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Research Article

Rate and Predictors of Unsuccess of Bariatric Surgery

Amr Arafa *[1]

*Correspondence to: Amr Arafa, Consultant surgeon, Al-Qassimi Hospital, Sharjah, UAE.

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Abstract

Introduction: *Obesity is an important health problem worldwide. It is associated with serious comorbidities that can reduce the quality of life and shorten life span. Bariatric surgery is the most effective therapeutic option. Different methods have been used to measure the success of bariatric surgery on weight loss.*

Aim of the study: *The aim of the present study is to determine the proportion of patients who could not achieve the goal of bariatric surgery and define some factors that could be associated with unsuccess of BS after one year of follow-up.*

Subjects and methods: *A retrospective case control study was adopted. Research tool included persona characteristics and associated co-morbidities, as well as anthropometric measurements. Simple descriptive analyses were used followed by multiple regression analysis.*

Results: *All 1104 medical records of cases admitted to the bariatric surgery unit in Al Qassimi Hospital, UAE within the period 2015 to 2019 were reviewed. The final analysis included 673 cases that were categorized into two groups according to success of bariatric surgery: Success (568) and unsuccess (105). After adjustment for the confounding effects between variables, only gender, age, diabetes, and percentage weight loss after 6 months of follow-up were retained in the model as predictors of BS unsuccess.*

Conclusion: *15.6% of patients did not achieve the required weight loss after one year of follow-up. The independent risk factors associated with this outcome were older age, female gender, diabetes, and percentage weight loss after 6 months of follow up. Further study should be carried out including many other factors that could be associated with the results of bariatric surgery.*

Keywords: *Bariatric surgery; predictors; unsuccess; weight loss.*

Introduction

Overweight and obesity are important health problems worldwide. Obesity is associated with comorbidities that increase morbidity and mortality among the affected population.**[**1**]** The worldwide prevalence of overweight and obesity has doubled since 1980 to an extent that nearly a third of the world's population is now classified as overweight or obese. It is estimated that in 2030, 51% of the population will be obese with a 33% increase in obesity prevalence and a 130% increase in severe obesity prevalence.**[**2**]**

Treatment of obesity is a global challenge. Bariatric surgery (BS) has been recognized as the most effective intervention to achieve and maintain substantial weight loss. **[**3,4**]**

Until recently, for patients with severe obesity or those with a body mass index (BMI) ≥ 40 kg/m2 or BMI > 35 kg/m2 and other comorbidities, BS is the most effective therapeutic option to achieve long-term significant weight loss and to improve control or even achieve remission of the associated co-morbidities.**[**5,6**]** These BMI limits were even reduced to 35 kg/m2 and 30 kg/m2 respectively in 2022. **[**7**]**

Different methods have been used to measure the impact of BS on weight loss. According to most publications, an adequate response to surgery is defined as a loss of excess body weight (or EBW) of at least 50%. **[**8,9**]**

It is important to stress that not all patients lose weight successfully, despite precise surgical technique and regular follow-up. **[**10,11**]**

It has also been reported that 15–35% of the patients that undergo BS do not reach their goal for weight loss. **[**5,12,13**]**

In previous studies, several factors have been associated with poor weight loss after BS, such as male gender, older age, greater initial weight and higher BMI, diabetes mellitus, psychiatric disorders, reflux disease, and poor follow-up after surgery. **[**11,14-18**]**

Determining the causes of BS unsuccess is a priority to optimize access to this procedure.

The aim of this study was to determine the proportion of patients that didn’t reach the goal of losing 50% of excess BMI or more during the first 12 months and highlight some personal, clinical and baseline characteristics of patients who underwent BS that could be associated with unsuccess of surgery after 12 months of follow-up.

Patients and Methods

Setting:

This study was carried out in Al Qassimi Hospital. It is the largest governmental hospital in the North Emirates (Sharjah) that is run under the Emirates Health Services, which was established by the Ministry of Health and Prevention in the UAE. It is a tertiary hospital that is equipped with the most advanced diagnostic laboratory and radiologic facilities, and it is Joint Commission International (JCI) accredited. The department of general surgery started the first sleeve gastrectomy (SG) operation in 2010. The BS unit was recognized as a center of excellence in October 2019. Now, this unit can manage the primary and revisional BS cases in addition to dealing with the complications.

