

Original Article



Factors Associated With Loss to Follow-up After Laparoscopic Sleeve Gastrectomy: A Single-Center Retrospective Study

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ABSTRACT

Purpose: After bariatric surgery, postoperative follow-up is important for evaluating long-term outcomes, such as successful weight loss and improvement of metabolic parameters. However, many patients are lost to follow-up within 1 year. This study aimed to identify the follow-up rate of bariatric surgery and predictive factors of loss to follow-up (LTF).

Materials and Methods: We retrospectively reviewed the data of 61 patients receiving bariatric surgery for obesity (laparoscopic sleeve gastrectomy; LSG group) and 872 for early gastric cancer (EGC group) from November 2018 to July 2020 in a single center. After 1:1 matching, we compared the LTF rate. In the LSG group, we analyzed the factors associated with LTF. Additionally, we collected weight data in the LTF group by a telephone survey.

Results: By 1:1 matching, 47 patients for each group were identified. The LTF rates of the LSG and EGC groups were 34.0% (16 patients) and 2.1% (one patient), respectively ($P=0.0003$). In the LSG group, the LTF rate increased over the postoperative month. Of the patients, 29.5% who missed a scheduled appointment within one year comprised the LTF group. In the analysis, no significant factors associated with LTF were identified. The only factor with borderline significance was dyslipidemia with medication ($P=0.094$).

Conclusion: The LSG group demonstrated a high LTF rate, although adherence to follow-up was closely related to postoperative outcomes. Therefore, educating patients on the significance of follow-up is important. Particularly, continuous efforts to identify the associated factors and develop a multidisciplinary management protocol after bariatric surgery are necessary.

Keywords: Obesity; Gastrectomy; Lost to follow-up; Postoperative care; Bariatric surgery

INTRODUCTION

The prevalence of obesity has rapidly increased worldwide, and the World Health Organization announced a global epidemic of obesity [1]. Based on the data from the Korean National Health Insurance Service, the prevalence of obesity in South Korea, defined as a

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Conflict of Interest

None of the authors have any conflict of interest.

Author Contributions

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body mass index (BMI) of ≥ 25 kg/m², has also increased from 29.7% in 2010 to 35.7% in 2018. Moreover, abdominal obesity, defined as a waist circumference of ≥ 90 cm in men and ≥ 85 cm in women, demonstrated a significant increase of 19.0% in 2009 to 23.8% in 2018 [2]. Obesity leads to a diversity of associated diseases. Hence, it is associated with healthcare and socio-economic burdens [3].

While other treatments for morbid obesity, such as exercise, medical treatment, and lifestyle modifications have failed to maintain weight loss, bariatric surgery is highlighted because of rapid weight loss, remission of comorbidities, improvement of quality of life, and sustainable weight loss [4-6]. Certainly, bariatric surgery could also induce inadequate weight loss or weight regain [7,8]. Therefore, regular follow-up after surgery is important to sustain weight loss as well as to prevent and treat complications [9,10]. Many studies have emphasized the importance of follow-up for successful weight loss [11-13].

The prevalence of bariatric surgery has increased significantly in South Korea [14]. However, no studies on how well the patients attend follow-up appointments and what factors are associated with the loss to follow-up (LTF) have been conducted. Thus, this study aimed to identify the LTF rate of patients receiving bariatric surgery and the factors associated with LTF.

MATERIALS AND METHODS

1. Study design

All patients undergoing laparoscopic sleeve gastrectomy (LSG) from November 2018 to August 2020 at a tertiary referral hospital in Seoul, South Korea were enrolled as the LSG group. Bariatric surgery was performed in accordance with the 2018 Korean Society for Metabolic and Bariatric Surgery Guidelines [15]. According to the guidelines, bariatric surgery is indicated for patients with a BMI of >35 kg/m² or >30 kg/m² with obesity-associated diseases such as type 2 diabetes mellitus (DM), hypertension, and fatty liver.

In the same period, patients who underwent curative radical gastrectomy because of gastric cancer and were pathologically diagnosed with early gastric cancer (EGC) were enrolled as the EGC group. The LTF rate of the EGC group was used to compare with that of the bariatric group because both groups underwent gastrectomy and needed to control their diet postoperatively. Most bariatric surgeries are conducted by upper gastrointestinal surgeons in South Korea.

Information regarding baseline characteristics and adherence status to follow-up was collected based on the electronic medical records. The collected data were as follows: age, sex, marriage status, residence, medical insurance status, American Society of Anesthesiologists score, comorbidities (type 2 diabetes, hypertension, psychiatric disease, and obstructive sleep apnea), first visited department, follow-up department, BMI at every visit, weight at every visit, operation time, and preoperative hemoglobin A1c.

