

# Research Article:

## Sleeve Gastrectomy in Male Patients With Morbid Obesity; A Prospective Cross-Sectional Study



Nasser Malekpour Alamdari<sup>1</sup> , Mohammad Moradi<sup>2</sup> , Saeed Safari<sup>3</sup> , Anahita Tavooosi<sup>4</sup> , Sara Besharat<sup>5</sup> , Hamid Asherloo<sup>2</sup> , Farnoosh Larti<sup>1</sup> 

1. Department of General Surgery, School of Medicine, Critical Care Quality Improvement Research Center, Shahid Modarres Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

2. Department of General Surgery, Firoozgar Research Development Center, Firoozgar Hospital, Tehran, Iran.

3. Department of General Surgery, Firoozgar General Hospital, School of Medicine, Iran University of Medical Sciences, Tehran, Iran.

4. Department of Cardiology, Imam Khomeini Hospital Complex, Tehran University of Medical Sciences, Tehran, Iran.

5. Department of Radiology, School of Medicine, Shahid Labbafinezhad Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran.



**Please cite this article as** Malekpour Alamdari N, Moradi M, Safari S, Tavooosi A, Besharat S, Asherloo H, et al. Sleeve Gastrectomy in Male Patients With Morbid Obesity; A Prospective Cross-Sectional Study. *Annals of Bariatric Surgery*. 2021; 10(2):99-104. <http://dx.doi.org/10.32598/ABS.10.2.4>

 <http://dx.doi.org/10.32598/ABS.10.2.4>



### Article info:

Received: 26 Sep 2021

Accepted: 12 Nov 2021

Publish: 31 Dec 2021

### Keywords:

Obesity, Sleeve gastrectomy, Gender, Weight loss

## ABSTRACT

**Background:** The predictors of successful outcomes after sleeve gastrectomy are not yet well recognized. Therefore, the purpose of this study was to assess factors predicting successful weight loss after surgery.

**Methods and Materials:** This was a retrospective cohort study performed in Firoozgar hospital during 2017-2019. Overall, 128 patients with morbid obesity (103 females and 25 males; BMI range: 36.05 to 58.47 kg/m<sup>2</sup>) were included. The success of sleeve was defined either as Estimated Weight Loss (EWL) %  $\geq$  50% at 6 months or EWL%  $\geq$  65% at 12 months after surgery. We had two groups (successful and unsuccessful) at 6 and 12 months after surgery.

**Results:** The mean $\pm$ SD of age, height, baseline weight and BMI (Body Mass Index) were 36.25 $\pm$ 11.11 year, 166.95 $\pm$ 9.65 cm, 119.40 $\pm$ 19.30 kg and 42.64 $\pm$ 4.03 kg/m<sup>2</sup>, respectively. Male and female patients were significantly different in reaching enough EWL% at 12 months after surgery (92.9% vs 56% respectively; P=0.012). The significant difference seen in mean ages between the two groups at 6 months (P=0.017) was disappeared at 12 months. In logistic regression analysis, the only independent factor to predict success was gender.

**Conclusion:** The patient's gender, height, weight or BMI, may have a predictive value to reach to a desirable weight after sleeve gastrectomy. Further investigations with large sample size are necessary to elucidate and predict more detailed findings.

### \* Corresponding Author:

Saeed Safari, MD.

Address: Department of General Surgery, Firoozgar General Hospital, School of Medicine, Iran University of Medical Sciences, Tehran, Iran

E-mail: saeedsf@gmail.com

## 1. Introduction

Laparoscopic Sleeve Gastrectomy (LSG) is currently used as the most performed bariatric operation worldwide due to its feasibility and small learning curve for surgeons. Moreover, its long-term weight loss has been satisfying in most studies [1, 2]. In sleeve gastrectomy as a restrictive procedure, up to 80% of the stomach is removed and a tubular conduit is remained. Antrum could be removed or preserved [3]. Post-operation complications are negligible including distal stenosis [4] leading to leakage or conduit twist [5, 6]. Nutritional deficiencies does not usually occur [7]. However, vitamin B12 deficiency has been reported rarely [8]. All these issues made it very popular among surgeons and patients as well.

