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Laparoscopic Sleeve Gastrectomy: An Effective Surgical Procedure for Control of Obesity: A Prospective Cohort Study

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Abstract: Obesity has come up in a big way resulting into constellation of metabolic abnormalities affecting mainly the productive age group resulting into loss of productivity of an individual as well as their nation. The conservative methods of treating obesity have been proved transient and unsatisfactory. Laparoscopic Sleeve Gastrectomy (LSG) results in long-term success in most of the morbidly obese patients. In the study conducted in the department of Surgery at ABVIMS & DR. RML Hospital, New Delhi on morbidly obese patients between November 2017 to March 2019, LSG resulted in significant weight reduction as well as control of the BMI. The effect of LSG in controlling weight as well as Body Mass Index (BMI) is more in the patients of BMI with <40 BMI as compared to patients of BMI>40.

Keywords: Obesity, LSG, BMI

1. Introduction

1.1 Obesity has become a global epidemic as its prevalence has risen very rapidly in recent decades. The World Health Organization has declared obesity as a disease in its International Classification of Diseases in 1979. Obesity is a simple index of weight-for-height that is commonly used in most part of the world to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m^2) [1].

Obesity has become a very serious issue in world now days with over 25% of the population being obese in US and 15% in Europe [2]. Even in developing countries like India, it is affecting 5% of the country's population. [5] ICMR-INDIAB Study (Phase-I) study showed that obesity rates are high in urban residents than the rural residents. In India, Overweight/ obesity is seen in 30–65% of adult urban population [3, 4]. As per a study conducted by Undavalli VK et al, in India, the prevalence of generalized, abdominal and combined obesity was found to be 56%, 71.2% and 51.3%, respectively [5]. Prevalence of obesity in India is up to 50% in women and 32.2% in men in the upper strata of the society [6].

Obesity may be associated with constellation of metabolic abnormalities, comprising hyperinsulinemia, hyperglycemia, hypertension, dyslipidemia with increased triglycerides, and decreased high-density lipoprotein [7]. It affects mainly the productive age group resulting into loss of productivity of an individual as well as the nation. Adipose tissue earlier recognised as merely an energy depot is now recognized as an active and inflammatory organ capable of producing a wide variety of factors known as adipokines [8]. Mature adipocytes are widely known as an active endocrine and paracrine organ secreting an increasing number of mediators that participate in diverse metabolic and inflammatory processes [7].

2. Management of Obesity

1.2 The main aim of treatment of obesity is to lose extra weight resulting into improvement of associated co-morbidities. The management options include lifestyle

modifications, increase physical activity, dietary restriction, pharmacological therapy, and Bariatric surgical. Most of the time, the non-surgical management options proves unsuccessful. The bariatric surgery results in long-term success in more than 80% of patients [9, 10].

The Surgery may be Malabsorptive, Restrictive or combination of both. Among bariatric surgeries, the laparoscopic sleeve Gastrectomy (LSG) is easier and effective procedure to control obesity. Initially LSG was advocated as the first step of a two-staged procedure for high-risk patients, with the intention of reducing co-morbidities and operative risk, and to be followed by either BPD-DS or laparoscopic Roux-en-Y gastric bypass (LRYGB). However often satisfactory weight loss was achieved after LSG, and second-stage procedures were found to be unnecessary. Therefore, LSG is now recognized as a primary procedure.

3. Materials and Methods

A prospective cohort study was conducted under my supervision in Department of Surgery at PGIMER (now renamed as ABVIMS) & DR. RML Hospital, New Delhi on 30 patients between November 2017 to March 2019, with exclusion criteria of any upper abdominal surgery, Severe reflux disease, Hiatus hernia, and Gastric ulcer. LSG was performed on study populations with morbid obesity as per WHO guideline after thorough examination by multidisciplinary team and proper consent. The Operative team and Operative Technique used for LSG was standardised with 5-port approach and stapler fired on 36-French (F) boogie into the stomach. All patients were followed up at 4, 12 and 24 weeks post-operatively.

4. Observations and Results

Out of the total 30 patients in our study, mean (±SD) age of the patients was 41.07 ± 9.4 years. Majority of the patients (76.66%) belonged to age group 31-50 years. 73.33% of the patients were females and 90% of our patients belonged to urban area.

