

COMPARATIVE STUDY OF LAPAROSCOPIC SLEEVE GASTRECTOMY VS MINI GASTRIC BYPASS, A SHORT-TERM FOLLOW-UP STUDY IN PATIENTS OF MORBID OBESITY UNDERGOING BARIATRIC SURGERY

Surgery

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ABSTRACT

Objectives: laparoscopic bypass (laparoscopic Roux-en-Y-gastric bypass) was found gold standard procedure as a bariatric surgery at the beginning, laparoscopic sleeve gastrectomy and laparoscopic mini gastric bypass are procedure challenging laparoscopic Roux-en-Y-gastric bypass, hence this Retrospective plus Prospective study to compare preliminary outcomes that is EWL%, comorbidity resolution and complications between LSG and LMGB during five-year period **Materials and methods:** All patients diagnosed case of obesity with or without comorbidities, and getting operated by laparoscopic sleeve gastrectomy or laparoscopic minigastric bypass technique were included. Retrospective plus prospective study was carried out. 105 patients were divided into two groups undergoing Laparoscopic MGB and LSG. **Results:** There is no statistical difference in % excess weight loss in patients of both groups of laparoscopic MGB and LSG. No statistical difference in co morbidity resolution and improvement in patients of both groups of laparoscopic MGB and LSG. No statistical difference in perioperative and post operative complications caused by both laparoscopic MGB and LSG. **Conclusions:** Laparoscopic Mini gastric bypass is safe procedure with low mortality and morbidity. and laparoscopic sleeve gastrectomy is safe procedure with acceptable post operative complications and low morbidity and no mortality

KEYWORDS

LSG, MGB, CO-MORBIDITY, %EWL

INTRODUCTION

It is well established fact that obesity is an epidemic with its tentacles spread to nearly every part of the globe. The rate of growth of the obese population has grown steadily in the developed countries. Due to globalization and introduction of cheap fast food that was easily within the reach of the Indians, sedentary lifestyle that came along, lack of exercise, hereditary factors prevalence of obesity especially childhood obesity has grown in the cities. This has led to rise in obesity related health problems in India as well.

The rise of non-communicable diseases like hypertension, diabetes mellitus, osteoarthritis has been directly linked to obesity. Grouped together under the name of metabolic syndrome, ever since the introduction of bariatric surgery in 1960s, there have been multiple studies that have proven the efficacy of the application of these methods in achieving a solution to significant weight loss in motivated individuals along with the resolution of comorbidities mentioned above. Bariatric procedures have been found to have long lasting results that are far superior to any non-surgical method of weight loss.

Despite laparoscopic bypass (laparoscopic Roux-en-Y-gastric bypass) was found gold standard procedure at the beginning, laparoscopic sleeve gastrectomy and laparoscopic mini gastric bypass are procedure challenging laparoscopic Roux-en-Y-gastric bypass. Hence this Retrospective plus Prospective study to compare preliminary outcomes that is EWL%, comorbidity resolution and complications between LSG and LMGB during five-year period

MATERIAL AND METHODS

This is a hospital based prospective plus retrospective study. Study carried out in Department of Surgery in tertiary care center and teaching institute of India over a period from July 2017 to Nov 2022. Cases from 2017 to November 2022 collected and evaluated. Preoperatively, fully informed consent was taken with explanation of risk. Study included 105 patients.

Inclusion Criteria:

1. BMI 32.5 or greater with 2 or more comorbidities.
2. BMI 35 or greater with no comorbidities
3. Failed attempts at weight loss, complications related to obesity, understanding of the surgery/risks.

Exclusion Criteria:

BMI less than 32.5, patients having symptoms of GERD, Unfit for general anaesthesia, patients below 18 years of age and above 65 years of age, patients not willing to adhere to dietary advice, treated or untreated psychiatric disorder associated with psychoses, Mental retardation [IQ <60- CONGNATIVE FUNCTIONING WHO 1968]/ inability to understand procedure, active substance abuse (alcohol or tobacco products) and severe depression, malignancy with poor 5year survival prognosis, patients who have undergone any other weight loss surgical procedure other than LSG or LMGB.