Patients were included in the bariatric program if their BMI was ≥ 40 kg/m2, or ≥ 35 kg/m2 with a comorbidity related to obesity. Also, patients with uncontrolled diabetes mellitus were included if they had BMI ≥ 30 kg/m2.

Despite limitations of BMI to accurately risk stratify patients with obesity for their future health risk, it is the most feasible and widely used criterion to identify and classify patients with overweight or obesity.**[**7**]** Revisional bariatric surgery was performed at lower body mass index levels, considering the regain of weight as a comorbidity. Patients with complications, e.g., persistent symptomatic GERD (gastro-esophageal reflux disease), hiatal hernia, deranged liver functions etc. were operated upon regardless of the presence or absence of obesity.

Excluded patients were obese patients with ages above 65 year or below 13-year-old, pregnant ladies, addicts, and people with mental illness that prevents the proper cooperation to achieve the goals of surgery. Also, obese patients with active malignancy or those on chemotherapy were excluded.

Bariatric Surgery

Types of primary BS that are conducted in Al Qassimi Hospital are SG, Mini gastric by-pass (MGB/ OAGB), Single anastomosis sleeve–ileal bipartition (SASI), and Roux-en-Y gastric by-pass (RYGB). Bariatric patients followed a strict protocol regarding inclusion and exclusion criteria, preoperative preparation, choosing the optimum operation, postoperative care and follow up. The protocol was monitored

by the quality department to achieve the hospital key performance indicators (KPI's).

Patients who were approved for surgery were advised to have a high protein with very low carbohydrate/ fat diet for two weeks before surgery.

All bariatric operations were done by or under the supervision of a consultant surgeon. They were performed laparoscopically under general anesthesia.

After surgery, patients were encouraged for early ambulation and respiratory exercises. Patients were discharged home when they fulfilled the discharge criteria (stable vital signs, no nausea and vomiting, can drink satisfactory fluids, minimal abdominal pain). Postoperative follow up with the multidisciplinary team was arranged after two weeks, one month, three months, six months, and 12 months after surgery.

Study Design

A retrospective case control study was adopted for this study. We collected data from the clinical records of all patients who were admitted to the BS unit at the selected hospital during the period from 2015 to 2019 inclusively.

Research tool included personal characteristics, associated co-morbid conditions, as well as anthropometric measurements.

Statistical analysis

Success of bariatric surgery was considered as losing 50% or more of excess BMI during the first 12 months.**[**19**]** Patients were divided into two groups according to their loss of excess BMI after 12 months.

Continuous variables were presented as means with standard deviations (SD) or medians with interquartile ranges (IQR). and compared using student t-test. Qualitative variables were presented as frequency and percentage and compared using the Pearson Chi-square (X2) test or Fisher' Exact test.

Logistic regression analysis was used to calculate the OR with 95% confidence interval (CI). For identification of independent variables associated with unsuccessful weight loss. Statistical significance was set to $P < 0.05$. All the explanatory variables included in the logistic model were categorized into two or more levels (R = reference category): gender: male^{R}, female; age (years): < 20^{R}, 20 – 29, 30 – 39, 40 – 49, > 50; nationality: Citizen^{R}, non-Citizen; hypertension: no^{R}, yes; DM: no^{R}, yes; sleep apnea: no^{R}, yes;

