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RESEARCH ARTICLE

COMPARATIVE STUDY BETWEEN LAPAROSCOPIC SLEEVE GASTRECTOMY AND LAPAROSCOPIC MINI GASTRIC BYPASS FOR TREATMENT OF MORBID OBESITY.

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Abstract

Background: Bariatric surgery proved to be the only successful treatment option leading to long-term weight loss with improvement of obesity related comorbidities. The Laparoscopic Sleeve Gastrectomy (LSG) is now one of the most popular bariatric procedure worldwide with rising prevalence over last decade, while the Mini Gastric Bypass (MGB) is now gaining some popularity as a relatively new bariatric procedure

Methods: The study involved forty patients; twenty of them had Laparoscopic Sleeve Gastrectomy (LSG), and twenty of them had Laparoscopic Mini Gastric Bypass (MGB). The patients were selected according to National Institute of Health (NIH) guidelines. All procedures were performed by the same team of experienced bariatric surgeons. all the patients had a one-year period of follow up after surgery and were evaluated for weight loss, morbidity (early, and late), impact on obesity associated diseases and effect on quality of life (QoL).

Results: The two groups were matched considering the demographic data. Operative time was significantly longer in MGB group (P = 0.001), with mean operative time in MGB group was 74.75, while in LSG group was 53.25 min. One patient (5%) from LSG group developed stenosis and was managed by endoscopic balloon dilatation. Mean excess weight loss % after one year was 66.99% (± 1.739%) for LSG group and 67.76% (± 1.813%) for MGB group. The QoL after one year was varied between good and very good in both groups, with 70% of LSG group lie in very good category, and 75% of MGB group lie in the very good category.

Conclusion: Both studied laparoscopic techniques; LSG and MGB were safe and effective, with similar results as regards significant weight loss and improvement of obesity-associated medical comorbidities and quality of life, with acceptable morbidity.

Introduction:-

Obesity is one of the greatest causes of preventable morbidity and mortality worldwide, with weight loss associated with reductions in risk of morbidity and mortality.

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Bariatric surgery has proved to be the only successful treatment option leading to long-term weight loss with clinical relevance resulting in an improvement of obesity-associated comorbidities including type 2 diabetes. Recent data on patients after bariatric surgery show that unlike the effects of lifestyle changes and hypocaloric diets, bariatric surgery results in meaningful increases in circulating levels of PYY and GLP-1 and a decrease in ghrelin level. (1-6)

Bariatric surgery is clearly confirmed to be beneficial in type 2 diabetes remission, at least in the short and medium term. Thus, patients with BMI >30 and <35 kg/m^2 with type 2 diabetes may also be considered for bariatric surgery on an individual basis, as there is evidence-based data supporting bariatric surgery benefits regarding type 2 diabetes mellitus remission or improvement in this group. (7, 8)

All currently used modern bariatric procedures are actually considered effective in the treatment of morbid obesity and its related comorbidities compared to non-surgical interventions. The choice of one bariatric procedure over another is generally influenced by a number of factors such as literature results, specific local conditions, and the experience of the surgical staff in each country. (9)

Most modern bariatric operations are based upon the performance of a gastric restriction procedure, responsible for the short-term weight loss, and a gastrointestinal bypass, which should warrant the maintenance of weight loss over time.

Every technique may be performed laparoscopically with a low rate of postoperative complications. (10, 11) However, an almost 1% operative death rate is usually communicated, and higher rates of non-lethal medical or surgical complications, including staple-line or anastomotic leaks and intestinal obstruction, are also reported. (12) Probably, there is not an ideal technique described yet, and efforts should be directed towards achieving a highly efficient simple operation, with easily reproducible results and a low rate of postoperative complications. (11) Different simple techniques have been devised and have been gaining popularity over the past years, as the sleeve gastrectomy and the mini-gastric bypass. (11, 13-15)

Laparoscopic sleeve gastrectomy (LSG) has seen growth in popularity because of the perceived simplicity of the surgical technique, resolution of co-morbidities, and excellent weight loss outcomes. (16) LSG was first conceived as a restrictive component of biliopancreatic diversion and duodenal switch with weight loss achieved by both restrictive and still not clearly defined endocrine mechanisms. LSG has, become widely considered as a primary restrictive bariatric procedure, LSG became the most commonly performed bariatric procedure (45.9%) in 2014 According to the IFSO worldwide survey of 2014. (17) The early findings from prospective and retrospective studies have been encouraging, the potential advantages include excellent weight loss outcomes, co-morbidity resolution, the relative ease of the technique, the avoidance of a foreign body or adjustments, a shortened operating time, and immediate restriction of caloric intake. (18)

Mini Gastric Bypass (MGB) was introduced by Rutledge (13) in 1997 as a different version of Mason's operation. MGB consisted of a lesser curvature-based long-sleeved gastric pouch anastomosed with a single jejunal loop, in a Billroth-II fashion, with no Roux-en-Y reconstruction, the long gastric tube places the single anastomosis of a loop bypass away from the esophago-cardiac (EC) junction and thereby avoids the problem of bile esophagitis present in the original Mason loop gastric bypass. (13, 19) According to the IFSO worldwide survey in 2014, Mini-gastric bypass/one anastomosis gastric bypass (MGB/OAGB) was the fourth most commonly performed bariatric procedure (1.8%). (17)

This study aimed at comparing laparoscopic sleeve gastrectomy and laparoscopic mini gastric bypass regarding their feasibility, effect on weight reduction, morbidity (early, during the first month postoperatively and throughout a follow up period of one year), impact on obesity related diseases and effect on quality of life.

Patients And Methods:-

This study involved forty patients in the Department of Surgery in Medical Research Institute, Alexandria University from December 2015 till August 2017. Patients were randomly allocated into two groups, using closed envelope technique, each of twenty patients; group "A" had laparoscopic sleeve gastrectomy (LSG) and group "B" had laparoscopic Mini Gastric Bypass**.**Inclusion criteria

1. 18-60 years old.

2. BMI > 40 or BMI of 35- 40 kg/m^2 with obesity related conditions, such as diabetes, impairedglucose tolerance, hypertension, hyperlipidemia ,or obstructive sleep apnea.
3. Failed non-surgicalweight reduction of at least six months and be willing and able to adhereto postoperative care.
4. Patients mustunderstand the risks, benefits, alternatives, necessary lifestyle changes, and expected outcomes.
5. Willingness to follow protocol requirements which include: signing the informed consent form, completing routine follow-up visits for the study duration, and completing all preoperative laboratory and diagnostic tests in addition to the quality of life questionnaire.
6. Females with childbearing potential, should accept using an appropriate contraception method for one year after surgery for fear of nutritional deficiencies during pregnancy.

Patients who did not match these criteria were excluded as well as patients with previous obesity surgery, major depressive disorder, psychosis, extensive abdominal surgery and sweet eaters.