Despite the fact, there is still no consensus regarding factors effective in enough weight loss after sleeve gastrectomy. Some patients fail to loose predicted weight loss after surgery, which might be due to wrong patient selection, technical errors or post-op habitual dietary intake of patients [9]. Knowing predictive factors for an appropriate weight loss helps us for better patients' selection and recognizing those who would not probably benefit from sleeve gastrectomy to be candidate for other bariatric procedures. Therefore, the purpose of this investigation was to assess predictive factors effective in an appropriate weight loss after sleeve gastrectomy.

## 2. Methods and Materials

This was a retrospective cohort study. A total of 128 patients with morbid obesity (103 females and 25 males; BMI range: 36.05 to 58.47 kg/m<sup>2</sup>) operated from January 2017 to January 2019 entered the study. Inclusion criteria were Body Mass Index (BMI) more than 40 kg/m<sup>2</sup> or above 35 kg/m<sup>2</sup> with comorbidities, age between 16 to 65 years, and failure of multiple dietetic regimens, mental health according to a psychiatric interview, normal upper GI endoscopy, and treated H. pylori. Exclusion criteria were uncontrolled alcohol or drug abuse, those with severe comorbidities with very high risk of operation, unwilling to participate in the study, non-cooperative patients, history of any previous bariatric surgeries, severe cardiopulmonary diseases and poor family support. All patients underwent a through interview, physical examination, laboratory study including thyroid function test, liver function test, complete blood count, electrolytes, coagulation profile, and BUN, creatinine and lipid profile. Patients underwent an upper GI endoscopy, abdominopelvic ultrasonography, chest x-ray,

echocardiography and ECG and were visited by a nutritionist, anesthesiologist, cardiologist, pulmonologist and psychiatrist. However, all patients participated in justifying classes to know about the procedure, outcomes, and possible complications.

The operation was started with placing the ports at standard sites. The greater curvature was devascularized starting from 4 cm from the pylorus up to the angle of Hiss. A conduit of stomach was tailored over a 37-Fr bougie in all patients using endo GIA linear staplers (Covidien or Ethicon). Antrum was preserved. No reinforcement was performed. An intraoperative leak test was performed using methylene blue gavage through the lavage tube.

Demographic characteristics and patients' weights after 6 (113 cases; 92 females) and 12 months (64 cases; 50 females) were recorded. The success of sleeve was defined either as Estimated Weight Loss (EWL)%  $\geq$  50% at 6 months or EWL%  $\geq$  65% at 12 months after surgery. We had two groups (successful and unsuccessful) at 6 and 12 months after surgery.

Data entered SPSS version 22 (SPSS Inc. Chicago, IL, The USA). Chi-square and Independent T-test were used for qualitative and quantitative measures. We performed both univariate analysis (t-test and crosstabs) and multivariate analysis to find any independent factor that could predict adequate weight loss after sleeve gastrectomy.

Declaration of Helsinki was obeyed in all steps. A written informed consent was obtained from all patients. Patients were free to leave the study at any time they preferred without affecting receiving a routine standard care.

## 3. Results

The mean $\pm$ SD of age, height, baseline weight and BMI were 36.25 $\pm$ 11.11 year, 166.95 $\pm$ 9.65 cm, 119.40 $\pm$ 19.30 kg and 42.64 $\pm$ 4.03 kg/m<sup>2</sup>, respectively. Demographic characteristics of the study participants are presented in Table 1. Male and female patients were significantly different in reaching enough EWL% at 12 months after surgery (92.9% vs 56% respectively; P=0.012). The mean height of the patients in successful and unsuccessful groups (6 months and 12 months) were also significantly different (168.68 vs 163.07; P=0.005 and 169.20 vs 163.87; P=0.037). The significant difference seen in mean ages between the two groups at 6 months (P=0.017) was disappeared at 12 months. The mean baseline weight and mean BMI were not different be-

**Table 1.** Baseline characteristics of the study participants

Variable		Mean±SD or No. (%)
Male participants		25 (19.5)
Age, year		36.25±11.11
Weight, Kg		119.40±19.30
Height, cm		166.95±9.65
Comorbidities	DM	14 (10.9)
	HTN	20 (15.6)
Body Mass Index, kg/m <sup>2</sup>	Baseline	42.64±4.03
	At 6 months	30.53±3.43
	At 12 months	28.11±3.91



tween the two groups. In logistic regression analysis, the only independent factor to predict success was gender.

