Original Article

A Comparative Study of Laparoscopic Bariatric Surgery: An Iraqi Experience

Ramiz S. Mukhtar* **FRCS.**

Summary:

Background: The World Health Organization has declared that obesity is a disease of pandemic significance. The number of performed bariatric procedures has rapidly and considerably increased over the past decade. The most frequently performed and best studied procedures are laparoscopic gastric banding (LAGB), laparoscopic sleeve gastrectomy (LSG) and laparoscopic Roux-en-Y gastric bypass (LRYGB).

Objectve: To provide a critical appraisal of the most important scientific evidence comparing the short term outcomes of these three weight-reduction procedures (laparoscopic gastric banding (LAGB), laparoscopic sleeve gastrectomy (LSG), and laparoscopic Roux-en-Y bypass (LRYGB)) using retrospectively collected data for patients with morbid obesity in Iraq.

Patients and Methods: Between August 2010 and November 2012, three types of bariatric operations (LAGB, LSG, LRYGB) were performed in a hospital in Baghdad for patients with morbid obesity by the same team. A total of 32 patients underwent LAGB operation (21 women and 11 men) with a mean age of years = 33.77 (range 16 to 52 years), and of the 29 patients underwent LSG operation (22 women and 7 men) with a mean age of years = 33.86 (range 20 to 52 years) and of the 9 patients underwent LRYGB (7 women and 2 men) with a mean age of years= 35.11 (range 25 to 45 years). Thereafter patients were followed up monthly for the first 3 months postoperatively.

Results: Using statistical Package for the Social Sciences Software (SPSS) version 15,we found the mean weight loss 1 month after surgery was 10.97kg (range 5-25 kg) for LAGB, 12.34 kg (range 6-21 kg) for LSG and 12.33 kg (range 10-20kg) for LRYGB. Mean weight loss 3 months after surgery was 18.81kg (range 7-38 kg) for LAGB, 22.48kg (range 10-59 kg) for LSG and 24.33kg (range 16-40kg) for LRYGB.

Conclusion: The results from our study showed that all the studied procedures had a significant weight reduction rate in the first three months post operatively and that LRYGB is superior to the LAGB and LSG in weight reduction, although, all procedures are associated with marked weight loss. The age of the patients did not influence the decrease in BMI or affect the type of the procedure in weight reduction for the studied group. The results of this study do not diverge from those previously reported in the literature regarding the complications and the resolution or at least
improvement of medical co-morbidities after these three procedures had been proved in this study.

Keyword: laproscopy . Barialric, Surgery, Iraq.

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Introduction:

Surgery has become an alternative for weight reduction in patients with clinically severe obesity when less invasive methods of weight loss have failed and patients are at high risk for obesity-associated morbidity or mortality (1,2). The evolution of bariatric surgery has been aimed at all times toward safer and more effective procedures. During the past 40 to 50years, Roux-en-Y gastric bypass (RYGB) has been the preferred surgical procedure performed by bariatric surgeons in the United States. However, this operation has always been challenged by alternative surgical procedures. After its introduction in 1966, the alternative was the jejunalileal bypass- an operation that was quickly abandoned due to its increased complication rate (1). As a consequence, gastroplasties (i.e., vertical banded gastroplasty (VBG)) became a promising alternative with no rerouting of the digestive tract. Ultimately, studies suggested that RYGB induced a considerably higher weight loss compared to VBG; this was probably related to the poor long-term weight control and the non adjustability of this purely restrictive approach (1,3).Then, in the early 1990s, Laparoscopic sleeve gastrectomy (LSG) instead of distal gastrectomy as part of the biliopancreatic diversion with duodenal switch (BPD/DS) was introduced into bariatric surgery (4,5). The most frequently performed and best studied procedures are laparoscopic gastric banding, laparoscopic sleeve gastrectomy and laparoscopic Roux-en-Y gastric bypass. These procedures differ significantly in many ways: the gastric band is exclusively a restrictive procedure, whereas bypass has both restrictive and malabsorptive features(3). the laparoscopic implantation of a gastric band is technically much less challenging, does not require any intra-corporeal anastomosis and is often performed by general surgeons without specific training for laparoscopic and/or bariatric surgery (3).It results in early and prolonged satiety, it is