All patients were subjected to complete history taking including age of onset of obesity, dietary habits, previous trial of weight reduction and history of obesity comorbidity, clinical examination, laboratory investigations including hormonal profile, cortisol and thyroid profile, abdominal ultrasonography, and upper gastrointestinal endoscopy; for preoperative assessment of the stomach and detection of any associated conditions as gastric ulcers, gastroesophageal reflux and gastric masses.

All patients were given the dose of 40 mg enoxaparin 12 hours prior to surgery (Caprini score less than 5). Venous prophylaxis was continued for 5 days after surgery by a dose of 40 mg every 24 hours.

Operative details were recorded, including; operative time, intraoperative complications, conversion, associated procedures, if any.

Postoperatively, gastrografin swallow radiological study was performed on post-operative day 1, before the patient was started on liquids, to assess the rate of gastric emptying, shape of the gastric tube and to discard any anastomotic or staple line leak, patients were to be discharged as soon as they accept a liquid diet without vomiting. Patients were prescribed proton-pump inhibitor and multivitamins containing iron, vitamin B-12, folic acid, and vitamin D.

Follow up visits were scheduled at 1 week and at 1, 3, 6, and 12 months after surgery for all patients in the postoperative period for the assessment of: Post-operative complications, Effect of operation on weight reduction and effect of operation on quality of life.

Post-operative blood tests; hemoglobin, serum proteins, iron, zinc, and calcium levels were measured every three months.

Upper Gastrointestinal Endoscopy was done when indicated clinically, for management of symptoms suggesting gastro-esophageal reflux, anastomotic stenosis, upper gastrointestinal bleeding, inflammation, or ulcers, or routinely 6 months after surgery in asymptomatic patients.

Weight loss was evaluated by means of Excess weight loss (EWL %) and BMI changes at 1, 3, 6, 12 months after surgery. Effect of operation on quality of life was assessed using Moorehead-Ardelt Quality of Life Questionnaire II at 3, 6, 12 months after surgery, six items were used for measuring a patient's subjective impression of QoL in the areas of: 1) general self -esteem, 2) physical activity, 3) social contacts, 4) satisfaction concerning work, 5) pleasure related to sexuality, and 6) eating behavior. Resolution of co-morbidities was assessed at the end of the study. Evaluation of the outcome of surgery using "updated BAROS",[20-22] it included the analysis of weight loss, improvements in obesity co-morbidities, and changes in health related quality of life (HRQoL) evaluation using the Moorehead-Ardelt Quality of Life Questionnaire II (MA-II). It was performed at 3, 6, and 12 months post-surgery.[22] This scoring system analyzes those 3 domains. The final score classifies the results into 5 outcome groups from failure to excellent, establishing an objective definition of success. [20]

Surgical procedures:
All surgical procedures were done laparoscopically with no conversions

Laparoscopic Sleeve Gastrectomy (LSG):

The patients were placed in reverse Trendelenburg position and french position with a 10° tilt with the surgeon standing between patient's legs. The operation was routinely performed with a standard five-port laparoscopic technique; a 12 mm port placed 2 cm to the right of the midline about halfway between the xiphoid and umbilicus, a 12 mm port placed about 4 cm to the left of midline between xiphoid and umbilicus, a 5 mm port placed just below left costal angle as laterally as possible in the sterile field, a 5 mm port placed in the right upper quadrant between the 12 mm port and the right costal margin, and a 5 mm port placed just below the xiphisternum. The greater omentum was sectioned close to the gastric wall and medial to the gastroepiploic vessels, using the Enseal device (Ethicon Endo-Surgery, Cincinnati, OH, USA). The dissection is started at the greater curvature of the stomach, in a perigastric fashion, and continued towards the left crus of the diaphragm. Thereafter, the pylorus is identified and the dissection continues to 5-6 cm from the pylorus. The stomach is then lifted to expose its posterior aspect, and all lesser sac attachments of the stomach are freed. After achieving enough space, linear staplers (60 mm long) with blue or green loads were used to transect the stomach starting from the antrum at the crow’s foot, along the lesser curvature and up to the angel of His while calibrating with 36 Fr sized bougie to create a narrow sleeve. Intra-operative leak tests (IOLT) were not done in all cases. We used surgical hemostatic clips to control bleeders along the staple line. After extraction of the excised part of the stomach, no drains were left in place.

Laparoscopic Mini Gastric Bypass:

The patient was placed similarly in reverse Trendelenburg position and french position with a 10° tilt with the surgeon standing between patient's legs. The operation was basically performed with a five-port laparoscopic technique. One 12 mm port for the stapler on the left side of the umbilicus, and another 12 mm port below the right costal margin. One 12 mm port for the camera just at the right side of the umbilicus. Two 5 mm ports; one below the xiphisternum, for liver retraction and another one below the left costal margin. After inspection of the abdominal cavity, a long gastric tube was created along the lesser curvature of the stomach, using the Enseal device (Ethicon Endo-Surgery, Cincinnati, OH, USA), usually created from the antrum at the crow’s foot using a 60-mm green stapler at a right angle to the lesser curvature Then a narrow tube was created along the lesser curvature side all the way to the esophago-cardiac junction using multiple stapler firings over a 36 French gastric bougie. The next step was to perform an antecolic Billroth II loop gastrojejunostomy with a 200-cm jejunal bypass. The jejunum is identified at the ligament of Treitz and measured to 200cm distally. The proximal limb should be always placed on the patient’s left side and distal limb on the patient’s right side to avoid torsion of the intestinal mesentery. The gastrojejunostomy was typically performed using a stapling technique in a side-to-side fashion with the afferent limb higher than the efferent loop so as to form an isoperistaltic conduit. Systematically, the staple line and the anastomosis were tested for leaks with methylene blue instillation through the nasogastric tube. We used surgical hemostatic clips to control bleeders along the staple line. One drain was left in place before closing the laparoscopy orifices.

Statistical analysis:

Statistical analysis was done using IBM SPSS version 20.

Results:-

The main demographic data are shownin **Table I**. The mean Preoperative weight for the LSG group was 130.80 (± 18.914) kg, while for the MGB group it was 131.80 (± 15.780) kg. The mean Preoperative BMI for the LSG group was 47.965 (± 5.076) kg/m^2, while for the MGB group it was 48.249 (± 4.500) kg/m^2.**Table** II shows the incidence of different preoperative comorbidities in the studied patients. One case from LSG group and two cases from MGB group had Grade “A” GERD (Los Angeles) that was treated medically successfully before surgery. **Table III** shows the different preoperative categories according to M-A QoLQII in both groups.

The mean operative time in LSG was 53.25 (± 6.129) minutes, while in the MGB, it was 74.75 (± 8.188) minutes. Statistically, the operative time for MGB was significantly longer than LSG (**Table IV**).

Table I: Demographic and anthropometric profile of patients.

