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Seasonality in the adverse outcomes in weight loss surgeries

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Abstract

Background: Weight loss surgery is a common procedure in the United States.

Objective: As weight loss surgery is largely an elective procedure for which patients and physicians can choose the timing, it could be helpful to explore the seasonality pattern of its perioperative adverse outcomes to help decide the timing of this surgery.

Setting: United States.

Methods: We used an obese adult sample (age ≥ 20 yr) of patients who underwent weight loss surgeries from the Premier Healthcare Database from 2011 to 2014. The International Classification of Diseases, Ninth Revision Clinical Modification procedure codes were used to identify weight loss surgery cases. Binary variables are used for 4 adverse outcomes, including hospital mortality, sepsis, deep vein thrombosis (DVT), and pulmonary embolism. The associations between the adverse outcomes and season of surgery were examined using logistic regressions, adjusting for age, sex, race, marital status, surgery types, body mass index, the Charlson co-morbidity index, and region.

Results: A total of 69,365 weight loss surgeries were identified for the analytic sample. The overall rate was .27% for hospital mortality, .16% for DVT, .10% for pulmonary embolism, and .20% for sepsis. For DVT, adjusted odds ratio for the fall was 2.68 (95% confidence interval: 1.39–5.19) and the odds ratio for the winter was 2.26 (95% confidence interval: 1.09–4.27) compared with the summer. For sepsis, adjusted odds ratio for the spring was 1.83 (95% confidence interval: 1.07–3.12) compared with that of the summer. The seasonality pattern was not statistically significant for hospital mortality and pulmonary embolism.

Conclusion: DVT and sepsis are more likely to occur in colder seasons compared with the summer season, although the crude rates of these adverse events were low. (Surg Obes Relat Dis 2017;■:00–00.) © 2017 Published by Elsevier Inc. on behalf of American Society for Metabolic and Bariatric Surgery.

One third of the U.S. adult population was obese in 2010, and 6.6% of Americans are estimated to be morbidly obese [1]. Many approaches are suggested to control or reduce excess weight, such as lifestyle changes, including

education, dietary modification, regular physical activity, and regular staff contacts with participants. However, these approaches can produce modest long-term weight loss of approximately 5% to 10% of starting weight [2]. Many patients select bariatric surgery as an effective option for treatment of substantial weight loss and improvement of obesity-related complications [3]. In 2013, an estimated 179,000 bariatric surgeries were performed in the United States, and the potential benefits of bariatric surgery are

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substantial [4]. Bariatric surgeries have been shown to be safe, with a low possibility of perioperative adverse outcomes [5]. For example, the 30-day postoperative mortality rate of bariatric surgery was .8 per 1000 based on a meta-analysis of randomized clinical trials published in 2014 [5]. Deep vein thrombosis (DVT) and pulmonary embolism (PE) are 2 common causes of morbidity and mortality during and after bariatric surgery [6,7]. The reported postoperative rate of DVT varies widely from 2 to 13 per 1000 at 30 days among different subtypes of bariatric surgeries [6,8]. Factors that have been identified as increasing these adverse outcomes include certain surgery types, older age, and postoperative anastomotic leak [8].

As bariatric surgeries for weight loss are largely an elective procedure in which patients and physicians choose the time for surgery, it could be helpful to explore whether there is a temporal pattern of these perioperative adverse outcomes. Such a pattern, if found, could reduce the risk of complications, especially for those patients with existing conditions for adverse outcomes. Previous studies have shown seasonal pattern for the occurrence of PE and DVT among the general population [9,10]. In this study, we aimed to examine the seasonality pattern of the incidence of adverse outcomes among primary bariatric surgeries within the initial hospitalization, including hospital mortality, sepsis, DVT, and PE.

