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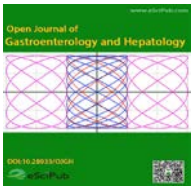

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LAPAROSCOPIC SLEEVE GASTRECTOMY FOR SUPER – SUPER OBESE PATIENTS (BMI>60 KG/M^2) - SINGLE INSTITUTION EXPERIENCE

Ludmil MARINOV MD*[1], Daniel KRAWCZYKOWSKI MD[2], Jean GUGENHEIM MD[3]

[1]Department of General Surgery, Medical Center of Brignoles, France
[2]Department of General Surgery, Medical Center of Brignoles, France
[3]Professor, University hospital of Archet, Nice, France

ABSTRACT

Background: According to the official WHO publications, obesity became one of the greatest public health challenges of the 21st century. In addition to causing various physical disabilities and psychological problems, excess weight drastically increases a person's risk of developing a number of noncommunicable diseases (NCDs), including cardiovascular disease, cancer and diabetes. The risk of developing more than one of these diseases (co-morbidity) also increases with body weight gain. Obesity is already responsible for 2–8% of health costs and 10–13% of death cases and the numbers rise progressively. **Objective:** To perform retrospective analysis of medical records data of patients with very specific range of morbid obesity (super-super obesity- BMI >60) with laparoscopic sleeve gastrectomy and systematized preoperative criteria and morbid risk for surgical treatment. **Methods:** Our study includes group of 13 patients with BMI>60 kg/m2. All patients taking part in the program for treatment of morbid obesity meet the criteria of the national regulatory health system. LSG was performed following official description. We conducted a 6, 9, 12, 24, 36, 60 months follow up of patient's status and evaluation of quality of life, and we presented the percentage of excess weight loss (EWL). **Results:** Evaluation of preoperative consultations and clinical examinations permitted to perform as first step Laparoscopic SG for all patients. Postoperative results were very satisfying for nine of our (69 %) patients. Three patients after interval of 10-15 months obtained complementary second step operation - duodenal switch. We found that LSG is effective procedure for SSO patients. **Conclusion:** The group of Super-super obese patients is very specific because conservative treatment is usually not effective, limited and only weight loss surgery may propose acceptable results. Patients with BMI super to 60 kg /m2 presented satisfying results of LSG, their co-morbidities are not absolutely contraindications, and only well conducted preoperative and long term postoperative evaluation may give good results. Preservation of the anatomy of the gastrointestinal tract permitted to perform all diagnostic procedures.

***Correspondence to Author:**
Ludmil MARINOV MD
Department of General Surgery, Medical Center of Brignoles, France
Consultant of General Surgery

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Introduction

According to the World Health Organization (WHO), Europe had the second highest proportion of overweight or obese people in 2014, behind the Americas. Globally, in 2014, 39 % of men and 40 % of women aged 18 or over were overweight. This share rose above 58 % in Europe and the Americas. By contrast, it was considerably lower in Africa and south East Asia [(1)].

The number of overweight and obese people has been growing in recent years and many people find it increasingly difficult to maintain a 'normal' weight in today's largely obesogenic environment. This environment spans from low breastfeeding rates to difficulties in geographically or financially accessing the ingredients of a healthy diet, to a lack of cooking skills, to the abundance and marketing of energy-rich foods, to urban planning choices and lifestyle pressures that often reduce the opportunity for physical activity (both at work or for leisure).Obesity is no longer a problem exclusive to high-income countries – over 60% of all obese individuals live in low- and middle-income countries.

The prevalence of obesity has risen up to three-fold in the last two decades. Half of all adults and one in five children in the WHO European Region are overweight. Of these, one third are already obese, and numbers are increasing fast unless obesity is urgently addressed, it will increase premature mortality and undermine economic development [(2)].

In the 1990s, the World Health Organization (WHO) decided that a BMI of 25 to 30 should be considered overweight and a BMI over 30 is obese. Some authors studying population of rare cases of obese patients define subgroups - Obesity>30 kg/m^2, Morbid obesity>40 kg/m^2 Super Obesity>50 kg/m^2 and Super Super Obesity >60 kg/m^2 [(3)].

Recent statistics confirmed proportional rising of each group, as super –super obese. Mainly these patients have specified co-morbidities that cause necessities of preoperative evaluation, before definition of the most effective save surgical method – the only treatment that may propose long –term weight-loss [(4,5,6)].