Study Design

Data collected from all patients getting operated for obesity with laparoscopic sleeve gastrectomy technique and laparoscopic minigastric bypass

Following Investigations were done

Complete Blood Count, KFT, LFT, Fasting Blood Sugar, Post Prandial Blood Sugar, HIV, Hbsag, Radiology: Xray Chest, Xray Neck Ap & Lateral, Glycosylated Hb, Measurement of Lean Body Mass, Pulmonary Function Test, Sleep Study, Ultrasonography Abdomen-Pelvis, Upper GI Endoscopy, ECG

Body Mass Index

Very severely underweight - less than 16

Severely underweight - 16-16.9

Underweight - 17-18.4

Normal - 18.5-24.9

Overweight - 25-29.9

Obese class I - 30-34.9

(Patients of class I and above were selected as candidates)

Operative Procedure

Common Steps For Mini-gastric Bypass And Sleeve Gastrectomy:

During operation, the various technical difficulties arising were noted. All patients were operated by laparoscopic approach under general anesthesia with inhalational and intravenous agents, with endotracheal intubation. All patients received an intraoperative dose of injectable Diclofenac.

Procedures were performed in dedicated bariatric operating rooms

fitted with appropriate equipment. The patients are placed in a split leg position over a dedicated bariatric table with capacity to accommodate a patient up to 350kg. Surgery is performed in a steep reverse Trendelenburg position. Usually, 4 ports were used. Pneumoperitoneum is created using Veress needle through the Palmer's point. The first 12mm supraumbilical left para-rectal port is inserted under optical guidance with a 0-degree laparoscope. In some cases, in which Liver was small 3 ports were used. The Veress needle is removed under laparoscopic view to rule out injury to the stomach. The remaining ports are inserted in the midline in the epigastrium and another port inserted in the right para rectal line and left subcostal region.

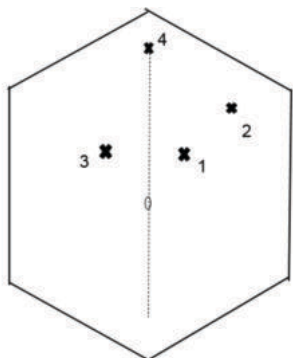


Image 1: Port position

- (1) 12 mm camera port -Left para-rectal supra-umbilical port (Midway between xiphi sternum and umbilicus).
- (2) 5mm right hand working port -5cm below left subcostal margin in midclavicular line.
- (3) 12mm left hand working port -Right para-rectal supra-umbilical.
- (4) 5mm/Subxiphoid /epigastric port -Liver retraction port.

Steps For Laparoscopic Sleeve Gastrectomy:

The liver is retracted using a needle holder via an epigastric (subxiphisternal) port by holding the Phreno-esophageal ligament. The surgery begins by the division of the gastrocolic omentum 4cm proximal to pylorus to preserve the pyloric antrum using the ultrasonic scalpel and proceeds up to the angle of His completely freeing the greater curvature. The short gastric vessels are identified and divided.

Dissection is performed up to the left crus of the hiatus by dedicated 45cm long bariatric laparoscopic instruments, and all attachments are released to completely mobilize the fundus posteriorly. The gastric sleeve is created using sequential firings of a 60-mm linear Endo GI stapling device with green cartridges used along the body of the stomach and blue cartridges used for fundus as it is relatively thinner. The staplers are applied alongside a 40Fr calibrating tube positioned against the lesser curve to avoid stenosis and to obtain a narrow gastric tube. The calibration tube is withdrawn, and a leak test is performed using intraoperative methylene blue dye occluding the pylorus. Precaution is taken to fire the stapler approximately 4 to 6 cm proximal to pylorus to avoid antrectomy. Hemostasis is ensured in cases of staple line bleeding by vascular clips or by burying the stapler line with barbed suture of dyed polydioxanone 2-0. A simultaneous cholecystectomy and ventral hernia repair are performed in patients with a preoperative diagnosis of gallstones and incisional hernia. Abdominal drain (24 Fr) is placed selectively, and port sites are closed. All port sites were infiltrated with 0.5 % Bupivacaine, just before closure of port sites.