Table 1. *Comparison of weight after surgery at different time intervals with that of before surgery.*

Weight in kg	Mean ± Stdev	Median (IQR)	P value
Before surgery	115.3 ± 14.36	112(108 - 126)	
After 4 weeks of surgery	97.13 ± 12.88	95(90 - 105)	<.0001
After 12 weeks of surgery	86.43 ± 13.29	85(75 - 93)	<.0001
After 24 weeks of surgery	76.52 ± 13.57	72(70 - 80)	<.0001

On Comparison of weight of study subjects after surgery at 4th, 12th and 24th week with that of weight before surgery, the difference found was statistically significant.

Table 2. *Comparison of weight at different time intervals between two BMI groups.*

Weight in kg	<40 kg/m^2 (n=3)		≥40 kg/m^2 (n=27)		P value
	Mean ± Stdev	Median (IQR)	Mean ± Stdev	Median (IQR)	
Before surgery	96.67 ± 5.69	95(92.750 - 101)	117.37 ± 13.53	114(110 - 129)	0.015
After 4 weeks of surgery	83.33 ± 5.77	80(80 - 87.5)	98.67 ± 12.57	95(90 - 108.75)	0.049
After 12 weeks of surgery	71.33 ± 3.21	70(69.25 - 73.75)	88.11 ± 12.92	85(80 - 94.5)	0.035
After 24 weeks of surgery	66.33 ± 3.21	65(64.25 - 68.75)	77.91 ± 13.88	73.5(70 - 80)	0.171

On Comparison of weight between two BMI group, the difference was significant statistically before surgery as well as at 4th weeks and 12th weeks of surgery. At 24th weeks of surgery it was not significant statistically.

Table 3. *Comparison of Body Mass Index (BMI) of study subjects after surgery at different time intervals with before surgery.*

BMI in kg/m^2	Mean ± Stdev	Median (IQR)	P value
Before surgery	46.48 ± 4.63	47.54(44.070 - 48.880)	
After 4 weeks of surgery	39.03 ± 4.23	40.02(35.370 - 42.220)	<.0001
After 12 weeks of surgery	34.78 ± 4.36	34.52(32.420 - 37.770)	<.0001
After 24 weeks of surgery	30.6 ± 4.22	29.51(27.695 - 32.985)	<.0001

On statistical analysis of Body Mass Index (BMI) of study subjects after surgery at different time intervals with that of before surgery found to be significant.

Table 4. *Comparison of Body Mass Index (BMI) of study subjects at different time intervals between BMI groups.*

BMI in kg/m^2	<40 kg/m^2 (n=3)		>=40 kg/m^2 (n=27)		P value
	Mean ± Stdev	Median (IQR)	Mean ± Stdev	Median (IQR)	
Before surgery	36.85 ± 1.75	37.37(35.518 - 38.060)	47.55 ± 3.44	47.75(45.573 - 49.127)	<.0001
After 4 weeks of surgery	31.87 ± 1.86	32.66(30.470 - 33.065)	39.83 ± 3.62	40.4(37.015 - 42.385)	0.001
After 12 weeks of surgery	27.31 ± 1.34	27.21(26.317 - 28.327)	35.61 ± 3.73	35.84(33.050 - 38.153)	0.001
After 24 weeks of surgery	25.39 ± 1.22	25.4(24.470 - 26.300)	31.32 ± 3.97	30.38(28.250 - 33.330)	0.019

On statistical analysis of two groups of Body Mass Index (BMI) of study subjects before surgery and at each follow up visit found to be significant.

5. Discussion

Obesity has reached almost epidemic levels in India as well as worldwide. The health consequences of obesity range from serious chronic illness to increased risk of premature death. Bariatric surgery has emerged as an acceptable treatment for morbid obesity achieving meaningful and sustained weight loss.

LSG exerts its weight losing effect by reduction in the capacity of the stomach to <100 mL, which induces early satiety sensation during eating and also cause decrease in serum levels of Leptin and Ghrelin resulting into decrease in appetite. Existing data demonstrate that LSG is an effective and safe procedure for super-obese or high-risk patients either as a single operation or as a bridge to more definitive surgery [11]. Short-term studies have confirmed the safety and effectiveness of LSG but long-term results are still contradictory.