The protocol for this retrospective study was approved by the Institutional Review Board of O O Medical Center, Seoul, South Korea (IRB No. 2021-1541).

2. Definitions of the collected information

Marital status was classified as single, married, or divorced, which includes separation by death. The residence of the patient was described as “near to hospital (near)” if the residence was in the same province as the bariatric center, and “far from hospital (far)” if the residence was located in another province. Medical insurance status was classified into 2. The first one was National Health Insurance, which covers the general population in South Korea, and the others cover all national financially supported populations. All medical comorbidities were defined as under medical treatment for type 2 diabetes, hypertension, or any type of psychiatric disease. Obstructive sleep apnea was diagnosed by polysomnography preoperatively.

Patients were classified by visits to the outpatient department. The “first visited clinic” category indicates whether the patient visited the surgery department for bariatric surgery (BS department) or was referred from other departments such as endocrinology or family medicine (other departments). The “follow-up department” category was defined as whether the patient visited the outpatient department for long-term postoperative care, which was classified as the BS department, or was referred to another department for postoperative medical care.

3. Definition of LTF

All the patients were followed up at the outpatient department with a follow-up scheduled on the 1st, 3rd, 6th, and 12th months postoperatively. The first visit at 1 month postoperatively had a 2-week window period, and the next visits had 1-month window periods. The patients were reminded by telephone one day before the scheduled visit. If they did not attend as scheduled, they were contacted by phone. Some patients did not attend an appointment during the window period and were thus considered absent.

The 2 criteria identified for LTF classification were as follows. In criteria A, the patients were divided into 2 groups. The attended (A) group was defined as the patients who maintained attendance at the outpatient department up to 1 year postoperatively. The LTF (A) group was defined as patients who were lost to follow-up within 1 year postoperatively. In criteria B, the patients were divided into 3 groups. The full f/u (B) group comprises the patients who attended all scheduled visits up to 1 year postoperatively. The skipped f/u (B) group adhered to follow-up visits up to 1 year but missed at least one visit during the year. The LTF (B) group was the same as the LTF (A) group.

4. Outcome measures

The primary outcome was LTF within 1 year postoperatively. The secondary outcome was postoperative weight loss, which was evaluated as excess weight loss (EWL). We conducted a telephone survey to gather the EWL data in the LTF group. We asked the patients regarding their weight change; minimum weight after gastrectomy and when it was; and their weight at the time of the survey.

5. Statistical analysis

Age, sex, and residence were matched between the 2 groups, and LTF rates were compared by McNemar tests. Matching was performed according to sex, address, and ≤ 5 -year age gap. Continuous parameters were analyzed using t-tests or Mann–Whitney U tests and presented as means and standard deviation. We compared proportions by χ^2 tests or Fisher’s exact test and described them as number (%). For criteria B, three groups were compared using Kruskal–Wallis tests for continuous parameters.

Significance was set at $P < 0.05$. All data were analyzed using IBM SPSS Statistics, version 24 (IBM Corp., Armonk, NY, USA).

RESULTS

Altogether, 61 patients in the LSG group and 872 patients in the EGC group were included in the study. By matching, we obtained 47 patients in each group matched for age, sex, and residence. The preoperative BMI in the LSG group was higher than that in the EGC group (Table 1). We analyzed the LTF rate between the groups. The LSG group (34.0%) tended to miss more appointments than the EGC group (2.1%, $P < 0.001$).

Among the enrolled patients in the LSG group, no re-operation or re-admission cases during the follow-up period were recorded. The patients were scheduled to visit at least 4 times within 1 year postoperatively. The LTF rate was increased according to the postoperative month. As presented in Table 2, only two patients were absent on the 1st postoperative month (3.3%); however, 24 patients (39.3%) were absent on the 12th postoperative month.

1. Criteria A

In the binary classification, 43 patients (70.5%) were in the (A) group and 18 (29.5%) were in the LTF (A) group. We researched the patient-related factors, preoperative status, and postoperative status that might affect LTF. The factors are listed in Table 3. The LTF (A) group was less likely to receive medical treatment for dyslipidemia with borderline significance ($P = 0.094$). Moreover, no associated factors for the LTF rate were identified in criteria A.

2. Criteria B

We classified the patients into three groups to analyze the associated factors (Table 4). Among them, patients in the full f/u (B) group comprised 49.18% of the total sample. Patients with skipped follow-up were 13 (21.6%), and the LTF (B) group included 18 patients. No associated factors for LTF could be identified. Patients with dyslipidemia had a slight association with criteria A, although the status of dyslipidemia did not affect the LTF in criteria B.

