10. Buchwald H, Avidor Y, Braunwald E, Jensen MD, Pories W. Bariatric surgery. A systematic review and meta-analysis. JAMA 2004; 292: 1724-1737. [CrossRef]
11. Buchwald H, Williams SE. Bariatric surgery worldwide 2003. Obes Surg 2004; 14: 1157-1164. [CrossRef]
12. Moser F, Gorodner MV, Galavani CA, Baptista M, Cheritien C, Horgan S. Pouch enlargement and band slippage. Surg Endosc 2006; 6: 1021-1029. [CrossRef]
13. Abdolbaki TN, Huang CK, Namos A, Neto MG, Talebpour M, Saber AA. Gastric plication for morbid obesity: a systematic review. Obes Surg 2012; 22: 1633-1639. [CrossRef]
14. Steinbrook R. Surgery for severe obesity. N Engl J Med 2004; 350: 1075-1079. [CrossRef]
15. Frantzides CT, Carlson MA, Moore RE, Zografakis JG, Madan AK, Puumala S, et al. Effect of body mass ındex on nonalcoholic fatty liver disease in patients undergoing minimally ınvasive bariatric surgery. J Soc Laparoendosc Surg 2004; 8: 849-855. [CrossRef]
16. Sjöström L. Surgical ıntervention as a strategy for treatment of obesity. Endocrinology 2000; 13: 213-320. [CrossRef]
17. Talebpour M, Motemedi SM, Talebpour A, Vahidi H. Twelve years experience of laparoscopic gastric plication ın morbid obesity: Development of technique and patient outcomes. Ann Surg Innov Res 2012; 22: 6-7. [CrossRef]
18. Ramos A, Galvao Neto M, Galvao M, Evangelista LF, Campos JM, Ferraz A. Laparoscopic greater curvature plication: initial results of an alternative restrictive bariatric procedure. Obes Surg 2010; 20: 913-918. [CrossRef]
19. Hess DS, Hess DW. Biliopancreatic diversion with a duodenal switch. World J Surg 1998; 22: 936-946. [CrossRef]
20. Felberbauer FX, Langer F, Shakeri-Manesch S, Schmaldienst E, Kees M, Kriwanek S, et al. Laparoscopic sleeve gastrectomy as an isolated bariatric procedure: intermediate-term results from a large series in three Austrian centers. Obes Surg 2008; 18: 814-818. [CrossRef]

21. Noun R, Chakhtoura G, Nasr M, Skaff J, Choucair N, Rkaybi N. Laparoscopic sleeve gastrectomy for mildly obese patients (body mass ındex of 30<35 kg/m^2): Operative outcome and short-term results. J Obes 2012; 2012: 813650. **[CrossRef]**
22. Padwal R, Kalerenbach S, Wiebe N, Birch D, Karmali S, Manns B, et al. Bariatric surgery: a systematic review and network meta-analysis of randomized trials. Obes Rev 2011; 12: 602-621. **[CrossRef]**
23. Fischer L, Hildebrandt C, Bruckner T, Kenngot H, Linke GR, Gelnrig T. Excessive weight loss after sleeve gastrectomy: a systematic review. Obes Surg 2012; 22: 721-731. **[CrossRef]**
24. Atlas H, Yazbek T, Garneu PY, Safa N, Denis R. Is there a future for laparoscopic gastric greater curvature plication a review of 44 patients. Obes Surg 2013; 23: 1397-1403. **[CrossRef]**
25. Niazi M, Maleki AR, Talebpour M. Short-term outcomes of laparoscopic gastric plication in morbidly obese patients: importance of postoperative follow-up. Obes Surg 2013; 23: 87-92. **[CrossRef]**
26. Dijian S, Huan Y, Yuedend W, Yun J, Xiaoli Z, Jinhiu Z, et al. Comparation of Short-term outcomes between laparoscopic greater curvature plication and laparoscopic sleeve gastrectomy. Surg Endosc 2013; 27: 2768-2774. **[CrossRef]**
27. Abdelbaki TN, Sharaan M, Abdel-Baki NA, Katri K. Laparoscopic gastric greater curvature plication versus laparoscopic sleeve gastrectomy: early outcome in 140 patients. Surg Obes Relat Dis 2014; 10: 1141-1146. **[CrossRef]**