Obesity Pillars 3 (2022) 100029

Contents lists available at ScienceDirect

Obesity Pillars

journal homepage: www.journals.elsevier.com/obesity-pillars

A cross-sectional survey of patients attending follow-up visits after sleeve gastrectomy: Factors affecting weight loss

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ARTICLE INFO

Keywords:
Bariatric surgery
Laparoscopic sleeve gastrectomy
Post-bariatric surgery patients
Weight reduction
Survey

ABSTRACT

Background: Bariatric surgery offers long-term weight loss and maintenance for patients with obesity. Several factors may be associated with patients' inability to achieve successful excess weight loss (EWL) after the surgery. The purpose of this study was to identify factors associated with improved or in-progress EWL among patients who had undergone laparoscopic sleeve gastrectomy (LSG).

Methods: This original clinical investigation was conducted at the Outpatient Surgical Department-Medical Research Institute Hospital at Alexandria University in Egypt. A sample size of 100 adult surgical patients who had undergone LSG was selected from patients who attended follow-up in the study setting. Group A had an EWL % $\geq$50 and group B had an EWL <50. Body Mass Index (BMI) classes were defined as 25–30 kg/m^2, >30–35 kg/m^2, >35–40 kg/m^2, >40 $\geq$ 45 kg/m^2

Results: Post-operatively, after six months, 100% of the patients in group A had a BMI between 25 and 30 mg/m2, compared to 0% in group B. Nevertheless, patients in group EWL<50 (group B) who had pre-operatively BMI class $\geq$45 mg/m2, had a reduction in weight of 89.5% post-operatively, (n = 2 still had a BMI >45 kg/m^2 post operatively), In total, 63.9% of the patients in group B managed to get towards a BMI of 30–35 kg/m^2 post-operatively. The main factors associated with group B (less %EWL after 6 months) were found to be related to higher preoperative BMI, the onset of obesity started in childhood, less preoperative weight loss, longer post-operative duration towards weight reduction, and lower postoperative compliance to dietary instructions (P = 0.0001, 0.048, 0.0001, 0.017, and 0.016, respectively).

Conclusion: Routine cross-sectional surveying can help clinicians in understanding patients' post-operative follow-up routines. Special attention to pre-operative BMI, weight-loss regimens, and childhood-onset as well as post-operative duration, low responders, and compliance with clinical assessment can improve weight loss outcomes.

1. Introduction

Worldwide obesity has nearly tripled since 1975 and is linked to more deaths worldwide than underweight. It is expected that by the year 2030, nearly 38% of the world's adult population will have overweight, while another 20% will have obesity [1,2]. Further, obesity greatly increases the risk of several chronic diseases such as type 2 diabetes and cardio-vascular diseases, and overall presents a major challenge to chronic disease prevention and health across the life span and around the world [2,3].

Bariatric surgery, specifically laparoscopic sleeve gastrectomy (LSG), is a common treatment for obesity. However, it is important to note that not all patients lose weight successfully following LSG, despite precision in surgical technique, nursing efforts, and regular follow-up [4].Therefore, outpatient surgical departments play an important role in the follow-up of the patients, including the guidance of the patient toward a healthy diet and standard physical activity as a multi-modal team approach. In this study, we used a survey to identify patients attending follow-up visits and the factors affecting excess weight loss among post-LSG patients for a good clinic perception of how the follow-up of the

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https://doi.org/10.1016/j.obpill.2022.100029
Received 30 June 2022; Received in revised form 20 July 2022; Accepted 20 July 2022

post-bariatric surgical patients can be adjusted or maintained to achieve better outcomes.

2. Methods

2.1. Study design

A cross-sectional survey on weight loss following LSG and factors affecting weight-loss was conducted between October and December 2021 at the surgical outpatient clinic department of the Medical Research Institute Hospital of Alexandria University in Egypt. Written and oral informed consent was obtained from all patients and data were analyzed anonymously. The study was conducted following the principles of the Declaration of Helsinki principles and approved by the local ethics committee.

2.2. Patient selection and inclusion criteria

Patients 18–65 years of age were screened and indicated according to the International Federation for the Surgery of Obesity criteria before LSG surgery. Patients received pre-and postoperative multidisciplinary counseling. The survey has been completed six months after a bariatric surgery procedure [5].

