Three-year experience of laparoscopic greater curvature plication in the treatment of morbid obesity

Mohamed Samir, Yasser Ahmed, Mohamed Ibrahim

Department of Clinical and Experimental Surgery, Medical Research Institute, University of Alexandria, Alexandria, Egypt

Correspondence Mohamed Samir Kamel, MD, MRCS, Surgical Department, Medical Research Institute, Alexandria University, 165 Horreya Street, Ibrahimeya, Alexandria, Egypt
Tel: 034297621, 034282373;
e-mail: mohamedsamir12@yahoo.com

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Background
Laparoscopic greater curvature plication (LGCP) is a new restrictive bariatric procedure. The aim of the present study is to report the outcome of LGCP in 40 morbidly obese patients over a period of 3 years of follow-up.

Patients and methods
All procedures were completed laparoscopically. The mean operative time was 123.5 min (85–200 min) and the mean duration of hospital stay was 1.1 days (1–3 days). No intraoperative complications were reported. The mean excess weight loss was 34.93 ± 19.85% at the end of the study.

Conclusion
LGCP is feasible and safe when applied to morbidly obese patients, but it has an unsustainable effect on weight loss.

Keywords:
gastric placation, laparoscopic, morbid obesity

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Introduction

The prevalence of obesity continues to increase worldwide at an alarming rate. A very high rate of obesity has been reported among Egyptians, especially among hypertensive Egyptian women, with an age-adjusted prevalence rate of 48.8% [1].

Gastric plication is a new restrictive bariatric procedure initially proposed by Tretbar *et al.* [2] and Wilkinson and Peloso [3]. Laparoscopic greater curvature plication (LGCP) was subsequently developed and introduced by Talebpour and Amoli [4].

In LGCP, the gastric wall is infolded to reduce the gastric capacity. It is performed without banding, partitioning, or transection of the gastrointestinal tract; instead, the reconfigured stomach is stabilized with sutures applied in multiple longitudinal rows. LGCP has resulted in minimal anatomic disruption and few complications.

The aim of this study is to report the effectiveness of this new procedure in terms of weight loss and morbidity in 40 morbidly obese patients over a period of 3 years of follow-up.

Patients and methods

All patients gave their formal consent. The protocol was approved the Ethical committee of the Alexandria university.

The patients' inclusion was according to the US National Institute of Health criteria for bariatric surgery [5].

Patients had to understand the risks, benefits, alternatives, necessary lifestyle changes, and expected outcomes.

Patients who did not fulfill the National Institute of Health criteria as well as patients who had undergone previous obesity surgery or extensive abdominal surgery or sweet eater were excluded.

All patients were subjected to the following: complete assessment of history including age of onset of obesity, dietary habits, previous attempts at weight reduction, and history of obesity comorbidity, clinical examination, and laboratory investigations including hormonal profile, and cortisol and thyroid profile.

Operative data of all patients were recorded including duration of the procedure, intraoperative complications, associated procedure, and cause of conversion if any.

Postoperative work-up included the following:

(1) Recording of postoperative complications, in the beginning and at the end of the study.
(2) Effect of operation on weight loss calculated at 1, 2, and at 3 years postoperatively in the form of:
    (a) Percentage of excess BMI loss (%EBMIL) calculated using the formula: (operative BMI–follow-up BMI)×100/(operative BMI–25).

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(b) Percentage of excess weight loss (%EWL) calculated using the formula: [(operative–follow-up weight)/operative excess weight]×100.