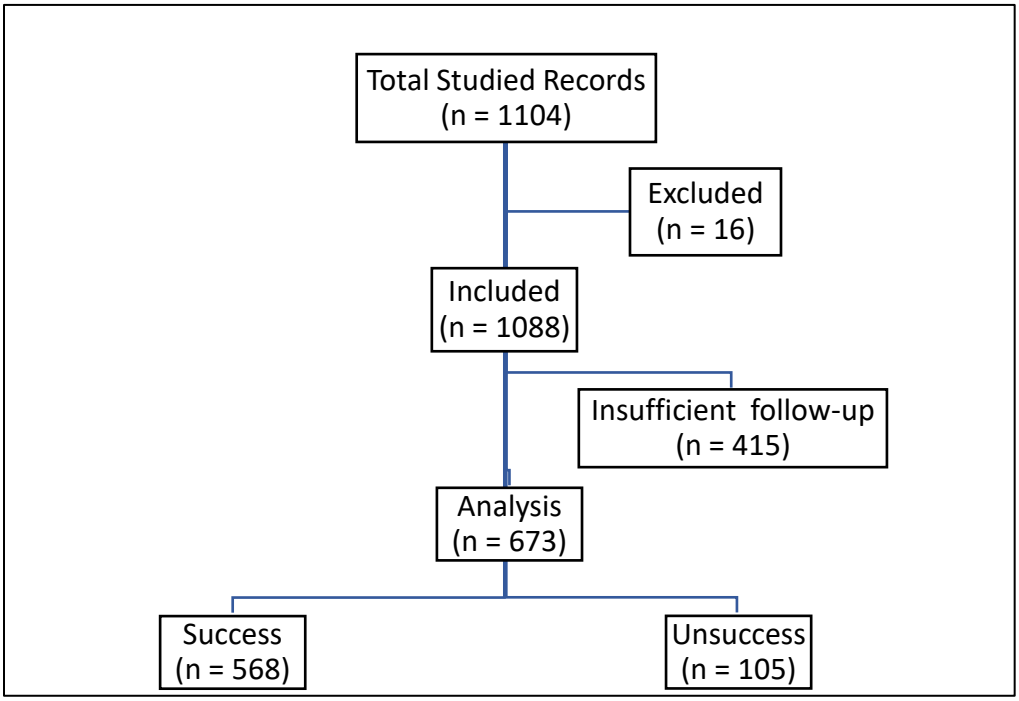
depression/anxiety: no[R], yes; GERD: no[R], yes; dyslipidemia: no[R], yes; asthma: no[R], yes; cardiac disease: no[R], yes; musclo-skeletal disorder: no[R], yes; type of BS: sleeve[R], MINI GB, SASI, Rou-en Y GB; operation: primary[R], revisional; LOS: 1-2[R], 3-4, > 4; complications: no[R], yes; readmission within 30 days after surgery: no[R], yes; initial BMI: 30 – 39[R], 40-49, ≥ 50; percentage weight loss after 6 months of BS: < 10[R], 10 – 19, ≥ 20. All statistical analyses were performed using SPSS - 22.

Ethical Aspects

Patients gave their informed consent to the processing of their data. The study was approved by the local Ethics Committee and was in accordance with the Declaration of Helsinki principles.**[**20**]**

Results

All 1104 medical records of cases admitted to the bariatric surgery unit in Al Qassimi Hospital, UAE within the period 2015 to 2019 were reviewed. Sixteen cases were excluded as they were operated open for non-bariatric surgery. After checking for follow-up of patients after the surgery, 415 cases were excluded due to insufficient follow-up data. The final analysis included 673 cases that were categorized into two groups according to success of bariatric surgery: Success (568) and unsuccess (105).



Flowchart of study population

Table 1 describes the personal, clinical, and surgical characteristics of the included cases. Females represented 68.6 % of patients and 87.7% were citizens. The mean age was 33.4 ± 10.1 ranged from 13 to 62 years.

Diabetes mellitus (23.2%), hypertension (19.2%), gastro-esophageal reflux (14.1%) and dyslipidemia (10.8%) were the most common co-morbidities associated. Sleeve gastrectomy (SG) (68.1%) overcame the other types of surgery, followed by Mini Gastric by-pass (MGB) (21.4%), Single Anastomosis Sleeve-Ileal by-pass (SASI) (8.5%), and Roux-en Y Gastric by-pass (RYGB) (2.1%). Most of the cases were operated upon as primary surgery (88.6%) while 11.4% were revisional operations.

The length of stay after surgery ranged from 1 to 14 days with a median equal 3 (IQR = 0).

Complications (1.8%) and re-admission within 30 days (4.2%) after surgery, were very rare.