2.3. Exclusion criteria

Patients who were unwilling or unable to sign an informed consent form were excluded from the study.

2.4. Laparoscopic sleeve gastrectomy (LSG)

The LSG procedures were performed by the same team throughout the study. Dissection was begun 6 cm from the pylorus (antrum preserving) until the gastroesophageal junction, followed by gastric transaction over 40F bougie through sequential stapler firings.

2.5. Survey interview and follow-up visits at the clinic

During outpatient consultation appointments with patients, a medical bariatric surgical nursing team administered the survey during 10- to 15-min personal interviews. All postoperative visits were assessed by a multi-disciplinary team (consisting of a surgeon, nutritionist, psychiatrist, and medical bariatric surgical nursing team) in the outpatient clinic. Follow-up with the nutritionist was conducted monthly. If emotional eating or any other disorder was diagnosed during a visit, a psychiatric consult was scheduled. The patient was followed up by the surgeon after the surgery and at later time points when necessary.

2.6. Sociodemographic characteristics questions

The patients' sociodemographic characteristics such as age, sex, occupation, level of education, and marital status were recorded.

2.7. Bariatric weight reduction questions

2.7.1. Preoperative factors

Preoperative factors included preoperative body mass index (BMI), the onset of obesity (childhood, adolescence, or adulthood), family history of obesity, history of following the diet regimen, eating disorders (overeating, night eating, or both), and scheduled preoperative weight loss regimen.

2.7.2. Clinical factors

Clinical factors included smoking, we took into consideration all medical conditions (such as diabetes mellitus, cardiovascular disorders, osteoarthritis), and psychiatric disorders obtained from the medical record.

2.7.3. Patient compliance with postoperative instructions

Patient compliance with post-operative instructions was included, and compliance with the dietary instructions and follow-up exercise regime were all asked during the interview and checked by the diary/logbook all patients filled in during the post-operative period.

2.8. Criteria for categorical weight loss and BMI classes

Using weight loss by an excess weight loss % criteria, the patients were classified into the following groups:

Groups A and B had an EWL% $\geq$50 and $<$ 50, respectively.

Pre-operative BMI classes were defined as 35 $>$ 40 kg/m^2, 40 $>$ 45 kg/m^2, $\geq$45 kg/m^2 and post-operative as 25 - $\leq$ 30 kg/m^2, $>$30–35 kg/m^2, 35–40 kg/m^2, $>$40 $\geq$ 45 kg/m^2 [6].

2.9. Statistical analysis

This was a cross-sectional, prospective, observational study. Descriptive and inferential statistics were used for analyses on all available data. All data were first tested for normality using the Kolmogorov−Smirnov test, Q-Q plot, and Levene's test. Categorical variables are expressed as numbers and percentages. Continuous normally and non-normally distributed variables are presented as means and standard deviations (sd) and medians and interquartile ranges (for skewed distributions), respectively. When appropriate, categorical variables were tested using Pearson's chi-square test or Fisher's exact test. Normally distributed continuous data were tested with the dependent samples using the Student's t-test for pre-and postoperative results. For skewed (non-parametric) data, The Wilcoxon signed-rank test was used. A P-Value of $\leq$0.05 was considered statistically significant. Statistical analyses were performed using IBM SPSS Statistics (SPSS Statistics for Windows, Version 27.0, IBM Corp., Armonk, NY, USA).

3. Results

3.1. Sociodemographic characteristics

This cross-sectional survey study included 100 patients who had undergone LSG at a single site. Pre-operative BMI in group A was 46.4% in BMI class 35–40, group B 16.6%. BMI 40–45 was in group A 53.6% and group B 56.9%. Group B alone had 26.4% of the patients with the highest BMI class $>$45 (p = 0.001). (Table 1, Fig. 1).

Post-operatively, after six months, 100% of the patients in group A had a BMI between 25 and 30 mg/m2, compared to 0% in group B.

Table 1
Sociodemographic characteristics at the time of the survey $>$6 months after the LSG procedure.

