



Original article

Cost of bariatric surgery and factors associated with increased cost: an analysis of national inpatient sample

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Abstract

Background: In the current healthcare environment, bariatric surgery centers need to be cost-effective while maintaining quality.

Objective: The aim of this study was to evaluate national cost of bariatric surgery to identify the factors associated with a higher cost.

Setting: A retrospective analysis of 2012–2013 Healthcare Cost and Utilization Project - Nationwide Inpatient Sample (HCUP-NIS).

Method: We included all patients with a diagnosis of morbid obesity (ICD9 278.01) and a Diagnosis Related Group code related to procedures for obesity, who underwent Roux-en-Y gastric bypass (RYGB), sleeve gastrectomy (SG), or adjustable gastric banding (AGB) as their primary procedure. We converted “hospital charges” to “cost,” using hospital specific cost-to-charge ratio. Inflation was adjusted using the annual consumer price index. Increased cost was defined as the top 20th percentile of the expenditure and its associated factors were analyzed using the logistic regression multivariate analysis.

Results: A total of 45,219 patients (20,966 RYGBs, 22,380 SGs, and 1,873 AGBs) were included. The median (interquartile range) calculated costs for RYGB, SG, and AGB were \$12,543 (\$9,970–\$15,857), \$10,531 (\$8,248–\$13,527), and \$9,219 (\$7,545–\$12,106), respectively ($P < .001$). Robotic-assisted procedures had the highest impact on the cost (odds ratio 3.6, 95% confidence interval 3.2–4). Hospital cost of RYGB and SG increased linearly with the length of hospital stay and almost doubled after 7 days. Furthermore, multivariate analysis showed that certain co-morbidities and concurrent procedures were associated with an increased cost.

Conclusion: Factors contributing to the cost variation of bariatric procedures include co-morbidities, robotic platform, complexity of surgery, and hospital length of stay. (Surg Obes Relat Dis 2017;■:00–00.) © 2017 American Society for Metabolic and Bariatric Surgery. All rights reserved.

Keywords:

Bariatric surgery; Roux-en-Y gastric bypass; Sleeve gastrectomy; Cost analysis

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Bariatric surgery is currently the most effective treatment for morbid obesity. Numerous studies have shown the superiority of bariatric surgery over medical management for weight loss, improvement of obesity-related co-morbidities, and increase in quality of life [1,2]. Several studies

have also demonstrated cost-effectiveness of bariatric surgery over medical treatment in different patient populations [3–8].

Medications and costs are shown to significantly decrease one year after bariatric surgery, especially for diabetes mellitus, sleep apnea, and hypertension [8,9]. An analysis of National Inpatient Sample database from 1988 to 2011 has shown better outcomes of bariatric surgery in recent years while providing overall cost savings [10].

Despite demonstrated benefits of bariatric surgery in treatment of morbid obesity, the number of nationwide bariatric procedures has not increased in proportion to the increasing prevalence of obesity [11]. Some obstacles are the surgical cost and insurances' hesitance to pay for these procedures [12]. In the current healthcare environment, bariatric surgical centers need to be more cost-effective while maintaining the quality of services. If the cost of admission for bariatric surgery is reduced, the bariatric procedures can be better justified and can potentially increase the number of weight loss procedures.

The aim of this study was to analyze the national cost of bariatric surgery and to identify factors associated with higher cost. Recognizing these factors will help allocating resources more effectively, and decreasing costs through interventions on modifiable risk factors.

Methods

Data source

De-identified data were retrieved from the Healthcare Cost and Utilization Project – Nationwide Inpatient Sample (HCUP-NIS) 2012 and 2013. The NIS is the largest all-payer inpatient healthcare database in the United States, including national estimates of hospital inpatient admissions. The database collects data from more than 7 million hospital admissions annually and is one of the largest longitudinal hospital care databases in the United States. HCUP-NIS provides researchers with information on clinical conditions, their healthcare costs and quality of services, outcomes, and practice patterns at the national, state, and community levels. In 2012, HCUP-NIS approximates a 20% stratified sample of all discharges from the U.S. community hospitals (excluding rehabilitation and long-term acute care hospitals). The NIS consists of all patients, including uninsured and insured ones (Medicaid, Medicare, and private insurances) [13]. The HCUP HIPAA certification was obtained in the process of database requisition and, office of Institutional Review Board at University of Oklahoma – Tulsa approved the study.

Study cohort, inclusion and exclusion criteria

We identified all the patients with a Diagnosis Related Group of 619, 620, and 621 (procedures for obesity) and diagnosis of morbid obesity based on the International

Classification of Diseases-9th revision (ICD-9 278.01), who underwent Roux-en-Y gastric bypass (RYGB), sleeve gastrectomy (SG), or adjustable gastric band (AGB) placement as the primary procedure. Of 46,319 patients, 1,100 patients (2.4%) were excluded due to missing hospital charges.

Main outcome and variables

NIS provides the total hospital charges for each hospital discharge. It also provides a unique annual cost-to-charge ratio for each hospital. These ratios have been internally validated by other studies [14]. Hospitalization cost was calculated from each patient's hospital total charge multiplied by the unique cost-to-charge ratio for each hospital. Inflation was adjusted using the annual Consumer Price Index. "Increased cost" was defined as the main outcome. A hospital cost above the 80th percentile was defined as "increased." Demographic and preoperative characteristics including age, body mass index (BMI), gender, and race as well as co-morbidities such as congestive heart failure, chronic pulmonary disease, diabetes mellitus, hypertension, chronic liver disease, peripheral vascular disease, chronic kidney disease, and bleeding disorders were retrieved. Using the globally accepted ICD codes, the procedures performed simultaneously with bariatric surgery were identified which included hiatal hernia repair, lysis of adhesions, cholecystectomy, removal of gastric band, ventral hernia repair, upper endoscopy, and liver biopsy. The length of stay (LOS) in hospital and mortality rate were also extracted.

The HCUP-NIS includes specific ICD-9 codes (V85.XX) for BMI. The ICD codes for BMI were obtained in 43,010 patients (95.1%) of our cohort. We categorized the BMI to less than 35 kg/m² (V85.0–V85.34), 35–39.9 kg/m² (V85.35–V85.39), 40–44.9 kg/m² (V85.41), 45–49.9 kg/m² (V85.42), 50–59.9 kg/m² (V85.43), and >60 kg/m² (V85.44 and V85.45).

Statistical analysis

Data are expressed as mean $\pm$ standard deviation or number and percentage. Patients with and without increased cost were compared using χ^2 or Fisher's exact tests for categorical variables and Student's t test or Mann-Whitney U tests for continuous variables. For multivariate analysis, only patients with RYGB and SG were included. Logistic regression models were fit to examine the contribution of factors to the increased cost. Multivariate models included factors with $P < .1$ in univariate analysis and adjustments were made in a backward stepwise elimination pattern. Odds ratio (OR) along with the 95% confidence interval was reported. The analysis was carried out using the statistical package for the social sciences (SPSS, Version 20, Chicago Inc, Illinois, USA).

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