Outcome Of Laparoscopic Sleeve Gastrectomy Versus Duodenal Switch In Management Of Morbid Obesity

Mahmoud A. Abd El-Razik, Mahmoud A. Abdel-Reheem, Omnia M. Hassan

General Surgery, Faculty of Medicine For Girls Al-Azhar University
O_rabie2003@yahoo.com

Abstract: ***Background***: Laparoscopic Sleeve gastrectomy (LSG) has gained enormous popularity as bariatric procedure, not only as first step in high-risk or super-obese patients but mainly as a sole and definitive operation in morbidly obese. Biliopancreatic diversion with duodenal switch (BPD/DS) is one of the most effective and durable procedures in terms of weight loss. ***Aim***: This study was designed to evaluate the results of LSG versus BPD/DS on complications, body mass index (BMI), excess weight loss (EWL), and comorbidities resolution. ***Methods***: Eighty obese patients were included in this study, were divided into two groups, the first group (mean BMI 44±6) include 40 patients underwent open BPD/DS, while the second group (mean BMI 42±5) included 40 patients underwent LSG. Analysis of demographic, operative data, complications and outcome. ***Results***: Mean operative time was 180±40min in group I and 95±25min in group II. Length of hospital stay was 9±2 days in group I and 3±1 days in group II. Conversion rate was 2.5% in group II. Mortality was 2.5% in group II . Major postoperative complications were registered in 18 patients in group I while only 2 patients in group II . In 7 cases, reoperation was needed in group I while one patient reoperation was needed in group II. The mean EWL 86.7% in group I and 63.5% in group II. Diabetes, hypertension, and hyperlipidemia were cured in 87.5%, 83.3%, and 100% in group I and 83%, 80%, and 100% successfully in group II . **Conclusion**: LSG can be performed for the majority of morbid obese patient . when surgery is indicated as a first step. The other mal-absorptive surgical component can be added later when LSG failed fulfill the attended goals of surgery in these cases. BPD/DS is a complex procedure associated with increased operative times hospital stay , and higher postoperative complication rates.

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1. Introduction

Surgical intervention for the control of morbid obesity and weight-related comorbidities has now become widely accepted as the most effective treatment option available[1]. Scopinaro *et al.*[2] introduced the biliopancreatic diversion (BPD) in 1979, combining a distal gastrectomy with a long enteric bypass. Hess *et al.* [3] subsequently modified this procedure by combining it with a Demeester[4] duodenal switch (described for treatment of bile reflux gastritis) to create the modern BPD/DS procedure for morbid obesity. LSG is derived from the BPD/DS[5,6]. Sleeve gastrectomy functioned as the restrictive component of the procedure. Later, LSG was advocated as the first step of a two-staged procedure for high-risk patients, with the intention of reducing co-morbidities and operative risk, and to be followed by either BPD/DS or laparoscopic Roux-en-γ gastric bypass (LRYGB)[7,8]. However, often, satisfactory weight loss was achieved after LSG, and second stage procedures were found to be unnecessary[9]. The success of the sleeve can be attributed to two main factors. First, a high-pressure system is conceived from a narrow lumen with the pylorus intact, which results in optimal restriction and improved satiety[10]. Second, appetite suppression is achieved by removing the gastric fundus, the ghrelin-producing portion of the stomach. Numerous studies indicate that sharp declines in fasting and postprandial levels of this orexigenic hormone following LSG cause a long-term reduction of hunger feeling, which significantly reduces intake[11].

2. Patients and Methods

This study was conducted at Al-Zahraa University Hospital, from January 2005 to December 2010. Eighty obese patients were randomly included in this study, were divided into two groups. The first group included 40 patients underwent open BPD/DS, while the second group included 40 patients underwent LSG. Indications for surgery in this study was (i) patients with BMI ≥40kg/m^2 with previous failed attempts at losing weight by diet and exercise, (ii) patients with BMI 35-40kg/m^2 with co-morbidity in which surgically induced weight loss is expect to improve these disorders, such as diabetes, hypertension, hyperlipidemia. Contraindications for surgery in this study, (i) Patients who is unable to participate in prolonged medical follow-up, (ii) Non stabilized psychotic disorders, (iii) Alcohol abuse, (iv) Diseases threatening life in the short term.