	Group A EWL$\geq$50% n = 28	Group B EWL$<$50% n = 72	P value
Age mean ± sd	34.75 ± 9.1	34.54 ± 11.2	0.930
Sex n%			
Female	24 (85.7%)	54 (75.0%)	0.246
Occupation n%			
Unemployed	15 (53.6%)	38 (52.8%)	0.679
Full-time	7 (25.0%)	23 (31.9%)	
Part-time	6 (21.4%)	11 (15.3%)	
Level of Education			
No education	0 (0.0%)	1 (1.4%)	0.715
Primary	10 (35.7%)	22 (30.6%)	
Secondary	6 (21.4%)	11 (15.2%)	
University	12 (42.9%)	38 (52.8%)	
Marital state			
Single	10 (35.7%)	28 (38.9%)	0.160
Married	16 (57.1%)	43 (59.7%)	
Divorced	2 (7.1%)	0 (0.0%)	
Widow	0 (0.0%)	1 (1.4%)	

EWL: Excess weight loss.

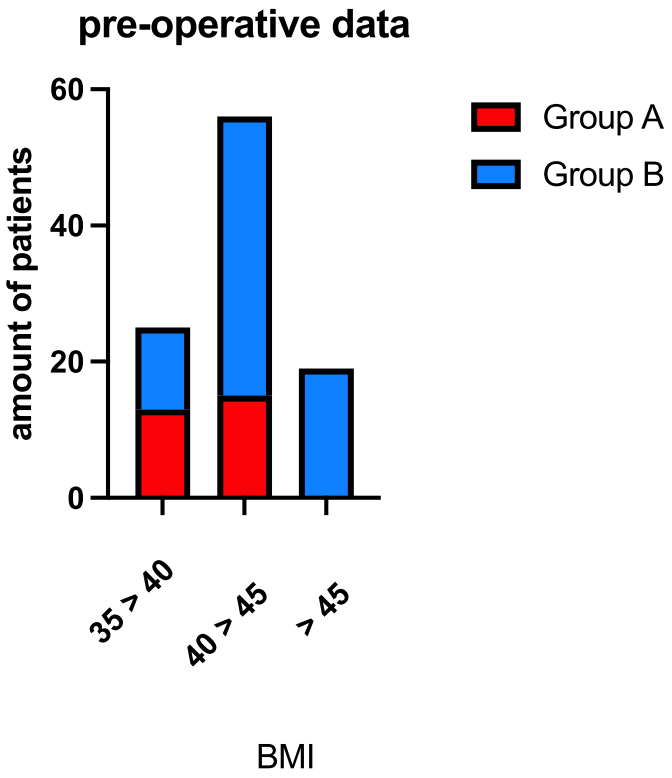

Fig. 1. Pre-operative BMI in groups A and B.

Nevertheless, patients in group EWL<50 (group B) who had pre-operatively BMI class ≥45 mg/m2, had a reduction in weight of 89.5% post-operatively, (n = 2 still had a BMI >45 kg/m^2 post operatively), In total, 63.9% of the patients in group B managed to get towards a BMI of 30–35 kg/m^2 post-operatively. (Table 1, Fig. 2). In group A, the mean ± sd age was 34.75 ± 9.1, and in group B it was 34.54 ± 11.2 (p = 0.930). Group A consisted of 24 female patients (85.7%), and group B 54 (75.0%) (p = 0.246) (Table 1).

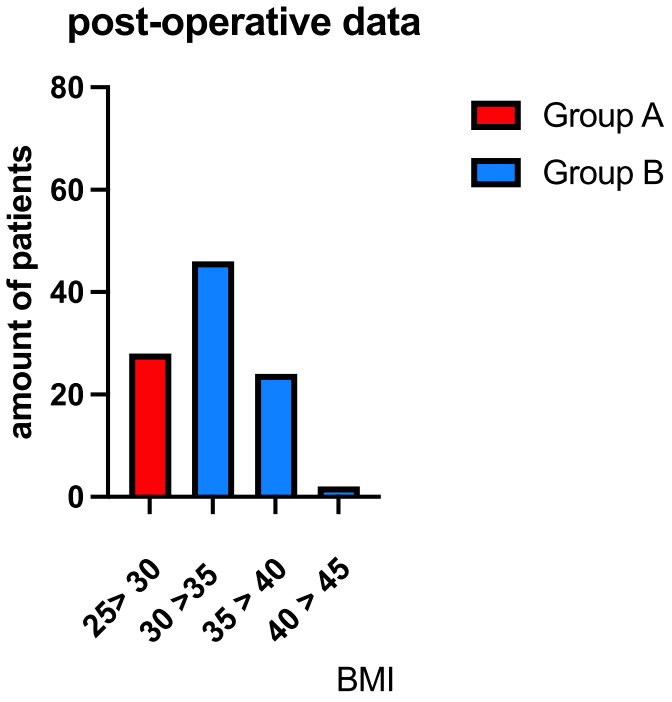

Fig. 2. Post-operative BMI in groups A and B.