Steps For Laparoscopic Mini Gastric Bypass:

After creation of pneumoperitoneum abdomen is entered using optical trocar and subsequently other ports are inserted. After inspection of the small bowel, liver, and any other grossly detectable abdominal pathology on initial laparoscopy, the first step is the creation of the lesser omental window. Dissection is started along lesser curvature midway between pylorus and crows' foot and a lesser omental window is created. The window is created for about 2-4 cm, lysing all the anterior and posterior adhesions to stomach, and the lesser sac is entered. Liver retraction is done by the assistant surgeon, using blunt instruments without traumatizing the organ. An endo-GIA stapler, usually 45-mm blue is engaged across the antrum of the stomach at right angles to its axis. An adequate lesser omental window free of adhesions is a prerequisite for this step. This first vertical firing should

not transect antrum more than 60% of its width. Anterior and posterior walls of the stomach must be grasped equally by the stapler to avoid a twist and "bird beaking" of the edges, thereby avoiding trouble in the gastro-jejunostomy.

A moderate-sized stomach pouch is the hallmark of MGB. The pouch is neither tight like that of a LSG, nor is it small-sized like that of a RYGB. A long wide and low-pressure tube is characteristic of stomach pouch created in MGB. First, transverse firing from the left para-rectal port using 60 mm green cartridge from the edge of the previously divided stomach will be done. The axis of division should be perpendicular to the first firing and parallel to lesser curvature of the stomach, making sure to divide the antrum longitudinally almost at the center. Subsequent firings are done along a 40-Fr Bougie. The dissection should be lateral to the left crus of the diaphragm, leaving a minimum cuff of 1 cm from the angle of His, and a stomach tube will be created. Care to avoid inadvertent injury to short gastric, inferior phrenic vessels and spleen is taken. Hemostasis attained by using hemostatic clips and suturing the staple-line on the pouch and on the bypassed stomach side. An antecolic loop gastro-jejunostomy is done.

An enterotomy is made on the jejunum 150-200 cm from ligament of Treitz. Gastrotomy is done on the anterior surface of the pouch midway between the two inferior angles and parallel to the previous staple-line. The Bougie is used to stabilize the pouch during gastrotomy. The gastrotomy and enterotomy are closed either by a 60mm green cartridge stapler or by using 2-0 Vicryl continuous extra-mucosal hand-sewn sutures. The leak test is done by using methylene blue to check the integrity of anastomosis. An abdominal drain is placed near anastomosis selectively. All port sites are closed after infiltrating with 0.5% Bupivacaine.

Postoperative Management

Postoperatively, patients monitored overnight in the surgical ICU. Ambulation is performed within 4 to 8 hours after surgery and chest physiotherapy started in the immediate postoperative period. Clear liquids started after 24 hours. The patients are discharged once oral intake of 1500- 2000 ml/24 h is established. A liquid diet given for 1 week, a pureed/soft diet for next 3 weeks, and normal diet of restricted, high protein low sugar, low fat diet for 1 month. Dietary counselling provided, and a normal consistency, low-calorie, high-protein diet advised at 2 months from surgery. Patients followed up at 3, 6, 12, 18 and 24th post-operative months. Patients followed up in surgical OPD during post-operative period and thereafter up to 2 years as per the needs of the patients. Patients kept on lifelong supplementation of iron, calcium and multivitamins.

Patients after uneventful discharge are followed up after 15 days to counsel and ensuring prescribed dietary schedule. Later the patients followed up on 1st month to record the weight and BMI loss. Any sort of gastrointestinal complaints like nausea, vomiting, heart burn to look for bile reflux and dumping syndrome. Patients asked about resumption of their daily routine activity. Follow up HbA1c, blood pressure records, lipid profile and obstructive sleep apnea (both objective evidences given by patient's family members and follow up sleep study) on 3rd month post op are done and treatment is given accordingly. Patients reviewed for parameter like blood sugar levels, blood pressure after 6 months also. A follow up upper GI endoscopy is mandatory after 1 year of bariatric surgery and then repeated every 1 year for surveillance.

Study Factors-

Factors studied in this study are age distribution, gender distribution, socioeconomic class distribution, Body Mass Index, co-morbidities and its resolution, Diabetes mellitus, Hypertension, OSAS, Dyslipidemia, %EWL, complication, overall mortality rate, post operative leak, enterocutaneous fistula, weight regain, venous thromboembolism/ pulmonary embolism, hemorrhage, port site hernia, marginal ulcers, stricture/stenosis.

Statistical Analysis

Bivariate analysis

- Comparison of baseline characteristics of study populations done by applying t test.
- Between-the-group comparison of weight of study population done by unpaired t test.
- Within-the-group comparison of weight done by unpaired t test.
- p value <0.05 considered as significant.

