The impact of selected factors on parameters of weight loss after sleeve gastrectomy

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Videosurgery Miniinv 2016; 11 (4): 288–294
DOI: https://doi.org/10.5114/wiitm.2016.64999

Abstract

Introduction: *The effectiveness of sleeve gastrectomy has been confirmed in many studies. The impact of individual factors on the parameters of weight loss is still not clear.*
Aim: *To identify important factors affecting the parameters of weight loss after sleeve gastrectomy.*
Material and methods: *The impact of prognostic factors and postoperative care components on body mass index (BMI) and percentage excess weight loss (%EWL) was assessed in a group of 100 consecutive patients who underwent laparoscopic sleeve gastrectomy.*
Results: *The baseline BMI and body mass in patients with BMI < 30 kg/m² and BMI ≥ 30 kg/m² 12 months after surgery were, respectively, 39.7 ±3.2 vs. 45.9 ±4.6 kg/m², p < 0.0001, and 114.4 ±16.8 vs. 130.3 ±18.5 kg, p < 0.0001. In the group with EWL < 50%, the average age was 47.1 ±7.7 vs. 40.6 ±10.8 in the group with EWL ≥ 50%, p = 0.0025. In the group of patients with preoperative weight loss, %EWL was 61.4 ±17.2 vs. 53.3 ±19.3% in the group with no weight loss, p = 0.0496. Body mass index of the patients who started physical activities was 30.6 ±4.2 kg/m² vs. 34.0 ±5.6 kg/m² in the patients with no physical activity, p = 0.0013, and %EWL was 63.4 ±14.6 vs. 47.0 ±19.9%, p < 0.0001, respectively. In the case of patients regularly consulted by a dietician BMI was 30.6 ±4.2 kg/m² vs. 35.1 ±5.5 kg/m² in the group without systematic consultations, p < 0.0001, and %EWL was 63.1 ±15.1% vs. 42.3 ±18.2%, p < 0.0001.*
Conclusions: *Lower baseline body weight parameters, younger age, preoperative weight loss, starting systematic physical activities and constant care of a dietician were conducive to achieving better results of surgery, as assessed on the basis of changes in BMI and %EWL.*

Key words: *sleeve gastrectomy, outcomes, prognostic factors, postoperative care.*

Introduction

Low effectiveness of conservative treatment of obesity, the constantly growing number of obese people and the dissemination of laparoscopic techniques are conducive to the development of bariatric surgery. Surgery is an attractive alternative due to the degree of weight loss, the durability of the effects achieved, the positive impact on the resolution of comorbidities of obesity and reduced cost of long-term care [1–4]. Sleeve gastrectomy is becoming an increasingly popular method among the many methods of surgical treatment of obesity [5, 6]. The effectiveness and safety of sleeve gastrectomy have been confirmed in many reports [7–9]. Bariatric results of the treatment depend on several factors. The factors whose influence on the outcomes raises doubts include preoperative weight loss, baseline body weight

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parameters, age and sex of patients [10–12]. It is also not clear which elements of postoperative care have the greatest impact on the results of sleeve gastrectomy. In the case of conservative treatment, adherence to diet results in a greater weight loss and prevents weight regain in long follow-up periods [13]. Other elements influencing the results of bariatric procedures may include participation in follow-up appointments and starting physical activity in the postoperative period [14–17].

Aim

The aim of the study was to identify important factors affecting the parameters of weight loss after sleeve gastrectomy.

Material and methods

The study included the first 100 patients who underwent laparoscopic sleeve gastrectomy in the period from January 2010 to April 2012 (67 women, 33 men). We analyzed prospectively collected data on 93 patients (63 women, 30 men) whose follow-up was at least 12 months. The analysis did not include 5 patients who did not attend the scheduled follow-up visit after 12 months and 2 patients who became pregnant during their follow-up. Patients with body mass index (BMI) of 35–39.9 kg/m^2 and at least one comorbidity, or with BMI ≥ 40 kg/m^2, were accepted for surgical treatment. Having expressed consent to the surgery, patients were referred for psychological and dietary consultations. During the entire period of treatment the patients were under the care of a dietician. No weight loss or weight gain before the surgery were no grounds to disqualify a patient from the surgery.

The study was approved by the Bioethics Committee at the Medical Centre of Postgraduate Education in accordance with Resolution No. 51/PM/2011 dated 08.03.2011.

