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Resource utilization associated with cervical hematoma after thyroid and parathyroid surgery

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ABSTRACT

Background: Postoperative cervical hematoma (PCH) after thyroid and parathyroid surgery is a well-known complication. This study used data from the Nationwide Inpatient Sample to identify risk factors, estimate mortality, length of stay (LOS), and total costs attributable to PCH in patients undergoing procedures for thyroid and parathyroid diseases.

Methods: Patients aged >18 y who underwent thyroid or parathyroid surgery between 2001 and 2011 were identified and stratified by the occurrence of PCH. Univariate analyses of patient demographics, clinical and hospital characteristics were performed. Multivariable logistic regression was used to determine risk factors for hematoma formation. LOS and costs were fit to linear regression models to determine the effect of PCH after adjusting for patient and hospital characteristics.

Results: Of patients who underwent thyroid or parathyroid surgery, 619 patients (0.8%) had a PCH. Predisposing factors included nonelective admission (emergent: OR = 2.01, $P < 0.0001$; urgent: OR = 1.47, $P = 0.003$), diagnosis of Graves' disease (OR = 1.90, $P < 0.0001$), or other benign pathology (OR = 1.43, $P = 0.011$) and having ≥2 comorbidities (2-3 comorbidities, OR = 1.24; $P = 0.036$ and ≥ 4 comorbidities, OR = 2.28; $P < 0.0001$). After adjusting for those characteristics, the total excess LOS and costs attributable to PCH were 2.1 d ($P < 0.0001$) and $7316 ($P < 0.0001$), respectively. In addition, after risk adjustment, odds of mortality more than tripled ($P < 0.0001$) in the setting of PCH.

Conclusions: Because risk for PCH is largely driven by preoperative patient risk factors, five clinicians have an opportunity to stratify patients accordingly and thereby minimize the resource utilization and health care spending among those with lowest risk.

Introduction

Since its inception in the 19th century, the field of head and neck endocrine surgery has generally been associated with low rates of morbidity and mortality in the surgical management of thyroid and parathyroid pathology. Indeed, by the early 20th century, Halsted remarked that thyroid surgery could be "accomplished by any competent operator without

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danger or mishap," while Mayo and Pemberton reflected "it is obvious, therefore, that the mortality rate is dependent more on the number of bad-risk patients accepted for operation, than on any factor in the operative or preoperative management".[1,2] Nearly, a century later, techniques in endocrine surgery have advanced, patient operative risk must still be managed, and although morbidity and mortality remain low, emphasis on surgical outcomes is increasingly important.[3-6]

The risks attendant to surgery of the thyroid and parathyroid glands have been well established. Postoperative cervical hematoma (PCH) is an important complication and has potentially grave consequences.[7] With a steadily increasing number of thyroid and parathyroid operations performed annually in the United States, the small proportion of patients who experience a PCH become more clinically significant.[8,9] Among approximately 100,000 patients projected to undergo thyroidectomy or parathyroidectomy in 2020, and at a reported PCH rate of approximately 1.5%, 1500 patients may be affected.[5,6,8,10] Due to this increasing volume, the patient-specific as well as economic implications likewise become important.

The aim of this study was to employ a comprehensive national database to identify risk factors for development of PCH following thyroidectomy and parathyroidectomy, the two procedures most relevant to the daily practice of endocrine surgeons, and to estimate the economic impact attributable to PCH in terms of length of stay (LOS) and total costs.

Methods

Data

This study was a retrospective cohort study using data from the Nationwide Inpatient Sample (NIS) of the Healthcare Cost and Utilization Project. The NIS is the largest all-payer administrative database containing prospectively collected patient records from a representative sample of approximately 95% of states participating in Healthcare Cost and Utilization Project across the US.[11] We included all admissions from 2001 to 2011, including those in which patients were admitted and discharged the same date (i.e., same-day discharges). Variables include demographics, hospital- and admission-related characteristics, and comorbidities. Outcomes such as postoperative neck hematoma, LOS, cost, and mortality were also abstracted and coded.

Patients undergoing thyroid or parathyroid surgery for treatment of thyroid or parathyroid pathology were identified using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis codes (193, 194.1, 242.00-242.01, 246.0-246.9, and 252.0-252.9) and procedure codes (06.02,06.2, 06.39, 06.4, 06.5-06.52, 06.81, and 06.89). Acknowledging that these two surgical procedures necessitate a different extent of dissection, the present study sought to address the consequences of hemorrhagic morbidity for both procedures to best inform the practice of head and neck endocrine surgeons. Patients were stratified according to development of postoperative hemorrhage, or hematoma or seroma complicating a procedure, using ICD-9-CM diagnosis codes (998.11-998.13). The code for seroma complicating a procedure was included as it is likely that if a fluid collection in the neck in the setting of recent surgical dissection was of such significance to be coded separately, the collection would likely have the same effect on outcomes regardless of whether it was called a hematoma or a seroma. For example, a patient with a cervical fluid collection, whether seroma or hematoma, might be observed longer as an inpatient to rule out any compressive sequelae and would therefore incur greater hospital costs. Patients were excluded if the database was missing information for sex, race, payer type, admission type, hospital size and teaching status, admitting diagnosis and index procedure, or total cost of admission. After 121,971 patients were excluded because of incomplete information, 78,470 patients remained to study.

Covariates and outcomes

Covariates in our model included demographics (age, sex, race/ethnicity, and primary payer), comorbidities (alcoholism, illicit drug use, obesity, weight loss, congestive heart failure, cardiac valvular disease, hypertension, vascular disease, chronic lung disease, cardiopulmonary disease, depression, psychiatric disease, neurologic disease, hemi-/paraplegia, peptic ulcer disease, liver disease, kidney disease, electrolyte disturbance, diabetes mellitus with and without complications, cancer with and without metastases, acquired immunodeficiency syndrome, arthritis, blood loss/anemia, and coagulopathy), and the use of antithrombotic or anticoagulant medications. Other covariates included geographic region of treatment facility (Northeast, South, Midwest, and West), admission type (emergent, urgent, and elective), year of discharge, hospital teaching status, hospital bed size (small, medium, and large), admitting diagnosis (parathyroid disease, benign thyroid disease, malignant thyroid disease, and Graves' disease), and index procedure (parathyroidectomy, partial thyroidectomy, substernal thyroidectomy, total thyroidectomy without neck dissection, and total thyroidectomy with neck dissection).

Primary outcomes included development of postoperative neck hematoma, mortality on index admission, LOS, and cost of index admission. More specifically, costs were estimated from a provider perspective and calculated using hospital-specific cost-to-charge ratios. These costs were subsequently adjusted to 2015 dollars using the Hospital and Related Services component of the Consumer Price Index.[11]

Statistical analysis

Patient- and hospital-related characteristics and diagnostic and procedural details were stratified by occurrence of PCH (hematoma, no hematoma). Means or proportions were reported. *T*-tests were used to compare continuous variables, and chi-squared tests were used to compare binary and categorical variables. Logistic regression was used to model the effects of baseline characteristics on odds of developing a neck hematoma postoperatively. Goodness of fit of the logistic regression models was measured as the area under the receiver operating characteristic curve. Generalized linear modeling was used to model the effects of PCH on LOS and cost of index admission after controlling for baseline