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Original article

Causes and risk factors for mortality within 1 year after obesity surgery in a population-based cohort study

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Abstract

Background: The use of obesity surgery has increased during the past decade. There is a need for population-based assessments of causes and risk factors for postoperative mortality. The objective of this study was to assess causes and risk factors for 1-year mortality after obesity surgery.

Methods: This nationwide retrospective population-based cohort study included essentially all obesity surgery patients in Sweden from 1980–2010. Data were collected from Swedish national registries and medical records. Patient characteristics, co-morbidities, and surgical procedures were assessed in relation to 1-year mortality through multivariable Cox proportional hazards regression, providing hazard ratios (HR), and 95% confidence intervals (CI) adjusted for age, sex, surgical procedure, surgical access, and co-morbidity.

Results: Among 22,487 obesity surgery patients the 1-year cumulative mortality was .38% (n = 85). Follow-up of cohort was complete. Median time of postoperative death was 45 days. Main causes of death included cardiopulmonary complications (myocardial infarction [n = 14; 16%], pulmonary embolism [n = 12; 14%], sudden cardiac arrest [n = 11; 13%]), and anastomotic leak (n = 12; 14%). Male sex (HR = 2.31; 95% CI 1.48–3.60), diabetes (HR = 2.47; 95% CI 1.44–4.23), and congestive heart failure (HR = 4.82; 95% CI 2.25–10.35) were independently associated with increased 1-year mortality, while age, hypertension, cerebrovascular disease, coronary heart disease, chronic obstructive pulmonary disease, asthma, and surgical procedure were not. Open surgery entailed an increased mortality compared to laparoscopic surgery from 2000–2010 (HR = 2.72; 95% CI 1.53–4.83), but not from 1990–1999 (HR = .39; 95% CI .11–1.32).

Conclusion: Although the absolute risk of mortality is low, the increased relative risk of mortality associated with male sex, diabetes, congestive heart failure, and open surgical access could influence clinical decision making. (Surg Obes Relat Dis 2014;▮:00–00.)

Keywords: Bariatric surgery; Metabolic surgery; Short-term mortality; Postoperative complications; Treatment outcomes; Epidemiology

Obesity is a threat to global public health and is associated with several co-morbidities [1]. Obesity surgery offers long-term weight reduction, longer life expectancy, increased quality of life, and alleviation of several co-morbidities [2]. The positive effects of surgery have led to

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an upsurge in its popularity. According to the Swedish Patient Registry, the annual volume of such procedures increased fourfold from 1987–2005, and reached 6,600 during 2010 [3,4]. A main concern of obesity surgery is that it comes with a risk of severe postoperative complications, including mortality, in people who are often young and reasonably healthy. Reported postoperative 30-day mortality range from .1%–1.1% [2]. Several risk-stratification systems for obesity surgery have been proposed [5–8], but none of them are routinely used, because there is uncertainty as to which preoperative factors increase risk of mortality.

Short-term mortality is best assessed in large and population-based (unselected) patient samples. Our aim was to assess causes of death and associations between potential risk factors and mortality within 1 year of obesity surgery using a population-based approach.

Methods

Study design

This Swedish nationwide, population-based retrospective cohort study included patients who underwent obesity surgery in 1980 through 2010 according to the Swedish Patient Registry. The study was approved by the regional ethics board in Stockholm. No informed consent was needed according to Swedish law. The Patient Registry holds information on all hospital admissions in Sweden, including admission and discharge dates, main- and co-diagnoses and surgical procedures. The registry was $>85\%$ complete nationally between 1980 and 1986 and 100% complete from 1987 onwards [9]. The validity of the register is high regarding both surgical procedures and diagnoses and considered suitable for large-scale population-based research [9,10]. The study outcome was death within 365 days of obesity surgery. Date of death was obtained through linkage to the Swedish Causes of Death Registry through personal identity numbers assigned to all Swedish residents [11]. This registry has nationwide coverage since 1961, and the recording of dates of death is 100% complete [12].

Obesity surgery cohort

All patients with a registered obesity surgery code and a diagnosis of obesity were identified from the Patient Registry. The codes from the Swedish and NOMESCO Classification of Surgical Procedures representing obesity surgery were 4750, 4751, 4752, 4753, and 4754 before 1997, and JFD00-01, JDF10-11, JDF20-21, and JFD00 from 1997 onwards. The codes representing obesity diagnosis were 287, 277, 278 A, and E66 in the International Classification of Diseases versions (ICD) 7, 8, 9, and 10, respectively. Patients under the age of 18 or those who underwent >1 obesity surgery procedure were excluded, to keep the cohort more homogenous and comparable to other studies.

Assessment of causes of death

Medical records of relevant in- and outpatient care and death certificates were retrieved for all patients who died within 365 days of surgery, and were reviewed independently by 2 authors. Information on surgical procedure, peri- and postoperative care, preoperative body mass index (BMI), and causes of death were documented according to a study-specific form. The causes of death that were likely related to surgery were divided into surgical complications and nonsurgical complication. The surgical complications were further grouped into technical and non-technical. Causes of death that were unknown or unlikely related to surgery were labeled as other causes.

Assessment of risk factors

Potential pre- and perioperative risk factors of 1-year mortality included age, sex, surgical procedure, surgical access (open or laparoscopic), and co-morbidity. Surgical procedures were categorized into simple and complex procedures. Simple procedures involve gastric restriction only (gastric banding, vertical banded gastroplasty, and sleeve gastrectomy), and complex procedures include procedures that are either malabsorptive (jejunoileal bypass) or combined restrictive and malabsorptive (gastric bypass and biliopancreatic diversion with duodenal switch). Co-morbidity included diabetes mellitus, congestive heart failure, coronary heart disease (acute myocardial infarction or angina pectoris), cerebrovascular disease (cerebral infarction or bleeding), hypertension, chronic obstructive pulmonary disease, and asthma. Co-morbidity data were retrieved from the Patient Registry and were based on the diagnosis codes from ICD 7-10. Preoperative co-morbidity was considered present if the disease code was recorded in the Patient Registry before the date of obesity surgery.

Statistical analysis

Cox proportional hazards regression analysis was used to calculate hazard ratios (HR) with 95% confidence intervals (CI) to assess factors associated with time until 1-year mortality. In multivariable modeling, HR was adjusted for the following 12 covariates: age (categorized into <45 yr or ≥ 45 yr), sex (female or male), surgical procedure (simple or complex), surgical access (laparoscopic or open), calendar period (1980–89, 1990–99, or 2000–2010), and 7 co-morbidities as specified above (yes or no for each).

Proportional hazards assumptions were evaluated by calculating the correlation between Schoenfeld residuals and the ranking of the failure time, and through plotting survival time against survival function on a logarithmic scale. We evaluated potential effect modification of