Surgical technique and post-operative care

All patients were treated laparoscopically, with a pneumoperitoneum at a pressure of 12 to 15 mm Hg using the Veress needle. The five-trocar technique was used. The width of the sleeve was calibrated using a 36 Fr bougie. The staple line was routinely reinforced with a continuous absorbable suture. Methylene blue was used to carry out the leak test. A Redon drain was placed along the staple line. On the first post-operative day a water-soluble contrast study was routinely performed. In the absence of signs of leakage, drinking was recommended. Patients were discharged on the second day after starting a liquid diet. Follow-up visits were performed after 10 days and 1, 3, 6, 9 and 12 months.

Parameters of weight loss

The baseline data from the surgery day were used for verifying weight loss. Very good bariatric outcomes were defined as a decrease in BMI below 30 kg/m^2 or achieving excess weight loss (EWL) ≥ 50%.

Identification of prognostic factors and elements of post-operative care influencing parameters of weight loss

The effect of the following factors was analyzed: age, gender, baseline BMI, baseline body weight, and preoperative weight loss aimed at obtaining a beneficial outcome of the surgery, defined as a decrease in BMI of less than 30 kg/m^2 or EWL ≥ 50%. The preoperative weight loss was assessed on the basis of the difference between the values recorded on the day of qualification for the surgery and the day of the surgery. The impact of compliance with dietary recommendations, eating sweets, systematic physical activities, dietary care, and follow-up visits on the decrease in BMI and %EWL was also assessed 12 months after the surgery. Absence during more than one follow-up visit during the follow-up period was determined as a lack of visits. Systematic physical activities were defined as physical activities at least 3 times a week. In the case of including sweets in the diet more than once a week, consumption of them was reported. In the case of finding a lack of compliance with dietary recommendations during more than one follow-up visit, the patient was included in the group not complying with dietary recommendations.

Statistical analysis

Student's *t* test was used for comparisons between groups. The analysis was performed using GraphPad Prism v.5.02 for Windows (GraphPad Software, San Diego California USA, www.graphpad.com). A *p*-value of < 0.05 indicated that the difference was statistically significant.

Results

The mean age of the patients was 43.0 ±10.2 years (range: 17–62), the mean weight on the surgery day was 124.9 ±19.4 kg (range: 82.0–180.0), and the mean BMI was 43.7 ±5.1 kg/m^2 (range: 34.2–56.0). Differences between men and women in the above parameters are shown in Table I. Four (4.3%) patients underwent concomitant cholecystectomy for symptomatic cholelithiasis, and 1 (1.08%) patient underwent cruroplasty with interrupted sutures due to a large hiatal hernia. The mean operative time was 123.1 ±33.2 min (range: 60–270). No conversion was recorded. Weight loss parameters are shown in Table II.

Prognostic factors for the outcome assessed according to the changes in BMI

After 12 months, BMI < 30 kg/m^2 was found in 32 (34.4%) and BMI ≥ 30 kg/m^2 in 61 (65.6%) patients. The mean BMI after surgery in both groups was, respectively, 26.6 ±1.9 kg/m^2 (range: 22.1–29.9) and 35.0 ±3.8 kg/m^2 (range: 30.0–46.1), $p < 0.0001$. A significant influence of the baseline body weight and the baseline BMI on the possibility of BMI decrease below 30 kg/m^2 was observed. Preoperative weight loss was also a factor contributing to the achievement of BMI < 30 kg/m^2, but the difference was not statistically significant. There was no effect of gender or the age of patients on outcome assessed on the basis of changes in BMI. The data are shown in Table III.

Prognostic factors for the outcome assessed on the basis of %EWL

Twelve months after the surgery, EWL < 50% was observed in 35 (37.6%) patients, and EWL ≥ 50% in 58 (62.4%) patients. Excess weight loss in both groups was 37.1 ±10.4% (range: 6.8–49.3) and 67.7

Table I. Characteristics of patients

Parameter	Female (*N* = 63) Mean ± SD (range)	Male (*N* = 30) Mean ± SD (range)	*P*-value
BMI [kg/m^2]	43.9 ±4.8 (34.8–54.9)	43.5 ±5.6 (43.2–56.0)	0.7395
Body weight [kg]	118.8 ±15.1 (82.0–151.0)	137.6 ±21.3 (106.0–180.0)	< 0.0001
Age [years]	42.5 ±11.1 (17–60)	44.1 ±8.0 (26–62)	0.4287

