



Social Factors as Predictors of Outcomes for Primary Bariatric Surgery

Marcoandrea Giorgi^{1*}, Gopal Goriparthi², Cullen Roberts², Yuqi Zhang², Seungjun Kim², Jung H Gong^{1,2}, Andrew Luhrs¹ and Sivamainthan Vithianathan¹

¹Department of Surgery, Brown University, The Miriam Hospital, Providence, Rhode Island, USA

²Department of Surgery Brown University, Rhode Island Hospital, Providence, Rhode Island, USA

Abstract

Introduction: Bariatric patients are a heterogeneous group of people. In this study we analyze social characteristics of patients undergoing primary bariatric operations to identify factors that could help predict outcomes after surgery.

Methods: A single center retrospective analysis was performed on all primary bariatric operations from January 2015 to January 2017. Patients undergoing Laparoscopic Roux-En-Y Gastric Bypass (LRNYGB), Laparoscopic Sleeve Gastrectomy (LSG) and Laparoscopic Gastric Banding (LGB) were included. The social factors analyzed were: insurance status (government based vs. private insurance), marital status (married vs. not married patients), employment status (employed vs. not employed), ethnicity (Hispanic vs. white vs. non-white population). Outcomes were: Length of Stay (LOS), 30 day hospital readmissions, any complications, re-operations, follow-up rates, ΔBMI (change in body mass index), %EBMIL (Percentage of Excess Body Mass Index Loss).

Results: 303 patients were included. 139 patients underwent LRNYGB (45.9%), 159 underwent LSG (52.8%), 4 underwent LGB (1.3%). As compared to those with government insurance, patients with private insurance had increased %EBWL (54.87 vs. 47.79, p=0.008) and ΔBMI (11.21 vs. 9.9, p=0.022) at the 6 month follow up visit. As compared to non-employed patients, employed patients had significantly lower rates of readmission (7% vs. 15.1% p=0.034) and complication rates (13% vs. 24.7% p=0.018). Married patients had higher rates of follow-up after 1 year compared to non-married patients (55.1% vs. 41.3%, p=0.017).

Conclusion: Social factors can be are important outcome predictors in primary bariatric surgery that can help stratify risk and individualize perioperative management.

Keywords: Bariatric Surgery; Obesity; Social Factors; Gastric Bypass; Sleeve Gastrectomy

Introduction

Obesity is a rising epidemic in America, affecting more than 90 million populations [1]. No state has an obesity rate of below 15%, the national goal. The cost for medical expenses of patients with obesity is significantly higher than the non-obese population, and the difference is impressive. It is estimated that the expenses for people with obesity are \$1,429 higher than the non-obese population, with a national burden over 140 billion USD [2].

Bariatric procedures have demonstrated significant success for weight loss and improvement in several comorbidities [3]. While several technical aspects of the procedures are key to guarantee excellent peri-operative outcomes, they may not be the only determinant factors. Careful patient selection has always been a key aspect of the bariatric process, with a lengthy and extensive work up in the pre-operative phase to guarantee optimal patients' readiness for surgery. Psycho-social suitability, particularly, has been proven to be imperative for this population [4].

Certainly, there are several other potential social factors that could have an impact, but given the vast variability, these disparities have not been well studied in the literature. Also, whether any of these factors could lead to any significant difference in post-procedural outcomes is also not well defined.

While susceptible to bias, a number of social characteristics have been proven to be effective determinants of outcomes in healthcare [5]. Specific social factors, such as insurance status, have been shown to influence surgical outcomes [6]; specifically, recent data on government-based

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*Correspondence:

Marcoandrea Giorgi, Department of Surgery, Brown University, The Miriam Hospital, 195 Collyer street, Providence, Rhode Island, 02906, USA, Tel: 4015538349;

E-mail: marcoandrea.giorgi@me.com

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insurances revealed some important disparities especially in terms of length of hospital stay and readmission rate [7]. These findings are of increasing importance to the bariatric surgeon, as we continue to see a rise in the utilization of weight loss procedures in the Medicare population, from 8.5% in 2006 to 16.3% in 2011 [8].

