A Study on Role of Laparoscopic Sleeve Gastrectomy in the Management of Morbid Obesity

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Abstract Obesity has assumed a pandemic and is responsible for serious medical, social, psychological, and economic implications, affecting all ages and socioeconomic groups. Hence, this prospective study was carried out to study the surgical benefits in such patients. A Prospective interventional study was carried out from June 2010 to November 2012 at IGGMC Nagpur performing laparoscopic sleeve gastrectomy (LSG) in morbidly obese patients, and its efficacy was determined. A total of 56 patients were studied. 26 (46.42 %) being males and 30 (53.57 %) females. The maximum number of patient's, i.e., 32 (57.14 %) were in the range of BMI 40–44.99 kg/m² with mean BMI-43.25 kg/m². Mean weight was 117 kg (range 92–180 kg). Common comorbidities observed were hypertension in 43 (76.78 %), bronchial asthma in 31 (55.35 %), and diabetes in 21 (37.5 %). All patients treated with LSG had a mean operative time of 154.9 min (range 110–310 min) with 0 % leak, one conversion to open, and no mortality. Postoperative hospital stay was 3.54 days (range 3–7). Complications were minimal with prolonged vomiting seen significantly in 28 (50 %) patients. Follow up at 24 months showed mean weight 74.72 kg (68–81 kg) with mean excess weight loss of 67.71 % (62.79–71.05 %) causing a mean BMI of 28.42 kg/m² (26.56–30.44 kg/m²). It also reduced mean BP to 120.36 mmHg (110–144 mmHg) and mean fasting blood sugar to 100.63 mg/dl (80–146 mg/dl). Surgery for obesity is definitely an answer for this gift of modernization, and LSG is a safe and effective technique for achieving weight loss. Quality of life improves astonishingly

and adds confidence to this mentally traumatic entity called “OBESITY”.

Keywords Obesity · LSG · BMI

Introduction

Obesity is our millennium gift from the revolutionizing modern era. More than 1.7 billion adults are overweight and at least 300 million of them are clinically obese [1]. It is a major contributor to the global burden of chronic disease and disability. Obesity is a serious condition with medical, social, psychological, and economic implications, affecting all ages and socioeconomic groups [2, 3]. The morbidity by obesity-related problems are already reaching those of cardiovascular and orthopedic disease to cancer indirectly. Conservative treatments have so far given disappointing long-term results. Pharmacotherapy provides only modest weight reduction. The National Institutes of Health consensus development conference in 1991 concluded that “surgical therapy offers the best long-term approach to treat morbid obesity, and is probably the most effective therapy to cure type 2 diabetes” (NIH 1991). Since then, the safety and effectiveness of bariatric surgery has made a rapid increase in bariatric procedures. Any remaining doubts about the effectiveness of bariatric surgery on the recovery from comorbid conditions were erased by the results of the Swedish Obese Subjects Study, in which 2- and 10-year recovery rates from diabetes, hypertriglyceridemia, hypertension, and hyperuricemia were significantly higher in patients who had undergone (Sjöström et al. [4]. 2004). The situation in India is no different. Current evidence suggests onset of obesity-related comorbidities in Asians is at a lower body mass

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index (BMI) level [5, 6]. It is widely recognized today that bariatric surgery is a safe and effective approach to treat morbid obesity and confer benefits in terms of comorbidity resolution, mortality reduction, and reduction in health care costs [7, 8]. With improved understanding, the pursuit for better surgical procedures continues. Laparoscopic sleeve gastrectomy (LSG) is being explored as an option for treating morbid obesity. Initially conceived as the restrictive part of a more complex procedure [bilio-pancreatic diversion-duodenal switch (BPD-DS)] [9, 10], it has been performed as the first step of a staged procedure in super-obese/ high-risk patients to allow some weight loss and hence risk reduction before a laparoscopic Roux-en-Y gastric bypass (LRYGBP) or BPD-DS [9, 10]. Encouraging early results obtained by the LSG have promoted its use as a solitary procedure [11, 12]. There is scanty published literature, mentioning the use of LSG as a primary restrictive procedure for morbid obesity. We report our early experience with LSG as a primary restrictive procedure in the Indian population.