In both groups, 53.6% and 52.8% (p = 0.679) were unemployed, respectively. The majority of the patients (42.9%, 52.8% [p = 0.715]) in both groups had received a university education, respectively. Furthermore, in group A 57.1% and in group B 59.7% of the patients were married instead of single, divorced, or widowed. (p = 0.160) (Table 1).

3.2. Bariatric weight loss survey

3.2.1. Preoperative factors

Family history of obesity was present in 32.1% of patients in group A and 27.8% of patients in group B (p = 0.666). The onset of obesity was significantly different between both groups. In 72.2% of patients in group B, it had started in childhood, compared to 53.6% in group A (p = 0.048). Both groups had a history of a diet regime before surgery (53.6%) (89.3% vs. 90.3%) (p = 1.00) (Table 2).

All the patients in group A (100%) had experienced pre-operative weight loss, compared to 27.8% in group B (p = 0.001). Both groups had eating disorders; overeating and night eating combined occurred in both groups, at 64.3% and 76.4%, respectively, but were not significantly different (p = 0.585) (Table 2).

3.2.2. Clinical factors

Both groups were 85.7% and 75.0% non-smokers (p = 0.246). In group B, associated medical problems were significantly more present, with 77.8% vs 7.1% in group A (p = 0.001 OR 53.3). A psychiatric disorder was absent in 92.9% and 81.8% in groups A and B, respectively (p = 0.222).

3.2.3. Duration of weight loss

Group A, 67.9% of the patients achieved EWL% >50% between 6 and 12 months, 32.1% of the patients it took more than 12 months to achieve this goal.

In group B, 43.1% of the patients did not have more weight loss (EWL % <50%) between 6 and 12 months. In 56.9% of the patients, it took longer than 12 months to not have more weight loss achieved and did not achieve the EWL% >50% criteria (p = 0.017 OR 2.8) (Table 2).

3.2.4. Patient's compliance with postoperative instructions

3.2.4.1. Visits. Approximately 17.9% and 11.1% of the patients in groups A and B, respectively, did not attend follow-up visits with a nutritionist. In groups A and B, 21.4% and 20.8% of patients, respectively, attended routine monthly follow-up visits. Furthermore, 60.7% of group A and 68.1% of group B did not have regularly scheduled visits to the nutritionist (p = 0.646).

3.2.4.2. Moment of consulting. While revising the nutritionist's notes, those in group B were found to not follow the instructions of the nutritionist about 58.2% of the time, compared to 39.2% in group A (p = 0.016; OR, 2.19). Exercise instructions were followed by 67.9% of patients in group A and 59.7 of patients in group B (p = 0.499) (Table 2).”

4. Discussion

This study assessed attendance to follow-up visits and its effect on EWL%, along with the variables that may have affected this in a cross-sectional design. Both groups had a significant reduction in weight loss; however, group A all reached EWL%≥50, compared to 0% of the patients in group B. Nevertheless, in group B's highest BMI class, 89.5% of the patients reduced their weight after 6 months, even though these patients had faced the biggest challenges in the beginning. Patients undergoing bariatric surgery have differing degrees of weight loss post-operatively, and a wide variety of factors may play a role in influencing weight loss outcomes. Identifying the factors associated with post-operative weight loss can help prevent its occurrence among bariatric

Table 2
Follow-up variables on weight reduction after >6 months.