Moreover, to build a model to predict success following surgery, ANCOVA test was used. EWL6M percentage was considered as the dependent factor and patients' gender was introduced as the fixed factor while age and height were the covariates. In our model the effect of all three independent variables and their interactions on each other were assessed. There were significant amounts of F-value for age and height and these variables had interaction effects. However, due to low amounts of "partial eta squared" their contribution in the model was not too much. Non-significant amounts of F-value for interactions with gender were notable. Besides, a low "observed power" was found for all other non-significant amounts of F-values. Furthermore, both height and age had negative effects on EWL6month while their interaction was antagonistic. Tests of between-subject effects considering EWL12month percentage as the dependent variable is presented in [Table 2](#).

Despite the fact, the same method of assessment was used for EWL12month but no significant relationship was found. Low power of analysis was seen in the assessments of factors, covariates and interactions as well.

#### 4. Discussion

At first, sleeve gastrectomy had been performed as the first stage for patients with severe morbid obesity. Thereafter, in 1999, LSG was first introduced as a single procedure for patients with morbid obesity [10-12]. Sleeve gastrectomy is associated with low morbidity and mortality rate with leakage as the most life-threatening complication [13]. Leakage has been reported up to 5-6 percent in different studies [14, 15]. In our survey we had no leakage. It seems that distal obstruction and gastric twist due to technical errors and acceptable nutritional status before the operation are important factors to predict leakage. Staple-line reinforcement has not been shown to be effective to reduce the risk of leakage [16] as was not performed in our study as well. We believe that stapling properly to avoid twisting and distal stenosis are the most important factors.

**Table 2.** Predicting %EWL at 12-month follow up as dependent variable

Variable	F	P
Age	0.032	0.858
Height	0.173	0.679
Sex	0.292	0.591



There is still ambiguity regarding prognostic variables for a successful weight loss after bariatric surgeries, especially sleeve gastrectomy. The only important factor in regression analysis in our study was male gender. Male patients reached an acceptable weight more probably than women. There is no study in the literature to reach to such a conclusion to our knowledge. It seems that men might have obeyed exercise instructions more than women postoperatively. Moreover, most of our patients did not undergo a second operation due to adequate weight loss following sleeve gastrectomy. No patient had a nutritional deficit at follow-ups. No Vitamin B12 deficiency was found in our series up to the time of follow-up. Some degrees of vitamin B12 deficiency has been reported in different studies [17]. Mortality rate in our series was zero as well which is consistent with some other studies without any mortality. However, some other investigations reported up to 4-5 percent mortality rates [18].

Abd Ellatif et al. in an investigation entitled “Long term predictors of success after laparoscopic sleeve gastrectomy” published in 2015 reported that smaller size of used bougie and less distance from the pylorus were related to significant %EWL after a mean follow up of 76 months [19]. Bougies with different sizes were not used in our study which could be considered in further randomized trials to yield more information.

Many other studies have investigated the effect of antrum removal in sleeve gastrectomy. Francesco Pizza et al. [20] in 2020 compared sleeve gastrectomy beginning at 2 or 6 from the pylorus and followed patients for 24 months. They finally concluded that a radical antrectomy improved weight loss at one-year follow-up but the effect disappeared after 2 years. Moreover, patients who underwent antrectomy complained of GERD more frequently than those without it. They did not suggest antrectomy in all patients. In our study however, antrectomy was performed in all patients, and a small number (5.46%) complained of reflux at one-year follow-up.

Diego Cadena-Obando et al. [21] in 2020 investigated factors which play a role in an effective weight loss following obesity surgery. They reported that inadequate weight loss after bariatric surgeries was associated with older age, hypertension, abdominal surgery or depression/anxiety. They included all types of bariatric surgeries which could yield a bias to understand the predictive factors for each bariatric procedure. Despite the fact, depression or anxiety would affect habitual status of patients after surgery and their dietary intake, and probably

affects the degree of weight loss. However, we did not examine them in our series.