*Dept. of Surgery, College of Medicine, University of Baghdad.

adjustable, and it is fully reversible. Laparoscopic sleeve gastrectomy (LSG) has been described as a possible first-stage operation before more complex procedures such as biliopancreatic diversion (BPD) with duodenal switch or Roux-en-Y gastric bypass (RYGBP) (6). The procedure involves removing 80% of the stomach, leaving behind only a sleeve of stomach (6). The third procedure, the laparoscopic Roux-en-Y gastric bypass (RYGBP) is a procedure that employs both mechanisms of restriction and malabsorption to achieve weight loss (7). This procedure is the most common weight-loss surgery performed in the US and constitutes nearly 80% of all bariatric procedures (7). The objective of this short overview is to provide a critical appraisal of the most important scientific evidence comparing laparoscopic gastric banding, laparoscopic sleeve gastrectomy, and laparoscopic Roux-en-Y bypass for patients with morbid obesity in iraqi patients ; a study that is conducted for the first time in iraq emphasizing the Iraqi experience in bariatric procedures which had started more or less late as compared with other countries .the first operation for obesity was gastric band and it was performed in 2008.

Patient and methods:

Between August 2010 and November 2011, three types of bariatric operations ((laparoscopic adjustable gastric band (LAGB), laparoscopic sleeve gastrectomy (LSG), and laparoscopic Roux-en-Y gastric bypass (LRYGB)) were performed in St Raphael hospital in Baghdad for patients with morbid obesity. All procedures were performed by the same team (surgeon experienced in bariatric surgery, assistants, and anesthetists). Permission was taken from the hospital managing department. Data was collected in a retrospective Cohort study and included the following demographics: age, gender, body mass index (BMI), weight loss, presence of co-morbidity (e.g diabetes and hypertension), and complications following surgery. All patients were given nutritive instructions two months prior to surgery.

Table (1) Distribution of demographic data among the study population

Description		LAGB	LSG	LRYGB
Number of patients		32	29	9
Gender (female/male)		21/11	22/7	7/2
Age (year)	Mean	33.77	33.86	35.11
	(range)	(16–52)	(20-52)	(25-45)
Pre-operative co-morbidities				
HTN (% patients)		1 (3%)	8 (27.6%)	2 (22%)
NIDDM(% patients)		3 (9.4%)	1 (3.5%)	1 (11%)
GERD (% patients)		2 (6.3%)	1 (3.5%)	
Asthma (% patients)			1 (3.5%)	

HTN (hypertension), NIDDM (non-insulin-dependent diabetes mellitus), GERD (gastroesophageal reflux disease). The total number of patients operated upon during this period was 87 patients but from 44 patients who underwent LAGB operation, only 32 patients were included in this study because of difficulties in the follow up. Similarly; of 34 patients underwent LSG, 29 patients were included for the same reason above. All 9 patients who underwent LRYGB were included in this study. So the total number included in the study was 70. A total of 32 patients underwent LAGB operation (21 women and 11 men) with a mean age of 33.77 years (range 16 to 52 years), and of the 29 patients underwent LSG operation (22 women and 7 men) with a mean age of 33.86 years (range 20 to 52 years) and of the 9 patients underwent LRYGB (7 women and 2 men) with a mean age of 35.11 years (range 25 to 45 years). Patient eligibility: According to the National Institutes of Health, potential candidates for bariatric surgery are patients with a body mass index (BMI)‡ 40kg/m 2 or those with a BMI ‡ 35 kg/m2 with associated co morbid conditions(1). Patients > 45 years old were thoroughly assessed before surgery. Evidence of previous successful and unsuccessful weight loss attempts by either dietary or weight loss drug therapy was requisite in every patient. Patient's comprehension and acceptance of the selected procedure were critical. Patients were also advised of the importance of regular follow-up for optimal results. Pre-operative evaluation; Careful pre-operative assessment was usually done for all patients before operation in order to diagnose and control co-morbid diseases (hypertension, diabetes mellitus, osteoarthritis…