Table 1. LTF rate within 1 year between the LSG and EGC groups by matching

Baseline characteristics	Total group				Matched group (1:1)			
	LSG (n=61)	EGC (n=872)	P value	SMD	LSG (n=47)	EGC (n=47)	P value	SMD
Mean age (years)	37.74±9.81	61.19±11.11	<0.0001	2.237	40.89±8.70	41.66±8.04		0.091
Sex			0.012	0.328				0.000
Male	29 (47.54)	555 (63.65)			23 (48.94)	23 (48.94)		
Female	32 (52.46)	317 (36.35)			24 (51.06)	24 (51.06)		
Residence			<0.0001	0.605				0.000
Near to hospital	43 (70.49)	364 (41.74)			32 (68.09)	32 (68.09)		
Far from hospital	18 (29.51)	508 (58.26)			15 (31.91)	15 (31.91)		
BMI (kg/m ²)	38.84±6.44	24.23±3.46	<0.0001	-2.828	38.67±6.45	23.64±3.15		-2.961
LTF					16 (34.04)	1 (2.13)		<0.0001

Values are presented as mean ± standard deviation or number (%).

LTF = loss to follow-up, LSG = laparoscopic sleeve gastrectomy, EGC = early gastric cancer, SMD = standardized mean difference, BMI = body mass index, LTF = loss to follow-up.

Table 2. LTF rate of the LSG group on the postoperative scheduled date

	1st month	3rd month	6th month	12th month
LTF	2 (3.28)	13 (12.31)	19 (31.15)	24 (39.34)

Values are presented as number (%).

LTF = loss to follow-up, LSG = laparoscopic sleeve gastrectomy.

Table 3. Comparison of the associated factors between the groups by criteria A

Associated factors	Attended (A) (n=43)	aLTF (A) (n=18)	P value
Mean age (years)	36.49±9.60	40.72±9.95	0.125
Sex			0.417
Male	24 (55.81)	8 (44.44)	
Female	19 (44.19)	10 (55.56)	
Marital status			0.896
Single	25 (58.14)	10 (55.56)	
Married	12 (27.91)	6 (33.33)	
Divorced, etc.	6 (13.95)	2 (11.11)	
Residence			0.671
Near to hospital	31 (72.09)	12 (66.67)	
Far from hospital	12 (27.91)	6 (33.33)	
Medical insurance, n (%)			>0.999
NHI*	36 (83.72)	15 (83.33)	
The others	7 (16.28)	3 (16.67)	
ASA score			0.499
>3	35 (81.40)	13 (72.22)	
≤3	8 (18.61)	5 (27.78)	
Comorbidities			
T2DM	20 (46.51)	6 (33.33)	0.343
HTN	22 (51.16)	12 (66.67)	0.266
Dyslipidemia	22 (51.16)	5 (27.78)	0.094
Psychiatric disease	10 (23.26)	5 (27.78)	0.751
OSA	11 (25.58)	4 (22.22)	>0.999
First visited clinic			0.210
BS department	12 (27.91)	8 (44.44)	
Other departments	31 (72.03)	10 (55.56)	
Preoperative HbA1c (%)	6.48±1.15	6.14±1.18	0.310
Initial BMI (kg/m ²)	38.99±7.06	39.23±6.64	0.903
Initial excess weight (kg)	40.25±22.56	40.32±20.37	0.991
1st month EBML (%)	32.47±16.73	29.76±15.52	0.576
1st month weight loss (kg)	31.65±21.43	28.39±14.96	>0.999
1st month EWL (%)	33.20±17.66	30.06±15.71	0.534
3rd month EWL (%)	61.72±26.51	81.16±75.8	0.401
6th month EWL (%)	71.99±27.58	63.14±30.63	0.509
Operation time (min)	109.80±38.97	111.70±30.90	0.858
f/u department			0.703
BS department	24 (55.81)	11 (61.11)	
Other departments	19 (44.19)	7 (38.89)	

Values are presented as mean ± standard deviation or number (%).

LTF = loss to follow-up, NHI = National Health Insurance, ASA score = American Society of Anesthesiologists score, T2DM = type 2 diabetes mellitus, HTN = hypertension, OSA = obstructive sleep apnea, BS department = department for bariatric surgery, HbA1c = hemoglobin A1c, EBML = excess body mass index loss, EWL = excess weight loss, f/u = follow-up.