Even though, a study performed in Poland in 2020 reported that gut microbiota has a role to predict successful weight loss after bariatric surgery. They reported that phylum Fusobacteria was the predominant microbiota in the oral cavity and phylum Firmicutes in intestinal flora in patients who achieved Estimated Weight Loss (%EWL) of  $\geq 50\%$ . However, phylum Actinobacteria and phylum Bacteroidetes were more commonly found in those who failed to achieve a desirable weight loss [22]. Their study lacked an appropriate sample size as they only included 31 patients. Also, the follow-up was quite short. However, it could yield a basis for further investigations.

Liang Wang et al. followed 384 patients who underwent sleeve gastrectomy for 5 years to examine the predictive factors to achieve a desirable weight loss. They finally concluded that only %EWL at 6 months could predict weight loss after 5 years of sleeve gastrectomy [23]. This study included many patients with a 5-year follow-up.

Furthermore, a worthy review has been issued very recently in February 2021 regarding different aspects of a successful bariatric surgery and any type of surgeries should be assessed in meta-analysis studies to indicate and collect reported findings [24-27]. They stated that several definitions are available for weight regain and less for insufficient weight loss. Different studies have used different definitions, which lead to inconsistency in the findings. They listed many factors affecting adequate weight loss after bariatric surgery including non-adherence, inactive lifestyle, some psychiatric disorders such as depression or eating disorders, dilatation of gastric pouch after sleeve gastrectomy etc. Besides, they reported that older age, male gender, higher preoperative BMI, mental health issues and some comorbidity are associated with poorer weight loss after bariatric surgery. Despite the fact, they summarized excellently the available researches regarding the predictive factors to achieve an appropriate weight loss after bariatric surgery.

Finally, as mentioned above from different studied, several factors affect the outcome of a bariatric surgery. These factors depend on the study population, ethnicity, socioeconomic status and the bariatric procedure. We admire the current trend of authors to find predictive factors to achieve a desirable weight loss in different study populations. We hope that these investigations could be a material for further reviews and meta-analyses to reach

to a conclusion in the upcoming years. This would help patients' selection and also early intervention despite a failure in weight loss.

## Ethical Considerations

### Compliance with ethical guidelines

All ethical principles are considered in this article. The participants were informed of the purpose of the research and its implementation stages. They were also assured about the confidentiality of their information and were free to leave the study whenever they wished, and if desired, the research results would be available to them.

### Funding

This research did not receive any grant from funding agencies in the public, commercial, or non-profit sectors.

### Authors' contributions

All authors equally contributed in preparing this article.

### Conflict of interest

The authors declared that they have no conflict of interest.

### Acknowledgments

We would like to thank all patients who kindly participated in the study.