Table II. Weight loss parameters

Evaluated parameter	Before surgery; mean ± SD (range)	12 months after surgery; mean ± SD (range)
Body weight [kg]	124.9 ±19.4 (82–180)	91.6 ±17.7 (56.5–142)
BMI [kg/m^2]	43.7 ±5.1 (34.2–56.0)	32.1 ±5.1 (22.1–46.1)
Weight loss (%)		26.6 ±8.5 (3–47)
Weight loss [kg]		33.3 ±11.4 (4–64)
%EWL		56.2 ±18.9 (6.8–102.1)

Table III. Prognostic factors for the outcome assessed according to the changes in BMI

Patients	Parameter	Mean ± SD (range)	Mean ± SD (range)	*P*-value
BMI < 30 as. vs. BMI ≥ 30 as.	BMI bs.	39.7 ±3.2 (34.2–44.6)	45.9 ±4.6 (36.8–56.0)	< 0.0001
BMI < 30 as. vs. BMI ≥ 30 as.	Age bs.	42.3 ±10.6 (17–62)	43.4 ±10.0 (19–60)	0.6346
BMI < 30 as. vs. BMI ≥ 30 as.	Weight bs.	114.4 ±16.8 (82–161)	130.3 ±18.5 (97–180)	< 0.0001
Pwl. (+) vs. pwl. (–)	BMI as.	30.7 ±4.8 (23.4–41.3)	32.8 ±5.2 (22.1–46.1)	0.0560
Female vs. male	BMI as.	32.1 ±4.6 (22.1–43.6)	32.2 ±6.1 (23.4–46.1)	0.9308

bs. – before surgery, as. – after surgery, pwl. – preoperative weight loss.

±12.5% (range: 50.4–102.1), $p < 0.0001$. Excess weight loss was significantly higher in patients with preoperative weight loss, as compared with those without weight loss. The average age in the group of patients with EWL ≥ 50% was lower than in the group of patients whose EWL was less than 50%. The results are shown in Table IV.

Impact of selected elements of post-operative care on the parameters of weight loss

Lower BMI was observed in patients adhering to dietary recommendations, regularly attending dietary consultations and in patients who started regular physical activities. Consuming sweets and participation in follow-up appointments had no significant impact on this parameter. The results are presented in Table V. All of the analyzed elements have a significant impact on the %EWL. This was particularly evident in the case of performing systematic physical activity and participation in dietary consultations. The data are presented in Table VI.

Discussion

In recent years, sleeve gastrectomy has become the second most common bariatric procedure performed worldwide [18]. Despite the similarity of the surgical technique, results, in terms of weight loss, achieved in individual patients may vary significantly. In the present study, the degree of weight loss was evaluated on the basis of %EWL and BMI changes in accordance with the recommendations of 2005

Table IV. Prognostic factors for the outcome assessed on the basis of %EWL

Patients	Parameter	Mean ± SD (range)	Mean ± SD (range)	*P*-value
EWL < 50% vs. EWL ≥ 50%	BMI bs.	44.9 ±5.2 (34.2–56.0)	43.0 ±4.9 (34.8–55.0)	0.0818
EWL < 50% vs. EWL ≥ 50%	Age bs.	47.1 ±7.7 (24–59)	40.6 ±10.8 (17–62)	0.0025
EWL < 50% vs. EWL ≥ 50%	Weight bs.	129.9 ±22.1 (97–180)	121.8 ±17 (82–161)	0.0528
Pwl. (+) vs. pwl. (–)	%EWL	61.4 ±17.2 (29–93)	53.3 ±19.3 (6.8–102.1)	0.0496
Females vs. males	%EWL	56.3 ±18.3 (6.8–102.1)	55.4 ±20.4 (13.9–93.4)	0.8335

bs. – before surgery, as. – after surgery, pwl. – preoperative weight loss.

