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Original Research Article

Evaluation of Preoperative and Clinical Factors Associated with Early Weight Loss Following Laparoscopic Sleeve Gastrectomy

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Abstract:

Background: The laparoscopic sleeve gastrectomy (LSG) procedure is well-established for obesity treatment. It is possible to determine various pre-operative and clinical parameters that are related to rapid weight loss after surgery.

Objective: In order to determine whether there is a connection between certain clinical, anthropometric, and demographic variables and the rate of weight loss immediately following laparoscopic sleeve gastrectom.

Methods: The study was based on an observational research design conducted in a hospital setting and involved 110 adults who were selected for laparoscopic sleeve gastrectomy over a one-year period at Netaji Subhas Medical College and Hospital, Bihta, Patna, Bihar, India. The variables included preoperative demographic characteristics, body mass index (BMI), and obesity-related comorbid conditions. Weight-loss effectiveness was assessed at three months postoperatively using absolute weight loss, percentage total weight loss (%TWL), and percentage excess weight loss (%EWL).

Results: The mean body weight in the dataset was found to decrease from 110.76 ± 18.20 kg to 92.72 ± 15.16 kg after three months, showing a mean body weight loss of 18.04 ± 4.34 kg. At 16.23 ± 2.64% of the total, the average body weight was lost; at 44.34 ± 12.21% of excess body weight, it was lost. Two independent variables that were shown to significantly predict early body weight loss were age ($p = 0.021$) and preoperative BMI ($p = 0.001$).

Conclusion: The case study's findings demonstrated rapid weight loss following laparoscopic sleeve gastrectomy, with the greatest reductions seen in patients with lower body mass indexes and younger ages. Preoperative evaluation and postoperative follow-up can help manage one's weight effectively.

Keywords: Laparoscopic Sleeve Gastrectomy; Bariatric Surgery; Early Weight Loss; Body Mass Index; Preoperative Factors; Obesity.

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Introduction

Being one of the public health issues, obesity causes a wide range of metabolic, cardiovascular, respiratory and musculoskeletal complications [1]. Adipose tissue accumulation over time can have several detrimental health consequences, such as insulin resistance, type 2 diabetes mellitus, hypertension, dyslipidaemia, obstructive sleep apnoea, and reduced quality of life [2]. Dietary, behavioural, physical activity and pharmaceutical interventions are all important tools in the management of obesity, however weight loss is difficult for individuals with severe obesity. In appropriately selected cases of obesity, therefore, metabolic and bariatric surgery should be viewed as an effective treatment for significant and permanent weight reduction [3].

Laparoscopic sleeve gastrectomy became popular due to the relatively simple surgical procedure, good results of weight loss and metabolic effects [4]. This surgery is based on longitudinal resection of the part of the stomach, which results in the formation of gastric sleeve with decreased gastric capacity. The process of food restriction in combination with the changes in gastrointestinal hormone signalling, the process of appetite control, gastric emptying and metabolism makes possible weight loss and treatment of several diseases associated with obesity [5].

Although the efficiency of laparoscopic sleeve gastrectomy is well-known, large variations are observed in weight loss after this operation [6]. There are patients that lose their weight quickly and substantially in the first period after the surgery and others that have a slower response. The differences in pre-operative parameters such as body weight, BMI, age, sex, metabolic condition, eating behaviour, physical activity and post-operative compliance

could influence the speed of weight loss after laparoscopic sleeve gastrectomy.

Postoperative weight loss during the early period is an important indicator in assessing bariatric surgery outcomes [7]. In the first months after sleeve gastrectomy, the patients usually have many alterations in their nutrition, body composition, appetite, metabolism, etc. During this period, the patients pass through several dietary stages of recovery according to the decreased volume of the stomach and changed nutrition needs. Moreover, weight loss depends not only on the surgical procedure itself but also on the physiological features and behaviour of each patient after the procedure.