Preoperative evaluation including age, sex, BMI, clinical evaluation mainly blood pressure, chest and heart examination. Laboratory investigations mainly complete blood picture, plasma glucose levels, lipid panel, serum calcium and serum albumen. Preoperative management should include; (i) Assessment of general health and nutritional status, (ii) Explanation of the dietary changes that are required after surgery, (iii) Ensuring that the patient is fully informed on the benefits, consequences and risks of the surgical options and the necessity of lifelong follow-up, (iv) Ensuring that the patient understands the limited outcomes of surgery, (v) In addition to the routine preoperative assessment as for any other major abdominal surgery, the patient may undergo further assessment such as pulmonary function test, endocrine disorders, gastro-esophageal disorders.

The patients were admitted on the morning of the surgery and subcutaneous heparin and graduated compression stocking are used for deep vein thrombosis prophylaxis.

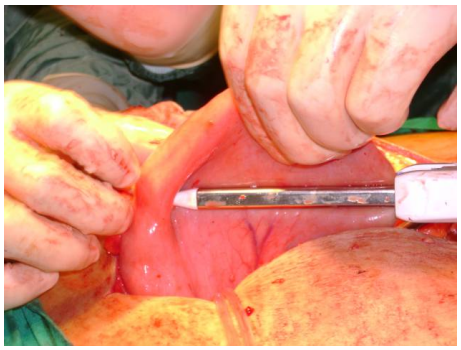
Surgical technique:

(i) The BPD/DS performed by an open approach. The sleeve gastrectomy is performed by mobilizing the greater curvature of the stomach distally to about 4cm past the pylorus and proximally to the angle of His, using a thermal sealing and ligation of short gastric vessels. To create the stomach tube, resection is typically begun along the greater curvature about 6cm proximal to the pylorus using linear stapler with serially firing toward the angel of His, (Fig. I). The stapler is applied alongside a 40F or a 60F bougie to create a stomach tube with a capacity of 150 to 250mL. Any bleeding site is ligate. The mal-absorptive component of the BPD/DS is a result of 2 anatomic changes: first, the duodenum is surgically divided several centimeters distal to the pylorus. Second, the ileum is divided approximately 250cm proximal to the ileocecal junction. The distal divided end of the ileum is then anastomosed to the proximal divided duodenum, forming the alimentary limb. The distal divided duodenum is closed. The remaining small intestine, containing only bile and pancreatic secretions, is anastomosed in an end to side manner to the distal ileum, typically 100cm proximal to the ileocecal junction. All anastomoses are hand sewn, and the alimentary limb is placed in the retrocolic position. A drain is left for 7 days. (ii) The LSG performed using five port positioning and two of the ports are 12mm while the rest are 5mm. After the liver is retracted, a 36F calibration tube is then inserted along the lesser curve of the stomach and the lesser sac is entered 6cm proximal to the pylorus which is the point where the sleeve gastretomy is performed. As the greater curve is mobilized proximally, a linear stapler or Echelon are used to perform the sleeve gastrectomy follows in parallel (Fig. II).

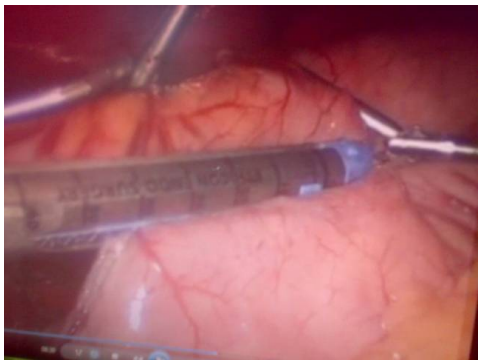
Haemostasis of the staple line and the dissected fat lateral to the greater curve is meticulous. The staple line is not over sewn. A drain was left for a couple of days.

A contrast swallow is performed on the second postoperative day in cases of LSG, while in cases of BPD/DS on the six postoperative day, and if there was no leak, patients were started to liquid diet. They would usually be discharged the same evening or the next day.

All data for this study are prospectively planed, including operative time, length of hospital stay, blood transfusion, conversion to open, and all complications, were collected during the inpatient stay. Follow-up visits were scheduled for 4, 8, 12, 18 and 24 months postoperatively, followed by yearly visits thereafter. Height and weight were measured at each visit, and BMI was calculated, also laboratory evaluations were performed at each visit. All postoperative complications, readmissions and re-operations were recorded.



(Fig I) SG by linear stapler (Open)



(Fig II) SG by Echelon stapler (Lap.)