However, little data exists on whether outcomes in bariatric surgery are affected by social status and to what degree. We hypothesize that collecting data on important social factors in addition to Body Mass Index (BMI) and comorbidities, will allow the bariatric surgeon to provide improved patient education and thus lead to better outcomes.

In this study, we analyzed some of the prominent social factors such as insurance, marital and employment status, smoking, drug abuse, race and ethnicity to see if there are any relevant correlations that are observed after primary bariatric procedures in terms of length of hospital stay, complication rate, reoperations, excess weight loss, and emergency department visits after discharge.

Methods

In this retrospective study we analyzed differences in clinical outcomes of primary bariatric surgery operations by patient social characteristics; the operations included were: Laparoscopic Roux-en-Y Gastric Bypass (LRNYGB), Laparoscopic Sleeve Gastrectomy (LSG), and Laparoscopic Gastric Banding (LGB). Revision surgeries were excluded.

The study was performed at a 247-bed academic hospital and ASMBBS/MBSQIP accredited with four fellowship trained surgeons who routinely perform bariatric surgery. All primary bariatric operations between 2015 and 2017 were included for analysis. Patients’ outcomes were analyzed at 6, 12 and up to 24 months after surgery when available.

LGB procedures were excluded from analysis due to the very low number in cases performed (n=4).

IRB approval was obtained, no patient’s consent was necessary given the retrospective methodology of the study.

All patients met the criteria for bariatric surgery and followed the Center of Excellence clinical pathways and underwent standard pre-operative evaluation including: nutritional education by trained bariatric dieticians, psychological evaluation, pre-operative cardiac evaluation, sleep study when necessary, pre-operative blood work, upper endoscopy or upper Gastro-Intestinal (GI) series, and Primary Care Provider (PCP) clearance. The social variables analyzed were: Insurance status (government based vs. private), marital status, employment status, smoking history, substance abuse history, race, and ethnicity. We did not have any cash payers among our patients.

The outcomes measured were: Length of Stay (LOS), Emergency Department (ED) presentations, Hospital readmissions, Complications, Re-operations, Follow-up rates, Change in Body Mass Index (ΔBMI), and Percent Excess Body Mass Index Loss (%EBMIL).

Statistical analysis of numerical data was performed using Student’s t-test, while categorical data were analyzed with either Pearson’s chi-squared test or Fisher’s exact test as appropriate for given sample size. Multi-variate regression analysis was performed on the univariate statistically significant data points.

Results

A total of 303 patients were included in this study. 239 patients

were female and 64 were male. Mean age on day of operation was 43.4 and mean BMI on day of operation was 46.5. 139 patients underwent LRNYGB (45.9%), 160 underwent LSG (52.8%), and 4 underwent LGB (1.3%). 302 out of 303 patients successfully underwent the planned procedure, with one procedure aborted due to septic shock (Table 1, 2).

For the univariate analysis, relative to patients with government insurance, patients with private insurance had greater %EBMIL (54.87 vs. 47.79, p=0.008) and ΔBMI (11.21 vs. 9.99, p=0.022) at the 6 months follow up visit. Relative to non-employed patients, employed patients had lower rates of readmission (7% vs. 15.1% p=0.034) and complication (13% vs. 24.7% p=0.018). Relative to non-married patients, married patients had higher rates of attending a greater than 1-year post-operative follow-up visit (55.1% vs. 41.3%, p=0.017). Relative to non-Hispanic black patients, non-Hispanic white patients had fewer per capita ED presentations (0.75 vs. 2.92, p=0.003). Relative to patients less than 45 years old on day of operation, patients 45 years old or older had higher rates of follow-up at 12 months (55.1% vs. 70.6%, p=0.006) (Table 3).

Regression multivariate analysis was performed for the univariate statistically significant data points. Private insurance and being married were found to be statistically significant factors for having respectively greater %EBMIL and ΔBMI at the 6 months follow up (coef -1.90; p=0.019) and for attending a greater than 1-year post-operative follow-up visit (OR 1.14; p=0.028) (Table 4).