	LSG	**MGB**	**Sig.**
Mean Age (years)	36.35 (±12.067)	38.40 (± 9.338)	0.552
Sex (female/male)	65% / 35%	70% / 30%	0.736
Mean Height (meter)	1.6485 (± 0.055)	1.6515 (± 0.060)	0.869

Mean Preoperative weight (kg)	130.80 (± 18.914)	131.80 (± 15.780)	0.857
Mean Preoperative BMI (kg/m^2)	47.965 (± 5.076)	48.249 (± 4.500)	0.853

Table II:-Preoperative co-morbidities

	LSG	MGB	Sig.
Preoperative Dyslipidemia	3 (15%)	5 (25%)	0.695
Preoperative Diabetes Mellitus	3 (15%)	4 (20%)	1.000
Preoperative Osteoarthritis	1 (5%)	2 (10%)	1.000
Preoperative Hypertension	2 (10%)	2 (10%)	1.000
Preoperative GERD	1 (5%)	2 (10%)	1.000

Table III:-Preoperative Moorhead-Ardelt Quality of Life Questionnaire II

		LSG	**MGB**	**Sig.**
Preoperative M-A QoLQII Categories	Very poor	5 (25%)	4 (20%)	1.000
	Poor	10 (50%)	10 (50%)	
	Fair	4 (20%)	5 (25%)	
	Good	1 (5%)	1 (5%)	

Table IV:-Operative time, intraoperative bleeding and hospital stay

	LSG	MGB	Sig.
Operative Time (minutes)	53.25 (± 6.129)	74.75 (± 8.188)	0.001*
Median Intraoperative Blood Loss (ml)	70 (50-150)	100 (50-200)	0.253
Mean hospital stay (days)	1.92 (± 0.33)	1.97 (± 0.42)	0.068

None of the forty patients suffered from intraoperative nor early (<30 days) postoperative major surgical complications (e.g. gastric leak, bleeding), one female patient was complaining of persistent vomiting, two weeks after discharge, and underwent upper GIT endoscopy which identified excess narrowing (stenosis) at the level of the Incisura Angularis and underwent endoscopic balloon dilatation for once and patient became well (**Table V**). Upper GI endoscopy after 6 months revealed 3 cases of GERD in LSG group; one of them of Grade "B" (Los Angeles) and two of them of Grade "A" (Los Angeles), in MGB group, only one case of Grade "A" GERD was identified. Those patients also had clinical symptoms of GERD, anti-reflux medications were prescribed for them with good response. The upper GI endoscopy was done at 12 months for symptomatic patients and identified another patient from LSG group with Grade "A" GERD (Los Angeles), anti-reflux medications were prescribed for her with good response. The statistical analysis shows no significant difference between both groups in occurrence of GERD (**Table VI**).

Table V:-Early postoperative complications

	LSG	MGB	Sig.
Postoperative bleeding	0 (0%)	0 (0%)	a
Postoperative leak	0 (0%)	0 (0%)	b
Postoperative stenosis	1 (5 %)	0 (0 %)	1.000

a: No statistics are computed because Postoperative bleeding is a constant.
b: No statistics are computed because Postoperative leak is a constant.

Table VI:-GERD incidence in both groups, confirmed by endoscopy

	LSG	**MGB**	**Sig.**
GERD after 6 months	3 (15 %)	1 (5%)	0.605
GERD after 12 months	1 (5%)	0 (0 %)	1.000

Error! Not a valid bookmark self-reference. shows the impact of LSG and MGB on weight loss, at one month, 3 months, 6 months, and one year after surgery. Mean BMI after twelve months was 31.790 (± 1.873) kg/m2 for LSG group and 31.694 (± 1.613) kg/m2 for MGB group. Mean excess weight loss % after one year was 66.99% (± 1.739%) for LSG group and 67.76% (± 1.813%) for MGB group. The statistical analysis shows significant changes of BMI in both groups after one year (**Table VIII**) with no significant difference between both groups in weight loss over time after surgery.**Table IX**, show improvements in **MA QoLQII** categories among patient of both groups over time after surgery. Statistical analysis shows significant improvement of QoL in both groups after 12 months of surgery (**Table X** and **Table XI**) no significant difference between both groups as regards improvement of quality of life over time after surgery.

Table VII:-Excess Weight Loss (EWL %) and Body Mass Index (BMI) through follow up period in both groups

	LSG	MGB	Sig.
Mean (EWL %) after one month (%)	17.41% (± 1.142%)	17.09% (± 0.988%)	0.350
Mean BMI after one month (kg/m2)	43.737 (± 4.074)	44.074 (± 3.742)	0.787
Mean (EWL %) after 3 months (%)	32.74% (± 1.451%)	33.29% (± 1.518%)	0.253
Mean BMI after 3 months (kg/m2)	40.032 (± 3.326)	40.118 (± 3.026)	0.933
Mean (EWL %) after 6 months (%)	46.84% (± 1.376%)	47.03% (± 1.169%)	0.638
Mean BMI after 6 months (kg/m2)	36.632 (± 2.772)	36.735 (± 2.256)	0.898
Mean (EWL %) after 12 months (%)	66.99% (± 1.739%)	67.76% (± 1.813%)	0.183
Mean BMI after 12 months (kg/m2)	31.790 (± 1.873)	31.694 (± 1.613)	0.863

Table VIII:-Pre-Operative BMI and BMI at one year in both groups**.**

	Mean Pre-Operative BMI	Mean BMI at 12 months	Sig.
LSG group	47.965	31.790	0.000*
LSG group	48.249	31.694	0.000*

Table IX:-Postoperativeassessment of quality of life using MA QoLQII

		LSG	MGB	Sig.
M-A QoLQII Categories (3 months after surgery)	Poor	5 (25 %)	5 (25 %)	1.000
	Fair	10 (50 %)	9 (45 %)	
	Good	4 (20 %)	4 (20 %)	
	Very good	1 (5 %)	2 (10 %)	
M-A QoLQII Categories (6 months after surgery)	Fair	5 (25 %)	5 (25 %)	1.000
	Good	10 (50 %)	10 (50 %)	
	Very good	5 (25 %)	5 (25 %)	
M-A QoLQII Categories (12 months after surgery)	Good	6 (30 %)	5 (25 %)	1.000
	Very good	14 (70 %)	15 (75 %)	

Table X:-Pre-Operative M-A QoLQII and Post-Operative M-A QoLQII in LSG group.

		Pre-Operative	At 12 months	Sig.
M-A QoLQII Categories in LSG group	Very poor	5 (25%)	0 (0%)	0.001*
	Poor	10 (50%)	0 (0%)	
	Fair	4 (20%)	0 (0%)	
	Good	1 (5%)	6 (30 %)	
	Very good	0 (0%)	14 (70 %)	

Table XI:-Pre-Operative M-A QoLQII and Post-Operative M-A QoLQII in MGB group.

