Original Article

Cost effectiveness of bariatric surgery in patients with obesity related comorbidities: A retrospective study

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Abstract

Background and Aim: Bariatric surgery has been reported to be an effective but expensive method for obesity management. This study aimed to determine the economic benefit for patients who underwent bariatric surgery. **Methodology:** We conducted a retrospective chart review of patients who underwent bariatric surgery and was on medications for obesity-related comorbidities at the Obesity Research Center in King Khalid University Hospital, Riyadh, Saudi Arabia. Data on the use and cost of medications before and after bariatric surgery were collected. **Results:** A total of 266 patients, 107 males (40.23%), and 159 Females (59.77%) with a mean age of 41.06 years were included in the study. There was a reduction in the mean number of medications used by patients before and 1-year post-op (before: 1.84, after: 0.52), with a significant reduction in the cost of medications (SAR5152.24 before, and SAR1695.36 after, 67% reduction, $P < 0.001$). Patients < 32 years old had the most reduction in medications cost (76.64% reduction). No significant difference in the cost reduction after surgery between genders ($P = 0.971$). There were significant reductions in numbers of out-patient clinic visits (2.26 ± 2.43 to 1.57 ± 1.42) and in-patient hospitalizations (0.31 ± 0.57 to 0.10 ± 0.36) after surgery ($P < 0.001$ and $P < 0.001$, respectively). **Conclusion:** Bariatric surgery can be considered as a cost-effective treatment for patients with obesity-related comorbidities. A significant reduction has been found in post-operative medications cost, out-patient clinic visits and in-patient hospitalizations after bariatric surgery.

Keywords: Bariatric surgery, cost-effectiveness, medication cost, obesity

Introduction

Obesity is defined as excessive fat accumulation in the adipose tissues of the body that may impair individual's health, and is measured by the body mass index (BMI). A BMI of 25.0 to 29.0 is defined as overweight, while a BMI higher than 30 is considered as obesity. According to the World health organization, there are more than 650 million obese people worldwide.[1]

Obesity is associated with comorbidities including insulin resistance and Type-2 diabetes, hypertension, non-alcoholic fatty liver disease, and dyslipidaemia.[2,3] Dietary modifications, intermittent fasting and exercise are known effective options to help reduce weight.[4] But for a majority of people who were not able to sustain their weight loss, anti-obesity medications and bariatric surgery may be needed.[5] Bariatric surgery is the next modality of treatment that showed better sustained up to 5 years of weight loss and treat the comorbidities associated with obesity.[6,7] Patients who had

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medical therapy coupled with bariatric surgery showed significant improvement of diabetes and hypertension compared to patients who just went through medical therapy alone.[8]

Studies have shown a huge reduction of medication use and cost after bariatric surgery particularly on antidiabetic, antilipidemic, and antihypertensive drugs.[8-10] Patients with obesity were more likely to have higher health care costs (>$5,000), which is congruent to the high cost of obesity-related comorbidities medications and the propensity of spending more money on weight-reducing drugs.[11-14] Furthermore, studies have also shown that apart from the decrease in the medications use, there was also a decrease in clinic visits and visits to the emergency room and consultations, and also was associated with decreased all-cause mortality particularly from cardiovascular and cancer mortality.[15-17] In this regard, we conducted this study to determine the cost-effectiveness of bariatric surgery and its effectiveness in sustaining weight loss.

Methods

We conducted a retrospective cohort study of all patients who underwent bariatric surgery at King Khalid University Hospital (KKUH), King Saud University Medical City in Riyadh, Saudi Arabia from January to December 2017. Using a convenience sampling technique, the participants were selected from the database of the Obesity Research Centre, and were divided into three different age groups (group I = <33 years old, group 2 = 33–45 years old, and group 3 = more than 45 years old). We included only patients with obesity-related comorbidities such as diabetes (DM), hypertension (HTN), dyslipidaemia (DLP), cardiovascular diseases (CVDs), and sleep apnoea (SA) were included. Patients who are not on any medications before bariatric surgery were excluded.

Data collected included the number of medications used for each patient before and after the bariatric surgery. The prices of the medications were obtained by official price invoice from the accounting department in our hospital. Then it was adjusted to a one-month supply and one-year supply for each drug.