SLEEVE GASTRECTOMY-PROCEDURE

History

The sleeve gastrectomy (SG) became a gold standard of treatment of morbid obesity. Its earliest development was originally the restrictive component of the bilio pancreatic diversion with duodenal switch procedure (BPDDS). The laparoscopic approach and the evolution of a reduced pouch volume have demonstrated results comparable to other stapling procedures. It was Doug Hess, in Bowling Green, Ohio, who performed the first open sleeve gastrectomy in March of 1988 later followed by Picard Marceau in Quebec as part of what is now known as the BPDDS[(7)].

In 1999, De Csepel, Jossart, and Gagner developed the first laparoscopic approach to the BPDDS on a porcine model [(8)]. The earliest experience was in higher risk patients with super super-morbid obesity as a safer staged procedure but this quickly developed into a single-stage stay alone SGoption for lower BMI patients.

The reason staged approach is safer in higher BMI patients is because of weight reduction and less comorbidity at the second stage if needed [(9,10.11)], use of more atraumatic operative technique as laparoscopy and introduction of strong postoperative relations between the patient and the bariatric team for long term follow up.

Technique

Position and instrumentation

LSG consist of longitudinal vertical 2/3 gastric resection and forming a tube starting from antrum, 6 cm from pylorus up to the angle of His. The patient is placed in the supine position 12-15 degrees with open legs (French position). The surgeon is positioned the between the legs of the patient [11,12,)].

The classic configuration is a 12 mm port in the supraumbilical position for a 30º scope, two additional 12mm ports at each flank to serve as the working channel for the leading surgeon, two 5mm ports located at the epigastrium for retraction of the liver, and a final more lateral port at the left flank to perform traction of the omentum and the stomach (**Fig.1)**.

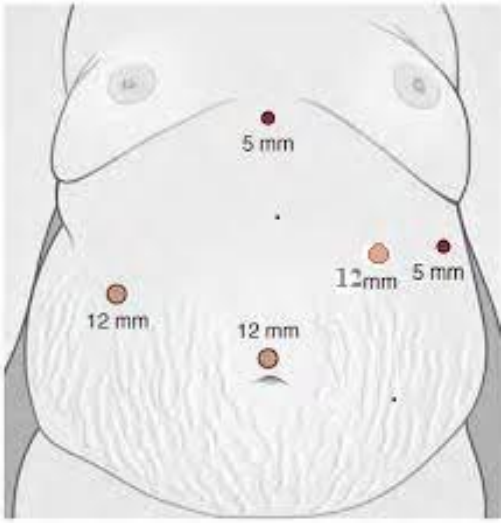


Fig.1 Trocars positions

Step 1. To open the ligament gastro frenicum and to expose the cardia and the left crus. Use of ultrasonic dissection is recommended.

Step 2. Mobilization - the second step is to section of the major omentum and cutting vascular supply of great curvature. This action is recommended to be performed with ultrasonic and start from antrum, 6-8 cm from pylorus or point, right to the prolongation of nerve of Latarjet on the antrum up to angle of His and visualization of the left diaphragm crus. It is necessary to perform mobilization of all gastro-pancreatic adhesions.

Second approach proposes opening of the ligament gastro colic on the middle of great curvature, followed by severing the stomach up to the cardia before freeing the greater curvature [13].

All of them need mobilization and hemostasis of the posterior and right side of cardia to prevent bleeding from spleen and the short vessels.

Step 3. Stapling-calibrated longitudinal gastrectomy is performed under 36 Fr tube of Faucher to control the diameter of the remaining stomach. Stapling is performed using staplers according to the recommendations for medical devises-the height of the staple and the thickness of the stomach anatomical part **(Fig.2).**

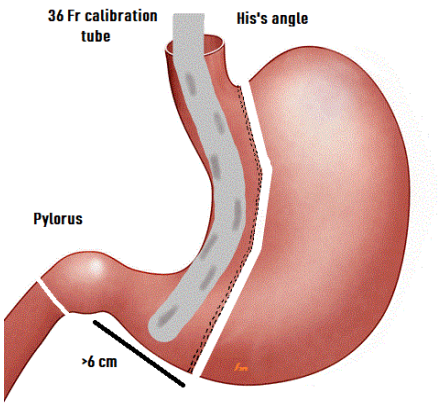


Fig.2 LSG-resection points

Consensus decision of manufactures and medical experts accepted that the antrum is thicker and needs higher staplers. [14,15,16] Chekan highlights the variable nature of the operated on organ wall thickness, which can be influenced by location, sex, age and preoperative features. The studies on complications after laparoscopic sleeve gastrectomy confirm the importance of surgeons' knowledge of the thickness of the operated on organ's wall.