		Pre-Operative	At 12 months	Sig.
M-A QoLQII Categories in MGB group	Very poor	4 (20%)	0 (0%)	0.001*
	Poor	10 (50%)	0 (0%)	
	Fair	5 (25%)	0 (0%)	
	Good	1 (5%)	5 (25 %)	
	Very good	0 (0%)	15 (75 %)	

All patients had normal lipid profile one year after surgery. All diabetic patients from both groups had remission from Diabetes Mellitus with HbA1c < 6.4% (

Table XII, Table XIII, Table XIVand**Table XV**), with no need for diabetes medication. Patients with osteoarthritis of weight bearing joints, had the pain resolved by the end of the study without analgesia intake. Patients suffered from hypertension, became well controlled without medical treatment (

Table XII, Table XIII).

Table XII:-The changes of preoperative co-morbidities in LSG group one year postoperatively

Co-morbidities in LSG group	Before surgery	12 months after surgery	Sig.
Dyslipidemia	3 (15%)	0 (0%)	0.230
Diabetes Mellites	3 (15%)	0 (0%)	0.230
Osteoarthritis	1 (5%)	0 (0%)	1.000
Hypertension	2 (10%)	0 (0%)	0.487

Table XIII:-The changes of preoperative co-morbidities in MGB group one year postoperatively

Co-morbidities in MGB group	Before surgery	12 months after surgery	Sig.
Dyslipidemia	5 (25%)	0 (0%)	0.0471*
Diabetes Mellites	4 (20%)	0 (0%)	0.106
Osteoarthritis	2 (10%)	0 (0%)	0.487
Hypertension	2 (10%)	0 (0%)	0.487

Table XIV:-Postoperative HbA1c in diabetic patients of both groups at 12 months of surgery.

	LSG	MGB	Sig.
Median HbA1c % in diabetic patients at 12 months	6 %	5.9 %	0.4

Table XV:-Pre-Operative and Post-Operative HbA1c at 12 months in diabetic patients of both groups**.**

	Median Pre-Operative HbA1c	Median HbA1c at 12 months	Sig.
LSG group	9 %	6%	0.109
MGB group	8.25%	5.9%	0.066

The overall result of the operation was assessed using the updated BAROS at intervals after surgery; at 3 months, 6 months, and one year after surgery. It assessed %EWL, effect on comorbidities, and QoL using MA QoLQII. Also, it evaluated the occurrence of complications or reoperations. **Table XVI** show the outcome of surgery among patients of both groups. At the end of the study, 36 patients had excellent outcomes and four patients had very good outcomes. The outcomes were similar between both groups over time with no statistical differences between both groups.

Table XVI:-Distribution of surgery outcomes according to updated BAROS

		LSG	MGB	Sig.
Updated BAROS Categories (3 months after surgery)	Fair	5 (25 %)	5 (25 %)	1.000
	Good	15 (75 %)	14 (70 %)	
	Very good	0 (0 %)	1 (5 %)	
Updated BAROSCategories (6 months after surgery)	Good	5 (25 %)	5 (25 %)	1.000
	Very good	10 (50 %)	10 (50 %)	
	Excellent	5 (25 %)	5 (25 %)	
Updated BAROSCategories (12 months after surgery)	Very good	2 (10 %)	2 (10 %)	1.000
	Excellent	18 (90 %)	18 (90 %)	

Discussion:-

Laparoscopic Sleeve Gastrectomy (LSG) is one of the principal bariatric procedure worldwide with excellent results for weight loss and reduction of comorbidities. Mini Gastric Bypass (MGB) has gained some popularities over years as a simple malabsorbtive bariatric procedure.In 2018, the IFSO MGB-OAGB Taskforce recommendations stated that OAGB is a recognized bariatric/metabolic procedure and should not be considered investigational.[23] In this study, we aimed at comparing both technique as regards their effect on weight loss, quality of life and resolution of obesity related comorbidities.

This study includedforty patients, twenty patient in each group. The mean age for the Laparoscopic Sleeve Gastrectomy (LSG) group was 36.35 (± 12.067) years, while mean age for the Laparoscopic Mini Gastric Bypass (MGB) group was 38.40 (± 9.338) years.Female patients represented the main population of this study (67.5%). It is a common finding in the literature that women are undergoing bariatric surgery more than men.[24-26]We included in this study patients with BMI ≥ 40 or BMI = 35–39 with one or more obesity-related comorbidities, and patients should have attempted ,and failed, several structured methods of weight loss according to NIH criteria.[27]

We excluded from the study sweat-eaters to avoid bias that may result from inappropriate EWL and weight regain.High-calorie liquids, such as sweetened drinks can be appealing to patients after surgery to satisfy sweet cravings or to evade the negative symptoms of eating solid foods, resulting in poor weight loss or even weight regain.[28]

We performed upper GI endoscopy routinely for all patients before surgery. Routine preoperative esophagogastroduodenoscopy (EGD) is performed in patients at many centers, because of alterations in foregut anatomy created with these bariatric operations. It is recommended by several specialty societal guidelines, even in asymptomatic patients, to detect upper gastrointestinal abnormalities.[29-33]

We used a 36 Fr bougie for sizing of the gastric sleeve. Marceau used a 60 Fr. Bougie for sizing of the vertical gastric pouch in his first series of sleeve gastrectomy.[34] The ASMBS recommends now the use of a34–40-Fr bougieto guide the stapling and maintain an adequate lumen of the gastric sleeve.[35] A consensus statement by the international sleeve gastrectomy expert panel in 2011 deemedthe optimal bougie size to be 32– 36 Fr.[36]We used a 36 Fr bougie for sizing of the gastric pouch in MGB. According to the IFSO Position Statement about Mini Gastric Bypass-One Anastomosis Gastric Bypass (MGB-OAGB) published in 2018, the majority of studies used a 36 Fr bougie; however, the bougie size varied from a 1 cm diameter nasogastric tube to a 42 French bougie. [23]

We don't routinely perform intra-operative leak tests (IOLT) in LSG, as they are unreliable and may be more harmful than benificial.[37-40] Bingham et al.[38] performed a retrospective multicenter study to assess the benefits and efficacy of routine IOLT in LSG, the reported that IOLT had "very poor sensitivity", as 91% of patients with post-LSG leaks had negative IOLT, and that routine IOLT did not decrease theincidence of post-LSG leaks. Bingham et al[40] in another retrospective study, found that all patients with post-LSG leaks had negative IOLT. Varban et al. [41] performed a case-control study to assess the effect of operative techniques on occurrence of clinically significant leak after primary LSG and they found no correlation between performing IOLT in LSG and reduction of post-LSG leaks.