Variable	**No.**	**%**
Gender:		
Male	211	31.4
Female	462	68.6
Age		
< 20	68	10.1
20-29	186	27.6
30-39	249	37.0
40-49	115	17.1
≥40	55	8.2
Min – max	13 - 62	
Mean (Standard deviation)	33.4 (10.1)	
Nationality:		
Citizen	586	87.1
Non-citizen	87	12.9
Co-morbid diseases		
Diabetes	156	23.2
Hypertension	129	19.2
Sleep apnea	11	1.6
Depression/anxiety	12	1.8
Gastroesophageal reflux disease	95	14.1
Dyslipidemia	73	10.8
Asthma	28	4.2
Cardiac	5	0.7
Thyroid	29	4.3
Musculoskeletal	38	5.6
Surgery:		
Sleeve gastrectomy (SG)	458	68.1

Mini gastric by-pass (MGB)	144	21.4
Single anastomosis stomach–ileal by-pass (SASI)	57	8.5
Roux-en-Y gastric by-pass (RYGB)	14	2.1
Operation		
Primary	596	88.6
Revision	77	11.4
Length of stay		
1-2	116	17.2
3-4	519	77.1
>4	38	5.6
Min – max	1 - 14	
Median (Interquartile range)	3 (0)	
Complication		
No	661	98.2
Yes	12	1.8
Re-admission		
No	645	95.8
Yes	28	4.2

Table (1): Personal, clinical, and surgical characteristics of the study population

Table 2 shows pre and post anthropometric measurements of the study cases. Preoperative body weight ranged from 75 Kg to 250 Kg with a mean equal 129 ± 26.3 Kg. The preoperative BMI ranged from 30 Kg/ m2 to 82 Kg/ m2 with a mean equal 46.2 ± 8.5 Kg/ m2. There was a decrease of the mean post-operative body weight after 3 months, 6 months and 12 months, **[**49 – 186 (101 ± 22.2)**]**, **[**42 – 175 (88.9 ± 19.90**]**, and **[**35 – 169 (81.6 ± 18.0)**]** respectively. The mean percentage weight loss after 6 months ranged from 4.2 to 67.9 %, with highest proportion (45.3%) lost ≥30% of their initial weight.

Measurements	No.	%
Pre-operative body weight		
Min – max	75 – 250	
Mean (Standard deviation)	129 ± 26.3	
Pre-operative BMI		
≥ 30	145	21.5
≥ 40	328	48.7
≥ 50	148	22.0
≥ 60	52	7.7
Min – max	30 – 82	
Mean (Standard deviation)	46.2 ± 8.5	
Post-operation weight (3 months)		
Min – max	49 - 186	
X (SD)	101 ± 22.2	
Post-operation weight (6 months)		
Min – max	42 - 175	
Mean (Standard deviation)	88.9 ± 19.9	
Post-operation weight (12 months)		
Min – max	35 – 169	
Mean (Standard deviation)	81.6 ± 18.0	
Percentage weight loss (6 months)		
< 10	29	4.3
10-19.9	148	22.0
20-20.9	191	28.4
≥30	305	45.3
Min – max	4.2 – 67.9	
Mean (Standard deviation)	30.0 ± 13.7	

Table 2: Pre and post anthropometric measurements of the study population.

Table 3 presents the distribution of bariatric surgery (BS) patients according to personal, clinical and surgical characteristics and success of surgery. The percentage of women in unsuccess group (91.0%) was significantly higher than in success group (66.4%), p = 0.003.

The mean age in years of cases in the unsuccess group (35.9 ± 10.6) was significantly higher than in the success group (32.9 ± 10.0), p = 0.04. with an increase of the proportion of older age in the unsuccess group. No significant difference between the two groups regarding co-morbidities except for diabetes and hypertension whereas the proportion of diabetes and hypertension were more frequently encountered among

unsuccess group than among the success one. (33.3% versus 21.3%, p = 0.01 and 26.7% versus 17.8%, p = 0.03 respectively)

No significant difference between the two groups regarding type of surgery, length of hospital stay, occurrence of postoperative complications or re-admission within 30 days of surgery.