Methods

The Premier Database prospectively collected standard hospital discharge data (both outpatient and inpatient hospital visits) from more than 600 hospitals in the United States [11]. The Premier database included detailed information about procedures and medicine usage [11]. Using a subset of this database containing adult obese patients aged ≥ 20 years, we performed a retrospective study for those who underwent bariatric surgery from July 1, 2011 through June 3, 2014.

For our analysis, we included patients with body mass index (BMI) ≥ 30 kg/m² [12]. Participants were divided into 3 groups based on BMI categories: 30 to 34.9, 35 to 39.9, and ≥ 40 kg/m². Dependent variables were binary outcomes for each of the 4 adverse outcomes, and independent variables included age, race/ethnicity, sex, BMI categories, bariatric surgery subtypes, marital status, region, and seasons. Race/ethnicity was defined according to medical-record reporting; for simplicity, this variable was categorized as non-Hispanic white, non-Hispanic black, and others. Four seasons in a year were defined as spring (March–May), summer (June–August), fall (September–November), and winter (December–February), and summer was used as the reference level.

We used the International Classification of Diseases, Ninth Revision Clinical Modification procedure codes to identify bariatric surgery cases: 44.31 (high gastric bypass),

44.38 (laparoscopic gastroenterostomy), 44.39 (other gastroenterostomy), 44.68 (laparoscopic gastroplasty), 44.69 (other repair of stomach), 43.89 (open and other partial gastrectomy), 45.51 (isolation of segment of small intestine), 45.91 (small-to-small intestinal anastomosis), 43.7 (partial gastrectomy with anastomosis to jejunum), 44.38 (laparoscopic gastric bypass), 44.95 (laparoscopic gastric banding), and 43.82 (laparoscopic sleeve gastrectomy) to identify bariatric surgery patients [13–15]. Hospital death was identified by discharge status labeled as “expired” for the index surgery. Sepsis (995.91) [16], PE (415.1, 415.11, 415.12, 415.13, and 415.19) [17,18], and DVT (451.11, 451.19, 451.2, 451.81, 451.9, 453.40, 453.41, 453.42, 453.8, and 453.9) [19,20] were identified by the International Classification of Diseases, Ninth Revision diagnosis codes, respectively.

Four multivariate logistic regressions were used to examine the association between the seasons and the occurrence of hospital mortality, DVT, PE, and sepsis during the inpatient visits for bariatric surgery. We used Firth’s penalized likelihood method [21] for estimation given the sparse nature of these adverse events. We adjusted for patient age, sex, marital status, race/ethnicity, BMI categories before surgery (30–34.9, 35–39.9, and ≥ 40 kg/m²), type of bariatric surgery (open versus laparoscopic bariatric surgeries), and the Charlson co-morbidity index [22]. We used the 4 regions of the United States as the geographic covariates (northeast, midwest, south, and west). Statistical analyses were performed with SAS software (version 9.4; SAS Institute, Cary, NC, USA). To address the possible issue of multiple inferences, we use the Dunnett’s multiplicity-adjusted confidence interval to determine the statistical significance in logistic regressions [23].

Results

We identified 69,365 bariatric operations in the Premier data set from 2011 to 2014. The median age of bariatric surgery recipients was 45 years (range, 20–89 yr), and approximately 95.00% aged from 20 to 65 years. Among them, 78.38% were female, 65.59% were non-Hispanic whites, 48.30% were married, and 79.32% had BMI ≥ 40 before the surgery (Table 1). In bariatric surgery patients, 90.04% surgeries were conducted under the assistance of laparoscope, and the most common bariatric surgery subtype was laparoscopic sleeve gastrectomy (41.56%), followed by laparoscopic gastric bypass (37.48%), and laparoscopic gastric banding (10.22%). Among the bariatric procedures, 27.85% were in spring, 27.30% were in summer, 21.50% were in fall, and 23.09% were in winter. There were statistically significant differences between the 4 seasons for the following variables: DVT, number of bariatric surgery patient, types of surgery, median age, marital status, and BMI. In particular, open surgery accounted for 13.34% in summer (the highest), while only

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