RESULTS**1. Age distribution**

Total number of patients undergoing mini gastric bypass were 54 patients i.e., n=54, from which the youngest patients was 21 years old and the eldest was 60 years old and the age range of the patients in study was between 21 to 60 years. Mean age of the patients undergoing MGB was 39.64 years. The most common age group of patients was 41 to 50 years in which 31 patients were operated that was 59.62%.

Total number of patients undergoing laparoscopic mini gastric bypass were 51 and the age range of the patients in study was between 21 to 60 years. The mean age of participants in this study is 38.66 years. The youngest participant is 18 years old. The oldest participant is 58 years old. The most common age group of patients belonged to that between 41-50 years which was 22 out of 51 (44%).

2. Gender Distribution

Among 54 participants of MGB, 17 i.e., 32.69% patients were males and 35 patients i.e., 67.31% were females. The male to female sex ratio is 1:2.05.

Among 51 participants of LSG 17 patients were males and 34 patients were females. The male to female sex ratio is 0.3.

3. Socioeconomic Class Distribution

12 out of 54 (23.08%) patients of MGB were amongst the middle class remaining 40 out of 54 patients (76.92%) belonged to the lower 11 out of 50 (22%) patients of LSG belonged to the middle class remaining 39 out of 50 patients (78%) belonged to the lower socioeconomic scale.

4. Body Mass Index

Bivariate analysis: (Unpaired t-test) Between-the-group comparisons of weight of study populations.

In the present study of 54 patients of morbid obesity who underwent laparoscopic Mini Gastric Bypass, the lowest Body Mass Index (BMI) of the patients operated was 33 kg/m². The highest BMI operated was 55.5 kg/m². The mean BMI operated was 38.81 kg/m². The most common group of patients belonged to the group of BMIs between 35-39.9 kg/m², i.e., 65.38%. The least common range of BMI was 50 to 60 kg/m² which accounted to 3.84%. 5 patients were amongst the BMI range of 32.5 to 34.9 kg/m² i.e., 9.62%. 11 patients fall in BMI range of 40 to 49.9 g/m² i.e., 21.16%.

Among 51 patients of morbid obesity who underwent laparoscopic sleeve gastrectomy, the lowest Body Mass Index (BMI) operated was 33.2 kg/m². The highest BMI operated was 53.5 kg/m². The mean BMI operated was 38.81 kg/m². The most common group of patients belonged to the group of BMI between 35-39.9 kg/m².

TABLE 1- Comparison of base line characteristics of study population.

Study factors		LAP MGB (n= 54)	LSG (n=51)
Age distribution	Age range	21-60	18-60
	Mean age	39.64	38.66
Gender (%)	Male	32.69	33.33
	Female	67.31	66.66
Socioeconomic status (%)	Upper	0	0
	Middle	23.08	22
	Lower	76.92	78
Mean BMI kg/m ²		38.81	38.78
Comorbidities	Diabetes Mellitus (%)	27.77	25.49
	Hypertension (%)	33.33	33.33
	Obstructive sleep apnea (%)	37.03	29.41
	Dyslipidemia (%)	14.81	13.72

5. %Excess weight loss

% EWL in the present study in patients undergoing laparoscopic Mini gastric bypass of total 54 patients at the end of 6 months are **72.62%**, at the end of 1 year was **80.55%** and at the end of 2 years was **85.83%**. And in patients undergoing laparoscopic Mini gastric bypass of total 51 patients at the end of 6 months are **72.62%**, at the end of 1 year was **78.55%** and at the end of 2 years was **81.83%**.

Table 2: Comparison of %EWL in two groups

OBSERVATIONS	LAP MGB (n=54)	LSG (n=51)	P values
%EWL at the end of 6 months	72.62	72.62	1.0000, NS
%EWL at the end of 1years.	80.55	78.55	0.7944, NS
% EWL at the end of 2 year	85.83	81.83	0.5774, NS

6. Comorbidity Resolution

Resolution of co morbidities in both groups laparoscopic mini gastric bypass and laparoscopic sleeve gastrectomy is summarized in following table, Comparison of both groups shows no statistical difference in resolution of comorbidities after laparoscopic MGB and LSG.