Surgical procedure

All surgical procedures took were performed under general anesthesia after administration of epidural analgesia and placement of pressure garments on both lower limbs. Low-molecular-weight heparin was administered 12 h before surgery; the procedure was performed in the French position. Pneumoperitoneum was achieved under vision using a five-trocar port technique. We started dissection of the greater omentum 4–6 cm from the pylorus. Dissection was performed using a harmonic scalpel (Ethicon Endo-Surgery Inc., 4545 Creek Creek Road, Cincinnati, OH 45242, USA) till the angle of His with complete mobilization of the fundus. The next step was to initiate gastric plication by imbricating the greater curvature over a 36 Fr bougie and applying a first row of interrupted stitches of 2-0 Ethibond (Ethicon Inc., Somerville, New Jersey, USA) sutures. This row guided another row created with a running suture line of 2-0 Prolene (Ethicon Inc.) or Ethibond. Intra-abdominal drains and gastrografin meal were performed optionally. In the postoperative period, patients were discharged as soon as they could be on a liquid diet without vomiting and received a prescription of a daily proton-pump inhibitor for 30 days. The postoperative diet was under the supervision of dietitian. Endoscopic evaluation was performed after 1 month in the first 10 cases.

Postoperative work-up included the following:

(1) Recording of postoperative complications in the beginning and at the end of the study.
(2) Effect of operation on weight loss calculated at 6 months and in the first, second, and third year of the study in the form of:
    (a) %EBMIL calculated using the formula: (operative BMI–follow-up BMI)×100/(operative BMI–25).
    (b) %EWL calculated using the formula: [(operative–follow-up weight)/operative excess weight]×100.
(3) Improvement or resolution of comorbidity and effect of operation on quality of life (QoL) was assessed using Moorehead–Ardelt Quality of Life Questionnaire II (MA QoLQII) [6]. Six items were used to measure a patient's subjective impression of QoL in the areas of:
    (a) General self-esteem,
    (b) Physical activity,
    (c) Social contacts,
    (d) Satisfaction in terms of work,
    (e) Pleasure related to sexuality, and
    (f) Eating behavior.

    All patients answered the questionnaire preoperatively and at the end of the study.
(4) Evaluation of gastric plication using 'updated BAROS' [7], which included analysis of weight loss, improvements in obesity comorbidities, and changes in QoL. This scoring system analyzes these three domains, assigning each of three or more points. The final score classifies the results into five outcome groups, from failure to excellent, establishing an objective definition of success (Fig. 1).

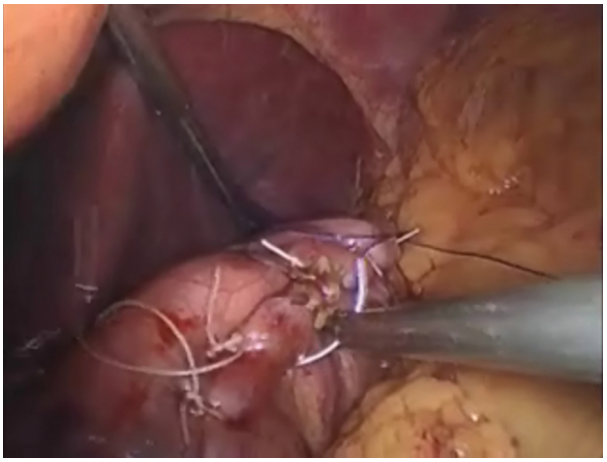
Statistical analysis

Statistical analysis was carried out using IBM SPSS, version 20 (PASW Statistics for windows, Chicago, SPSS Inc. USA).

Quantitative variables such as age, BMI, and weight were summarized by mean and median as measures of central tendency and SD, minimum, and maximum as measures of dispersion, whereas categorical variables were sex and preoperative eating.

Repeated-measure analysis of variance test was used to study whether there was a statistically significant difference in the mean weight, EWL, BMI, and BMI loss preoperatively, and 1, 2, and at 3 years postoperatively. The Mauchly test of sphericity was used to study the homogeneity of variance along different measures and the Greenhouse–Geisser test was also used. Post-hoc tests were used for pairwise comparisons for significant results. A parametric test was used because of the large sample size (>30) in each condition.

Figure 1



Second layer of plication.