Weight loss after bariatric surgery can be evaluated using multiple parameters. One measure of the patient's weight reduction is the percentage of total weight loss (%TWL), which is calculated as the ratio of the patient's weight loss after the procedure to their initial weight. %EWL is the weight lost relative to the excess body weight of the patient and it has been used in studies on bariatric surgery outcomes for a long time [8]. The interpretation of these indicators should take into account the baseline BMI of the patient and the approach to calculating the ideal body weight of the patient. Standardization of outcome measures is needed to compare patients and find the predictors of weight loss.

The most studied predictor of weight-loss outcomes after bariatric surgery is preoperative BMI. It is possible that the patients with a high baseline BMI can lose more weight and have different relative weight-loss values compared to the patients with low baseline BMI. Therefore, the connection between preoperative BMI and postoperative weight loss depends on the measure used.

Age and gender are other demographic characteristics that can impact weight loss results. Different body compositions, metabolism rates, levels of physical activity, and comorbidities associated with obesity can vary depending on age and thus can affect the post-surgery weight loss. Differences related to fat distribution, hormone regulation, body composition and so on can be connected with the sex and can explain different weight loss outcomes as well [9]. Nevertheless, such dependencies are inconsistent, and their individual contribution needs to be studied after controlling for other characteristics.

Metabolic comorbidities, especially type 2 diabetes mellitus, can be used as predictors of weight loss post-operation as well. This disease may lead to differences in insulin resistance, metabolic regulation, medication intake, obesity severity, and so on. Hypertension, dyslipidaemia and other obesity conditions can additionally indicate the metabolic burden prior to surgery. Identification of such conditions can show if preoperative clinical status impacts early postoperative weight loss.

Postoperative factors like adherence to the diet, level of physical activity, nutritional follow-up, and postoperative complications can also influence the weight loss results. People who have had sleeve gastrectomy need specific postoperative care including hydration, sufficient protein consumption, intake of micronutrients, progressive diet, and follow-up clinical consultations. Poor adherence and complications can disrupt the process of nutritional rehabilitation and weight loss. Such factors are especially important since they are potentially modifiable.

While there is plenty of scientific literature on bariatric surgery, the issue of identifying reliable early weight loss predictors is still complicated. The difference between the target population, obesity level at the beginning of the treatment, the technique of surgical intervention, postoperative follow-up period, and other criteria may cause the inconsistency between different researches. In addition, the predictors of the long-term weight loss may have different associations with weight changes in the first months after surgery [10]. It is important to analyze early outcomes independently from the long-term ones.

Prospective observational research allows collecting information about preoperative and postoperative clinical features of patients and analysis of the relationship between such features and postoperative weight changes. The processes of weight loss can be investigated through a mix of prospective studies that take into account specific confounding factors and aim to quantify the association between the chosen predictors and weight loss results.

Methodology

The current research utilized an empirical methodology to determine the effect of pre-operative and clinical factors on early weight loss after laparoscopic sleeve gastrectomy. This methodology involves the determination of patient characteristics, anthropometry, obesity comorbidities, and weight loss outcome post-surgery. To determine if clinical variables at baseline were associated with weight loss three months later, a well-designed methodology employing statistical methods was utilised. The research design, setting, period, participants, methodology, data analysis, and ethical issues will be discussed in the subsequent sections.

Study Design: In this study, an observational prospective study carried out in the hospital setting was developed in order to determine preoperative and clinical variables which are linked to early weight loss after LSG. The variables related to demographics, metabolic, anthropometric, and clinical aspects were analyzed to determine the variables associated with early weight loss after surgery.

Study Area: This study was carried out at the Department of General Surgery, Netaji Subhas Medical College & Hospital, Bihta, Patna, Bihar, India.

Study Duration: The investigation lasted for a one year from January 2024 to December 2024.

Study Participants: The study involved 110 adult subjects with obesity who had undergone primary laparoscopic sleeve gastrectomy at the study facility. Subjects were chosen based on specific inclusion and exclusion criteria. Demographic, anthropometric, metabolic, and clinical data were gathered to examine the determinants of rapid postoperative weight loss.