Table 3. Comparison of CO- MORBIDITY RESOLUTION in two groups

	Co-morbidity	Remission			Improvement		
		LMGB (n=54)	LSG (n=51)	P value	LMGB (n=54)	LSG (n=51)	P value
1	Diabetes Mellitus	66.67%	61.53%	0.5830	13.33%	23.07%	0.1932 (NS)
2	Hypertension	88.88%	88.23%	0.1932	5.55%	5.88%	0.9419 (NS)
3	OSA	75%	80%	0.5402	25%	20%	0.5402 (NS)
4	Dyslipidemia	75%	71.42%	0.6787	25%	28.57%	0.6795 (NS)

7. Complication

Intra operative and postoperative complications which occurred in both groups were studied and compared, as summarized in following table.

Table 4: Comparison Of Complications In Two Groups

Sr No	Complications	Laparoscopic Mgb Frequency	Lsg Frequency	P Value
1	Overall Mortality Rate	1.85%	0%	0.3154
2	Overall Complication Rate	1.85%	3.92%	0.5285
3	Sleeve Leak	1.85%	1.96%	0.9671
4	Weight Regain	0%	1.96%	0.3150
5	Venous Thromboembolism/ Pumonary Embolism	0%	0%	Na
6	Hemorrhage	0%	0%	Na
7	Port Site Hernia	0%	0%	Na
8	Marginal Ulcers	0%	0%	Na
9	Stricture/Stenosis	0%	0%	Na

DISCUSSION

- Maximum patients being operated for morbid obesity with laparoscopic Mini Gastric Bypass were in the age group of 41-50 years, i.e., in the 5th decade of life and the incidence was 31 out of 54 patients i.e., 59.62%. Maximum patients being operated for morbid obesity with laparoscopic sleeve gastrectomy were in the age group of 41-50 years, i.e., in the 5th decade of life and the incidence was 22 out of 51 patients i.e., 44%.
- The mean age who underwent laparoscopic Mini Gastric Bypass for morbid obesity is 39.05 years. The mean age who underwent laparoscopic sleeve gastrectomy for morbid obesity is 38.70 years. P value is 0.44 (NS).
- In the present study of patients undergoing laparoscopic Mini Gastric Bypass for morbid obesity, there were 17 males and 37 females and the male to female sex ratio is 1:2.05. In the present study of patients undergoing laparoscopic sleeve gastrectomy for morbid obesity, there were 17 males and 34 females and the male to female sex ratio is 1:2.
- Majority of patients in the present study belonged to the lower socioeconomic class. (76.19%)
- Majority of patients undergoing laparoscopic bariatric procedures i.e., laparoscopic mini gastric bypass belonged to the obesity class II (66.66%). Majority of patients undergoing laparoscopic sleeve gastrectomy belonged to the obesity class II (68.62%). P value is 0.9 (NS). Incidences of co morbidities like Diabetes mellitus is 27.77% and 25.49% in lap MGB and LSG group respectively, similarly, incidence of Hypertension is 33.33% in lap MGB group and 33.33% in LSG group, OSAS is 37.03% and 29.41% in lap MGB and LSG group, dyslipidemia is 14.81% and 13.72% in lap MGB and LSG group, in the patients undergoing laparoscopic bariatric surgery i.e., laparoscopic mini gastric bypass and laparoscopic sleeve gastrectomy. There is no statistical difference

observed in incidences of co – morbidities in both groups undergoing laparoscopic bariatric surgery i.e., laparoscopic mini gastric bypass and laparoscopic sleeve gastrectomy