We performed intra-operative leak tests (IOLT) for all cases using methylene blue, it was negative for all cases. We placed tube drains in the left subphrenic space in all patients. The use of IOLT in MGB is constant in the literature but the placement of drain is a controversial issue. Rutledge and Kular[42] reported the use of blue dye IOLT in all patients and the no use of abdominal drains in most of patients. Kim et al. [43]reported the use of intraoperative blue dye leak test and closed suction drains in the subphrenic space in MGB. Lee et al.[44] also reported the use of suction drain in the lesser sac at the end of operation. Carbajo et al.[45] also reported the use of subhepatic drains. Noun et al.[46] reported the use of IOLT and no use of abdominal drains in MGB. Chakhtoura et al.[47] reported the use of suction drains left behind the anastomosis. Musella et al.[48] reported the use of methylene blue IOLT and placement of drains in all patients.

The mean operative time for LSG in our study was 53.25 (± 6.129) minutes, while in the MGB, it was 74.75 (± 8.188) minutes. Statistically, the operative time for MGB was significantly longer than LSG. MGB consumes more time than LSG, due to mobilization of the bowel and sewing of the defects left after stapled gastrojejunostomy. The operative time for both techniques varies in the literature among different studies. Tucker et al.[49] reported a mean operative time of 60 (58–190) minutes for LSG in primary cases. Han et al.[50]reported a mean operative time of 70 (45-100) minutes for LSG in primary cases.Young et al.[51] analyzed the data of 5000 patients who underwent LSG using the American College of Surgeons National Surgical Quality Improvement Program database, and reported a mean operative time of 101 minutes for LSG in primary cases. Mongol et al.[52]reported a mean operative time of 120 (90-150) minutes for LSG in primary cases.

Rutledge and Kular[42] reporteda mean operative time of52 ± 18.5 min for MGB in primary cases. Carbajo et al.[53] reported 86 (45–180) minutes for MGB in primary cases. Peraglie et al.[54] reported a mean operative time of 70

(43–173) minutes for MGB in primary cases. Piazza et al[55] reported 120 (90–170) minutes for MGB in primary cases. Lee et al.[56] reported 115.3 ± 24.6 minutes for MGB in primary cases.

None of the forty patients suffered from intraoperative nor early (<30 days) postoperative surgicalcomplications (e.g. gastric leak, bleeding) and none required reoperation.Staple line leaks and bleeding after LSG have been reported to be some of the most serious postoperative complications, due to the long staple line, several large published series have reportedthese 2 complications to occur in 1% to 3% of patients.[51, 57-64] Anastomotic bleeding and marginal ulcers are frequently reported complications after the MGB, anastomotic leaks, staple line bleeding and leaks are less frequently complications. There is no possibility of internal hernia in MGB because the anastomosis ismade in an antecolic fashion, which does not createa window in the mesocolon.[65] Rutledge,[13]in his first series, reported an overall complication rate of 5.2%, thatdeclined from the 26% to less than 4% in the last200 patients. Rutledge and Kular[42] reported two patients died in the first 30 dayspost-operatively; one from myocardial infarction 4 weeks aftersurgery and the other from myxodema leading to statusepilepticus and coma 1 week after MGB, giving a 30-day mortality rate of 0.18 %, minor early complications rate of 4.6 %, major early complications rate of 1.3 %, they defined major complication as a hospital stayof >2 weeks and/or the need for redo procedure or any life threatening complication. [42]Review of the publishedobservational studies indicates a major complicationrate of less than 2 %, with 1 % leakage rate.[19]

One of our patients was complaining of persistent vomiting, two weeks after discharge, and underwent upper GIT endoscopy which identified excess narrowing (stenosis) at the level of the Incisura Angularis and underwent endoscopic balloon dilatation, and she was improved after only one session. Sleeve stenosis was reported to occur due to the intentional narrow tubularization of the stomach. It currently is reported tooccur in 0.26% to 4% of LSG operations.[64]The true incidence of stenosis incurrent practice because early published series of LSG tended to use larger bougies with the intention of two-stageweight loss. The literatureremains contradictory regarding the correlation of stenosisrates with bougie size used. For example, Cottom et al.[66]reported using 46- to 50-Fr bougies with a stenosis rate of 3.9%, whereas Lalor et al.[67]reported using either a44- or 52-Fr bougie with a stenosis rate of only 0.7%. Thissuggests another technical cause independent of bougiesize, this type of stenosis most likely occurred due to over-narrowing of the sleeve at the incisura, especiallywhen the sleeve starts closer to the pylorus. Narrowing here can occur due to over-retractingthe greater curvature where tension is progressively appliedcan cause stretch on the stomach during division. Once thebougie is removed, the stomach will recoil, resulting in anarrowing.A twisted or spiral sleeve is another cause of symptomatic stenosis, due to progressive rotation of the staple line in ananterior to posterior plane that can lead to a narrowing despite afairly normal luminal diameter. This curve can make passage of enteric contents difficult, resulting in a functionalstenosis. This often is demonstrated by easy passage of theendoscope or balloon dilator through the narrowed area.[68, 69]A functional sleeve stenosis also can result fromexternal sources such as a hematoma that causes the sleeveto scar in a kinked manner.[70] Traditionally, the treatment of stenosis of the gastrointestinal tractis endoscopic balloon dilation.[69] Parikh et al.[64] reported successful management of symptomatic stenosis by pneumatic balloon dilatation alone and pneumatic balloon dilatation followed by insertion of metallic stents for failed pneumatic balloon dilatation alone. Burgos et al.[71]reported successful management of symptomatic stenosis by pneumatic balloon dilatation. Eubanks et al.[72] reported management of stenosis using endoscopic silicone covered metallic stents. Shnell et al.[73]reported successful management of symptomatic stenosis by pneumatic balloon dilatation.

Upper GI endoscopy after 6 months revealed 3 cases of GERD in LSG group; one of them of Grade “B” (Los Angeles) and two of them of Grade “A” (Los Angeles), in MGB group, only one case of Grade “A” GERD was identified. Those patients also had clinical symptoms of GERD, anti-reflux medications were prescribed for them with good response. The upper GI endoscopy was done at 12 months for symptomatic patients and identified another patient from LSG group with Grade “A” GERD (Los Angeles), anti-reflux medications were prescribed for her with good response. The statistical analysis shows no significant difference between both groups in occurrence of GERD. Gastroesophageal reflux disease (GERD) is highly prevalent in morbidly obesepatients and a high body mass index is a risk factor for the development of this co-morbidity.[74] Chiu et al.[75]reviewed A total of 15 reports studying LSG and GERD, and found that the evidence of the effect of LSG on GERD did not consolidate to a consensus.However, in the Fourth International Consensus Summit on SG in 2012, postoperative GERD was the mostfrequently reported complication in a collective seriesof>46,000 SGs performed by 130 surgeons worldwide,with a mean incidence of 7.9%.[76]It has been hypothesized that SG determines an imbalancebetween the intraluminal pressure of the gastric tubule and that of the lower esophageal sphincter (LES) postoperatively, the former is increased because oflack of compliance to ingested fooddue to resection ofthe fundus, the most expandable gastric portion, whereas thelatter decreases because of the division of the sling musclefibers of Helvetius.[77]Intrathoracic migration of the proximal portion of thegastric tubule may contribute to the decrease of the pressuregradient between the esophago-gastric junction (EGJ)migrated above in the mediastinum (low pressure) and thegastric remnant below in the abdomen (high pressure),favoring GERD.[78]An additional confounding factor is the composition ofthe refluxate after SG, reflux episodes occur more frequently in the postprandial state and are made up chieflyofnonacid ingested food. This may determine absence ofsymptoms and relative lack of efficacy of PPI therapy in themanagement of GERD-related complications.[79]