Table V. Impact of selected elements of post-operative care on BMI 12 months after surgery

Evaluated factors	BMI, mean ± SD (range)	BMI, mean ± SD (range)	*P*-value
Diet (+) vs. diet (–)	31.5 ±4.8 (22.1–41.4)	33.9 ±5.7 (25.7–46.6)	0.0481
Sweets (–) vs. sweets (+)	31.7 ±5.1 (22.1–1.4)	32.5 ±5.1 (25.8–46.1)	0.4806
Pa (+) vs. pa (–)	30.6 ±4.2 (23.4–39.9)	34.0 ±5.6 (22.1–46.1)	0.0013
Dc (+) vs. dc. (–)	30.6 ±4.2 (22.1–41.4)	35.1 ±5.5 (25.7–46.1)	< 0.0001
Fv. (+) vs. fv (–)	31.6 ±5.1 (22.1–46.4)	33.7 ±4.8 (25.7–43.6)	0.0750

Pa. – physical activity, dc. – dietary consultations, fv. – follow-up visits.

Table VI. Impact of selected elements of post-operative care on %EWL 12 months after surgery

Evaluated factors	%EWL, mean ± SD (range)	%EWL, mean ± SD (range)	*P*-value
Diet (+) vs. diet (–)	59.7 ±17.5 (22.5–102.1)	45.4 ±19.4 (6.8–76.6)	0.0014
Sweets (–) vs. sweets (+)	60.1 ±18.2 (22.5–102.1)	51.6 ±18.9 (6.8–81.3)	0.0293
Pa (+) vs. pa (–)	63.4 ±14.6 (33.7–93.4)	47.0 ±19.9 (6.8–102.1)	< 0.0001
Dc (+) vs. dc. (–)	63.1 ±15.1 (28.1–102.1)	42.3 ±18.2 (6.8–81.3)	< 0.0001
Fv. (+) vs. fv(–)	58.9 ±18.5 (22.5–102.1)	47.8 ±17.9 (6.8–76.6)	0.0130

Pa. – physical activity, dc. – dietary consultations, fv. – follow-up visits.

[19]. In the analyzed group, the above parameters were similar to the data presented in the literature [7, 20–22]. The impact of each factor on the final outcome of the bariatric treatment is still not clear. An additional difficulty in the interpretation of the results is the lack of a clear definition of success of the surgical treatment of obesity. What is more, there are many different definitions and scales [23–26]. The manner of defining success affects the reported results of treatment. In the current study, a very good outcome included EWL ≥ 50% and BMI decrease below 30 kg/m^2. A more restrictive criterion in this approach is to obtain a BMI < 30 kg/m^2.

We did not find any effect of the age or gender of patients on the degree of BMI decrease. In the case of patients with preoperative weight loss, the mean BMI after the surgery was lower than in patients without weight loss, but the difference was not significant. Significant differences were however observed in the case of the baseline weight and BMI. In the group of patients with BMI < 30 kg/m^2, both the mean weight and BMI before the surgery were lower than in the case of patients with BMI ≥ 30 kg/m^2, $p < 0.0001$. Reports on the impact of initial body weight parameters on %EWL and the rate of BMI decrease in the postoperative period are contradictory [11, 27]. Certainly, it is much more difficult for patients with the initial BMI > 50 kg/m^2 to achieve a decrease of BMI below 30 kg/m^2 [11]. This study confirms the beneficial effect of lower baseline body weight parameters on the possibility of achieving a lower BMI after the surgery. Taking the decrease in BMI below the target as the measure of success, patients with lower body weight parameters should therefore be eligible for surgery. In the current study, a lower baseline BMI also favored higher %EWL, but the difference was not significant. Other reports also do not confirm any significant influence of the baseline BMI on %EWL [11, 27]. Chopra *et al.* noted higher %EWL in the group of patients with the baseline BMI < 50 kg/m^2 as compared to patients > 50 kg/m^2, but the difference was significant only after 6 and 12 months, and it faded after 24 months [12]. Alvarado *et al.* reported that baseline BMI higher by one was related to achieving EWL lower by 1.34%, but these results concerned the Roux-en-Y gastric bypass [28]. In the present study, a significant impact on the %EWL was only found in the case of the age of the operated patients and their weight loss before the surgery. Numerous studies have confirmed a beneficial effect of younger age on both the %EWL and percentage excess body mass index loss (%EBMIL). Contreras *et al*. reported EBMIL in patients under 45 years of age, 12 months after the surgery, at the level of 91 ±26.6% and 73.1 ±24.1%, $p < 0.0001$, in the group ≥ 45 years of age. A significant difference was also found when comparing the two groups in terms of the proportion of patients who achieved EBMIL ≥ 50%. In the case of younger patients, the percentage was 97.4%, and it was 85.1% in the case of older patients, $p < 0.001$ [10]. Chopra *et al*. found that EWL% was higher in patients < 40 years of age than in the group > 40 years of age, but the differences were only significant after 12 and 24 months. After 24 months, the difference between the mean %EWL in both groups was 11% [12]. Other reports did not confirm the beneficial effect of patients' younger age on %EWL [11]. Another factor whose influence is controversial is the preoperative body weight loss. Recommending weight loss before the surgery is not always accepted by patients. Making the surgery conditional on weight loss can promote disqualification of patients for whom bariatric treatment brings measurable health benefits. On the other hand, preoperative body weight loss is an effective way to assess patients' involvement in the therapeutic process [29]. Many studies have shown beneficial effects of preoperative weight loss on the parameters of weight loss in the postoperative period [28–30]. This phenomenon can be maintained only for short periods of follow-up [31, 32]. Not all reports confirm the positive effect of preoperative weight loss [33]. In our study %EWL in the patients with preoperative weight loss was 61.4 ±17.2%, and it was 53.3 ±19.3% in the group of patients with no preoperative body weight loss, $p = 0.0496$. The prerequisite to demonstrate a significant effect can be weight loss by a specified value, e.g. excess body weight loss by 5% [30]. Undoubtedly, in patients with a high initial BMI, weight loss may be justified due to the beneficial effects on the overall health and the reduced risk of perioperative complications.