Other comparisons for both univariate and multivariate regression analysis revealed no statistically significant differences in measured outcomes. When all white patients were compared to all non-white patients, no statistically significant differences were observed in any measured outcome, including no difference in per capita ED presentations. Additionally, no statistically significant differences were observed between genders in any measured outcome. Similarly, no statistically significant differences were observed in any measured outcome between those with a history of smoking and those with no smoking history, as well as between those with a history of substance abuse and those with no substance abuse history.

Discussion

Obesity is an epidemic in the United States. In 1990, obese adults made up less than 15 percent of the population in most U.S. states [9]. Today, nationwide, roughly two out of three U.S. adults are overweight or obese (69%) and one out of three is obese (36%) [10]. Obese patients are a heterogeneous group of patients, rising from different social, economic and ethnic backgrounds; while U.S. obesity rates have, overall, stayed steady since 2003, the rates are still rising in some groups, and disparities persist: Non-Hispanic black, Hispanic, and Mexican American adults have higher rates of obesity than non-

Table 1: Demographics.

Total number of patients (n)	303
Males	64 (21.2%)
Females	239 (78.8%)
Mean age (Median)	43.4 (44)
Mean BMI (Median)	46.5 (45)
LRNYGB patients	139 (45.9%)
LSG patients	159 (52.8%)
LGB patients	4 (1.3%)

Table 2: Social categories.

Insurance Status	Marital Status	Employment Status	Smoking Status	Substance Abuse Status	Race/Ethnicity
Government Based (n=106)	Married (n=136)	Employed (n=230)	Past Smokers (n=28)	Current/Past Substance Abuse (n=8)	Hispanic, Black (n=7)
Private (n=197)	Non Married (n=167)	Non Employed (n=73)	Not Past Smokers (n=275)	No Substance Abuse History (n=295)	Hispanic, Other (n=30)
					Hispanic, White (n=27)
					Non Hispanic, Black (n=25)
					Non Hispanic, Other (n=3)
					Non Hispanic, White (n=211)

Table 3: Univariate Statistically Significant Outcomes.

Private Vs. Government Based Insurance	6months %EBWL 54.87 vs. 47.79, p=0.008
	ΔBMI 11.21 vs. 9.9, p=0.022
Employed Vs. Not Employed	readmission rate 7% vs. 15.1% p=0.034
	complication rate 13% vs. 24.7% p=0.018
Married Vs. Not Married	>12 months f/u rate 55.1% vs. 41.3%, p=0.017
Non-Hispanic white patients Vs. Non-Hispanic black patients	Per capita ED-presentations 0.75 vs. 2.92, p=0.003
Patients 45 or older Vs. Patients less than 45	12 months follow up rate 70.6% vs. 55.1%, p=0.006

Table 4: Univariate Statistically Significant Outcomes.

Private Vs. Government Based Insurance	6 months %EBWL 54.87 vs. 47.79,
	ΔBMI 11.21 vs. 9.9, (coef -1.90; p=0.019)
Married Vs. Not Married	>12 months f/u rate 55.1% vs. 41.3%, (OR 1.14; p=0.028)

Hispanic white adults [10].

The correlation between obesity and social factors with the associated health behaviors has been studied before [11,12] but a single cause-effect reason could not be appreciated. More refined analyses of micro-environmental influences have been conducted by multiple authors on the role of social facilitation of eating [13], behavioral eating traits [14] and sedentary behaviors [15], each of these factors seem to play a role in the rising obesity epidemic but no one factor is enough to explain it fully. On the other hand, researchers started to analyze the role of genetics as influence on obesity and obesity promoting behaviors. Maes et al. put forward a most comprehensive review of this literature, the results of which suggest potential significant support for an inheritable component to BMI and fat mass. Similarly, smaller studies have demonstrated genetic influences on eating phenotypes, independent from body fat [16-18].

While there is a significant amount of data on social influences on obesity epidemic there is a paucity of data on how social factors may influence post-operative outcomes in the general surgery literature. In the orthopedic and cardiac surgery literature some analyses have been done to answer this question and, while a correlation of social disadvantage situations with surgical outcomes was appreciated, no clear answers were found on if and how social factors can be important determinants of surgical outcomes [19,20].