Materials and Methods

This prospective study was carried out in the Department of Surgery of a Medical College and Hospital, over a period from June 2010 to November 2012. Approval from institutional ethics committee and Maharashtra University of Health Sciences, Nashik was taken before commencing the study. After informed and written consent, the study participants were interviewed and examined according to the preformed and pretested proforma and then operated as per the defined procedures. Preoperatively, fully informed consent was taken with explanation of risk of conversion to conventional laparoscopy/open procedure.

The inclusion criteria were as follows: body mass index, (1) 40 or greater with no comorbidities (2) 35 or greater with comorbidities, failed attempts at weight loss, complications related to obesity, understanding of the surgery/risks, and compliance with diet/exercise requirement. Exclusion criteria were as follows: unfit for general anesthesia, patients not willing to adhere to dietary advice, BMI < 34, patients having symptoms of GERD, treated or untreated mental illnesses associated with psychoses, active substance abuse, and severe depression. Preoperative data collected included age, sex, weight, body mass index, concomitant medical conditions (like hypertension, chronic obstructive airway disease, diabetes mellitus, OSAS, diabetes mellitus), and previous upper or lower abdominal surgery. The Moorehead Ardelt II questionnaire was used to assess the quality of life¹³⁸. All the patients were given a

preoperative very low-calorie diet (<800 kcal/day) to induce weight loss, assess commitment, and to ease technical difficulty of surgical procedure, as this regimen is known to shrink liver size. Low molecular weight heparin, compression stockings, and pneumatic sequential compression devices were used in a peri-operative period as prophylaxis for deep venous thrombosis. 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 75 mg, and the next dose was scheduled 6 h later. All port sites were infiltrated with 0.5 % Bupivacaine, just before closure of port sites. Laparoscopic sleeve gastrectomy (LSG) was performed in all cases. Procedures were performed in dedicated bariatric operating rooms fitted with appropriate equipment. The patient is placed in a split leg position with the knees slightly flexed and hip externally rotated. Surgery is performed in a steep reverse Trendelenburg position. Using the xiphisternum as an anatomical landmark, an arc is made at 18 cm, with ports in the midline (camera port), right and left mid-clavicular lines, and left mid-axillary line. The liver is retracted using a liver retractor via an epigastric (sub-xiphisternal) port. The surgery begins by the division of the gastrocolic omentum beginning 5–6 cm proximal to the pylorus (identified by “crow’s foot”) using the ultrasonic shear and proceeds up to the angle of His. The short gastric vessels are identified and divided. Dissection is performed up to the left crus of the hiatus, and all attachments are released to completely mobilize the fundus. The gastric sleeve is created using sequential firings of a 60-mm linear stapling device. The staplers are applied alongside a 32-Fr calibrating tube positioned against the lesser curve so as 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. The resected specimen is placed in an endobag and retrieved via the umbilical port site. A simultaneous cholecystectomy and intra-peritoneal onlay mesh (IPOM) repair is performed in patients with a preoperative diagnosis of gallstones and incisional hernia. Abdominal drain is placed, hemostasis is ensured, and port sites are closed. Average blood loss was calculated by measuring the number of soaked gauze pieces used. A single soaked gauze piece of 4 in in size amounted to a blood loss of 12.5 ml. Postoperatively, patients are monitored overnight in the surgical ICU. Ambulation is encouraged, and chest physiotherapy is started in the immediate postoperative period. An upper GI contrast study using water-soluble contrast (Gastrograffin) is done on the second postoperative day. Clear liquids are started on confirmation of staple-

line integrity. The patient is discharged once oral intake of 1500–2000 ml/24 h is established. A liquid diet is given for 2 weeks, a pureed/soft diet for 6 weeks, and normal diet thereafter. Dietary counseling is provided, and a normal consistency, low-calorie, high-protein diet is advised at 2 months from surgery. Patients are followed up at 3, 6, 12, and 24 postoperative months. The following parameters were recorded: blood pressure, blood sugar levels, resolution in asthma and OSAS, weight, BMI, and excess weight loss (EWL%).

$$\text{EWL}\% = \frac{\text{Preop weight} - \text{Post op Weight}}{\text{Preop weight} - \text{ideal weight}} \times 100$$

Results

Fifty-six morbid obese patients were included in this study and were subjected to laparoscopic sleeve gastrectomy. Two patients were lost to follow up after being discharged from the hospital. The observations found during this study were as follows.