etc). So, patients were required to have the following preoperative workup: complete blood count, chemistry panel, lipid profile, liver function tests, urine analysis, pregnancy test, chest X-ray, and electrocardiogram. In potential gastric bypass patients, an abdominal ultrasound was required. Once patients were considered acceptable surgical candidates, it was recommended by the surgeon that they follow a low-sugar liquid diet 10 days before surgery.Anesthetic technique Routinely, a single dose of preoperative prophylactic antibiotics (third generation cephalosporin) was used. A single dose of enoxaparin 4000 IU subcutaneously given six hour prior to surgery. In the operating theatre, 2 wide bore canulae, and ranitidine, dexamethasone, midazolam, were given intravenously. Monitoring was done by NIBM (oscillometry cuff) , pulse oximetry, 3 leads ECG with S-T trending, carbon diaoxide and anesthetic agent were analysed using gas analyzer (Datex corp.).General anesthesia induction started with propofol1%, ketamine, and tramadol given intravenously. Endotracheal intubation was facilitated with rocuronium when patient was in Ramping position. Maintenance of anesthesia run with isoflurane 1.5 % in 100% oxygen.200 mcgm fentanyl was given just prior to insertion of verress needle together with rocuronium 20 mg to be top-ups with fentanyl 100mcgm and rocuronium 10 on 20 minutes intervals. Diclofenac 75mg IV infusion (Novartis ®) followed by paracetamol (perfalgan®) 1gm infusion were given intraoperatively. Ondasteron (Zofran ®) 8mg and esomeprazol (nexium®) were given intravenously at the end of the operation.At the end of operation, all the patients were kept intubated and mechanically ventilated with 100% oxygen for variable periods. Full reversal was done when the patient regained consciousness and spontaneous recovery of muscle power. Extubation was done after repositioning the patient in a head up position to be followed by oxygen inhalation via face mask. Intermittent boluses of morphine were given to treat the post operative pain as per-patient demand. All the patients were discharged to the ward after they have a sustained SpO2 > 95% on room air for at least 30 minutes.Surgical techniqueLaparoscopic adjustable gastric band technique. This procedure relies on gastric restriction. An inflatable silicone band is placed around the gastric cardia to achieve a 15-mL gastric pouch with an adjustable outlet that is determined by the volume of fluid inserted into the band reservoir.Our procedure differs from the commonly used procedure for LAGB in that the latter one places the patient in the semilithotomy position, and the first trocar was inserted using the Optiview, one handbreadth from the left costal margin, two fingers off midline. This is a 10- to 12-mm port for the 30 camera. Other differences were induction of pneumoperitoneum with CO2 up to 20mmHg, the second trocar, 5-mm (right-hand working port), was inserted in the left upper quadrant, midclavicular line, two fingers below the costal margin, and the third trocar was positioned at the level of the left anterior axillary line for the assistant. This is an 18-mm trocar that allows the introduction of the band into the abdomen. In addition three anterior gastrogastric sutures of 2–0silk were placed to maintain the band in position. The tubing of the band was positioned in the left upper quadrant in the subcutaneous position in the anterior wall fascia.laparoscopic sleeve gastrectomy.Five trocars are used for sleeve gastrectomy in the same manner of positioning trocars for laparoscopic gastric band mentioned above and the surgeon was standing between the patient's legs. Our procedure differs from the standardized technique of LSG in the order of introducing the trocars, the use of a 34-Fr tube positioned along the minor gastric curvature as the leading structure for the stapling line to follow, and the starting point of stomach dissection is 7–8 cm prepyloric. Typically, four to five staple lines are needed.2.5.3 Laparoscopic Roux-en-Y gastric bypass. For the RYGB, five ports were used in a similar manner for trocars introduced for laparoscopic sleeve gastrectomy and gastric band mentioned above.Our procedure differs from the standard procedure for LRYGB as we commonly used six ports, the small bowel was stapled and divided 50 cm beyond the ligament of Treitz, and the gastrotomy was closed by a single layer using 3–0 polyglactin (Vicryl) sutures.Postoperative care:After band surgery, patients can start oral in the same day while post sleeve and bypass, patients can start oral after 3 days. Patients were discharged when they felt they could take enough liquids to maintain adequate hydration, without nausea, vomiting or pain. The drain was removed 7-10 days post operative. Patients were kept on blenderized fluid for 1 month. Solids were started 4 weeks postoperatively. Patients were encouraged to have high protein intakes. All patients with gastric bypass were placed on multivitamins, calcium, and iron starting approximately 1 week postoperatively. Patients with sleeve gastrectomy given vitamin B complex, including vitamin B12 supplementation as needed. Proton pump inhibitors were used in all patients with sleeve gastrectomy and gastric bypass for the first month postoperatively and then as needed. Follow-Up: The surgeon, at the outpatient clinic, checked all patients after 4 to 6 weeks. Thereafter patients were followed up monthly for the first 3 months postoperatively then every 3 months until the end of the first year then yearly. Data is collected from the follow up chart of the clinic. Some patients follow up chart were unavailable, for this reason we contact them by telephone.