This study focuses on how social factors affect post-operative outcomes for patients undergoing primary bariatric surgery. Due to the multitude of social factors that play a role in a patient's post-operative course it is hard to pinpoint which factors play a significant role in determining outcomes? For this reason, we focused on different subsets of social characteristics, from insurance, marital and employment status, smoking and substance abuse history, and finally race and ethnicity. This analysis is broader than other studies

performed on this topic, but no single social factor has been shown to have by itself a major impact on surgical outcomes, and no investigation was performed specifically for bariatric surgery patients.

Other studies have previously looked at insurance status as a factor in outcomes with bariatric surgery. Hayes et al. [6] found that patients with Medicare and Medicaid had an increased amount of time from the start of process to the surgery date compared with patients with private insurance but failed to find any difference in post-operative outcomes. Other studies also failed to find a difference in postoperative weight loss based on insurance status [21,22]. A previous study by Jambheker et al. [23] also found that the Medicare group compared with patients with Medicaid or commercial insurance had lower weight loss during the first year, but this difference did not persist to year 2.

In our experience, we found that the patients with private insurance had a higher %EBMIL at 6 months after surgery compared with patients with government-based insurance. The difference did not persist to other follow up times and at greater than 12 months follow up the %EBMIL was very similar between patients with private insurance or government-based insurance (68.33 vs. 68.22).

It is hard to interpret these numbers due to the low power of the study; our hypothesis is that private insurance could be a marker of higher social status, along with education and possibility to maintain healthy habits which would make a bariatric operation more likely to be successful with higher %EBMIL. This could lead to different post-operative strategies to improve weight loss and overall outcomes for government-based insurance patients, individualizing their care based on their social needs, although age may also be a confounder since elder patients tend to have non-private insurance. The unchanged difference of %EBMIL after 12 months from the primary operation would suggest that insurance status and its associated determinants do not play an important role in determining weight loss, but this will

have to be validated in a larger patient population.

Compliance with follow up visits has been associated with better postoperative outcomes in previous studies [24,25]. We hypothesized that specific social characteristics could predict compliance with post-operative visits thus allowing us to institute potential new strategies to identify these patients and improve their follow up rates. In our experience, patients that were married had a higher follow up rate at >12 months compared with patients that were not married (55.1% vs. 41.3%, $p=0.017$), also patient in the younger age group (<45 years old) had statistically significant lower rates of follow up compared to the older age group (>45 years old) at the 12-month interval (55.1% vs. 70.6%, $p=0.006$). These results have not been consistent in the rest of the literature: some authors have shown that patients with better social support have better compliance with medical recommendations [26]. However, the effect of marital status in the general population is not as clear, some authors found a modest increase in medical adherence in patients that were married, but the opposite was found in study by others [27], single patients were more likely to be adherent compared with married patients in bariatric follow up. While marital status could be a factor associated to improved follow up rates by having social support and help, it is understandable that in some instances these social relationships can be harder to manage and negatively affect post op appointment adherence. Also, the impact of non-marriage relations can bias the results as well.

We didn't appreciate statistical difference for follow up rates in the employed vs. non-employed groups, but in other studies being employed was associated with higher follow up rates [6]. For the same groups, we interestingly found that the complication and readmission rates were higher in the unemployed group versus the employed group; this was hypothesized to be for possible different comorbidity rates or different overall health status, hypothesizing that employed patients are able to access a wider variety of medical care and have their pre-operative conditions better managed leading to overall improved outcomes.

Finally, there was no statistically significant difference between males and females for all of the study outcome measures.

The main limitation of our study is the low power on the subset analyses. While some statistical significance can be assumed to persist with a bigger pool sample, it is hard to predict the how the different social factors will play a role in the outcomes. The multivariate regression analysis was helpful to confirm statistical power on some of our data points, but these results need to be validated in a bigger sample size. Due to the low power of the subset analysis and poor follow up rates we could not perform an analysis after in the long term which will be base of future projects.

Conclusion

Social factors play an important role in determining outcomes of bariatric surgery. Identifying the population subsets more prone to complications and poor follow up can help instituting specific protocols and individualized care to improve overall outcomes.

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