3. Telephone survey

We contacted the LTF group by phone. As some of them did not answer the phone, we attempted to contact the patients two more times. Those who were lost to follow-up who never reacted to the three calls are indicated as “uncontacted” in **Table 5**. The mean maximal EWL in the LTF group was 88.9% on the mean 15th postoperative month. At the time of the survey, their mean postoperative month was the 22nd month, and their mean EWL was 75.5%. In the attended (A) group, data on weight were collected from their electronic medical records. Their maximal EWL was 83.2% at 11 postoperative months, and their current EWL was 75.2% at 15 postoperative months.

Table 4. Comparison of the associated factors between the groups by criteria B

Associated factors	Full f/u (B) (n=30)	Skipped f/u (B) (n=13)	LTF (B) (n=18)	P value
Mean age (years)	35.10±9.48	39.96±9.44	40.72±9.95	0.151
Sex				0.637
Male	16 (53.33)	8 (61.54)	8 (44.44)	
Female	14 (46.67)	5 (38.46)	10 (55.56)	
Marriage status				0.526
Single	19 (63.33)	6 (46.15)	10 (55.56)	
Married	6 (20.00)	6 (46.15)	6 (33.33)	
Divorced, etc.	5 (16.67)	1 (7.69)	2 (11.11)	
Residence				0.823
Near to hospital	21 (70.00)	10 (79.92)	12 (66.67)	
Far from hospital	9 (30.00)	3 (23.08)	6 (33.33)	
Medical insurance				>0.999
NHI	25 (83.33)	11 (84.62)	15 (83.33)	
The others	9 (30.00)	2 (15.39)	3 (16.67)	
ASA score				0.429
>3	23 (76.67)	12 (92.31)	13 (72.22)	
≤3	7 (23.33)	1 (7.69)	5 (27.78)	
Comorbidities				
T2DM	15 (50.00)	5 (38.46)	6 (33.33)	0.498
HTN	16 (53.33)	6 (46.15)	12 (66.67)	0.490
Dyslipidemia	17 (56.67)	5 (38.46)	5 (27.78)	0.133
Psychiatric disease	7 (23.33)	3 (23.08)	5 (27.78)	0.927
OSA	8 (26.67)	3 (23.08)	4 (22.22)	>0.999
First visited clinic				0.284
BS department	7 (23.33)	5 (38.46)	8 (44.44)	
Other departments	23 (76.67)	8 (61.54)	10 (55.56)	
Preoperative HbA1c (%)	6.43±1.04	6.59±1.44	6.14±1.18	0.381
Initial BMI (kg/m ²)	40.23±7.83	36.15±3.73	39.23±6.64	0.225
Initial excess weight (kg)	44.36±25.25	30.78±10.05	40.32±20.37	0.190
1st month EBML (%)	33.26±18.84	30.65±10.77	29.76±15.52	0.783
1st month weight loss (kg)	35.21±24.17	23.43±9.50	28.39±14.96	0.293
1st month EWL (%)	34.23±19.84	30.83±11.47	30.06±15.71	0.828
3rd month EWL (%)	62.01±28.01	60.49±20.56	81.16±75.8	0.938
6th month EWL (%)	72.84±26.84	68.82±31.97	63.14±30.63	0.780
Operation time (min)	111.60±42.49	105.69±30.44	111.70±30.90	0.381
f/u department				0.300
BS department	19 (63.33)	5 (38.46)	11 (61.11)	
Other departments	22 (36.67)	8 (61.54)	7 (38.89)	

Values are presented as mean ± standard deviation or number (%).

LTF = loss to follow-up, NHI = National Health Insurance, ASA score = American Society of Anesthesiologists score, T2DM = type 2 diabetes mellitus, HTN = hypertension, OSA = obstructive sleep apnea, BS department = department for bariatric surgery, HbA1c = hemoglobin A1c, EBML = excess body mass index loss, EWL = excess weight loss, f/u = follow-up.

DISCUSSION

In this study, approximately one-third of the patients who underwent LSG were lost to follow-up within 1 year, which was a very high rate compared to that of other disease groups. However, we could not identify any predictive factors for LTF.

We assessed the patients' EWL in the LTF group by telephone survey. The LTF group had a relatively similar weight loss as that of the attended group in this study. Moreover, the EWL of the LTF group was not poor compared with that of other studies [16-18]. However, the telephone survey had some limitations. It was not an exact examination but a statement by the patients over the telephone, which could have contained errors. Therefore, we did not conduct an analysis to compare the EWL between the groups because it is insignificant.