All statistical tests were considered at a 0.05 significance level.

Results

Forty patients were included in this study, 34 women (85%) and six men (15%). Their age ranged from 18 to 50 years, with a mean of 34.26 ± 9.38 years. Majority of patients were in the third and fourth decades of life (47.6%). In all, 28 patients (70%) were obese from childhood, whereas 12 patients (30%) developed obesity in adulthood. In all, 26 patients (65%) were married (Table 1). The duration of follow-up ranged from 20 to 36 months, with a mean of 29.74 ± 3.73 months.

No conversion occurred in any of the 40 patients. The total operative time ranged from 85 to 200 min, with a mean of 123.45 ± 33.065 min, and patients' hospital stay ranged from 1 to 3 days, with a mean of 1.1 ± .37 days (Table 2). However, one female patient complained of frequent vomiting and underwent upper gastrointestinal endoscopy 1 week postoperatively; it was found that excess narrowing was present at the level of the gastric cardia and endoscopic relocation of mucosal fold was performed successively. The patient became well.

Intraoperative complications

In two female patients, there was excessive bleeding from the pancreatic surface during dissection of posterior adhesion between the posterior gastric wall and the pancreas, and this was controlled successively. None of the other 40 patients had major intraoperative complications.

Postoperative complications

None of the patients had major early medical complications (e.g. deep vein thrombosis, pneumonia, lung atelecatsis, pulmonary embolism, etc.), but two of our patients had to be reoperated in the first week because of leak from herniated fundus between sutures.

The first patient was a 46-year-old man with a BMI of 41 with controlled hypertension and the other patient was a 38-year-old woman with a BMI of 45 with no comorbidities.

(1) The female patient presented on day 2 with severe upper abdominal pain and fever; computed tomography indicated herniation of the fundus through the cardia with minimal leakage of dye and minimal collection left subphrenic.
(2) The male patient presented 1 week postoperatively with persistent fever, abdominal distension, and tachypnea. Computed tomography indicated supphrenic collection, left pleural effusion, pelvic collection, and leaking dye. Our male patient underwent repair of leak and reinvagination of the fundus. In the other patient, after reduction of the fundus from curra, the fundus was unhealthy and was excised by a stapler and layer reinforcement was performed for the suture line.
(3) Both of them lost weight satisfactorily during the first year; after that, the woman stopped losing weight and her BMI remained at 36. The male patient regained 10 kg of the total 25 kg he had lost during the first year.

However, one or more minor complications were experienced by a few patients (Table 3).

All patients had nausea, vomiting, and epigastric pain with varying degrees of severity and 80% of patients were dissatisfied during the first week because of these symptoms; however, they improved on prokinetics

Table 1 Demographic data of the 40 patients studied

Demographic data	*n* (%)
Age groups (years)	
<35	20 (50)
35–<45	15 (37.5)
45–50	5 (12.5)
Range (years)	18–50
Mean ± SD	34.26 ± 9.38
Sex	
Male	6 (15)
Female	34 (85)
Marital status	
Single	14 (35)
Married	26 (65)
Onset of obesity	
Childhood	28 (70)
Adulthood	12 (30)

Table 2 Technique

Operative details	Description
Operative time (mean ± SD)	123.45 ± 33.065
Conversion	No
Drain number [*n* (%)]	7 (17.5)
Associated procedures	
Laparoscopic cholecystectomy	3
Paraumbilical hernia repair	1

Table 3 Minor postoperative complications

Minor complications	Frequency [*n* (%)]
Surgical complications (minor)	
Wound seroma	1 (2.5)
Trocar site infection	5 (12.5)
Persistent vomiting	4 (10)

and proton-pump inhibitors. One female patient had frequent vomiting after resuming liquids and underwent endoscopic dilatation. Also, one female patient had excessive vomiting and underwent endoscopy on postoperative day 2; mucosal edema was present.