3. Results

A total of 80 patients underwent open BPD/DS (group I) and LSG (group II) during the study period and were included for analysis. Preoperative demographics including age, sex, BMI and existing comorbidities are presented in table (1).

Table (1): Demographics of all patients undergoing open BPD/DS and LSG

Parameter	All patients (n=80)	Open BPD/DS (group I) (n=40)	LSG (group II) (n=40)	*P*-Value
Age (years)	31±13	36±7	29±8	0.001
Sex				
Male	7 (8.7%)	4 (10%)	3 (7.5%)	0.001
Female	73 (91.3%)	36 (90%)	37 (92.5%)	
Preoperative BMI (kg/m^2)	43±7	44±6	42±5	0.05
Comorbidities				
Hypertension	17 (21.2%)	12 (30%)	5 (12.5%)	0.001
Diabetes	14 (17.4%)	8 (2.4%)	6 (15%)	
Dyslipidemia	14 (17.4%)	9 (22.5)	5 (12.5)	

Operative data for all patients undergoing open BPD/DS and LSG are shown in Table (2). There was a significant difference in mean operative time, estimated blood loss, or initial length of hospital stay between the open BPD/DS and LSG. One patient in the laparoscopic group (2.5%) required conversion to open surgery. There were no major intraoperative complications in both groups.

Table (2): Operative data for all patients undergoing open BPD/DS and LSG

Parameter	All patients (n=80)	Open BPD/DS (group I) (n=40)	LSG (group II) (n=40)	*P*-Value
Operative time (min)	160±65	180±40	95±25	0.001
Length of hospital stay (d)	7±6	9±2	3±1	0.05
Blood transfusion	10	10	-	0.05
Conversion to open approach	1	-	1	0.05

Complications after open BPD/DS and LSG are shown in Table (3).

Table (3):Early postoperative complications for all patients undergoing BPD/DS and LSG

Parameter	All patients (n=80)	Open BPD/DS (group I) (n=40)	LSG (group II) (n=40)	Management	*P*-value
Postoperative mortality					
Stenosis at gastric outlet	1 (1.25%)	-	1 (2.5%)	Re-operation with leakage and multisystem failure	0.05
Postoperative morbidity					
Duodeno-ileal stricture	1 (1.25%)	1 (2.5%)	-	Operative reconstruction	0.05
Pulmonary embolism	1 (1.25%)	1 (2.5%)	-	Anticoagulant	0.05
Vomiting and epigastric pain	3 (3.75%)	3 (7.5%)	-	Antimetic with proton pump inhibitor	0.05
Wound infection	2 (2.5%)	2 (5%)	-	Antibiotics dressing and 2ry suture	0.05
Diarrhea	3 (3.75%)	3 (7.5%)	-	Antidiarrheal drugs	0.05

Late complications after open BPD/DS and LSG are shown in Table (4). Two cases (5%) of laparoscopic group complaining of gastro-esophageal reflux disease (GERD) that required readmission and medications.

On the other hand patients with BPD/DS developed incisional hernia in 2 cases (5%) were electively repaired without complication, perforated duodenal ulcer in 1 case (2.5%) required reoperation, 2 cases (5%) of sever hypocalcaemia required calcium infusion twice time daily, one case (2.5%) developed cholelithiasis required cholecystectomy, and two cases (5%) developed severe anaemia and cachexia requiring revision of BPD/DS with reanastomosis between biliopancreatic limb and alimentary limb.

Table (4):Late postoperative complications for all patients undergoing BPD/DS and LSG

Parameter	All patients (n=80)	Open BPD/DS (group I) (n=40)	LSG (group II) (n=40)	*P*-Value
GERD	2 (2.5%)	-	2 (5%)	0.05
Revision of operation	2 (2.5%)	2 (5%)	-	0.05
Incisional hernia	2 (2.5%)	2 (5%)	-	0.05
Perforated duodenal ulcer	1 (1.25%)	1 (2.5%)	-	0.05
Hypocalcaemia	2 (2.5%)	2 (5%)	-	0.05
Cholelithiasis	1 (1.25%)	1 (2.5%)	-	0.05