Table 1. Dimensions of commonly available staple cartridges used at gastrointestinal surgery according to tissue thickness

Color	Row	Tissue type	Open staple height	Closed Staple height	Range of tissue thickness mm
Grey	6	Mesentery	2.0	0.75	2.0-3.25
White	6	Vascular	2,5	1	1.0-2.0
Bleu	6	Standard	3.5	1.5	1.5-1.75
Gold	6	Standard	3.8	1.8	1.8-3.0
Green	6	Thick	4.1	2.0	2.0-3.25

It is recommended to avoid placing the mechanical suture too close to the bougie to prevent bleeding, stenosis and leakage. Final cutting need to be minimum 1 cm from angle of His- vascularization at this height is poor. In this stage, to avoid resection line bleeding, depending on the preferences one may use single clips application, GORE® SEAMGUARD® Bioabsorbable staple line reinforcement material or single suture.

Step 4. After extraction of the excised part of the stomach and abdominal toilette, it is strongly recommended to perform routine IOLT (intraoperative line test) after SG.Injection of 100 ml Blue Methylene solution by the calibration tube after clamping of pylorus must confirm tightness of the resection line and avoiding the most rarest complications-leaks and fistulas.

RESULTS

Patient characteristics

We selected 76 patients with BMI >50 kg/m^2 who obtained Laparoscopic Sleeve Gastrectomy (LSG) as method of choice proposed by bariatric surgeon. From this group, 13 patients were with BMI > 60 kg/m^2 and were classified as Super Super Obese (SSO). The mean age of women was 31 years (range 17÷61). The mean weight was 165, 8 kg (143-207 kg). Average BMI was 66 kg/m^2 (60.0 -85 kg/m^2). Three SSO men are included in the statistics: Mean age of 32 years (range 27-41 year), with mean weight of 187 kg (range of 196 ÷175 kg). The mean BMI was 64.3 kg/m^2 (range 62.6÷65.9).

LSG - technique

All of them were examined and selected for Bariatric surgery according to the medical instruction of good practice by Health authority. Preoperative consultation with gastroenterologist, psychiatrist and dietician was followed, just before the approval of the regional commission.

The patients were operated by previously described surgical technique. Laparoscopic approach was performed in all thirteen patients. In one patient intraoperative complication imposed laparotomy. Dissection of greater curvature by Himpen's methodology was performed in nine and in three starting by middle

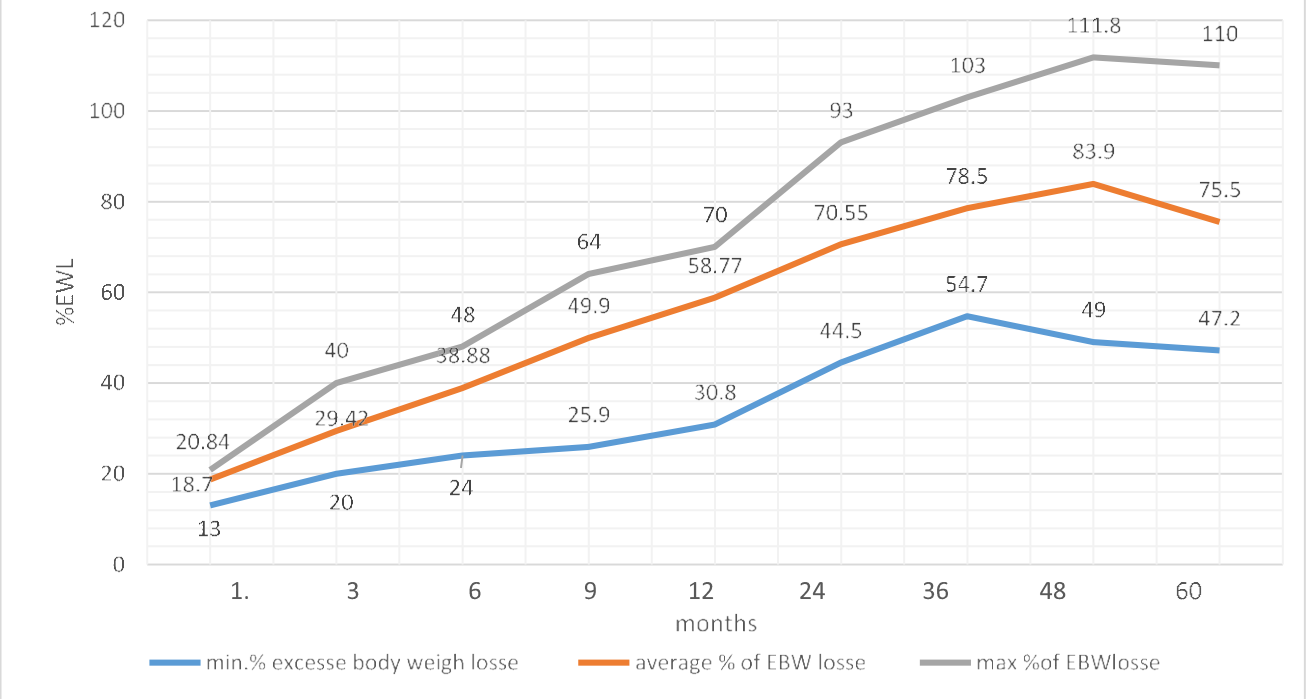
point. Sleeve resection was performed under calibration of 36 Fr tube of Faucher to avoid narrowing. The stapling line started strongly 6-8 cm from pylorus. Dimension of staplers were type Gold – with open stapler height 3.8 mm and closed 1.8 mm in six cases as single type, combination of Gold-Green – in four patients and in three as single type Green. Reinforcement of resection line with clipping was taken in four patients with resection used Green stapler as single model and in two patients with combination of Green –Gold.