The MGB has lower incidence of GERD due to lower pressure in the stomach but may have an incidence of bile reflux.[80] BR after MGB is a subject of ongoing debate, even though until now there has not been a study that actually demonstrated BR after MGB. Everyone agrees that bile exposure to esophageal mucosa is extremely harmful. The effect of bile exposure to the gastric mucosa on the other hand is more controversial.[81]

Jammu et al.[82] reported that GERD was maximally seen after LSG(9.4 %), followed by RYGB (1.7 %), and lowest in MGB (0.6 %) with bile reflux seen in 0.4 % of MGBpatients and was nil in LSG and RYGB. Johnson et al.,[83] in a retrospective analysis of five centers, reported that the main indication for revision surgery after MGB was bile reflux. A review by Mahawar et al.[84] addressed the issue of BR after MGB, they concluded that according to the literature,BR will lead to higher incidence of histological gastritis, but itdoes not always translate into adverse symptomatic outcome.

Effect on Weight Loss

Mean excess weight loss % (EWL) after one month in our patients was 17.41% (± 1.142%) for LSG group and 17.09% (± 0.988%) for MGB group, mean excess weight loss % after three months was 32.74% (± 1.451%) for LSG group and 33.29% (± 1.518%) for MGB group, mean excess weight loss % after six months was 46.84% (± 1.376%) for LSG group and 47.03% (± 1.169%) for MGB group, mean excess weight loss % after one year was 66.99% (± 1.739%) for LSG group and 67.76% (± 1.813%) for MGB group. The statistical analysis shows no significant difference between both groups in weight loss over time after surgery.

Felsenreich et al.[85] reported A mean EWL of 71±25% was reached at a median of 12 months after LSG. Bohdjalian et al.[86] reported a mean EWL of 57.5 ±% after one year of LSG. Himpens et al.[87] reported a mean EWL of 57.7% (0 to 125.5) after one year of LSG. Cottam et al.[66] reported a mean excess weight after LSG at 1 year of 46%. Fischer et al.[88] performed a systematic review over 123 papers describing 12,129 patients who had LSG. They reported a mean EWL of 56.1% after 12 months.Buchwald et al.[89] in their meta-analysis of a total of 136 fully extracted studies, which included a total of 22,094 patients, they reported a mean excess weight after LSG at 1 year of 68.2% (61.5%-74.8%). Brethauer et al.[18] reported a mean EWL after LSG in 24 studies (1662 patients) of 33–85%, with an overall mean EWLof 55.4%. Parikh et al.[90] reported an overall mean EWL after LSG in 54 articles of 57.6%.

Rutledge et al.[13] reported a mean excess weight loss of 51% at 6 months, 68% at 12 months after MGB as a primary procedure. Wang et al.[65]reported a mean EWL at 3 months of 39.1%, at 6months of 55.6%, and at 12 months of 69.3%. Kular and Rutledge[42]reported a mean EWL at 12 months of 61.2 %. Piazza et al.[55]reported a mean EWL at 12 months of 65%. Lee et al.[56] in their study comparing the RYGB to the MGB, reported The percentage of excess weight loss (EWL) was 58.7% at 1 year in the RYGB group, and 64.9% in the MGB group. Musella et al.[48] reported a mean EWL of 70.12% ±8.35 at 12 months in primary MGB procedures. Noun et al.[46]reported a mean EWL of 69.9±23.1 at 12 months in 1000 primary MGB procedures.Mahawar et al.[91] performed a systematic review over 14 articles, describing 5,095 published MGB primary procedures, and they reported a mean excess weight loss (EWL) at 12 months of 76%.

Effect on quality of life

There were significant improvements in all categories of the questionnaire over time in both sides of our study and the overall score of the questionnaire was significantly got better. The Moorehead-Ardelt Quality of Life Questionnaire (MA-QoLQII) was originally developed as a disease-specific instrument to measure subjective QoL in obese subjects in thefollowing six key areas: self-esteem, physical well-being, social relationships,work, sexuality and eating behavior, the results of this questionnaire were combined with scores for weight loss andimprovement of medical conditions in the Bariatric Analysis and ReportingOutcome System (BAROS), which is a quantitative measure used to measure theoutcome of bariatric surgery.[92]it has been found useful, reliable and reproducible in numerous clinical trials in different countries.[93]

Major et al.[94] performed a prospective study over patients who were treated for morbid obesity by either LSG or RYGB, assessing the quality of life, using SF-36 (*Short Form Health Survey*) and MA-QoLQII, before commencement of the surgical treatmentand after surgical treatment, and they found no significant differences in body weight loss between the two types of procedures with improvement of obesity-related diseases, together with significant enhancement the quality of life. No differences were noted in terms of the quality of life improvement between particular types of surgical procedures. Dejeu et al.[95]investigated the weight changes and the impact of laparoscopic sleeve gastrectomy on quality of life in 1 year after LSG, they reported a significant improvement in all domains of SF-36 and also MA-QoLQII in 1 year ($p<0.0001$).

Kolotkin et al.[96]conducted a systematic review of 12 review articles that have evaluated the evidence of the impact of obesity and weightmanagement on QoL, they found that in all populations, obesity was associated with significantlylower generic and obesity-specific QoL. The relationship between weight loss and improved QoL was consistently demonstrated after bariatric surgery, while improved QoL was evident after non-surgical weight loss, but was not consistently demonstrated, even in randomized controlled trials. This inconsistency maybe attributed to variation in quality of reporting, assessment measures, studypopulations and weight-loss interventions.

Resolution of Co-morbidities

In this study, both groups had dramatic improvement of co-morbidities. Three patients (15 %) from LSG group, and five patients (25 %) from MGB group had dyslipidemia. All these patients had normal lipid profile one year after surgery. Three patients (15%) from LSG group and four patients (20%) from MGB group had type 2 Diabetes Mellitus and were receiving oral hypoglycemic agents. All these patients had remission from Diabetes Mellitus. One patient (5%) from LSG group and two patients (10%) from MGB group had Osteoarthritis of weight bearing joints, the pain resolved by the end of the study in these three patients. Four patients suffered from hypertension, two (10 %) from LSG group and, two (10 %) from MGB group, and became well controlled without medical treatment.

