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Economic impact of bleeding complications after mastectomy



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ABSTRACT

Background: We sought to determine the incidence of postmastectomy bleeding, identify bleeding predictors, and evaluate the economic impact.

Methods: Using the 2011 Healthcare Cost and Utilization Project-Nationwide Inpatient Sample, hospital discharges for a primary diagnosis of breast cancer were extracted using International Classification of Diseases, Ninth Revision, Clinical Modification procedure codes 85.34–85.48 for mastectomy and diagnosis codes 174.0–174.9 for breast cancer. Discharges with postoperative bleeding were identified using International Classification of Diseases, Ninth Revision, Clinical Modification diagnosis codes 998.11 and 998.12. Discharges with male gender or a history of coagulation disorders were excluded. Bleeding complication rates and reoperation rates were assessed. Predictors and the impact of bleeding on length of stay and hospital costs were determined using regression analysis and projected to the national level.

Results: A total of 7907 discharges met inclusion criteria; 201 had bleeding complications (2.54%), with 42 cases requiring reoperation. On univariate analysis, the presence of congestive heart failure (CHF), obesity, diabetes, chronic pulmonary disease, and the absence of concomitant reconstruction were associated with increased bleeding events. On multivariate analysis, only the presence of CHF remained as a significant predictor of bleeding complications (odds ratio [95% confidence interval], 2.45, [1.25–4.92], $P = 0.009$). On average, bleeding complications extended the length of stay by 1.3 d ($P < 0.0001$) while increasing hospital costs by \$5495 per admission ($P < 0.0001$). Projected to a national level, bleeding complications accounted for an additional 1254 d of hospital care at a cost exceeding \$5.3 million.

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Conclusions: Postmastectomy bleeding complications had an incidence of 2.54%, with CHF the only independent predictor identified. Such bleeding events, although infrequent, are associated with substantial economic costs.

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1. Introduction

There is significant pressure placed on the health care community to improve quality while simultaneously keeping costs low. The Agency for Healthcare Research and Quality, attempting to help providers deliver safer and higher quality care, developed a set of outcome measures providing information on “potential in-hospital complications or adverse events following surgeries, procedures, or childbirth.” These outcome measures are known as patient safety indicators (PSIs) and are often used by providers and/or institutions to identify adverse events that might need further study while also providing the opportunity to assess the incidence of these events or complications [1]. One such PSI is postoperative bleeding.

In breast cancer surgery, postoperative hemorrhage and/or hematoma is a serious and potentially avoidable complication potentially affecting medical outcomes and costs of care [2]. The incidence and impact of both postoperative bleeding and venous thromboembolism (VTE) need to be examined to establish concordant guidelines for VTE prophylaxis in the breast cancer surgery population [3]. Currently, the American College of Chest Physicians guidelines recommend using the Caprini score to determine the need for pharmacologic VTE prophylaxis [4]. Before this change in 2012, the American College of Chest Physicians grouped breast surgical procedures with other general surgical procedures, recommending routine pharmacologic and mechanical VTE prophylaxis [5]. The American Society of Breast Surgeons, in contrast, recommend for selective pharmacologic VTE prophylaxis, noting a concern for likely increased risk of bleeding complications [3].

Although many studies have investigated VTE in the breast cancer surgery population, studies examining postoperative bleeding remain rare [6–10]. Furthermore, no studies have addressed the economic impact of bleeding complications after breast cancer surgery in terms of treatment costs and health care utilization. As a result, we aimed to determine the incidence of postoperative bleeding in the breast cancer surgery population, identify potential risk factors for bleeding or reoperation as a result of bleeding, and finally, evaluate the impact on hospital utilization and treatment costs using a nationally representative data set.

2. Materials and methods

2.1. Data source and patient selection

The study used hospital inpatient data from the Health Care Utilization Project-Nationwide Inpatient Sample (NIS) for 2011. The NIS is the largest publicly available all-payer inpatient care database in the United States with records from approximately 8 million hospital stays each year. It contains

discharge data from hospitals in 46 participating States (approximately 20% stratified sample of all inpatient admissions to US community hospitals). Because of its large size, the NIS can be used to assess relatively infrequent events such as postoperative hematoma and/or hemorrhage.

International Classification of Diseases, Ninth Revision (ICD-9) codes were used to select the patient population and define outcomes and exposures. Women with a principal diagnosis of invasive breast cancer (ICD-9 diagnosis code of 174.0–174.9) and principal ICD-9 procedure codes for mastectomy with or without reconstruction were included in the study. We selected only patients with invasive breast cancer to keep the study population homogenous, given that cancer might affect the hemostatic mechanism in ways that noncancer cases do not (Table 1). ICD-9 diagnosis codes 998.11 or 998.12 were used to identify discharges with postoperative hematoma and/or hemorrhage with or without a procedure code for control of hemorrhage or drainage of hematoma (ICD-9 procedure codes 39.98 or 86.04, respectively). Women with coagulopathy were excluded. Women with breast conserving surgery were excluded because the overwhelming majority of breast conserving surgeries are performed on an outpatient basis and are therefore not captured in the NIS.

Patient demographic information (including age, race, and comorbidities) as well as total charges, overall length of stay (LOS), and general hospital information (such as hospital bed size, ownership, location, and teaching status) were collected.

2.2. Statistical analysis

All statistical analyses were performed using the sampling weights and stratified sample design of the NIS to obtain national estimates.

Baseline patient demographic and treatment information were reported using means for continuous variables and frequencies or percentages for categorical variables. Univariate analyses were performed using the chi-squared test for categorical variables and the unpaired Student t-test for continuous variables. Variables noted to have an association with postoperative bleeding on univariate analyses were included in a multivariate logistic regression to identify independent risk factors for postoperative bleeding. Of note, the variables used in the multivariate analysis were tested for collinearity or correlation before inclusion in the model. Additionally, patients with bleeding complications were further divided into two groups as follows: those requiring reoperation and those managed nonoperatively. The potential predictors for reoperation were assessed using logistic regression analysis. A P value of <0.05 was considered statistically significant.

To assess the economic impact of postoperative bleeding, treatment costs were obtained by converting hospital charges

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