Mean weight of patients in our study before surgery were found statistically significant on comparision with their Pre-operative weight. Similarly On Comparison of weight between two BMI group (<40 kg/m^2 and ≥40 kg/m$^{2)}$ the study subject showed that pre-operatively and post-operatively at 4th and 12th week the differences in loss of weight were significant on statistical analysis. At 24th weeks of surgery, differences in loss of weight were not statistically significant. It was probably because of callousness of the study subject towards their strict diet patters and also because of failure in following dietary instructions over the period of time. A Study by Erol V et al [12], reported preoperative mean (±SD) weight of patients 120.6 (91-147) kg. Weight losses in second and fourth week and second month were statistically significant compared to preoperative period ($p<0.01$). Similarly a study by Hady HR et al [13], mean (±SD) weight of patients before surgery was 151.2 ±25.19 and on the 7th postoperative day %excess weight loss (%EWL) was 13.57 ±2.92 ($p < 0.05$); after the 1st month %EWL was 22.04 ±3.95 ($p < 0.001$); after 3 months 32.5 ±4.73 ($p < 0.00001$); and after 6 months %EWL was 48.98 ±6.58 ($p < 0.00001$). These studies also showed significant weight loss after LSG, which proves it to be effective in long-term weight loss.

In our study, mean (±SD) BMI before surgery was 46.48 ± 4.63 kg/m^2. Postoperatively, mean (±SD) BMI was 39.03 ± 4.23 kg/m^2, 34.78 ± 4.36 kg/m^2 after 12 weeks, and 30.6 ± 4.22 kg/m^2 at 4th, 12th and 24th weeks respectively. Postoperative at each follow-up visit, BMI was significant on statistical analysis. A study by Erol V et al [12], reported that compared to preoperative values, postoperative 2nd, 4th week and 2nd month BMI values were lower and statistically significant ($p < 0.01$). In a similar study by Hady et al [13], in 100 patients who underwent LSG, preoperative BMI was 52.15 (median), postoperative values were found respectively 42.72 in the 3rd month and 37.98 in the 6th month and decrease in BMI was reported to be statistically significant.

On basis of BMI, patients were divided in to low BMI group (BMI <40 kg/m^2) and high BMI group (BMI ≥40 kg/m^2). The difference between mean (±SD) body weight of patients between two BMI groups was statistically significant before surgery and also at 4 week 12 weeks and 24 weeks after surgery ($P<0.05$). A study by Mui WL et al [14], reported that patients with BMI <35 kg/m^2 seemed to obtain more significant weight loss from LSG compared with patients with a BMI >35 kg/m^2. Boza C et al [15], found that the patients with a preoperative BMI >40 kg/m^2 achieved lower % EWL in comparison with the patients with BMI <40 kg/m^2 (50.2% vs 72.7%) at 5 years. Wang X et al [16], also found that patients with a BMI <40 kg/m^2 could achieve significant weight loss from LSG compared with patients with a BMI ≥40 kg/m^2. In a similar study by Elbanna H et al [11], who compared the pre & post-operative BMI of Group I (BMI <50 kg/m^2) with that of Group II (BMI >50 kg/m^2) and found the statistically significant difference in BMI.

In recent studies by Sczepaniak JP et al [17], Mehaffey JH et al [18], and Wang X et al [16], in addition to %EWL, % total weight loss (%TWL) was also used to assess weight loss after a bariatric procedure. It was reported that the %TWL gradually increased along with the increase in BMI. It was found that the %TWL was higher in patients with BMI >40 kg/m^2 after LSG treatment. These findings of %TWL are opposite to those from the %EWL. This may be because of following reasons:(1) high BMI group had a significant reduction in weight but did not get as close to their ideal weight as the low BMI patients [18]; and (2) the %EWL may be more affected by baseline weight than %TWL [17]. Thus, it is still controversial to evaluate the weight loss effect according to the % EWL and the %TWL seems to be more believable.

6. Conclusion

LSG is an effective surgical procedure for control of morbid obesity in terms of weight as well as BMI control. It is more effective in lower BMI group <40 as compared to BMI>40. A study on larger no. of morbidly obese patients is required to recommend and advocate LSG as procedure of choice for control of Obesity.

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