## References

- [1] Shabbir A, Dargan D. The success of sleeve gastrectomy in the management of metabolic syndrome and obesity. *Journal of Biomedical Research*. 2015; 29(2):93-7. [PMID]
- [2] Salminen P, Helmiö M, Ovaska J, Juuti A, Leivonen M, Peromaa-Haavisto P, et al. Effect of laparoscopic sleeve gastrectomy vs laparoscopic Roux-en-Y gastric bypass on weight loss at 5 years among patients with morbid obesity: The SLEEVEPASS randomized clinical trial. *JAMA*. 2018; 319(3):241-54. [DOI:10.1001/jama.2017.20313] [PMID] [PMCID]
- [3] McGlone ER, Gupta AK, Reddy M, Khan OA. Antral resection versus antral preservation during laparoscopic sleeve gastrectomy for severe obesity: Systematic review and meta-analysis. *Surgery for Obesity and Related Diseases*. 2018; 14(6):857-64. [DOI:10.1016/j.soard.2018.02.021] [PMID]
- [4] Levy JL, Levine MS, Rubesin SE, Williams NN, Dumon KR. Stenosis of gastric sleeve after laparoscopic sleeve gastrectomy: Clinical, radiographic and endoscopic findings. *The British Journal of Radiology*. 2018; 91(1089):20170702. [DOI:10.1259/bjr.20170702] [PMID] [PMCID]
- [5] Aurora AR, Khaitan L, Saber AA. Sleeve gastrectomy and the risk of leak: A systematic analysis of 4,888 patients. *Surgical Endoscopy*. 2012; 26(6):1509-15. [DOI:10.1007/s00464-011-2085-3] [PMID]
- [6] Plamper A, Lingohr P, Nadal J, Rheinwalt KP. Comparison of mini-gastric bypass with sleeve gastrectomy in a mainly super-obese patient group: first results. *Surgical Endoscopy*. 2017;31(3):1156-62. [DOI:10.1007/s00464-016-5085-5] [PMID]
- [7] Ben-Porat T, Elazary R, Goldenshluger A, Sherf Dagan S, Mintz Y, Weiss R. Nutritional deficiencies four years after laparoscopic sleeve gastrectomy-are supplements required for a lifetime? *Surgery for Obesity and Related Diseases*. 2017; 13(7):1138-44. [DOI:10.1016/j.soard.2017.02.021] [PMID]
- [8] Al-Dirbashi OY, Sharma C, Al Dahouri N, Al Aidaros A, Al-Muhairi S, Beiram R, et al. Role of functional biomarkers to identify early vitamin B12 deficiency in patients with sleeve gastrectomy: A cross-sectional study. *Medicina*. 2020; 56(3):142. [DOI:10.3390/medicina56030142] [PMID] [PMCID]
- [9] Noel P, Nedelcu M, Nocca D, Schneck AS, Gugenheim J, Iannelli A, et al. Revised sleeve gastrectomy: Another option for weight loss failure after sleeve gastrectomy. *Surgical Endoscopy*. 2014; 28(4):1096-102. [DOI:10.1007/s00464-013-3277-9] [PMID]
- [10] Lasnibat JP, Braghetto I, Gutierrez L, Sanchez F. Sleeve gastrectomy and fundoplication as a single procedure in patients with obesity and gastroesophageal reflux. *Arquivos Brasileiros de Cirurgia Digestiva*. 2017; 30(3):216-21. [DOI:10.1590/0102-6720201700030012] [PMID] [PMCID]
- [11] Sammour T, Hill AG, Singh P, Ranasinghe A, Babor R, Rahman H. Laparoscopic sleeve gastrectomy as a single-stage bariatric procedure. *Obesity Surgery*. 2010; 20(3):271-5. [DOI:10.1007/s11695-009-0038-x] [PMID]
- [12] D'Hondt M, Vanneste S, Pottel H, Devriendt D, Van Rooy F, Vansteenkiste F. Laparoscopic sleeve gastrectomy as a single-stage procedure for the treatment of morbid obesity and the resulting quality of life, resolution of comorbidities, food tolerance, and 6-year weight loss. *Surgical Endoscopy*. 2011; 25(8):2498-504. [DOI:10.1007/s00464-011-1572-x] [PMID]
- [13] Lalor PF, Tucker ON, Szomstein S, Rosenthal RJ. Complications after laparoscopic sleeve gastrectomy. *Surgery for Obesity and Related Diseases*. 2008; 4(1):33-8. [DOI:10.1016/j.soard.2007.08.015] [PMID]
- [14] Gagner M, Buchwald JN. Comparison of laparoscopic sleeve gastrectomy leak rates in four staple-line reinforcement options: A systematic review. *Surgery for Obesity and Related Diseases*. 2014; 10(4):713-23. [DOI:10.1016/j.soard.2014.01.016] [PMID]
- [15] Parikh M, Issa R, McCrillis A, Saunders JK, Ude-Welcome A, Gagner M. Surgical strategies that may decrease leak after laparoscopic sleeve gastrectomy: A systematic review and meta-analysis of 9991 cases. *Annals of Surgery*. 2013; 257(2):231-7. [DOI:10.1097/SLA.0b013e31826cc714] [PMID]
- [16] Dapri G, Cadière GB, Himpens J. Reinforcing the staple line during laparoscopic sleeve gastrectomy: Prospective ran-