Inclusion Criteria

- Age 18 years and above.
- Patients undergoing primary laparoscopic sleeve gastrectomy.
- With pre-operative anthropometric data and clinical history available.
- With informed consent to participate and post-operative follow-up.

Exclusion Criteria

- Patients who have had bariatric surgery previously.
- Patients who are having other surgeries at the same time.
- Patients with illnesses that would make body weight evaluation difficult.
- Gravid patients and those not willing to participate.

Sample Size: A total of 110 participants who had undergone laparoscopic sleeve gastrectomy within the one-year period of the study were used. Participants for the study were chosen through consecutive sampling method according to the defined inclusion and exclusion criteria. The sample involved those participants who had the necessary demographic and clinical data for the study.

Study Procedure: Data collection was done prospectively by a structured clinical proforma. The pre-operative information gathered included age, gender, body weight, height, BMI, co-morbid conditions associated with obesity and any laboratory results. All patients underwent laparoscopic sleeve gastrectomy following institutional guidelines. The patient's weight at three months post-op was documented alongside information about the operation and any issues that may have occurred. Three measures of weight reduction success were observed: absolute weight loss (AWL), (%TWL), and (%EWL). The optimal BMI, was determined using a reference of 25 kg/m².

Statistical Analysis: Data was coded and processed with the help of IBM SPSS Statistics 27.0. Mean ± SD or median and interquartile range are used to display continuous data, whereas percentages and frequencies are used for categorical data. The data distribution was then tested using various methods, including the Mann Whitney U test, independent sample t test, Pearson's or Spearman's correlation, and independent simplest. The analysis of factors independently associated with early weight loss was done by conducting multivariable linear regression. Regression coefficients with 95% confidence interval were calculated with the help of $p<0.05$.

Ethical Considerations: The study was done according to the guidelines of ethics. The ethics committee gave their permission, and consent from the patients was taken before starting the study.

Results

In Table 1, the demographic and pre-operative anthropometric characteristics of the 110 subjects are shown. The biggest number of participants belonged to the age range from 41 to 50 years (35.5%), then 31-40 years (33.6%), 18-30 years (18.2%), and older than 50 years (12.7%). As far as the gender is concerned, the majority of participants (54.5%) were women, while men accounted for 45.5%. Pre-operative BMI varied among the participants and 59.1% of the participants had BMI of 40 kg/m² or more, 24.5% had BMI of 35-39.9 kg/m² and 16.4% had BMI of 30-34.9 kg/m². Mean age was 38.77 ± 9.64 years, while mean pre-operative BMI was 41.43 ± 5.72 kg/m².

Table 1: Demographic and Preoperative Anthropometric Characteristics of Study Participants (N = 110)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	18–30	20	18.2
	31–40	37	33.6
	41–50	39	35.5
	>50	14	12.7
Sex	Male	50	45.5
	Female	60	54.5
BMI (kg/m²)	30–34.9	18	16.4
	35–39.9	27	24.5
	≥40	65	59.1
Total participants		110	100.0

Table 2 below shows the prevalence of co-morbid diseases related to obesity among the 110 subjects. The most prevalent condition was type 2 diabetes mellitus, diagnosed in 56 (50.9%) patients, while the rest, 54 (49.1%) patients, were non-diabetics. Hypertension affected 44 (40.0%) patients, while it was non-existent in 66 (60.0%) patients. Dyslipidaemia was found in 40 (36.4%) patients, while 70 (63.6%) were without dyslipidaemia. The prevalence revealed that many patients undergoing laparoscopic sleeve gastrectomy also had other metabolic diseases, such as diabetes mellitus and hypertension. The conditions were regarded as important clinical variables in exploring their relationship with early postoperative weight loss.

