ELSEVIER

Surgery for Obesity and Related Diseases ▮ (2017) 00–00

SURGERY FOR OBESITY AND RELATED DISEASES

Original article

Trends in utilization of bariatric surgery, 2010-2014: sleeve gastrectomy dominates

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Received October 7, 2016; accepted January 20, 2017

Abstract

Background: Bariatric surgery is the most effective treatment for morbid obesity. Furthermore, the proportion of various types of bariatric procedures has significantly changed over the last two decades. Sleeve gastrectomy (SG) has been increasingly chosen as a primary bariatric procedure in recent years.

Objectives: This study aimed to analyze the changing pattern of bariatric surgery utilization from 2010 to 2014.

Settings: Using the American College of Surgeons National Surgical Quality Improvement Program database from 2010 to 2014.

Method: We identified patients aged ≥18 years with a body mass index (BMI) ≥35 kg/m^2 undergoing primary bariatric surgery. The trend of surgical procedures was analyzed from 2010 to 2014.

Results: A total of 93,328 patients were included (age of 44.6 ± 11.8 years and BMI of 46.2 ± 7.9 kg/m^2). Roux-en-Y gastric bypass (RYGB), adjustable gastric band, and SG comprised 58.4%, 28.8%, and 9.3% of the procedures in 2010 which changed to 37.6%, 3.1%, and 58.2% in 2014, respectively. Baseline BMI of SG patients decreased from 47.5 to 45.6 kg/m^2 ($P < .001$). The proportion of diabetic patients undergoing RYGB increased (30.4% to 33.2%, $P < .001$) but decreased among those having SG (26.6% to 22.8%, $P = .001$). The proportion of patients with hypertension having RYGB remained unchanged while decreased among SG patients (56.2% to 47.6%, $P < .001$). Female patients among the SG group increased from 73.2% to 77.7% ($P < .001$).

Conclusion: SG has been increasingly performed in the United States superseding adjustable gastric band and RYGB. The trend is in favor of females, lower BMI, and lower ratio of patients with diabetes and hypertension. More data are needed on outcomes of SG to assess its long-term effectiveness and credibility. (Surg Obes Relat Dis 2017;▮:00–00.)

Keywords: Bariatric surgery; Obesity; Trend; Sleeve gastrectomy; Gastric bypass; Gastric band; NSQIP

Despite available multidisciplinary programs, obesity still accounts for a major public health concern in the United States [1]. Bariatric surgery as the only effective treatment for morbid obesity is now being performed as one of the most common elective gastrointestinal procedures.

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http://dx.doi.org/10.1016/j.soard.2017.01.031

1550-7289/

Furthermore, along with the emerging research, technologies, and new surgical techniques, the proportion of performed bariatric procedures has changed over time.

Sleeve gastrectomy (SG) has gained popularity in recent years. According to the University Health System Consortium clinical database, the number of SGs has increased from .9% in 2008 to 36.3% in 2012 [2]. It has been explained that the national increase in the performance of SG is due to its lower 30-day risk-adjusted serious morbidity and equivalent 30-day mortality compared with the laparoscopic Roux-en-Y gastric bypass (RYGB) [3].

Although a recent study analyzed the statewide trends in bariatric surgery from 2002 to 2012 according to the population factors, no association was found between the procedure rates and the pattern of obesity or diabetes [4]. The aim of this study was to analyze the changing pattern in utilization of primary bariatric procedures in the United States between 2010 and 2014, using the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database.

Methods

Design

The ACS-NSQIP database, which is a multicenter, prospectively collected database by participant academic and community hospitals, was used to identify the study population. The ACS-NSQIP database collects information on multiple variables from patients undergoing major surgical procedures [5]. Data were retrieved from 2010 to 2014. There were 285, 315, 374, 435, and 517 participating sites from 2010 to 2014, respectively. The American College of Surgeons is not responsible for the analysis on this data.

Population

Patients aged ≥18 years with a Body Mass Index (BMI) ≥35 kg/m^2 who underwent primary bariatric surgery from 2010 to 2014 were identified. The International Classification of Diseases codes were used to select patients with morbid obesity and the Current Procedural Terminology codes were used to identify patients who underwent adjustable gastric banding (AGB), RYGB, and SG. Revisional bariatric procedures were not included.

Analysis

We analyzed the semi-annual proportion of each bariatric procedure. Demographic characteristics and co-morbidity distribution were compared among RYGB, SG, and AGB for each year to identify the changing patterns. Categorical variables and proportions were analyzed by χ^2 tests, student *t-test*, and ANOVA were used for continuous variables. Data are presented as mean ± SD and number (%). P value < .05 was considered statistically significant. Analysis was performed using statistical package for social sciences (SPSS, version 23, Chicago, Inc.)

Results

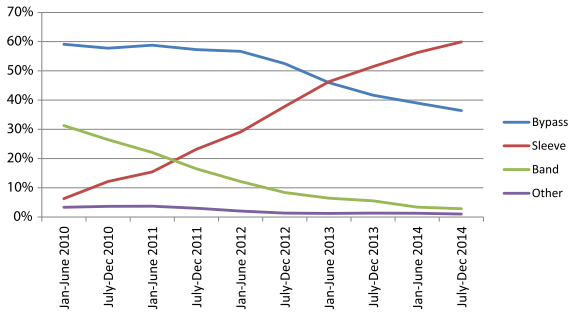
During January 2010 and December 2014, a total of 93,328 patients were analyzed. The average age of patients was 44.6 ± 11.8 years with a BMI of 46.2 ± 7.9 kg/m^2. Women constituted 78.2% of the study population.

Proportion of bariatric procedures

RYGB, AGB, and SG included 58.4%, 28.8%, and 9.3% of the procedures in 2010 which changed to 37.6%, 3.1%, and 58.2% in 2014, respectively. Annual distributions of bariatric procedures are shown in Fig. 1. While there was a slight decrease in proportion of RYGB, the proportion of SG showed a linear increase, and AGB decreased significantly over the study period.

Changing patterns according to the bariatric procedure

There was no significant change in the mean age of the study population over time, and the age of patients in each procedure group did not change over the study period. While the proportion of female patients was stable in the entire cohort over the time period, the proportion of female patients undergoing SG increased from 73.2% in 2010 to 77.7% in 2014 (P < .001). Over time, baseline BMI of RYGB patients did not change (46.8 kg/m^2 to 46.5 kg/m^2) while the BMI of patients undergoing SG showed a significant decrease (47.5 kg/m^2 to 45.6 kg/m^2, P < .001) (Fig. 2). Additionally, the frequency of patients with baseline BMI > 50 kg/m^2 decreased among SG patients (32% to 22.4%, P = .001) but remained unchanged among



	2010 (N=17,129)	2011 (N=16,426)	2012 (N=17,723)	2013 (N=20,693)	2014 (N=21,357)
Gastric Bypass	58.4%	58.0%	54.5%	43.8%	37.6%
Sleeve Gastrectomy	9.3%	19.3%	33.7%	49.0%	58.2%
Adjustable Gastric Banding	28.8%	19.3%	10.1%	6.0%	3.1%
Other	3.5%	3.4%	1.7%	1.2%	1.1%

Fig.1. Changing pattern of primary bariatric procedures from 2010 to 2014.