Characteristics	Success (n=568)		Unsuccess (n=105)		Test of significance (p)
	No.	%	No.	%	
Gender					
Male	191	33.6	20	19.0	X^2=8.75 (p=0.003)
Female	377	66.4	85	91.0	
Nationality:					
Citizen	493	86.8	93	88.6	X^2=0.25 (p=0.62)
Non-citizen	75	13.2	12	11.4	
Age (years)					
<20	59	10.4	9	8.6	X^2=9.99 (p=0.04)
20-29.9	162	28.5	24	22.9	
30-39.9	214	37.7	35	33.9	
40-49.9	94	16.5	21	20.0	
≥50	39	6.9	16	15.2	
Min - Max	14 – 62		14 – 62		
Mean ± SD	32.9 ± 10.1		35.9±10.6		
Comorbidity					
Diabetes	121	21.3	35	33.3	X^2=7.20 (p=0.01)
Hypertension	101	17.8	28	26.7	X^2=4.52 (p=0.03)
Sleep apnea	11	1.9	0	0.0	Fisher's Exact (p=0.23)
Depression/anxiety	10	1.8	2	1.9	Fisher's Exact (p=1.00)
Gastro-esophageal reflux	78	13.7	17	16.2	X^2=0.44 (p=0.51)
Dyslipidemia	57	10.0	16	15.2	X^2=2.48 (p=0.12)
Asthma	23	4.0	5	4.8	Fisher's Exact (p=0.79)
Cardiac	4	0.7	1	1.0	Fisher's Exact (p=0.47)
Thyroid	24	4.2	5	4.8	Fisher's Exact (p=0.79)
Musculoskeletal	32	5.6	6	5.7	X^2=0.001 (p=0.97)
Surgery:					
Sleeve gastrectomy	393	69.2	65	61.9	X^2=6.18 (p=0.10)
Mini gastric by-pass	117	20.6	27	25.7	
Single anastomosis stomach–ileal by-pass	47	8.5	8	7.6	
Roux-en-Y gastric by-pass	9	1.6	5	4.8	

Operation:					
Primary	502	88.4	94	89.5	X^2=0.11 (p=0.74)
Revision	66	11.6	11	10.5	
Length of stay:					
1-2	102	18.0	14	13.3	X^2=3.00 (p=0.22)
3-4	437	76.9	82	78.1	
>4	29	5.1	9	8.6	
Complications:					
No	558	98.2	103	98.1	Fisher's Exact (p=1.00)
Yes	10	1.8	2	1.9	
Re-admission:					
No	547	96.3	98	93.3	Fisher's Exact (p=0.18
Yes	21	3.7	7	6.7	

Table (3): Distribution of bariatric surgery patients according to personal, clinical and surgical characteristics and success of surgery.

Table 4 presents the distribution of BS patients according to pre- and post-anthropometric measurements and success of surgery. The preoperative body weight was insignificantly higher in the success group (129.7 ± 26.2) than in nonsuccess group (126.6 ± 27.2). Also, the preoperative BMI was higher in the unsuccess group (47.4 ± 8.1) than the success group (46.0 ± 8.5) insignificantly.

Post-operative body weights after 3 months, 6 months, and 12 months were significantly higher in unsuccess group than in success group significantly (p <0.001); 114.1± 24.3 versus 97.0 ± 20.9 , 106.8 ± 22.4 versus 86.0 ± 17.8 and 103.2 ± 19.4 versus 77.7 ± 14.7 respectively. The same pattern was seen regarding the percentage weight loss after 6 months of follow-up (P < 0.001).

Measurements	Success (n=568)		Unsuccess (n=105)		Test of significance (p)
	No.	%	No.	%	
Pre-operative body weight					
Min – max	129.7 ± 26.2		126.6 ± 27.2		t = 1.40 (p = 0.16)
Mean (Standard deviation)	84.0 - 250		75.0 – 200.0		
Pre-operative BMI					
≥ 30	127	22.4	18	17.1	X^2=2.40 (p=0.49)
≥ 40	272	47.9	56	53.3	
≥ 50	127	22.4	21	20.0	
≥ 60	42	7.4	10	9.5	
Min – max	46.0 ± 8.5		47.4 ± 8.1		
Mean (Standard deviation)	30.0 – 82.0		36.0 – 69.6		
Post-operation weight (3 months)					
Min – max	49.0 – 186.0		63.0 – 177.0		t = 7.36 (p < 0.001)
X (SD)	97.0 ± 20.9		114.1 ± 24.2		
Post-operation weight (6 months)					
Min – max	42.0 – 163.0		66.0 – 175.0		t = 10.75 (p < 0.001)
Mean (Standard deviation)	86.0 ± 17.8		106.8 ± 22.4		
Post-operation weight (12 months)					
Min – max	?25.0 – 141.0		67.0 – 169.0		t = 15.65 (p < 0.001)
Mean (Standard deviation)	77.7 ± 14.7		103.2 ± 19.4		
Percentage weight loss (6 months)					
< 10	6	1.1	23	21.9	X^2=223.31 (p<0.001)
10-19.9	85	15.0	63	60.0	
≥20	477	84.0	19	18.1	
Min – max	4.2 – 67.9		4.8 – 28.7		
Mean (Standard deviation)	32.4 ± 12.9		15.4 ± 5.2		

Table (4): Distribution of bariatric surgery patients according to pre and post anthropometric measurements and success of surgery.