Data Analysis :The data analysis of the current study was done by using Statistical Package for the Social Sciences Software (SPSS) version 15. Two types of the statistical tests including One-Way Anova and Chi-Square were used

in the analysis. In addition, data were normally distributed, therefore, the mean of the continuous variables was considered.

Results:

Mean weight loss 1 month after surgery was 10.97kg (range 5-25 kg) with a standard deviation SD = 4.87 for LAGB, 12.34 kg (range 6-21 kg) with (SD) = 4.01 for LSG and 12.33 kg (range 10-20kg) (SD) = 3.28 for LRYGB. Mean weight loss 3 months after surgery was 18.81kg (range 7-38 kg) with a SD =6.91 for LAGB, 22.48kg (range 10-59 kg) with (SD)=9.11 for LSG and 24.33kg (range 16-40kg) (SD)= 6.82 for LRYGB (table 3-1).The association between body mass index (BMI) and type of operation is presented in table (2). This table shows a significant association between these two variables. However, the bypass operation was found to be associated with losing weight significantly (p = 0.04) more than the other two types of operation which were included in this study. The difference in measuring BMI before and 3 months after operation was higher in those patients who underwent bypass surgery.

Table (2) Showing BMI before and after three months of each studied bariatric operation with the new mean value for each group and the association between body mass index (BMI) difference and type of operation

Operation Type	Total N (%)	Preoperative BMI (kg/m2) range	Mean (kg/m2)	Postoperative BMI (kg/m2) range	Mean (kg/m2)	BMI Difference Mean (±SD)	P value
LAGB LSG LRYGB	32 (45.71%) 29 (41.42%) 9 (12.85%)	37.64 - 62.49 40.48-79.04 45.91 -65.74	48 48.25 50.05	30.75-56.81 28.71-65.86 36.36-51.90	41.3 40.13 41.22	6.69 (2.35) 8.12 (3.20) 8.82 (2.28)	0.04
Total	70 (100%)						

In table (3), the bypass type is clearly seen to be more associated with the reduction in the body mass index among the male population of the current study. In contrast, there is no significant difference in the association between BMI and the operation types among the female population of the study.

Table (3) The association between body mass index (BMI) and type of operation in the male and female population of the study

Operation Type	Male N (%)	BMI Difference Mean (±SD)	P value	Female N (%)	BMI Difference Mean (±SD)	P value
Band Sleeve Bypass	11 (15.7%) 7 (10%) 2 (2.9%)	6.29 (1.92) 8.61 (2.27) 10.59 (4.59)	0.03	21 (30%) 22 (31.4%) 7 (10%)	6.91 (2.57) 7.96 (3.48) 8.32 (1.45)	0.38
Total	20 (28.6%)			50 (71.4%)		

In the current study, a cross tabulation was done between type of operation and the difference in BMI in terms of age group. According to table (4), there is no significant difference according to these variables (age, operation type, and the difference in BMI) since the p value = 0.166. As a result, the association between operation type and BMI difference is still significant regardless of the patients' age among the study population.