Statistical analysis was done using the Statistical Package for Social Sciences (SPSS) version 22.0 for Microsoft Windows (SPSS Inc., IBM, Armonk, New York, USA). Categorical variables are expressed as number and percentage, and continuous variables are expressed as mean and standard deviation. Paired *t* test was done to determine the difference in the pre-operative against postoperative mean number of visits. We used one-way analysis of variation (ANOVA) test to determine whether there are statistically significant differences between the means of the three groups, and the graphs were generated via Microsoft excel. A value of $P < 0.05$ was considered statistically significant. This study fulfilled the required ethical approvals by the institutional review board of the College of Medicine, King Saud University, Riyadh, Saudi Arabia. Ethical approval was obtained from the Institutional Review Board, College of Medicine, King Saud University, Riyadh, Saudi Arabia (Ref #: E-20-4645).

Results

We included 266 patients who underwent bariatric surgery in 2017, 107 (40.2%) males and 159 (59.8%) females (M: F ratio of 1:1.48). The mean age of all patients 41.1 ± 11.5 years (range of 13–73 years). There were 56 (21.1%) patients with DM alone, 13 (4.9%) with HTN alone, 5 (1.9%) with DLP, 28 (10.5%) with gastroesophageal reflux disease (GERD), and 29 patients (10.9%) with multiple comorbidities. One hundred and seven patients had 1–3 ER visits preoperatively (40.2%) and 90 patients (33.8%) had ER visits post-operatively. [Table 1] The number of ER, inpatient admission and outpatient visits also significantly reduced postoperatively ($P = 0.013$, $P < 0.001$, and $P < 0.001$, respectively). [Table 2]

There was a significant reduction in the mean number of medications from 1.84 ± 0.6 number of medications preoperatively to 0.52 ± 0.49 medications postoperatively ($P < 0.001$). Consequently, there was also a significant reduction in the mean annual cost of medications from 5,152.4 ± 185.90 SAR preoperatively to 1,695.36 ± 164.06 SAR postoperatively (67.0% reduction, $P < 0.001$). There were no significant differences between age groups or between genders in terms of cost reduction, although the percentage of cost reduction was relatively higher in patients aged <33 years old compared to age group 33 to 45 and age group >45 years old ($P = 0.601$ and $P = 0.290$, respectively). [Table 3] Table 4 shows the effect of bariatric surgery on specific-disease medications cost before and after bariatric surgery. The reduction of cost was significant in all obesity-related comorbidities (HTN ($P < 0.001$), DM ($P < 0.001$), GERD ($P < 0.001$) and multiple comorbidities ($P < 0.001$).

Discussion

The impact on a patient's life suffering from obesity comes not just on the concomitant complications associated with it but much more so with the frequent visits to the hospital, their quality of life but also the economic burden of maintaining expensive medications.

In this study, we examined the economic cost effect on patients who underwent bariatric surgery and found out a huge significant reduction not only in the medication expenses, but also in the number of medicines taken by patients and their frequency of visits to the hospital including inpatient admission. Our findings reinforce existing literatures on the impact of bariatric surgery on decreasing the use of medications and this prompt decrease in the use of medications is largely related to the reduction of the obesity comorbidities like hypertension, diabetes and dyslipidaemia.[17,18] In fact, the total medication cost reduction in our cohort of up to 76.64% is high compared to a report which showed a decrease of 24.2% in total drug cost over a follow-up duration ranging from 6 to 24 months after bariatric surgery.[19] On the contrary, a report showed that the cost of medication postoperatively increases among male post-bariatric surgery patients because of their higher tendency to regain

Table 1: Clinicodemographic profile of 266 patients who underwent bariatric surgery (January to December 2017)

Clinicodemographic variables (categorical)	*n*	%
Gender		
Male	107	40.2
Female	159	59.8
Comorbid conditions present		
Diabetes Mellitus	56	21.1
Hypertension	13	4.9
Dyslipidaemia	5	1.9
Reflux disease	28	10.5
Diabetes + hypertension + dyslipidaemia	29	10.9
Age groups		
Group I (<33 years old)	85	32.0
Group II (33-45 years old)	86	32.3
Group III (>45 years old)	95	35.7
Clinicodemographic variables (continuous)	Mean±SD	Range
Age, in years	41.1±11.5	13-73

Table 2: Mean outpatient, in-patient hospitalization and ER visits (preoperative vs. postoperative)