	Group A EWL≥50% n = 28	Group B EWL<50% n = 72	P value Odds Ratio (OR)
Preoperative factors n%			
Pre-operative BMI			
35 > 40 kg/m^2	13 (46.4%)	12 (16.7%)	**0.001***
40 > 45 kg/m^2	15 (53.6%)	41 (56.9%)	**OR: NA**
≥45 kg/m^2	0 (0.0%)	19 (26.4%)	
Post-operative BMI			
25 - ≤ 30 kg/m^2	28 (100%)	–	**0.001***
>30–35 kg/m^2		46 (63.9%)	
35 - 40 kg/m^2		24 (33.3%)	
>40 ≥ 45 kg/m^2		2 (2.8%)	
Family history of obesity			
Yes	19 (67.9%)	52 (72.2%)	0.666
No	9 (32.1%)	20 (27.8%)	
The onset of obesity			
Childhood	15 (53.6%)	52 (72.2%)	**0.048***
Adolescence	8 (28.6%)	12 (16.7%)	**OR: NA**
Adulthood	5 (17.9%)	8 (11.1%)	
History of diet regimen			
Yes	3 (10.7%)	7 (9.7%)	1.000
No	25 (89.3%)	65 (90.3%)	
Preoperative weight loss regimens			
Yes	28 (100%)	52 (72.2%)	**0.001***
No	0 (0.0%)	20 (27.8%)	**OR: NA**
Eating disorders			
Absent	2 (7.1%)	3 (4.2%)	0.585
Overeating	1 (3.6%)	2 (2.8%)	
Night eating	7 (25.0%)	12 (16.7%)	
Both	18 (64.3%)	55 (76.4%)	
Clinical factors n%	**Group A EWL≥50% n = 28**	**Group B EWL<50% n = 72**	**P value**
Smoking			
Yes	24 (85.7%)	54 (75.0%)	0.246
No	4 (14.3%)	18 (25.0%)	
Associated medical problem			
Yes	26 (92.9%)	16 (22.2%)	**0.001***
No	2 (7.1%)	56 (77.8%)	**OR: 53.3**
Psychiatric disorders			
Yes	26 (92.9%)	59 (81.9%)	0.222
No	2 (7.1%)	13 (18.1%)	
Post-operative duration of weight loss			
6–12 months	19 (67.9%)	31 (43.1%)	**0.017***
>12 months	9 (32.1%)	41 (56.9%)	**OR: 2.8**
Patient's compliance with postoperative instructions			
Follow up visit with nutritionist			
No	5 (17.9%)	8 (11.1%)	0.646
Not monthly	17 (60.7%)	49 (68.1%)	
Monthly	6 (21.4%)	15 (20.8%)	
Nutritionist instructions Followed up?			
Yes	17 (60.7%)	30 (41.7%)	**0.016***
No	11 (39.3%)	42 (58.3%)	**OR: 2.19**
Exercises instructions Followed up?			
Yes	19 (67.9%)	43 (59.7%)	0.499
No	9 (32.1%)	29 (40.3%)	

BMI: Body mass index, EWL: excess weight loss, NA: not applicable, OR: Odds ratio.

surgery patients [7–9]. Group B falls in line with a study of Binda et al., in 2016 [6] who assessed the prognostic factors for weight loss outcomes after bariatric surgery in a similar study. Additionally, a study from 2014 [5] found that the higher the preoperative BMI, the longer the weight reduction takes after surgery will be. This has a logical explanation, but this study was most interested in what factors influence this from an outpatient clinical setting.

This survey found that most patients were females who were married and did not work outside the home. These factors can play a part in hindering the patient's willingness to lose weight. A study in 2011 showed a correlation between female sex and post-bariatric surgery poor weight loss outcomes. This same study found a relationship between psychosocial stressors, such as depression, anxiety, and poor self-esteem, and delayed weight loss after bariatric surgeries, especially among female patients [10]. Furthermore, a 2022 study [11] on emotional eating disorder after bariatric surgery noted that inadequate weight loss and weight regain are known drawbacks of bariatric surgery that may be related to psychological or behavioral issues [12]. Non-compliance with dietary recommendations is strongly linked to insufficient weight loss after bariatric surgery [13]. All these factors should be further investigated on the effect of good or bad responders on weight loss after bariatric surgery and should be given attention to in the postoperative phase.

The presence of childhood-onset of obesity had significantly more presence in group B than in group A, compared to adolescence and obesity in the adulthood period. Having obesity in childhood may lead to an early onset of metabolic disorders, a lack of healthy eating habits, and a lack of exercise. A study by Sillén and Andersson in 2017 [4] tested 281 patients and found that childhood obesity could be associated with lifelong reduced physical activity, decreased self-esteem, depression, and social isolation, which may further cause failure to lose weight after surgery, especially weights were higher prior to surgery. Also, a study found that childhood obesity had an increased risk for cardiometabolic disease and cancer in adulthood [14].