Table (4) The interaction between BMI and type of operation in terms of age group among the study population

Operation Type	Age group	BMI Difference Mean (±SD)	P value
Band	≤ 28 29-38 ≥ 39	5.86 (1.40) 8.08 (2.68) 6.67 (2.72)	0.166
Sleeve	≤ 28 29-38 ≥ 39	6.66 (1.54) 9.52 (4.41) 7.55 (1.32)	
Bypass	≤ 28 29-38 ≥ 39	10.91 (2.67) 7.74 (1.80) 7.83 (0.84)	
Total	70 (100%)		

complications in these groups developed post operatively within the first 10 days are shown in table (5). The most frequent complication was abdominal pain which developed in the first 24 hour postoperatively in the epigastric area. The complications were clinically assessed and managed in a conservative way.

Table (5) Post operative complications for the three studied groups

Post operative Complication	LAGB	LSG	LRYGB
Abdominal pain	7 (22%)	13(45%)	1 (11%)
Gastric erosion	1 (3%)	Nil	Nil
Anastomosis leak	Nil	Nil	1 (11%)
DVT	Nil	1 (3%)	Nil
Staple line bleeding	Nil	2 (7%)	Nil
Wound infection	4 (13%)	5(17%)	Nil

association between type of operation and the abdominal pain as a side effect of the weight loss procedures was detected (Tab. 5). The abdominal pain occurred more significantly among patients who were exposed to sleeve operation ($p < 0.05$).

The comorbidities were clinically assessed depending on history and clinical examination and prescribed medications. All patients with non-insulin dependent diabetes mellitus (NIDDM) had improvement in their readings that necessitated stoppage of medication (resolved) or decrease the doses of medications (improvement) table(6). In asthma, the patient noticed a decrease in the frequency of attacks and the use of medications. It was clear that there was improvement of co morbidity after 3 months of the operations .

Table (6) Shows the improvement and resolution of comorbidities after surgical bariatric procedures for the affected patient group.

1	77	Hypertension (%) resolved	GERD (%) improved	Asthma (%) improved
LGB	2 (66.7%)	1(100%)	2 (100%)	Nil
LSG	5 (62.5%)	1 (100%)	1 (100%)	1 (100%)
LRYGB	1 (100%)	2 (100%)	Nil	Nil

GERD = gastroesophageal disease

Discussion:

In 1994, the use of LRYGB was first reported in the USA, and since being introduced, its use has become widespread (8). In contrast to a variety of techniques developed for creation of anastomoses, there was no major technical modifications in LRYGB in the past 15 years(9).In 1993, Belachew and Legrand placed the first laparoscopic adjustable gastric band (AGB) using the LAPBAND _ system (Allergan Inc., Irvine, CA, USA) (10).The sleeve gastrectomy was introduced into the menu of laparoscopic bariatric surgical operations after the "Magenstrasse" and Mill technique (M&M) (11) .It was initially performed in 1998, and was then first performed laparoscopically in 1999(12).In Iraq the first laparoscopic weight reduction procedure was done in ( ) in medical city complex in Baghdad , and it was gastric band, and since that time there was a rising number of patients who were subjected to different types of laparoscopic bariatric surgeries.The results from our study showed that all the three procedures had a significant weight reduction rate in the first three months post operatively at the same rate, although previous studies comparing LAGB and LRYGB concluded that both surgical procedures offer sustained weight loss in the majority of patients and there was slower initial weight loss after lap band compared to that of gastric bypass (1).Laparoscopic sleeve gastrectomy is an effective surgical procedure for the treatment of morbid obesity(13,14), even as the sole bariatric operation(11) . As previously mentioned, a hormonal mechanism plays a crucial role in weight loss after sleeve gastrectomy(15). Excess BMI loss was higher after sleeve gastrectomy than after gastric band. This reduction of BMI was considered to be a success for gastric band. Thus, results of sleeve gastrectomy should be considered as a success(16). Weight loss after sleeve gastrectomy has been reported to be similar to that after gastric bypass and larger than that after LAGB(5). In spite of this, gastric banding should still be considered a valuable therapeutic option in bariatric surgery as mortality is low and reversibility is possible with comparably low technical effort(17). The LRYGB is the best one in achieving marked acceptable weight reduction and superior(18) on the other two procedures and considered as a primary bariatric procedure in the surgical management of morbid obesity(19). This result augment other studies that declare that LRYGB is the gold standard operation for long-term weight control in the United States(20) and UK (21) , and it should be considered the treatment of choice in the management of morbidly obese patients (22).The results of this study do not diverge from those previously reported in the literatures.The age of the patients did not influence the decrease in BMI or affect the type of the procedure in weight reduction for the studied group. This result augmented studies who stated that "age is no longer a significant variable and does not tend to predict success in weight loss"(23).The laparoscopic approach has been shown to offer significant health care benefits, of

