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Reoperative parathyroidectomy: who is at risk and what is the risk?

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ABSTRACT

Background: Persistent and recurrent hyperparathyroidism necessitate reoperation, which is associated with increased procedure-specific complication rates. The effect of reoperative parathyroidectomy on more generalized outcomes is poorly understood. We sought to determine patient, provider, and perioperative characteristics associated with reoperation, as well as to determine the associated risks.

Methods: All patients receiving a parathyroidectomy in the American College of Surgeons National Surgical Quality Improvement Program database (2008–2011) were identified. Patients receiving initial parathyroidectomy were compared with those receiving reoperative parathyroidectomy. Descriptive statistics and univariate analyses were performed. Multivariate logistic regression models were developed for significant outcome measures.

Results: Of 9114 parathyroidectomies performed, 8738 (95.9%) were initial and 376 (4.1%) were reoperative. The annual rate of reoperation was 3.6%–4.8%. Patients undergoing reoperative parathyroidectomy were more likely to be obese (48.5 *versus* 40.0%, $P = 0.009$) and American Society of Anesthesiologist class 3 (40.7 *versus* 30.3%, $P = 0.001$) than patients undergoing initial parathyroidectomy. There was no difference in gender, age, or race. Reoperations had a longer median operative time (101 minimum, interquartile range [IQR] [74–146] *versus* 76 [55–105], $P < 0.001$) and a longer postoperative length of stay (median days until discharge 1, IQR [1–1] *versus* 1, IQR [0–1], $P < 0.001$). No difference was found in the rates of mortality and common postoperative morbidity as measured in NSQIP. Patients undergoing reoperation were more likely to be readmitted within 30 d (12.7 *versus* 2.6%, $P < 0.001$). After adjusting for confounders, reoperation continued to be significantly associated with readmission (odds ratio 3.82, confidence interval: 1.63–8.97; $P = 0.002$).

Conclusions: Obesity and an American Society of Anesthesiologist 3 classification are independently associated with reoperation. Readmission within 30 d is associated with reoperation and is a target for patient education and quality improvement after this procedure.

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1. Introduction

Persistent and recurrent hyperparathyroidism may necessitate reoperation. Reoperative parathyroid surgery is challenging, even for experienced surgeons, due to tissue fibrosis and distortion of normal anatomy [1–3]. As a result, cure rates after reoperative parathyroidectomy are substantially lower than initial procedures, with only 89.7% of patients cured after receiving a reoperative procedure [4]. Initial parathyroidectomies have an overall complication rate ranging from 1.45%–3.40% [4,5], with procedure-specific complication rates of only 2.3% [6]. In comparison, rates of recurrent laryngeal nerve palsy have been reported to range from 4%–15% [2,7] for reoperative surgery. Hypoparathyroidism occurs in 10%–20% of reoperative parathyroidectomy patients with the resulting hypocalcemia often necessitating additional medical care or inpatient hospitalization [2,7], demonstrating the magnitude of the dangers of reoperation.

The overall morbidity, mortality, and readmission rates after reoperative parathyroidectomy have not been investigated. Recently, readmission and mortality rates have generated significant interest as quality measures defined by the Centers for Medicare and Medicaid Services [8]. For now, these measures are only publically available for a discrete set of conditions; however, there are plans to expand the reported outcome measures to provide further transparency. Given the additional risk associated with reoperative parathyroid surgery, a clear understanding of the association with mortality and readmission rates may be useful to patients and providers.

In this study, we sought to examine the patient and provider characteristics associated with reoperative parathyroidectomy and to determine the generalized risks associated with reoperation in a multi-institutional cohort.

2. Methods

We performed a retrospective cohort study using data from the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) Participant Use File (PUF) from 2008 to 2011. The Participant Use Files were obtained from the ACS NSQIP website. The Participant Use Files are compliant with the Health Insurance Portability and Accountability Act, and as such, no identifying hospital, patient, or provider information is included [9]. The validity of the ACS NSQIP data has been described elsewhere [10–12]. In 2008, 211 hospitals participated in the program, and in 2011, 315 hospitals participated. Data were collected for 240 variables describing patient characteristics, preoperative and postoperative events, and mortality rates [13].

Patients undergoing parathyroidectomy were identified by the current procedural terminology codes for the procedures: initial parathyroidectomy is classified as 60500 and reoperative parathyroidectomy 60502. Patients aged <18 y were excluded. Patients who received long-term dialysis, those taking immunosuppressant agents, and those with abnormal preoperative creatinine levels were excluded to restrict the study to patients with primary hyperparathyroidism. Patients undergoing parathyroid autotransplantation were identified by current procedural terminology code 60512.

Patient characteristics examined in this study included: age, race (American Indian, Asian, black or African American, Pacific Islander, other, and unknown), gender, American Society of Anesthesiologist Physical Status class (ASA class), and body mass index (BMI). We categorized BMI (kg/m^2) into underweight (BMI<18.5), normal (18.5–24.9), overweight (25.0–29.9), and obese (>30.0) using the World Health Organization classification system [14]. ASA class was categorized according to established criteria into class 1 (normal and healthy), class 2 (mild systemic disease), class 3 (severe systemic disease), class 4 (severe systemic disease i.e., a constant threat to life), class 5 (moribund), and class 6 (brain-dead, with organs being removed for donation purposes) [15]. Medical comorbidities examined included: diabetes mellitus, ventilator dependence, history of chronic obstructive pulmonary disease, current pneumonia, ascites, esophageal varices, congestive heart failure, history of myocardial infarction, previous percutaneous coronary intervention and previous cardiac surgery, angina, hypertension requiring medication, peripheral vascular disease, current rest pain, history of cerebrovascular accident, history of transient ischemic attack, hemiplegia, paraplegia or quadriplegia, history of a central nervous system tumor, presence of a disseminated cancer, presence of an open wound or wound infection, current steroid use, recent weight loss of >10% of body weight in the last 6 mo, presence of bleeding disorders, recent blood transfusion, recent administration of chemotherapy, and recent administration of radiation therapy. Perioperative variables examined were surgeon specialty, resident participation in the case, inpatient *versus* outpatient status, operative duration, and surgical length of stay.

The primary outcome variable of interest was readmission. Readmission was a new variable included in the database for the first time in 2011. It is recorded as a binary variable reflecting a readmission to any hospital within 30 d after the index surgical procedure. Secondary outcomes of interest included 30-d morbidity and 30-d mortality. A composite variable was created to capture any morbidity within 30 d, including wound infection, pneumonia, wound dehiscence, reintubation, pulmonary embolus, failure to wean from ventilator, renal insufficiency, cardiac arrest, myocardial infarction, urinary tract infection, septic shock, sepsis, neurologic deficiency, postoperative bleed, deep venous thrombosis, and cerebrovascular accident.

Descriptive statistics were performed. To compare the association between patient characteristics and postoperative outcomes, the Wilcoxon rank-sum test, the Fisher exact test, and the chi-squared test were used, as appropriate. Multivariate logistic regression was used to examine the association between reoperation and outcomes of interest with adjustment for patient characteristics significantly associated with both reoperation and each individual outcome studied. Independent models were created for each outcome of interest. The readmission model used only patients from 2011 due to the unavailability of data for the early cohort. A P value <0.05 was considered statistically significant. All data were