Table 2: Distribution of Preoperative Clinical Comorbidities (N = 110)

Clinical characteristic	Present n (%)	Absent n (%)
Type 2 diabetes mellitus	56 (50.9)	54 (49.1)
Hypertension	44 (40.0)	66 (60.0)
Dyslipidaemia	40 (36.4)	70 (63.6)

The variations in anthropometric measurements after laparoscopic sleeve gastrectomy in the three months after operation are shown in Table 3. Body weight had reduced from 110.76 ± 18.20 kg prior to surgery to 92.72 ± 15.16 kg after surgery. The average body weight reduction recorded was 18.04 ± 4.34 kg. In the same way, BMI showed a decrease from 41.43 ± 5.72 kg/m² to 34.67 ± 4.64 kg/m². The average reduction in total body weight was 16.23 ± 2.64%, whereas the average reduction in excess body weight was 44.34 ± 12.21%. It was shown in this study how much weight was lost in the short term following laparoscopic sleeve gastrectomy.

Table 3: Preoperative and Three-Month Postoperative Weight-Loss Outcomes

Anthropometric parameter	Mean ± SD
Preoperative body weight (kg)	110.76 ± 18.20
Body weight at three months (kg)	92.72 ± 15.16
Preoperative BMI (kg/m²)	41.43 ± 5.72
BMI at three months (kg/m²)	34.67 ± 4.64
Absolute weight loss (kg)	18.04 ± 4.34
Percentage total weight loss (%TWL)	16.23 ± 2.64
Percentage excess weight loss (%EWL)	44.34 ± 12.21

The correlations between selected preoperative parameters and percentage total weight loss at three months are outlined in Table 4. Subjects in the age group 18-40 had higher mean %TWL 16.81 ± 2.33% compared to those aged above 40 years who had a mean %TWL of 15.61 ± 2.82%, representing a statistically significant difference ($p = 0.018$). Also, subjects with preoperative BMI of ≥40 kg/m² had significantly higher mean %TWL of 16.67 ± 2.55% compared to those whose BMI was less than 40 kg/m² who had a mean %TWL of 15.60 ± 2.67% ($p = 0.039$). On the other hand, female subjects exhibited slightly higher mean weight loss compared to their male counterparts but the difference was not statistically significant ($p = 0.656$). Non-diabetic and non-hypertensive subjects had higher mean %TWL than their respective diabetic and hypertensive counterparts, whereas dyslipidaemic subjects had higher mean %TWL than non-dyslipidaemics. Nonetheless, none of the above comorbidities were significantly correlated with percentage total weight loss ($p > 0.05$).

Table 4: Association of Preoperative and Clinical Factors with Percentage Total Weight Loss

Variable	Category	Mean %TWL ± SD	p-value
Age	18–40 years	16.81 ± 2.33	0.018
	>40 years	15.61 ± 2.82	
Sex	Male	16.11 ± 2.28	0.656
	Female	16.33 ± 2.92	
Preoperative BMI	<40 kg/m²	15.60 ± 2.67	0.039
	≥40 kg/m²	16.67 ± 2.55	
Diabetes mellitus	Present	16.01 ± 2.59	0.361
	Absent	16.47 ± 2.69	
Hypertension	Present	15.83 ± 2.46	0.187
	Absent	16.50 ± 2.73	
Dyslipidaemia	Present	16.43 ± 2.69	0.559
	Absent	16.12 ± 2.62	

A multivariate linear regression analysis was conducted to determine independent determinants of early postoperative % total weight reduction, and the results are shown in Table 5. After controlling for other variables, age became a statistically significant predictor of %TWL with a negative correlation (B = -0.061, p = 0.021), suggesting that postoperative weight loss was somewhat lower with increasing age. Patients whose body mass index (BMI) was higher before surgery lost a greater proportion of their initial weight than those whose BMI was lower before surgery (B = 0.156, p = 0.001). The presence of hypertension appeared with a negative regression coefficient (B = -1.022), but its association with %TWL was not statistically significant (p = 0.052). The female gender, diabetes mellitus, and dyslipidaemia were not statistically significant independent predictors of early weight loss. The model was able to predict about 18.0% of variance in the dependent variable, as the adjusted R^2 value was equal to 0.132. In general, the results revealed that the age and preoperative BMI were the main independent predictors of early weight loss.