- domized clinical study comparing three different techniques. *Obesity Surgery*. 2010; 20(4):462-7. [DOI:10.1007/s11695-009-0047-9] [PMID]
- [17] Kwon Y, Kim HJ, Lo Menzo E, Park S, Szomstein S, Rosenthal RJ. Anemia, iron and vitamin B12 deficiencies after sleeve gastrectomy compared to Roux-en-Y gastric bypass: A meta-analysis. *Surgery for Obesity and Related Diseases*. 2014; 10(4):589-97. [DOI:10.1016/j.soard.2013.12.005] [PMID]
- [18] Moszkowicz D, Arienzo R, Khettab I, Rahmi G, Zinzindohoué F, Berger A, et al. Sleeve gastrectomy severe complications: Is it always a reasonable surgical option? *Obesity Surgery*. 2013; 23(5):676-86. [DOI:10.1007/s11695-012-0860-4] [PMID]
- [19] Abd Ellatif ME, Abdallah E, Askar W, Thabet W, Aboushady M, Abbas AE, et al. Long-term predictors of success after laparoscopic sleeve gastrectomy. *International Journal of Surgery*. 2014; 12(5):504-8. [DOI:10.1016/j.ijso.2014.02.008] [PMID]
- [20] Pizza F, D'Antonio D, Lucido FS, Gambardella C, Carbonell Asins JA, Dell'Isola C, et al. Does antrum size matter in sleeve gastrectomy? A prospective randomized study. *Surgical Endoscopy*. 2021; 5(7):3524-32. [DOI:10.1007/s00464-020-07811-1] [PMID]
- [21] Cadena-Obando D, Ramírez-Rentería C, Ferreira-Hermosillo A, Albarrán-Sánchez A, Sosa-Eroza E, Molina-Ayala M, et al. Are there really any predictive factors for a successful weight loss after bariatric surgery? *BMC Endocrine Disorders*. 2020; 20(1):20. [DOI:10.1186/s12902-020-0499-4] [PMID] [PMCID]
- [22] Stefura T, Zapala B, Stój A, Gosiewski T, Skomarowska O, Krzysztofik M, et al. Does postoperative oral and intestinal microbiota correlate with the weight-loss following bariatric surgery?-A cohort study. *Journal of Clinical Medicine*. 2020; 9(12):3863. [DOI:10.3390/jcm9123863] [PMID] [PMCID]
- [23] Wang L, Sang Q, Zheng X, Du D, Zhang N, Lian D. Early weight loss following laparoscopic sleeve gastrectomy is predictive of long-term weight loss in morbidly obese Chinese. *Obesity Surgery*. 2021; 31(2):820-8. [DOI:10.1007/s11695-020-05037-7] [PMID]
- [24] El Ansari W, Elhag W. Weight regain and insufficient weight loss after bariatric surgery: definitions, prevalence, mechanisms, predictors, prevention and management strategies, and knowledge gaps-a scoping review. *Obesity Surgery*. 2021; 31(4):1755-66. [DOI:10.1007/s11695-020-05160-5] [PMID] [PMCID]
- [25] Kermansaravi M, Shahmiri SS, DavarpanahJazi AH, Valizadeh R, Berardi G, Vitiello A, et al. One anastomosis/mini-gastric bypass (OAGB/MGB) as revisional surgery following primary restrictive bariatric procedures: A systematic review and meta-analysis. *Obesity Surgery*. 2021; 31(1):370-83. [DOI:10.1007/s11695-020-05079-x] [PMID] [PMCID]
- [26] Kermansaravi M, Davarpanah Jazi AH, Shahabi Shahmiri S, Eghbali F, Valizadeh R, Rezvani M. Revision procedures after initial Roux-en-Y gastric bypass, treatment of weight regain: A systematic review and meta-analysis. *Updates in Surgery*. 2021;73(2):663-78. [DOI:10.1007/s13304-020-00961-w] [PMID]
- [27] Krmansaravi M, Shahmiri SS, Davarpanah Jazi AH, Valizadeh R, Weiner RA, Chiappetta S. Reversal to normal anatomy after one-anastomosis/mini gastric bypass, indications and results: A systematic review and meta-analysis. *Surgery for Obesity and Related Diseases*. 2021; 17(8):1489-96. [DOI:10.1016/j.soard.2021.04.013] [PMID]