All patients were followed-up with office visits, with exception of 3 cases in group I (BPD/DS) and 2 cases in group II (LSG) who refused follow-up. The mean excess weight loss (EWL) in group I was 29.6%, 48.2%, 66.4%, 77.8%, 86.7%, at 4, 8, 12, 18 and 24 months respectively. In group II the mean EWL was 23.2%, 37.8%, 46.7% , 58.8% and 63.5% at 4,8,12,18 and 24 months respectively. Weight loss was significantly higher in group I than in group 2. The effect of surgery on co-morbid diseases such as diabetes, hypertension and hyperlipidemia revealed improvement and discontinuation of treatment in 7 diabetes cases (87.5%) in group I and 5 cases (83%) in group II, while improvement in one case (12.5%) in group I and one case (17%) in group II. Cases of hypertension achieved cure in 10 cases (83.2%) of group I, and 4 cases (80%) in group II, while 2 cases (17.7%) in group I and one case (20%) in group II the dose of treatment was reduced. All cases of hypelipidemia were improved completely in both groups. No significant difference between two groups.

4. Discussion

The LSG has rapidly gained wide consensus among surgeons involved in bariatric surgery due to the several advantages[12] , (i) LSG can be used as the first step of a staged procedure in high-risk patients that may benefit of second step procedure after having achieved a considerable weight loss, (ii) it does not involve any digestive anastomosis, (iii) it does not alter the bowel continuity, (iv) the surgical technique is easier, (v) the operative time is shorter, (vi) the rate of postoperative complications are lower, (vii) it does not result in mineral and vitamins deficiencies[13,14]. BPD/DS is a bariatric operation with restrictive and malabsorptive effects [15]. Despite several good descriptions of the technique and its excellent weight loss results, the BPD/DS is infrequently performed nowadays. The possible reasons for its slow adoption in the United States can be attributed to its malabsorptive side effects and its technical complexity [16]. Rosenthal, [17] reported that, the average length of hospital stay 2.5±0.43 days, the conversion rate was 1.05±1.85 after LSG. Himpens *et al.,*[18] reported that a higher GERD incidence for the SG (21.8%) at 1 year but at 3 years follow-up only one out of 40 patients (3.1%) was still on proton pump inhibitor (PPI) medication. In this study the average length of hospital stay 3 days in LSG, the conversion rate was 2.5%, GERD rate was 5% and mortality 2.5% which is relatively not different from the previous study.

Nelson *et al.* [1] reported that; the length of hospital stay 7±3 days, mortality rates ranged between 0% and 1.9% and major postoperative morbidity rates ranging from 2.8% to 16.7% for open BPD/DS. Marceau *et al.*[19] reported that after DS, serum calcium decreased despite the calcium supplement. Most patients remained within normal, but in 20% serum calcium was below normal; serious deficiency (1.3%).

Anthon et al. (2003) [20] reported that; after DS a higher reversal rate of 5.8% caused by protein malnutrition or diarrhea. In this study, the length of hospital stay in cases of BPD/DS ranged between 6-11 days which is significantly higher than LSG group; sever calcium deficiency associated with sever low backache reported in 5% of cases after DS, which improved only by intravenous calcium twice daily. Two patients (5%) are thought to have frequent malodorous stool and flatus and associated with severe loss of weight, these patients were treated by revisions with reanastomosis of alimentary limb and bilio-pancreatic limb.

Brethaver, [21] reported that the mean EWL after SG ranged from 33% to 85% with an overall mean EWL of 65.4%. Hess *et al.*[3] reported that the mean EBWL after DS (80%) at 2 years. Nelson et al. (2011)[1] reported that the mean EBWL after DS (85%). In this study the mean EBWL after DS (86.7%), while after SG (63.5%) at the end of 2nd year which is significantly higher after DS.

Kazunori *et al.* [22] reported that the resolution of DM in 92.9% of cases and improvement in 7.1% of cases, the resolution rate of hyper-lipidemia 100% after 3 months; and the resolution of hypertension was in 85.7% and improvement in 14.3% after SG. Sudan and Jacobs, [17] reported that patients who underwent the BPD/DS were more likely to resolve type II diabetes (100%), hypertension (68%) and dyslipidemia (72%). In this study the effect of BPD/DS versus LSG on co-morbid patients revealed improvement of type II diabetes (87.5% versus 83%), hypertension (83.3%

versus 80%) and hyperlipidemia improved (100%) in both groups.

Conclusion:

LSG can be performed for the majority of morbid obese patient. when surgery is indicated as a first step. The other mal -absorptive surgical component can be added later when LSG failed fulfill the attended goals of surgery in these cases. BPD/DS is a complex procedure associated with increased operative times hospital stay , and higher postoperative complication rates.

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