TOTAL NO. OF PATIENTS	56
MALE	26 (46.42 %)
FEMALE	30 (53.57 %)
MEAN AGE (years)	38 (range 19–48)
MEAN WEIGHT (kg)	117 (range 92–180)
MEAN HEIGHT (meters)	1.64 (range 1.55–1.8)
MEAN BMI (kg/m ²)	43.25 (range 35.93–59.45)

The patient with lowest BMI was 35.93. The maximum number of patient's, i.e., 57.14 % were in the range of BMI 40–44.99 kg/m² followed by the range of 45–49.99 kg/m². The comorbidity with maximum incidence in morbidly obese population found was hypertension present in 43 (76.78 %) followed by bronchial asthma present in 31 (55.35 %). Diabetes mellitus was seen in 21 (37.5 %), coexistent cholelithiasis was seen in 6 (10.71 %) whereas coexistent incisional hernia was seen in 15 (26.78 %) patients. Mean operative time was found to be 154.9 min ranging from 110 to 310 min. The time required decreased with the experience of the surgeon as the number of cases progressed. One patient required conversion to open. The average blood loss was found to be 19.77 ml. No incidence of splenic injury or presence of any leak on intraoperative methylene blue dye test. The intraoperative mortality rate was nil. All the patients were mobilized after a postoperative period of 6 h. The average postoperative stay required was found to be 3.54 days. There was no incidence of postoperative bleeding or intra-abdominal abscess formation. There was no evidence of leak on gastrograffin study which was done 24 h

postoperatively. Wound infection was seen in a single patient amounting to the incidence of 1.7 %. Prolonged vomiting was seen in 50 % of patients which gradually resolved over a period of 6 months. The follow up can be summarized as follows.

	Total number of patients=56	Post-operative			
	Preoperative	3 months (N=54)	6 months (N=49)	12 months (N=27)	24 months (N=11)
MEAN WEIGHT (kg)	117 (92–180)	105.654 (85–152)	85.85 (70–102)	77.48 (68–88)	74.72 (68–81)
MEAN BMI (kg/m ²)	43.18 (35.93–59.045)	39.18 (33.20–50.80)	32.03 (27.34–37.34)	29.27 (26.44–32.84)	28.42 (26.56–30.44)
MEAN EWL%	–	19.11 (12.19–29.50)	51.20 (40.74–65.57)	65.25 (45.45–75.55)	67.71 (62.79–71.05)
MEAN SYS BP (mmHg)	146.46 (120–170)	128.22 (100–160)	123.34 (100–150)	121.11 (100–150)	120.36 (110–144)
MEAN Fasting BS	133 (86–206)	107.16 (60–168)	103.57 (60–160)	107.18 (80–160)	100.63 (80–146)

Follow up patient parameters at 3, 6, 12, and 24 months
The comorbidity resolution seen was as follows.

Comorbidities	Preoperative (n=56)	Patients with resolution of comorbidities			
		3 months (n=54)	6 months (n=49)	12 months (n=27)	24 months (n=11)
Diabetes mellitus	21 (37.5 %)	13 (61.9 %)	14 (19) (73.68 %)	5 (7) (71.42 %)	3 (4) (75 %)
Hypertension	43 (76.78 %)	30 (69.76 %)	23 (31) (74.19 %)	14 (16) (87.5 %)	7 (8) (87.5 %)
Osas	13 (23.21 %)	10 (76.92 %)	11 (11) (100 %)	7 (7) (100 %)	2 (2) (100 %)
Bronchial asthma	31 (55.35 %)	26 (83.87 %)	27 (27) (100 %)	15 (15) (100 %)	6 (6) (100 %)

Comorbidity resolution after laparoscopic sleeve gastrectomy

Improvement in quality of life, which was calculated by Moorehead Ardel II scoring system, was seen in 45 out of 49 (92.59 %) patients at the end of 6 months and 10 out of 11 (90.9 %) in patients who were followed up after 2 years. Only a single patient showed no improvement in quality of life at the end of 24 months. Most of the patients had fair or good quality of life. The parameter which showed maximum improvement was ability to work, self-esteem, and social life.