Preoperative weight loss regimens were done by 100% of the patients in group A and 72.2% in group B ($p = 0.001$). In 2016, Binda et al. [6] found a similar study effect on the mean postoperative BMI which was lower in patients who had undergone a preoperative weight loss regimen than in patients without this preparation. However, this finding was not found in a study conducted by Still et al., in 2014, which suggested that losing weight on a preoperative schedule showed no significant impact on postoperative outcomes [5]. Since 72.2% of the patients in group B did follow a weight loss regimen and had a significant reduction from the highest BMI class, this suggests that it may influence weight loss in general.

Furthermore, in 56.9% of the patients, it took longer than 12 months to have not more weight loss achieved and at the same time did not achieve the EWL% >50%. We noted that the longer the postoperative duration, the poorer the adherence to post-operative instructions would be, and the more patients would fall back into to poor eating habits and regain weight. In this regard, Bastos [15] stated that a longer post-operative duration of more than 2 years significantly affected the outcome of bariatric surgery. Another study found that early post-operative weight loss can be used to identify patients whose predicted weight loss trajectories are suboptimal [16]. In a study from 2021 on early postoperative weight loss as predictive variable on the five year outcome, showed a positive association between weight loss at 3 and 12 to predict 60 months postoperative. Patients who are bad responders in the first 3 months, will also have a poor outcome in 60 months [17]. Therefore, during the follow up extra attention to the first period of weight loss could potentially increase overall weight loss. Preparing the low-responder patients at the beginning and the patients with a long follow-up and low %EWL for specific treatments with, for example, additional training and assessments [11] or medication therapy may be of help. As this survey showed, a routine survey, for the future of all post-operative patients, can help to identify the low responders earlier and help the provide outpatient clinics with feedback on how adjustments to policy can be carried out. This will help in better predicting outcomes and treatment of the patients.

Regarding patient compliance with postoperative instructions, this survey revealed that following dietary instructions had a positive significant association with weight loss outcomes postoperatively. The majority of group B had no compliance with postoperative dietary instructions. This result was in line with other studies on the relationship between following a dietary regimen and weight reduction post-bariatric surgery [6]. Attention to no-shows and lack of post-operative instructions must be properly redirected throughout the post-operative period. Therefore, in general, this study gives a good insight into how the behavior is from a patient with this cross-sectional survey. Where mostly

the focus is on what treatment, therapy, or another type of study between groups in a prospective, retrospective, or another type of design is so good, this single point in time measurements should therefore not be underestimated. Because after testing treatment and implementing this, the validation of this same treatment must not be forgotten, and therefore more cross-sectional survey's must be deployed in daily practice as a validation tool.

4.1. Limitations

Nevertheless, a limitation of the cross-sectional design is, that it provided a bias on the factor of time because it was not known when a change would occur or if patients intend to change over time. However, it does reflect well the prevalence of all findings. Increasing the frequency of baseline measurements gives a good indication over time of whether bariatric delayed weight reduction factors are being followed differently by patients post-operatively. Also, unemployed as socioeconomic factor was not clear if this unemployment was through an own decision to stay at home or by the fact that it was no income, so possible poverty. Another limitation is that this study fully focused on outpatient clinics with questionnaires. Therefore, lab findings on metabolic biomarkers as hormonal levels or insulin restriction for possible delayed weight loss were not measured and analyzed. In the future, a combination of survey and lab findings may provide better insights into internal changes and delays.

5. Conclusion

Routine cross-sectional surveying can help clinicians in understanding patients' post-operative follow-up routines. Special attention to pre-operative BMI, weight-loss regimens, and childhood-onset, as well as post-operative duration, low responders, and compliance to clinic assessment, can help the outcome of a patient.

Disclosures

No competing interests were applicable. Furthermore, the authors declare that they have no conflict of interest. ICMJE disclosure form is signed by all the authors.

Author contribution

Conceptualization: MH, MK, MA. Methodology BT, MK. Formal analysis: MK, BT. Writing: Original Draft: MH, BT. Writing: Review and Editing: MK, MA, MH, ASSA. Supervision: BT. All contributors reviewed, edited, and approved the final submission and publication.

Ethical review

All procedures performed in studies involving human participants were by the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

All patients provided written and oral informed consent.

Source of funding

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

Acknowledgment

None.

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