- 6 The average percentage excess weight loss(%EWL) after laparoscopic mini gastric bypass at end of 6th months is 72.62%, at the end of 12th month is 80.55% and the average percentage excess weight loss at the end of 24th months 85.83%. The average percentage excess weight loss(%EWL) after laparoscopic sleeve gastrectomy at end of 6th months is 72.62%, at the end of 12th month is 78.55% and the average percentage excess weight loss at the end of 24th months 81.83%.
- 7 Resolution of co morbidities in both groups laparoscopic mini gastric bypass and laparoscopic sleeve gastrectomy is summarized in table no 3, Comparison of both groups shows no statistical difference in resolution of comorbidities after laparoscopic MGB and LSG.
- 8 Among the 54 patients studied 4 patients (7.40%) had intra-operative stomach pouch staple line bleed. In 1 patient (1.85%) there was intraoperative gastrojejunostomy leak with positive Methylene Blue leak test. Anastomotic site reinforced with sutures. In 2 patients, (3.70%) there was minor injury to the liver during retraction
- 9 Post operatively, minor complications encountered during this study were minor wound infections observed in 3 patients (5.55%) treated conservatively by local wound care. 3 out of 54 i.e., 5.55% had Hemoglobin less than 9g% and suffered from iron deficiency anemia. 1 patient out of 54 i.e., 1.85% experienced dumping syndrome, patients was managed conservatively. Amongst Post-operative major complications was 1 patient out of 54 i.e., 1.85% presented with enterocutaneous fistula, who happened to have intraoperative anastomotic leak and later developed jejunocutaneous fistula on 28th postoperative day, patients were managed conservatively with application of stoma bag over fistula and monitoring fistula output and patients was started on low sugar, low fat, high protein diet with restricted fluids. Out of 54 patients of study, 1 patient i.e., 1.85% developed immediate post-operative leak and underwent immediate exploratory laparotomy but succumbed and thus reports 1.85% of mortality in our study of laparoscopic Mini gastric bypass in patients of morbid obesity.
- 10 Out of the 51 patients operated for morbid obesity, the incidence of intraoperative complications was studied in 8 patients i.e., 15.68% had intraoperative staple line bleeding. In 1 patient i.e., 1.96%, there was intra-operative staple line leak with positive Methylene Blue test due to the last staple misfire. Repeat firing of the stapler was done in this case and complete staple line was reinforced with sutures. Repeat methylene blue test was negative in this patient. In 2 patients i.e., 3.92% there was minor injury to the liver during retraction. This was managed by compression with gauze piece.
- 11 Post-operative complications in 1 patient i.e., 1.96% who initially lost 30 kg in the first 8 months and at the end gained 10 kgs. The cause for this was evaluated by performing an upper gastrointestinal endoscopy which revealed that the fundus was another 1 patient i.e., 1.96% developed a suture line leak. Patients was managed conservatively by Mega stent. Minor complications encountered during this study were minor wound infections observed in 2 patients i.e., 3.92% treated conservatively by local wound care and post-operative nausea vomiting treated conservatively with proton pump inhibitors and prokinetics.

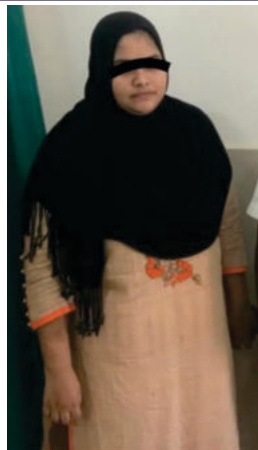
On comparing complications of laparoscopic mini gastric bypass and laparoscopic sleeve gastrectomy, there is no statistical difference in perioperative and post operative complications caused by both laparoscopic MGB and LSG



Weight 86 KG BMI 38.2Kg/m



Weight 65 kg after 1 years of follow up. BMI 28.9kg/m



Preoperative Weight-96kg
BMI-36.2kg/m2



o/c/o LSG weight – 59 kg after
1 yr follow up BMI- 22.2 kg/m2

CONCLUSION-

- Most number of patients that opt for laparoscopic bariatric procedure i.e., laparoscopic Mini gastric bypass and laparoscopic sleeve gastrectomy are in the 4th and 5th decade of life.
- Obesity is more common in females and they are more commonly opting laparoscopic bariatric procedure i.e., laparoscopic Mini gastric bypass and laparoscopic sleeve gastrectomy surgery.
- If facilities are available then even the patients of lower socioeconomic strata opt for laparoscopic bariatric procedure
- Laparoscopic Mini gastric bypass and laparoscopic sleeve gastrectomy produces comparable excess weight loss as early as 3 months and with good short term weight loss. Without significant difference in % EWL in 2 years follow up.
- Laparoscopic Mini gastric bypass and laparoscopic sleeve gastrectomy both procedure causes complete or partial remission of the comorbidities like diabetes mellitus, Hypertension and obstructive sleep apnea syndrome and dyslipidemia without significant statistical difference in outcome.
- Laparoscopic Mini gastric bypass is safe procedure with low mortality and morbidity. and laparoscopic sleeve gastrectomy is safe procedure with acceptable post operative complications and low morbidity and no mortality.
- Further long-term studies are mandatory to better determine the benefits/risk balance after these two laparoscopic bariatric procedures.

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