Intraoperatively all LSG were tested for tightness of resection line searching defect and leaks with Blue Methylene. Operative time ranges between 125 minutes (the first year of introduction of LSG method) and 55 minutes now. There is an exception of 960 minutes for a patient with abdominal intraoperative complication. Post-operative gastrografin Swallow test was performed at first day and considered well calibrated in nine and slightly large in three without any resizing at 3 years. The hospital stay was mean 5 days (range 2÷8 days).

Postoperative Follow up

We used patient's documentations for 6 weeks, 3, 6, 12, 24 and 36 months for bariatric follow up. A surgeon in a relation with the patient's general practitioner conducted all laboratory tests. We have sent a questionnaire asking information for the condition of the patient and their opinion about their social realization.

The data of preoperative patient's weight and height, forming a group of 13 patients with BMI > 60 kg/m^2, classified as Super-Super Obese. Follow up documentations permitted to obtain real information about BMI evaluation 100% (13 patients) at 3 weeks, 3, 6 and 12 months, 53% (7patients) at 24 months; 30 %(4 patients) at 3 and 10 years. Last two numbers were obtained by telephone, internet and personal letter communication the last 2 months.



Graphic 1. Short-term excess weight loss

Nine of the patients (69%) had single LSG with well average results for this type of operation, compared to the recent publications. Three patients (30%) unless no good results after second examination obtained second step Duodenal Switch at period of 10 to 15 months

after LSG According to Diagram 1, the percentage of excess body weight loss after LSG in group of SSO patients at 3 months is 29.42%, respectively 38.88 % at 6 months , 49.9 at 9 months , 58.77% at 12 months , 70.55% at 24 , and 78.55% at 36months ,results comparable with the results most cited in literature reviews **(17,18,19,20,21,22,23,24,25).**

Tab.2 EWL –literature review

Author	Ps numbers	Pre op BMI	Follow-up Months	% EWL Months	Morbidity Rate (%)	Mort Rate (%	Weight Regain (%)
Dupree et al(2018) **(20**	86	67.4	6	NR		0.14	
Weiner et al. (2007) **(21)**	120	60.7	60	NR	17.5	0.8	13.3
Cottam et al. (2006) **(22)**	126	65.3	12	NR/46	14	0.8	NR
Catheline et al. (2006) **(23)**	4	65	6	40/NR	25	0	0
Baltazar et al. (2005) **(24)**	7 7 16	61-74 >40 35-43	4-27 4-16 3-27	56.1 33.6-90 62.3	6.7	3.3	NR
Regan et al. (2003) **(25)**	7	63	11	NR/33	42.8	0	0
Marinov et al. 2019	13	65.15	**6 months (100%)** **12 m (100%)** **24months (53%)**	**38.88 (6 m)** **58.77(12 m)** **70.55(24 m)**	**19.4**	**7 (1 pt.)**	**14 (2pts.)**

Comorbidities

Comorbidities were assessed preoperatively in attempt to ameliorate intra and postoperative vital conditions of the patient **(Tab. 3).** SSO patients usually present one or more comorbidities.