Many patients' hope for weight loss is associated with the surgery, mostly with no emphasis on lifestyle changes before and after the surgery. Regardless of the type of intervention, failure to comply with recommendations will again result in increased body weight [34]. In order to obtain good treatment results, a comprehensive multidisciplinary team ap-

proach is needed along with good identification of adverse factors which may occur in the postoperative period. This study confirms a significant impact of compliance with dietary recommendations on decreases in BMI. Avoiding consumption of sweets was less important in this context. The impact of compliance with dietary recommendations is clear in the case of %EWL. The beneficial effect of constant dietary care is obvious in the case of Roux-en-Y gastric bypass [35]. The present study confirms a clear effect of systematic participation in dietary consultations on decreases in BMI and %EWL after sleeve gastrectomy. It is important to educate patients on the proper reporting of food intake. This is conducive to identifying the causes of too low weight loss. Attempts to determine the causes of poor weight loss should not cause patients' discomfort and cannot be perceived as negative assessments. In this area of contact with patients, dieticians who have experience in working with bariatric patients should play major roles. The frequency of follow-up visits after the bariatric surgery performed depends on the type of bariatric procedure and comorbidities [14]. Odom *et al.* reported that the risk of further weight gain in patients after Roux-en-Y gastric bypass is inversely proportional to the frequency of appointments [15]. Regular appointments allow for the identification of patients with possible complications and affect the results of weight loss. In the present study, the patients who systematically attended follow-up visits had significantly higher %EWL. In the case of their BMI, a tendency to obtain better results was observed. Unfortunately, in most cases, the willingness of patients to participate in follow-up appointments after bariatric surgery is much lower than before the surgery [36, 37]. Intensive care in the postoperative period and the patients' constant contact with the team providing treatment are essential, particularly in later years after the surgery [38, 39]. Data on the impact of follow-up visits on the outcomes of sleeve gastrectomy are limited. This study showed that it is a factor favorably affecting the degree of weight loss. The importance of physical activities in the treatment of obesity was highlighted in the recommendations of 1998. Physical activities should be part of a comprehensive treatment program for obesity and a factor preventing re-gaining body weight [40]. The beneficial effect of physical activities on %EWL and BMI decrease was also confirmed in the present study. Patients should be advised to take up moderate aerobic exercises first for a minimum of 150 min and, eventually, 300 min per week, including strength training 2–3 times a week [14]. Regular physical activities are associated with obtaining better results of weight loss after bariatric surgery [17, 41]. Beneficial effects are particularly evident in the case of increasing the time devoted to physical activities after the surgery, as compared to the period before the surgery [42].

Conclusions

It can be stated that the younger age of patients and preoperative weight loss are conducive to achieving a higher %EWL. Lower baseline parameters of weight facilitate very good results, defined as a BMI decrease < 30 kg/m^2. Starting systematic physical exercises, dietetic care and adherence to recommendations in the postoperative period positively influence the parameters of weight loss after sleeve gastrectomy.

Conflict of interest

The authors declare no conflicts of interest.

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Received: 20.11.2016, **accepted:** 11.12.2016.