Table 5. Results of telephone-survey in the LTF group

Patient No.	At the time of maximum EWL		At the time of survey	
	Postoperative month	EWL (%)	Postoperative month	EWL (%)
1-uncontacted				
2	28	58.87	30	51.86
3-uncontacted				
4-uncontacted				
5	8	37.84	28	15.77
6	16	65.67	24	57.05
7-uncontacted				
8	20	92.62	23	84.50
9	15	85.72	23	74.63
10-uncontacted				
11	3	167.71	22	101.82
12	3	43.86	20	26.63
13	12	153.52	19	153.52
14-uncontacted				
15	17	41.93	19	38.00
16	19	143.13	19	143.13
17	12	86.64	16	83.70
18-uncontacted				

LTF = loss to follow-up, EWL = excess weight loss.

In the present study, patients lost to follow-up within 1 year did not indicate any baseline or clinical differences from well-attending patients. Pharmacologic treatment for dyslipidemia may be only associated with the attended (A) group with borderline personality disorder ($P=0.094$). However, no proper interpretation of this association was observed.

A younger age has been identified as a factor for LTF in previous studies [10,19-21]. Younger patients may be more likely to change their socio-economical positions, such as job and residence, and thus, they will be more likely to be lost to follow-up than older patients. However, no association between age and follow-up was identified in this study. This could be affected by the shorter period of follow-up of one postoperative year than that of other studies. Although age and sex were not associated with LTF in this study, older female patients demonstrated more help-seeking attitudes than others [22]. Therefore, if we observe the LSG group for a longer time, sex and age may be associated with LTF.

The address of the patients was also not associated with attendance. We analyzed the patient's attendance by distance from the hospital; however, the distance does not reflect its actual accessibility. Kedestig and Stenberg [19] have reported that residents of large cities were more likely to be lost to follow-up because of the chronic stress of urban life.

Kedestig and Stenberg [19] have also demonstrated an association between LTF and depression. However, owing to our small sample size, we could not confirm this association. Moreover, some studies have reported the risk of LTF in certain personality disorders such as relation avoidance and phobic disorder [21,23]. Therefore, we need to monitor patients with psychiatric disorders to make them attend follow-up for a longer time.

Many other factors need to be considered when managing the LSG group. Some studies have also mentioned cognitive factors, ethnic backgrounds, social factors, and familial factors as associated factors [10,21,23-25]. Gourash et al. [9] have suggested strategies to increase follow-up rates in clinical trials. They adjusted the appointment schedules individually and reminded patients to visit the hospital by various communication methods.

Studies have demonstrated the importance of long-term follow-up for the success of bariatric surgery [21,25-27]. To achieve good follow-up attendance of patients after bariatric surgery, identifying who is likely to skip follow-up visits is crucial. However, this study failed to identify such information, although this was the goal. Nevertheless, in the beginning era of bariatric surgery in South Korea, these efforts will develop as we improve bariatric surgical outcomes. We should continuously consider how well patients attend appointments after bariatric surgery to manage their weight loss and complications. Moreover, we need to consider a multidisciplinary approach to postoperative care, which deals with comorbidities of the patients as well as psychological and nutritional consulting, as a standardized protocol.

Sara M. et al. evaluated the impact of travel distance on adherence to follow-up, and divided the patients into two cohorts by 50 miles [28]. They have reported that those who lived farther have higher attrition for every visit. Hence, significant differences in adherence to follow-up were observed between the two cohorts for 3 years postoperatively. However, after 3 years, the follow-up compliance was not significantly different between the two groups. Despite the results indicating that a greater distance disrupts follow-up for 3 years, they could not determine any differences in postoperative outcomes, EWL, or complications. Through their study, they have suggested that telecommunication or video-conferencing technology could be a future method of follow-up after bariatric surgery. Moreover, face-to-face visits are not essential for managing a patient's lifestyle modification or weight loss improvement. Some studies have already indicated support regarding telecommunication in bariatric surgery [29,30].

This study has several limitations. First, it was a single-center retrospective study with a small sample size. Therefore, it could not generally reflect the situation of patients receiving bariatric surgery. Additionally, some personal data such as residence or marital status might have some errors because the survey was not accurately conducted for clinical research. Thus, we need to collect the patient's social and clinical baseline information more carefully at the first visit. Second, in the early years of bariatric surgery, this center did not have a standard follow-up protocol. The patient's appointment schedules were different for each surgeon. Moreover, some patients were followed up by endocrinologists or family doctors. Continuous efforts to create a program for the bariatric center can improve the follow-up of the patients on surgical outcomes.

In conclusion, LSG has a low postoperative follow-up rate. Although this study did not identify predictive factors for LTF, continuous efforts to determine them will help to enhance weight loss and manage complications in patients receiving bariatric surgery. Moreover, a postoperative management protocol with multidisciplinary care should be considered.

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