Approximately 80% of obese adults have at least one, and 40% have two, or more associated diseases such as T2DM, hypertension, cardiovascular disease, cancers, dyslipidemia and/or insulin resistance.[97, 98] Weight loss is associated withan improvement in fasting glucose, insulin resistanceand dyslipidemia.[99, 100]Several surgical studies have demonstrated the safety and efficacy of bariatric surgery, especially in terms of reduction in comorbidities over time.[27, 101, 102]

Perry et al.[101] conducted a retrospective cohort analysis using Medicare fee-for-service patients from 2001 to 2004, and diagnosed presence of 5 conditions commonly comorbid with morbid obesity (diabetes, sleep apnea, hypertension, hyperlipidemia, and coronary artery disease). They examined the morbidly obese patients who did and did not undergo bariatric surgery, with up to 2 years follow-up and found that morbidly obese Medicare patients who underwent bariatric surgery had increased survival rates over the 2 years when compared with a similar morbidly obese nonsurgical group (P 0.001). For patients under the age of 65, this survival advantage started at 6 months postoperatively and for patients over age 65, at 11 months. The surgical group also experienced significant improvements in the diagnosed prevalence of the 5 most prevalent weight-related comorbid conditions relative to the nonsurgical cohort after 1 year post surgery (P 0.001), And they concluded that bariatric surgery appears to increase survival even in the high-risk, both for individuals aged 65 and older and those disabled and under 65. In addition, the diagnosed prevalence of weight-related comorbid conditions declined after bariatric surgery relative to a control cohort of morbidly obese patients who did not undergo surgery.

Buchwald et al.[102]performed a systematic review on 621 studies with 135,246 patients undergoing RYGB, BPD/DS, LSG and GB. Diabetes Resolution by Procedure. In the 621 studies, the diabetic patients had an overall 78.1% resolution of their clinical manifestations of diabetes, and diabetes was improved or resolved in 86.6%. Diabetes resolution was greatest for patients undergoing biliopancreatic diversion/duodenal switch (95.1% resolved), followed by gastric bypass (80.3%), sleeve gastroplasty (79.7%), and then laparoscopic adjustable gastric banding (56.7%). The proportion of patients with diabetes resolution or improvement was fairly constant at time points less than 2 years and 2 years or more. Postoperative insulin levels decreased significantly, as did HgA1c and fasting glucose values.

Swarbrick et al.[100]reported that onemonth after bariatric surgery accompanied by a 10-12%weight reduction, the decrease in the BMI and improvement of insulin resistance were significant, but the reduction offasting glucose was not significant.
Insulin resistance is the principal cause of glucose intolerance, T2DM and it also induces the progression ofatherosclerosis. It has been shown that in addition to markedweight loss following bariatric surgery, insulin resistanceameliorates.[89]Furthermore some studies have demonstrated specific differences among the several techniquesof bariatric surgery. The changes in the metabolic outcomesare different when restrictive procedures or malabsorptionapproaches are used.[102]The mechanisms involved in the improvement of insulin sensitivity are likely to involvethe immediate reduction in food intake (accompanied bymodulation of intestinal incretin hormones),[103]followedby the reduction of excess adiposity. [104]

Lee et al.[44] in their prospective, randomized trial compared the safety and effectiveness of laparoscopic Roux-en-Y gastric bypass (LRYGBP) and laparoscopic mini-gastric bypass (LMGBP) in the treatment of morbid obesity. They included eighty patients who met the NIH criteria were recruited and randomized to receive either LRYGBP (n = 40) or LMGBP (n = 40), and found that both LRYGBP and LMGBP are effective for morbid obesity with similar results for resolution of metabolic syndrome and improvement of quality of life. LMGBP is a simpler and safer procedure that has no disadvantage compared with LRYGBP at 2 years of follow-up.

Rutledge and Walsh[105]prospectively assessed the results in 2,410 MGB patientstreated from September 1997 to February 2004, and reportedMGB is a relatively low-risk bariatric operation in skilled hands, which results in good weightloss and improvement in all major associated medical illnesses that were measured; 85% improvement in patients with gastro-esophageal reflux, and 83% improvement in patients with diabetes, 80 % improvement in patients with hypertension, and 89% in patients with hypercholesterolemia.

Vidal et al.[106] conducted a twelve-month prospective study on the changes in glucose homeostasis and the Metabolic Syndrome in 91 severely obese T2DM subjects undergoing laparoscopic SG (SG; $n = 39$) or laparoscopic Roux-en-Y gastric bypass (GBP; $n = 52$), matched for DM duration, type of DM treatment, and glycemic control was conducted.At 12 months after surgery, subjects undergoing SG and GBP lost a similar amount of weight (%EBL: SG: 63.00 ± 2.89%, BPG: 66.06 ± 2.34%; $p = 0.413$). On that evaluation, T2DM had resolved, respectively, in 33 out of 39 (84.6%) and 44 out of 52 (84.6%) subjects after SG and GBP ($p = 0.618$). The rate of resolution of the MS (SG: 62.2%, BPG: 67.3%; $p = 0.392$) was also comparable. A shorter DM duration ($p < 0.05$), a DM treatment not including pharmacological agents ($p < 0.05$), and a better glycemic control ($p < 0.05$), were significantly associated with T2DM resolution in both surgical groups. Weight loss was not associated with T2DM resolution after SG or GBP, but was associated with resolution of the MS following the two surgical procedures ($p < 0.05$).they concluded that at 12 months after surgery, SG is as effective as GBP in inducing remission of T2DM and the MS, and that SG and GBP represent a successful an integrated strategy for the management of the different cardiovascular risk components of the MS in subjects with T2DM.

Abbatini et al.[107] studied 60 morbidly obese T2DM patients who underwent AGB (24 patients), GBP (16 patients), or SG (20 patients) between 1996 and 2008 were retrospectively. Age, sex, body mass index (BMI), estimated weight loss (EWL), fasting glycemia, HbA1c, euglycemichyperinsulinemic clamp, discontinuation of diabetes treatment, and time until interruption of therapy were evaluated.54 patients received oral hypoglycemic agents for at least 12 months before surgery, and 6 patients received insulin. The mean follow-up period was 36 months. The resolution rate was 60.8% for the AGB patients, 81.2% for the GBP patients, and 80.9% for the SG patients. The postoperative time until interruption of therapy was 12.6 months for the AGB patients, 3.2 months for the GBP patients, and 3.3 months for the SG patients. Insulin resistance was restored to normal values in all the patients. The greatest improvement from preoperative values occurred in the SG group. The anti-diabetic effect was similarly precocious after GBP and SG compared with AGB. This difference may indicate that a hormonal mechanism may be involved, independent of weight loss.