After adjustment for the confounding effects between variables, table 5 illustrated variables that retained as significant determinants for the outcome of interest (unsuccess of bariatric surgery).

Older age seemed to be at higher risk of unsuccess of bariatric surgery as patients in the age group ≥ 50 years old were more prone to unsuccess as compared to those in the age group < 20 years (OR = 2.91, CIs: 1.16 – 3.3). Also, female cases were more liable for unsuccess of surgery than males (OR = 2.98, CIs: 1.30 – 4.01). Diabetic patients had more than triple risk of unsuccess BS (OR = 3.17, CIs: 1.73 – 8.01). Higher percentage of weight loss after 6 months of surgery was significantly associated with success of bariatric surgery as loss of 10 to 19.9% and ≥20 % of preoperative weight decrease the risk of unsuccess (OR = 0.12, CIs: 0.05 – 0.63) and (OR = 0.01, CIs: 0.002 – 0.050) respectively.

Variables	Odds Ratio	95% CIs
Age (years)		
< 20 [R]	1	
20 – 29	0.93	(0.67 – 2.53
30 – 39	1.11	(0.59 – 3.52)
40 - 49	1.59	(0.78 – 4.11)
≥ 50	2.93	(1.16 – 3.3)
Gender		
Male	1	
Female	2.98	(1.30 – 4.01)
Co-morbidity		
Diabetes mellitus:		
No [R]	1	
Yes	3.17	(1.73 – 8.01)
Percentage weight loss after 12 months of surgery		
<10 [R]	1	
10-19.9	0.12	(0.05 – 0.63)
>20	0.01	(0.003 – 0.050)

Table (5): Factors associated with success of bariatric surgery, results of logistic regression analysis.

[R] = Reference Category, OR = Odds Ratio, CIs = Confidence interval

Discussion

Bariatric surgery is an effective and approved method of treatment of morbid obesity. However, it should be realized that some patients, due to various reasons, will not achieve satisfactory weight loss.**[**21**]**

A variable percentage of patients failed to achieve the goal of successful weight-loss. Approximately 15–20% do not achieve or sustain this goal of BS, depending on the period of follow-up after surgery. In the present study 105 out of 673 patients (15.6%) could not achieve the successful weight loss 12 months after BS, a proportion that, more or less, goes with data reported by others. **[**5,22,23**]**

In their study, Cadena-Obando et al. 20% of patients who underwent BS could not achieve lose 50% of their excess weight within the first year of surgery.**[**24**]** However, Voglino et al. reported that unsuccess of BS to lose weight loss increased from one to three years of follow-up, being 7.42%, 13%, and 17.16% at one, two, and three years after BS. **[**25**]**

It is important to learn about factors influencing the effectiveness of BS. Controversial data were reported regarding variables that could be associated with predictors of unsuccess.**[**26**]**

Predictor variables of the success of BS are controversial and may be specific to each population or therapeutic process. As many patients with severe obesity ask for BS, more information as well as the goal of intervention for each patient is required to select the best candidates for surgery.

In the present study, we found that older age, female gender, diabetes, and lower percentage BMI loss after 6 months of follow-up were significantly associated with unsuccess of BS. sex and age have been associated with successful weight loss in many studies but not in others. **[**27,28**]**

Regarding gender, we found that the majority of cases (462/673) were females, and they were more liable for unsuccess of BS that goes in accordance with some other studies. This could be explained by the fact that women are more commonly obese than men and more likely to be housewives who may live sedentary life. However, the influence of gender in weight loss has been a matter of argument. **[**29,30,31,32**]**

Discordant results in the literature in the male sex, where Masood et al. showed a greater weight regain in the male sex,**[**33**]** while Shantavasinkul et al. found it as a factor protective in univariate analysis but not in multivariate analysis.**[**34**]**

In the their study, Sillén L and Andersson reported that gender did not seem to affect weight loss.**[**16**]** In previous studies, results are controversy, with no gender differences, while others have reported greater EWL in women. **[**11,15,35**]**

Age is one of the most commonly associated predictor factors of success of BS, with younger patients having better results. **[**29,36,30**]** In the majority of previous studies, age was proved to be a factor more commonly correlated with BS success and younger patients have a higher propability of successful surgeries. **[**29,36**]**

The present study supports these findings, as we found that the proportion of older cases was significantly higher in the unsuccess group than in success group.