Discussion

Bariatric surgery with its early reports and most promising results led to the dawn of a new era of adventure and hope for the problems when it came to this stratum of patients labeled “obese”. And with reporting of cases and improving economy, it was clear that our Asian continent including Indians were on a rising trend with the western population. Current evidence suggests onset of obesity-related comorbidities in Asians at lower body mass index (BMI) levels. LSG was started as the first step procedure for morbidly obese patients later on to be posted for Duodenal switch operations. Later studies by some surgeons like Bemante et al. (2006) [13], Roa et al. (2006) [14], Givon- Madhala et al. (2007) [15] etc. guided that LSG alone is very much effective and useful in inducing a substantial weight loss. Our study of 56 patients also gives an excellent response in most of the desired outcomes for obese patients. Cottam et al. (2006) [16] in their two-stage approach for severely obese patients ($\text{BMI} > 60 \text{ kg/m}^2$) used LSG as step 1 and furnished the following results in 126 patients. Their mean BMI was $65.3 \pm 0.8 \text{ kg/m}^2$. Operative risk showed that 42 % were ASA III and 56 % ASA IV. Mean comorbid conditions per patients were 9.3 ± 0.3 with major complications seen in 13 % and one death. Mean EWL was 46 %. This first step not only resulted in weight loss but also succeeded in reducing comorbidities and improved quality of life in all. This study was the pioneer in showing results in a higher BMI group and truly laid the principles for its use in lesser BMI patients. Moshe Rubin et al. (2008) [17] published their early results of LSG in 120 patients. They reported no intraoperative complication, no hemorrhage, and no leak. In a median follow up of 11.7 months, %EWL was 53 ± 24 %, and BMI reduced to 43 ± 5 to $34 \pm 5 \text{ kg/m}^2$. Patient satisfaction scoring at least 1 year after surgery was 3.6 ± 0.8 . Our study differs in that we did not override the stapler line by sutures and preserved nearly 1.5 to 2 cm of fundus around the angle of His. This prevented vomiting in most of the patients and even saved time for surgery. Sammour et al. (2010) [18] in his article of LSG as a single stage surgery in 100 patients gave the following important results. The mean BMI was of 50.3 kg/m(2) (range, 34.5–72.8 kg/m(2)). Forty-five patients were super-obese. The median hospital stay was 2 days (range, 1–7 days). Mean follow up was 12.0 months (range, 0.9–23.3 months). Mean excess weight loss was 62.9 % (range, 7.2–129.0 %). Twenty-five percent of patients were diabetic, and 45 % of patients were hypertensive preoperatively. Diabetics and hypertension resolved or improved in 72 and 60 % of patients, respectively. There was a major complication rate of 7 %, including three staple-line leaks (one requiring laparotomy), two staple-line bleeds (one requiring laparotomy), and one infected hematoma and no mortality. Gluck et al. (2011) [19] reported their series of 204 patients with BMI between 35 and 43 kg/m². The mean percent excess

weight loss (%EWL) was 49.9 % ($n=159$), 64.2 % ($n=138$), 67.9 % ($n=77$), 62.4 % ($n=34$), and 62.2 % ($n=9$) at 3, 6, 12, 24, and 36 months, respectively. For patients with $\text{BMI} \leq 43.0$, the mean postoperative %EWL was 58.9 % ($n=72$), 74.1 % ($n=67$), 75.8 % ($n=39$), 72.1 % ($n=17$), and 78.7 % ($n=5$) at 3, 6, 12, 24, and 36 months, respectively. Operative complications include leak (0.0 %), abscess (0.5 %), hemorrhage (1.0 %), sleeve stricture (1.0 %), and severe gastroesophageal reflux disease with need to convert to laparoscopic Roux-en-Y gastric bypass (0.5 %). They concluded its excellent outcomes as a single stage procedure. Thus, it clearly highlights the usefulness of LSG as a primary procedure for treating obese individuals safely and effectively.

Conclusion

Laparoscopic sleeve gastrectomy is a beneficial and excellent technique for reducing weight and thereby reducing comorbidities in the obese patients. The most common comorbidities associated with obesity are hypertension, bronchial asthma, and diabetes mellitus. Laparoscopic sleeve gastrectomy is a safe and effective technique for achieving weight loss in morbidly obese patients. Weight loss and comorbidity resolution also improves quality of life in morbidly obese patients. A strict dietary regime should be followed in order to achieve effective results and needs a good patient compliance. To ensure optimal outcomes, surgery needs to be performed in a multidisciplinary approach and needs an aggressive pre- and post-operative management. Restrictive bariatric surgery can be offered as first line surgery to morbid obesity patients who fail conservative management. However, further studies need to be carried out in understanding the long-term results of laparoscopic sleeve gastrectomy.

Compliance with Ethical Standards

Conflict of Interest All authors contributing for this publication has no conflict of interest.

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