Table 5: Multivariable Linear Regression Analysis of Factors Associated with Percentage Total Weight Loss

Predictor variable	Regression coefficient (B)	95% confidence interval	p-value
Age (years)	−0.061	−0.113 to −0.009	0.021
Female sex	0.391	−0.567 to 1.350	0.420
Preoperative BMI (kg/m²)	0.156	0.070 to 0.242	0.001
Diabetes mellitus	−0.214	−1.220 to 0.793	0.675
Hypertension	−1.022	−2.052 to 0.007	0.052
Dyslipidaemia	0.227	−0.791 to 1.245	0.659

Discussion

This study followed 110 patients who had undergone laparoscopic sleeve gastrectomy to see which preoperative and clinical variables were associated with rapid weight loss [11] Jambhekar et al. (2018). Research has shown that in the three months following surgery, patients see a considerable reduction in body weight and BMI. The average weight before surgery dropped from 110.76 ± 18.20 kg to 92.72 ± 15.16 kg, and the average absolute loss of weight was 18.04 ± 4.34 kg, according to Kashihara et al. (2021) [12]. The overall percentage loss of weight was 16.23 ± 2.64%, with an additional percentage loss of 44.34 ± 12.21%. These results show that LSG causes significant weight loss, which might be related to a reduction in gastric volume, appetite control, and the introduction of new diets Mocanu et al. (2021) [13].

As for the demographic data, most patients belong to the middle-aged category, and 54.5% are females. Moreover, a great number (59.1%) of them have preoperative body mass index equal to 40 kg/m² or more, meaning that patients have severe obesity Mouawad et al. (2022) [14]. In terms of the clinical characteristics, patients had diabetes mellitus (50.9%), hypertension (40.0%), and dyslipidaemia (36.4%). Such results show that a significant number of patients suffering from metabolic disorders related to obesity undergo bariatric surgery Randell et al. (2018) [15]. However, these conditions do not have a statistically significant relation to the results of weight reduction after the procedure Sisik and Basak (2020) [16].

We have found two factors affecting the result of the procedure significantly: age and preoperative body mass index. Patients aged from 18 to 40 have a significantly higher mean %TWL compared to those who are older than 40 years (16.81% versus 15.61%, p = 0.018). Also, patients having a preoperative BMI ≥ 40 kg/m² have more weight loss compared to those with a lower BMI (16.67% versus 15.60%, p = 0.039) Vennapusa et al. (2020) [17]. The multivariable regression has shown a negative relationship between age and %TWL (B = −0.061, p = 0.021), as well as a positive relationship between the BMI before the operation and %TWL (B = 0.156, p = 0.001).

The presence of sex and obesity comorbid conditions did not yield any significant independent predictors of percentage total weight loss. While female participants lost more average %TWL compared to their male counterparts, the results were not statistically significant (p = 0.656). In addition, diabetes mellitus, hypertension and dyslipidaemia were not considered significant independent variables Vuagniaux et al. (2019) [18]. According to the research results, about 18.0% of variance in early weight loss could be attributed to the regression model, indicating that some other parameters should be accounted for in order to achieve further success in weight loss, such as adherence to diet, exercise and other postoperative measures Wang et al. (2021) [19].

The study had a number of limitations, including the fact that it was conducted at one single centre with small sample size (n = 110 patients) and short follow-up period of three months. It means that no long-term weight loss and/or metabolic effects could

be established as well as the likelihood of weight regain could not be assessed Yılmaz Kara et al. (2021) [20]. Moreover, there was no consideration of any behavioural and nutritional factors in the regression analysis. Further research on a large population sample and longer follow-up period is needed.

Conclusion

In this study, 110 individuals who had undergone laparoscopic sleeve gastrectomy were examined to determine factors associated with rapid weight loss. At the three-month mark, the average absolute weight loss was found to be 18.04 ± 4.34 kg, while percentage (%TWL) was reported at 16.23 ± 2.64%, and percentage (%EWL) at 44.34 ± 12.21%. Age and preoperative BMI were found to be significantly correlated with early weight loss, while there were no statistically significant correlations found between other variables, such as gender, diabetes mellitus, hypertension, and dyslipidaemia.

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