These events could be explained by the limitation of adherence to exercise plans in older patients which made them even more sedentary. Also, older patients live sedentary life and they practice less physical activities.

Age alone may not be the only predictor factor, as with ageing, more comorbidities and are present.**[**37,38**]**

Previous studies reported that patients with higher preoperative BMIs are less likely to reach normal weights and a BMI > 50 kg/m2 as a risk factor for failure after BS, and that patients with super obese or super super obesity may never reach the goal of a normal weight.**[**39,36,31,39**]** However, BS still provides substantial benefits of weight loss and remission of co morbid disease.**[**40**]**

Greater pre-operative weight and BMI are associated with lesser weight loss after BS.**[**11,15,41**]** This could be due to a lower level of activity in severely obese patients. It may be also due to genetic differences as indicated on some studies.**[**11**]** However, in the present study, the initial BMI was not significantly associated with unsuccess of BS.

In fact, the associations between initial BMI and weight loss after BS have been shown highly contrasting. Some studies found indirect association,**[**42,43**]** while others found direct association.**[**27,44,45**]**. On the other hand, no relationships have been reported by others.**[**46,47**]**

In spite of this, studies have shown that BS can be performed safely in patients with BMI ≥70 kg/m2.**[**48**]** Therefore, BS should be considered as a preferred method to achieve clinically significant weight loss in patients with extreme BMI.

In this study, we found that preoperative comorbidities such as hypertension and diabetes were statistically significant predictors of weight loss after a year of follow-up.

Several studies reported that diabetes is associated with a lower EWL.**[**11,17,32**]**

In accordance with previous studies, our results showed an association between lower EWL and preoperative diabetes and hypertension one years after surgery.**[**49,50**]**, Also, Eusebio et al. reported that several baseline patient characteristics, such as elevated fasting glucose levels have been associated with poor weight loss. **[**26**]**

In our study higher percentage of weight loss after 6 months of follow-up was proved to be associated with success of BS. This goes with a previous study that concluded that a poor weight loss during early periods after surgery may predict a unsuccess to lose weight even in the following periods of follow-up.**[**24**]**

After adjustment for confounding, results of logistic regression analysis, only gender, age, diabetes mellitus and percentage of weight loss after 6 months of follow-up were retained in the model as predictors of unsuccess of BS.

The differences of our results from other studies may be attributed to the variability of populations, study samples and included factors, as well as periods of follow-up. Also, the definitions of unsuccess of BS that were used in different studies might play a significant role in comparison of trials. **[**1,50**]**

Limitation:

There are several limitations to this study.

The main limitation is the nature of this study that depends on collecting data from patient record. Only the available data were analyzed, and many other data reported in previous studies that could be associated with unsuccess of BS were deficient. Among these factors are ethnic and social characteristics of participants, and personal characteristics as physical activity, smoking, and food habits as well as attendance at follow-up appointments.

The study patients come from a single hospital, which may make the results less liable for generalization. However, this hospital is considered one of the largest hospitals in UAE which accept many cases for BS. Also, the relatively low proportion of patients with long term follow-up limits adds another limitation to make more general conclusions.

Despite what has been stated above, we believe that the results of our study are very important because they highlight the proportion of unsuccess of BS as well as some predictors that could be associated with unsuccess. Also, our results are, more or less, coinciding with previous studies.

Conclusion

Bariatric surgery is highly effective in producing adequate excess weight (EBW) loss, regardless of the technique used. However, 15.6% of patients did not achieve the required weight loss after one year of follow-up. The independent risk factors associated with this outcome were older age, female gender, diabetes, and percentage weight loss after 6 months of follow up. Further study should be carried out including many other factors that could be associated with the results of BS.

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