Assessment of weight loss

Preoperative weight of the patients studied ranged from 95 to 160 kg, with a mean of 117.79 ± 15.95 kg. One year postoperatively, the mean weight was 94.35 ± 15.197 kg, at 2 years of follow-up, the mean weight was 92.83 ± 16.272 kg, and at 3 years of follow-up, it was 97.35 ± 18.440 (Table 4), with a statistically significant weight regain during the third year of follow-up in relation to the mean weight at the 1 year follow-up ($P = 0.007$).

The mean %EWL at 1 year postoperatively was 39.48 ± 13.96%, at 2 years postoperatively, the mean was 42.06 ± 17.98%, and at 3 years postoperatively, it was 34.93 ± 19.85% (Table 5). There was a statistically significant difference between (%EWL) at 1 and 3 years of follow-up ($P = 0.013$), indicating significant weight regain.

The mean %EBMIL at 1 year postoperatively was 46.37 ± 17.01%, at 2 years postoperatively, it was 49.45 ± 21.81%, and at 3 years postoperatively, it was 40.81 ± 23.54% (Table 6). There was a statistically significant difference between %EBMIL at 1 and 3 years of follow-up ($P = 0.006$), indicating significant weight regain.

Six of our patients (15%) had completely regained their initial weight by the end of the third year of follow-up; two of them were offered a revision surgery in the form of sleeve gastrectomy and the other four are not considering another operation.

Eight of our patients (20%) regained more than 70% of the lost weight; the remaining patients stopped losing weight and they reported an increase in the amount of food consumption. Only nine (22.5%) patients in our series maintained satisfactory EWL (>50%) after 3 years.

Changes in preoperative comorbidities

Throughout the follow-up during the third year, we found that there was no improvement in the hypertensive and diabetic conditions of our patients (Table 7).

Two of patients who achieved improvement in their respiratory problems returned to the their previous conditions. In all, 50% of osteoarthrotic patients started complaining again from joint pains especially their knees.

Effect on quality of life

All patients were subjected to a diagrammatic questionnaire (MA QoLQII) and were required to answer six questions on the changes that occurred in their QoL postoperatively at the end of the first year. They had already answered the same questionnaire preoperatively. There were significant improvements in all categories of the questionnaire. Also, the overall score of the questionnaire had improved significantly.

The overall result of the operation was assessed at the end of the first year using the updated BAROS. It assessed %EWL or %BMI loss, effect on comorbidities, and QoL using MA QoLQII. Also, it evaluated the occurrence of complications or reoperations. The outcome of the operation was good in 18 patients (46.1%), very good in four patients (10.25%), fair in 12 patients (30.8%), excellent in one patient (2.65%), and failed in four patients (10.25%).

By the end of the third year, almost 40% of patients reported failure of the operation.

Discussion

Bariatric surgery is a promising option for morbidly obese patients with an average loss of two-thirds of excess weight within 1.5 years. Here, we present our experience with the technique of LGCP over a period of 3 years of follow-up in an attempt to explore and develop a low-cost procedure.

The mean %EWL in the present study was 34.93 ± 19.85 at 3 years of follow-up, which is considerably lower than that reported previously in the literature [4,6,8]. In the present study, most of our patients (85%) reported weight regain during the period of follow-up, which reflects the unsustainable effect of weight loss of LGCP.

Table 4 Weight range of the patients studied postoperatively versus preoperatively

	Preoperative weight (kg)	1 year postoperatively	2 years postoperatively	3 years postoperatively
Range	95–160	70–135	68–142	72–155
Mean ± SD	117.79 ± 15.95	94.35 ± 15.19	92.83 ± 16.27	97.35 ± 18.44

Talebpour and Amoli [4] reported a mean %EWL of 21.4% at 1 month, 54% at 6 months, 61% at 12 months, 60% at 24 months, and 57% at 36 months. In the publication of Skrekas *et al.* [8], the mean %EWL was 51.7% at 6 months, 67.1% at 12 months, and 65.2% at 24 months. Ramos *et al.* [6], in their series of 42 cases, reported a mean %EWL of 20% for the first month, 32% at 3 months, 48% at 6 months, 60% at 12 months, and 62% at 18 months.