particular interest are reports of decreased postoperative pain resulting in a shorter hospital stay and an earlier return to normal activity(24). However, many patients still experience significant pain that require strong analgesia including opiate during their early recovery period.Our results support previous findings that the primary driving factors behind the increased rates of morbidity are wound infections. This might be due to that obese patients are at risk for wound complications, including dehiscence, infection, and slow healing. This is due to the poor vascularity of adipose tissue, increased wound tension, greater intra-abdominal pressure, and the frequent presence of diabetes (7).A single case of deep venous thrombosis in one limb had occurred in spite of our preoperative and intraoperative use of enoxaparin. This made us to declare that the institution of venous thrombembolism (VTE) prophylaxis can potentially be a life-saving measure for the obese patient. Although it is recommended that sequential compression devices be applied in the operating room, prior to the administration of anesthetic agents but in this study we did not have this facility. The administration of either unfractionated or low-molecularweight heparin preparations, early postoperative mobilization, and frequent ambulation comprise the triad that is considered "venous thrombembolism prophylaxis" (7).Leak or bleeding occurred in this study due to the long staple line in LSG and LRYGB which makes it liable for bleeding and leakage; hence the reinforcement of the staple line became the standard practice in our procedures and many other who strongly recommended staple-line reinforcement (13). This reinforcement in our study was carried-out by running non absorbable suture. Some studies mentioned oversewing the staple-line by continuous or interrupted absorbable sutures to prevent bleeding and leaks (11). Some studies claimed that antecolic Roux limb orientation was associated with a higher rate of both intraoperative and postoperative anastomotic leaks(25). Others stated that antecolic LRYGB is safe (26). In this study Postoperative staple line bleeding occurred in two patients, but the bleeding stopped spontaneously.The main postoperative complications after LSG are leak, bleeding, stricture, abscess, and wound infection(12)and the most frequently reported perioperative complications associated with laparoscopic RYGB are wound infection, anastomotic leak, gastrointestinal tract hemorrhage (10) and that what was found in our work too.Resolution or at least improvement of medical comorbidities after these three procedures had been proved in this study. Although, long-term follow-up of these patients will be necessary to determine the durability of their improved health and lower pharmaceutical expenses(27). In other studies, Bariatric surgery leads to improvement or remission of a wide range of obesity-related comorbidities, including Type 2 diabetes (80%), hyperlipedemias (70%), hypertension (75%), and obstructive sleep apnea (80%) (28). Bariatric surgery is effective in the cure of NIDDM. The LAGB procedure is less effective than LRYGB and LSG procedures. The present study confirms other studies results (29). However, there is reasonable evidence that the more complex bariatric procedures may lead to a greater likelihood of remission, rather than merely improvement, of comorbidities(9). There are several limitations to this study. First of all, only short-term outcomes of weight reduction and complications that occur within 3 months of the procedure were collected. Important longer-term outcomes, beyond 3 month, such as reoperations, or need for revisional surgery, were not assessed. Measures of clinical efficacy including biochemical, lipid profile or quality of life, and patient satisfaction could also not be assessed in the current study.

Conclusion:

We found that LRYGB is superior to the LAGB and LSG in weight reduction. Although all procedures are associated with marked weight loss especially for those patients who tried different types of exercises, diet, or medications. The result of this study is comparable to other studies.

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