Gill et al. made a systematic review that included a total of 27 studies and 673 patients. The baseline mean body mass index for the 673 patients was 47.4 kg/m2 (range 31.0–53.5). The mean percentage of excess weight loss was 47.3% (range 6.3–74.6%), with a mean follow-up of 13.1 months (range 3–36). DM had resolved in 66.2% of the patients, improved in 26.9%, and remained stable in 13.1%. The mean decrease in blood glucose and HbA1c after sleeve gastrectomy was −88.2 mg/dL and −1.7%, respectively. They concluded that most patients with type 2 DM experienced resolution or improvement in DM markers after LSG. LSG might play an important role as a metabolic therapy for patients with type 2 DM.

Milone et al.[108] a cohort of 31 patients, 15 subjects underwent SG (48.4%), and 16 underwent MGB (51.6%), after adjusting for various clinical and demographic characteristics in a multivariate logistic regression analysis, high hemoglobin A1c was determined to be a negative predictor of diabetes remission at 12 months (OR = 0.366, 95%CI: 0.152-0.884). Using the same regression model, MGB showed a clear trend toward higher diabetes remission rates relative to SG (OR = 3.780, 95%CI: 0.961-14.872).

Jammu and Sharma[82] analyzed a prospectively collected bariatric database of 473 MGBs, 339 LSGs, and 295 RYGBs. They reported a mortality rate was 2.1 % in LSG, 0.3 % in RYGB, and 0 % in MGB. Leaks were highest in LSG (1.5 %), followed by RYGB (0.3 %), and zero in MGB. Bile reflux was seen in <1 % in the MGB series. Persistent vomiting was seen only in LSG. Weight regain was 14.2 % in LSG, 8.5 % in RYGB, but 0 % in MGB. Hypo-albuminemia was minimal in LSG, 2.0 % in RYGB, and 13.1 % in MGB (in earlier patients where bypass was >250 cm). The resolution of comorbidities: dyslipidemia, type 2 diabetes (T2D), hypertension, and percent excess weight loss (%EWL) was maximum in MGB. GERD was maximum in LSG (9.8 %), followed by RYGB (1.7 %), and minimal in MGB (0.6 %).they suggested that MGB is the effective and safe procedure for patients who are compliant in taking their supplements. LSG may be done in non-compliant patients and those ready to accept weight regain.

The overall outcome of surgery

The overall result of the operation was assessed using the updated BAROS[20] at intervals after surgery; at 3 months, 6 months, and one year after surgery. It assessed %EWL, effect on comorbidities, and QoL using MA QoLQII. Also, it evaluated the occurrence of complications or reoperations. At the end of the study, 36 patients had excellent outcomes and four patients had very good outcomes. The outcomes were similar between both groups over time with no statistical differences between both groups.

The Bariatric Analysis and Reporting Outcome System (BAROS) was developed by NIH Consensus Conference panelists at 1998 to answer a need for a standardized method to analyze and report outcomes of bariatric surgery.[109, 110] Feedback from its users and additional research prompted some changes in 2009, the updated BAROS includes the percentage of excess body mass index loss, new criteria for the diagnosis of diabetes, and clarifies the concept of its “improvement.” The wording and drawings in the quality-of-life questionnaire were modified. A sixth question, analyzing eating behavior, was added, and the scoring key was changed to a 10-point Likert scale, creating the Moorehead-Ardelt Quality of Life Questionnaire II.[20]The BAROS has been used in many countries since the late 1990s, and proved to be very useful for evaluating and reporting the results of obesity treatments, allowing the comparison of the results of different surgical series and surgical bariatric techniques.[111-115]

There are no much published data about the use of Bariatric Analysis and Reporting Outcome System (BAROS) for evaluation of the outcome of MGB. Most of the published data are from the research on RYGB and LSG.

In the work published by Ribeiro et al.,[116] authors present preliminary data on the impact of Roux-en-Y Gastric Bypass (RYGB) bariatric surgery on patients from two cities, using the BAROS. This retrospective study included 50 patients over 18 years of age of both genders (with a mean age of 40 years) who had undergone RYGB and had a follow-up of at least 3 months. Prior to surgery, 48% of patients were morbidly obese with a mean weight and body mass index (BMI) of 119.37 ± 18.44 kg and 43.54 ± 5.33 kg/m2, respectively. Following surgery, these parameters decreased significantly to 78.01 ± 11.06 kg and 28.46 ± 3.61 kg/m2, respectively. With regard to obesity-associated comorbidities, 78% of patients reported having comorbidities, especially hypertension (44%), rheumatism (34%), dyslipidemia (24%) and diabetes (20%). After surgery, the resolution rates were 77, 24, 100 and 100%, respectively, for these same clinical conditions. With regard to QOL, some patients reported feeling better (8%) or much better (92%) after surgery: the majority of these patients reported improvement of their physical activities (64%), social and family activities (66%), working capacity (68%) and sexual interest (68%). By using the BAROS, QOL improvement was classified as failure (2%), good (8%), very good (24%) and excellent (66%). These data are very similar to data of other larger and longer series published by Suter et al.[117]and Costa et al.[118]

D'Hondt et al.[119] performed a retrospective study that evaluated long-term weight loss, resolution of comorbidities, quality of life (QoL) using Medical Outcomes Survey Short Form 36 (SF-36) and Bariatric Analysis and Reporting

Outcome System (BAROS) questionnaires, their study included 102 patients who underwent LSG as a sole bariatric operation between January 2003 and July 2008., which were sent to all patients. A total of 83 patients (81.4%) were eligible for follow-up evaluation. Their mean initial body mass index (BMI) was 39.3 kg/m2. No major complications occurred. At a median follow-up point of 49 months (range, 17–80 months), the mean %EWL was 72.3% ± 29.3%. For the 23 patients who reached the 6-year follow-up point, the mean %EWL was 55.9% ± 25.55%. The mean BAROS score was 6.5 ± 2.1, and a "good" to "excellent" score was observed for 75 patients (90.4%).

Keren et al.[120]compared patients attending regular clinic routine with those who were lost to follow-up after sleeve gastrectomy with regard to anthropometry, comorbidity, quality of life, and food tolerance and determined who benefited most from the operation. They designed a retrospective review performed on patients 30 months after undergoing sleeve gastrectomy. Body mass index was used to report weight loss. Bariatric Analysis and Reporting Outcome System (BAROS) was used to assess the outcome of surgery. A total of 119 patients participated in the study. For groups I and II, the mean percentage of excess BMI loss at 30 months was 82.08 ± 9.83 and 74.88 ± 8.75, respectively, with better comorbidity improvement in group I. BAROS scores were 7.62 ± 0.72 and 6.92 ± 0.92. FTS was 24.30 ± 2.09 and 22.55 ± 2.27, respectively, showing the advantage of regular follow up after sleeve gastrectomy.

Conclusions:-

1. In the short term, both Laparoscopic Sleeve Gastrectomy and Laparoscopic Mini Gastric Bypass result in effective weight loss and improving obesity comorbidities with a very low rate of complications.
2. The risk of de novo GERD after LSG, and risk of bile reflux after MGB need to be kept in mind and explained to the patient when counselling for these procedures.

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