Our result of %EWL was much lower than the published studies and we believe that this may be because of the lack of a standard technique for the operation or poor compliance of some of our patients to strict adherence of follow-up dietary instructions.

From the technical viewpoint, although we followed the same rules for most of surgeons as reported by Abdelbaki *et al.* [7], the patients who regained weight were divided into two groups after radiological and endoscopic examinations of the stomach.

Overall 70% of patients declared increased amount of food intake, despite the presence intact suture lines which was mainly due to increase size of the remaining stomach. The other group showed failure of the suture line, the fundus was back in its normal position storing food, and slowly emptying into the rest of the stomach; two patients showed complete disruption of the suture line, with the presence of suture material inside the stomach.

LGCP has not been associated with mortality. The minor complication of postoperative nausea and/or vomiting was reported by most of our patients in the current series, and by almost all patients in the previous LGCP studies.

Pujol Gebelli *et al.* [9] reported three patients with persistent vomiting; one patient had severe symptoms that required upper gastrointestinal endoscopy to relocate an invaginated gastric fold and facilitate passage. The other two patients required reoperation because of intractable vomiting and it was found that in one of them, there was a gastrogastric hernia, which required revision to sleeve gastrectomy, whereas the other patient required reversal of plication.

In the study of Talebpour and Amoli, complications included one case with persistent vomiting, which, on reoperation, was found to be caused by a single adhesion causing a kink in the plicated stomach, one case of early postoperative leak attributed to high endogastric pressure because of persistent vomiting, one case of acute prepyloric gastric perforation far from the suture line, and one case of intrahepatic abscess 6 months after the operation caused probably by an intrahepatic hematoma and treated with laparoscopic drainage.

Current evidence on LGCP is scant and has mostly been described in very small series with few patients followed beyond 6 months. Low cost, short hospital stay, absence of prosthetic material, and reversibility make it an attractive option.

Table 5 Percentage of excess weight loss postoperatively

	1 year postoperatively	2 years postoperatively	3 years postoperatively
Range (%)	3.92–63.82	−7.84 to 68.08	−15.83 to 59.57
Mean ± SD	39.48 ± 13.96	42.06 ± 17.98	34.93 ± 19.85

Table 6 Percentage of excess BMI loss at postoperative intervals

	1 year postoperatively	2 years postoperatively	3 years postoperatively
Range (%)	4.54–74.93	−9.8 to 85.85	−17.13 to 71.36
Mean ± SD	46.37 ± 17.01	49.45 ± 21.81	40.81 ± 23.54

Table 7 Changes in preoperative comorbidities after the first year

Comorbidity	*n* (%)	Postoperative			
		Resolved	Improved	Unchanged	Aggravated/new complain
Major					
HTN	6 (14.3)	1	4	1	0
DM	3 (7.1)	1	1	1	0
Dyslipidemia	4 (9.5)	2	2	0	0
Respiratory	10 (23.8)	0	8	2	0
Osteoarthritis	22 (52.4)	3	16	3	0
Infertility	0	0	0	0	0
Minor					
Lower extremity venous stasis disease	10 (23.8)	0	8	2	0
GERD	0	0	0	0	7
Urinary stress incontinence	4 (7.1)	0	4	0	0
Menstrual irregularities	2 (4.8)	2	0	0	0

DM, diabetes mellitus; GERD, gastroesophageal reflux disease; HTN, hypertension.

Further research is required to determine the appropriate indications for LGCP.

The current study found that, over a period of 3 years, LGCP is safe, but it has an unsustainable effect on weight loss.

Acknowledgements

Conflicts of interest

None declared.

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