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ORIGINAL INVESTIGATIONS

Bariatric Surgery and Emergency Department Visits and Hospitalizations for Heart Failure Exacerbation

Population-Based, Self-Controlled Series

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ABSTRACT

BACKGROUND The United States is battling obesity and heart failure (HF) epidemics. Although studies have suggested relationships between obesity and HF morbidity, little is known regarding the effects of substantial weight reduction in obese patients with HF.

OBJECTIVES This study investigated whether bariatric surgery is associated with a decreased rate of HF exacerbation.

METHODS We performed a self-controlled case series study of obese patients with HF who underwent bariatric surgery, using the population-based emergency department (ED) and inpatient sample in California, Florida, and Nebraska. Primary outcome was ED visit or hospitalization for HF exacerbation from 2005 to 2011. We used conditional logistic regression to compare the outcome event rate during sequential 12-month periods, using pre-surgery months 13 to 24 as the reference period.

RESULTS We identified 524 patients with HF who underwent bariatric surgery. During the reference period, 16.2% of patients had an ED visit or hospitalization for HF exacerbation. The rate remained unchanged in the subsequent 12-month pre-surgery period (15.3%; $p = 0.67$). In the first 12-month period after bariatric surgery, we observed a nonsignificantly reduced rate (12.0%; $p = 0.052$). However, the rate was significantly lower in the subsequent 13 to 24 months after bariatric surgery (9.9%; adjusted odds ratio: 0.57; $p = 0.003$). By contrast, there was no significant reduction in the rate of HF exacerbation among obese patients who underwent nonbariatric surgery (i.e., cholecystectomy, hysterectomy).

CONCLUSIONS Our findings indicate that bariatric surgery is associated with a decline in the rate of HF exacerbation requiring ED evaluation or hospitalization among obese patients with HF. (J Am Coll Cardiol 2016;67:895–903)

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ABBREVIATIONS AND ACRONYMS

BMI = body mass index

BNP = B-type natriuretic peptide

CI = confidence interval

CPT = Current Procedural Terminology

ED = emergency department

HCUP = Healthcare Cost and Utilization Project

HF = heart failure

ICD-9-CM = International Classification of Diseases-Ninth Revision-Clinical Modification

LV = left ventricular

LVEF = left ventricular ejection fraction

OR = odds ratio

SEDD = State Emergency Department Database

SID = State Inpatient Database

Heart failure (HF) is a significant public health burden that affects approximately 5.7 million adults in the United States (1); the total number of patients is projected to increase by 46% from 2012 to 2030 (2). HF exacerbations contribute to a substantial proportion of the burden, accounting for 676,000 emergency department (ED) visits and 1.02 million hospitalizations annually (1). The total (direct and indirect) cost for treating patients with HF, within which the majority (80%) is related to hospitalizations, was $30.7 billion in 2012 and is projected to increase to $69.8 billion in 2030 in the United States (2).

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In parallel, the United States also has experienced an obesity epidemic (3). Approximately 40% of patients hospitalized for HF exacerbation are obese (4), and studies have demonstrated an association between obesity and HF-related morbidity. For example, epidemiological studies report a "dose-effect" relationship between body mass index (BMI) and rates of hospitalization for HF exacerbation in patients with obesity, suggesting possible causality (5-7). Additionally, potential pathophysiological mechanisms exist that link obesity to HF exacerbation (e.g., excessive accumulation of adipose tissue leads to hemodynamic changes that may result in alterations in cardiac performance and left ventricular (LV) morphology) (8-10). Therefore, obesity is recognized as a possible risk factor for HF exacerbation (8). Substantial weight loss, on the other hand, has been associated with reversal of several hemodynamic abnormalities and adverse LV remodeling among patients with obesity and HF (8,9). However, little is known about whether substantial weight loss results in a decreased rate of HF-related adverse events (11). Bariatric surgery is the most effective method to achieve substantial weight loss (12) and can theoretically lead to improved HF control among patients with obesity.

In this context, we aimed to investigate whether bariatric surgery, used as an instrument to achieve significant weight loss, is associated with significantly reduced rates of ED visits and hospitalizations for HF exacerbation among obese patients with HF.

METHODS

STUDY DESIGN AND SETTING. We performed a self-controlled case series study utilizing the Healthcare Cost and Utilization Project (HCUP) State Emergency Department Database (SEDD) (13) and State Inpatient Database (SID) (14). The study was designed to perform intraperson comparisons among those who experienced both the exposure and the outcome. No separate control group was necessary because this study design allows each person to function as his or her own control (15). The major advantage of this design is that both measured and unmeasured confounders are controlled as long as they do not change over time during the study period (15). Because the exposure of this study (i.e., bariatric surgery) is transient and discrete, and the outcome is characterized as a short-term event, the present study meets the required assumptions of self-controlled study designs (15). We assessed the rate of ED visits or hospitalizations for HF exacerbation for 4 consecutive years: 2 years before and 2 years after bariatric surgery.

The data were extracted from HCUP SEDD and SID in California, Florida, and Nebraska from 2005 to 2011. HCUP includes all-payer, encounter-level information and is the largest longitudinal hospital care data collection available in the United States. The SEDD is a database from short-term, acute-care, nonfederal hospitals in participating states that encompasses all ED visits, including treat-and-release encounters and transfers. The SID captures all inpatient discharges from short-term, acute-care, nonfederal, general, and other specialty hospitals, and this database includes those admitted through the ED. Taken together, all ED visits regardless of disposition and all hospitalizations regardless of the source of admission were able to be identified. The 3 states were chosen as their data included unique encrypted patient identifiers, making it possible to perform longitudinal follow-up of specific patients across years, and for their high data quality. Details of the study design, databases, and statistical analysis methods have been previously published (13,14,16). The institutional review board of Massachusetts General Hospital waived review of this study.

STUDY POPULATION. Steps were taken to identify all obese patients with HF who underwent bariatric surgery in the databases from the 3 states. First, patients age ≥18 years with at least 1 ED visit or hospitalization for HF exacerbation between January 1, 2005, and December 31, 2011, were identified using the International Classification of Diseases-Ninth Revision-Clinical Modification (ICD-9-CM) diagnosis codes for HF (402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, and 428.0) in the primary diagnosis field (17). Second, among patients