Tab.3 Comorbidities before operation and results after 5 years later

COMORBIDITIES					
	Total Before LSG	Aggravation/ Appearance	No change	Amelioration	Disappear
Diabetes mellitus	3			3	
Hypertension	3		1	1	1
Migraine	3	1			2
SAS	5			2	3
GERD	1			1	

Early remission of Diabetes mellitus type 2 has been reported by many authors **(26, 27,28), 29).** Hypercholesterolemia was corrected and was not significant. All patients obtained

intraoperative fine needle biopsy - in seven of them liver changes in different stages were discovered -from liver steatosis in four cases to hepatitis, cirrhosis and fibrosis in two cases.

Postoperative complications including vomiting at early postoperative period, asthenia and pleural effusion were found. No surgical interventions were used to resolve this. One patient died at ninth postoperative month after attempt of surgical treatment of postoperative eventration-patient presented tracheal stricture after tracheostomy and died after prolonged cardiopulmonary insufficiency.

DISCUSSION

LSG is newly introduced and well accepted operative technique for the last decade. The stomach is surgically stapled and sealed using a calibration guide tube to measure the size of the stomach tube left behind, removing around four-fifths of the stomach permanently. This is one restrictive procedure, which reduces food and drink intake, caused by smaller, near to 200 ml new stomach. It is restrictive for hormonal influence –resection of great curvature decrease part of stomach responsible for Ghrelin secretion –appetite stimulation hormone. It is proposed and used as single method of treatment in patients with BMI > 30kg/m^2 or first stage of combination with second stage Duodenal Switch to patients witch BMI >50 kg/m^2 , classified in group Super obese(SO) , and more often for patients with BMI >60kg/m^2 – group named Super -Super obese (SSO). The wide acceptance of Sleeve gastrectomy may be explained with the great effectiveness in young patients and patients with significant operative risk factors as advanced liver diseases (steatosis, hepatitis, cirrhosis), cardiopathy – arterial hypertension, pneumopathy with dyspnea and SAS (Sleep apnea syndrome). Contraindications for LSG include previous gastrectomy; severe GERD, Barret's esophagus, patient's choice. Absolute contraindications to sleeve gastrectomy, and to any bariatric procedure, are mental/cognitive impairment, advanced neoplasia, unstable coronary artery disease.

In comparison to other bariatric procedures LSG presents many advantages as low rate of intra and post-operative complications, lack of foreign body, no gastrointestinal bypass and anastomosis; preserving pylorus sphincter with fastest than normal "gastric" emptying, which avoid peptic ulcers. Lack of gastrointestinal bypass avoid risk of intestinal obstruction, internal hernias, small percent of vitamin deficiencies, osteoporosis and protein malnutrition. Bleeding from stapled gastric line is the first most usual intraoperative complication and usually may be diagnosed immediately after section. Used of no compatible to the gastric anatomy dimensions of stapler is the explanation. In addition clipping or separate suture is placed for reinforcement.

Still the most dangerous complication is fistulas appearing in the upper third of the resection line at cardia. Principal explanation is poor vascularization and ischemia after resection and the use a stapler that is not the correct one**.**

Diagnosis of fistulas which leak and resection line hemorrhage needs multidisciplinary team of surgeon, radiologist, resuscitator and gastroenterologist to specify gravity and treatment steps to avoid complications. Failed LSG as insufficient weight loss followed by weight regain, with recurrence of previous or appearance of new comorbidities may be seen in recent publications [(30)]. Two hypotheses are accepted: technically, not correct calibration at time of resection or insufficient stomach fundus resection, followed by remnant stomach dilatation. In addition, there is denervation that provokes stomach tube muscle distortion. Re-sleeve can be performed if the sleeve is too large (>300ml) and the patient is regaining weight or conversion to RYGB mainly for intractable GERD.

Percentage of EWL in our group of patients is acceptable compared to other publications concerning methods and BMI of patients. That means that well technically performed procedure

and long-term specialist follow-up may lead to the expected results.

CONCLUSION

LSG present now method of choice for patients with BMI >60 kg/m^2 forming group of SSO. Low-grade traumatic procedure, avoidance of anatomical misplacement and organ bypasses, this technique proposes lifesaving option for patients with high-grade comorbidities. High patient's weight, respectively BMI, and sex are not contraindications for this procedure. Preoperative preparation, as preoperative weight loss is recommended, but not exactly mandatory if operation is indicated and preparation is in time. Preoperative multi-specialist team consultations are necessary to evaluate comorbidities and starting correction to optimize patient's vitals parameters. The second step including duodenal switch (DS) is to be considered if no satisfied percentage EWL is found in the interval of 6 to 12 months after LSG. Finally, LSG proposes good choice for all patients with morbid obesity, especially SSO.

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