Areas of visit	Pre-operative visit Mean±SD	Postoperative visit Mean±SD	*P*	95% CI
Emergency room	0.74±0.91	0.57±0.85	0.013	0.034-0.292
Inpatient	0.31±0.57	0.10±0.36	<0.001	0.140-0.281
Outpatient	2.26±2.43	1.57±1.42	<0.001	0.429-0.946

Table 3: Mean cost of medications before and after surgery

Group	Mean cost before surgery	Mean cost after surgery	% of cost reduction
1	4186.82	977.93	76.64%
2	5059.58	1597.28	68.43%
3	6067.32	2426.06	60.01%

Table 4: Effect of bariatric surgery on the medication cost according to comorbidities

Comorbidities present	Preoperative mean medication cost in SAR	Postoperative mean medication cost In SAR	*P*
HTN	1855.38	342.46	<0.001
DM	3827.13	1080.00	<0.001
GERD	5294.57	2556.00	<0.001
DLP	879.20	124.40	0.073
HTN + DM + DLP	8880.01	3258.76	<0.001

HTN: Hypertension, DM: Diabetes millets, GERD: Gastroesophageal regurgitation disease, DLP: Dyslipidaemia

weight compared to females.[20] Our study showed no significant difference in the medication cost postoperatively across genders at least in short-term follow-up.

We also found significant reductions in the medication cost for patients with comorbid conditions after undergoing bariatric surgery, which is consistent with previous studies,[21] This is in contrast to other studies that medication costs post-bariatric surgery among obese diabetics remains the same as with preoperative medication costs.[22,23] We also found that there were significant reductions in the frequency of hospital visits post-bariatric surgery. This is in contrast to previous studies that reported increase in the frequency of outpatient and in-patient hospitalizations after bariatric surgery where gastrointestinal complications were the most frequent causes of post-operative hospitalizations.[14] Furthermore, psychological illness and low educational levels particularly among female patients were identified as confounding factors in the failure to maintain their weight loss after bariatric surgery.[24]

Studies have shown that many primary care physicians (PCPs) are fully aware of the indications and benefits of bariatric surgery for patients with obesity. However, many PCPs do not frequently recommend and refer patients for bariatric surgery.[25,26] One of the significant barriers for non-referral of patients with obesity for bariatric surgery among PCPs is their non-comfortable participation in the long-term care of a postoperative bariatric patient including management of long-term side effects and perceived ineffectiveness of bariatric surgery.[27] It is well understood that PCPs are on the frontlines and they are the ones who can easily diagnose and recommend weight loss management for morbid obesity. This study reinforces the economic benefit for patients with obesity to be referred for bariatric surgery, and PCPs who are on the frontlines may reconsider these benefits (not only its health advantages) to refer patients for surgical intervention.

This study highlighted how significant reduction in the economic cost with regards to cost of medicines, cost of treatment and even in the number of medications that patient has to consume. The magnitude of the economic reduction not only echoes through our patients' financial and psychological burden but on a bigger scale, the reduction in the morbidity rates for complications associated with obesity on a national scale.

We were only able to determine a short-term economic cost analysis (one-year post-bariatric surgery) which serves as a limitation of the study. It would be ideal to determine the long-term cost analysis (at least 5 years) to see whether these patients who underwent bariatric surgery have maintained their weight loss and weight reduction and did not develop any further comorbid condition that warrants medication and additional economic cost in their treatment.

Conclusion

Bariatric surgery can be considered as a cost-effective treatment for patients with obesity-related comorbidities. A significant reduction has been found in post-operative medications cost, out-patient clinic visits and in-patient hospitalizations after bariatric surgery.

Summary of key points

1 Patients with obesity had one or more comorbid conditions prior to bariatric surgery including diabetes, hypertension,

dyslipidaemia and GERD which all significantly reduced after bariatric surgery
2 There were more females than males who underwent bariatric surgery (M: F ratio of 1:1.48)
3 The number of ER, inpatient admission, and outpatient visits also significantly reduced after bariatric surgery
4 There was also a significant reduction in the mean number of medications after bariatric surgery
5 The cost reduction of treatment reduced by 67.0% from 5,152.4 ± 185.90 SAR preoperatively to 1,695.36 ± 164.06 SAR postoperatively.

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Conflicts of interest

There are no conflicts of interest.

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