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Safety of Outpatient Thyroidectomy: Review of the American College of Surgeons National Surgical Quality Improvement Program

Eamon J. McLaughlin, MD; Jason A. Brant, MD; Andres M. Bur, MD; John P. Fischer, MD; Jinbo Chen, PhD; Steven B. Cannady, MD; Ara A. Chalian, MD; Jason G. Newman, MD

Objectives/Hypothesis: To investigate national trends in admission status after thyroidectomy in the United States and to evaluate the factors associated with 30-day unplanned readmission and reoperation.

Study Design: Retrospective review of American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP)

Methods: The ACS-NSQIP database was queried for patients who underwent a partial or total thyroidectomy between 2005 and 2014. Outpatient surgery was defined as discharge on the day of surgery. Patient demographic information, unplanned hospital readmission, and reoperation were reviewed. Risk factors were identified using logistic regression modeling.

Results: A total of 76,604 cases met inclusion criteria as described above. There were 1,473 (1.9%) patients who underwent reoperation and 477 unplanned 30-day readmissions (1.4%) for procedures performed since 2012. There was a significant positive trend in the percentage of thyroidectomy (partial and total) patients who underwent outpatient procedures by year of operation (P < .001). Outpatient procedures were not more likely to have unplanned readmissions or reoperations. Independent patient risk factors for unplanned readmission and reoperation included current dialysis, chronic steroid use, unintentional weight loss, American Society of Anesthesiologists class 3 to 4, and active bleeding disorders.

Conclusions: Over the past decade there has been a clear trend toward increasing outpatient thyroid surgery. Thyroidectomy performed as an outpatient was not found to be an independent risk factor for readmission or reoperation. Patients with serious medical comorbidities and active bleeding disorders are at increased risk of unplanned readmission or reoperation and should have their surgery performed on an inpatient basis.

Key Words: Thyroid surgery, outpatient surgery, postoperative complications, readmission.

Level of Evidence: 2c.

INTRODUCTION

Thyroid surgery has traditionally been performed as an inpatient procedure. However, with increased awareness of the risks of hospitalization and emphasis on reduction of healthcare costs, there has been rising interest in performing thyroidectomy as an outpatient procedure.1–3 There have been numerous studies investigating what factors should be used to decide whether or not to admit patients overnight following thyroidectomy.4–10 Previous studies demonstrated a trend toward thyroidectomy being performed on an outpatient basis; however, there have not been any recent large-scale investigations of the trends (since 2006) in this practice over time.11–13

Concerns of outpatient thyroid surgery are primarily related to postoperative complications that would lead to significantly increased morbidity and mortality if they occurred in an outpatient setting. These include hematoma causing airway compromise, hypocalcemia, and vocal cord paresis leading to airway obstruction.11,14 In 2013, the American Thyroid Association published their statement on outpatient thyroidectomy.15 This consensus statement provided an outline of how to select patients for ambulatory surgery; however, the risks and benefits of inpatient versus outpatient thyroid surgery continue to be debated.

The American College of Surgeons National Surgical Quality Improvement Program database provides validated, risk-adjusted information on surgical procedures and patient characteristics from a large number of cases, and a variety of practice settings from across the United States. This served as an ideal patient sample to investigate trends in thyroid surgery and to determine patient characteristics that should be considered in the decision of whether or not to admit patients following thyroid surgery.

MATERIALS AND METHODS

The 2005 to 2014 American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) databases were reviewed identifying encounters for which partial or total thyroidectomy was included as the primary procedure. Reviewed
cases were those that included any of the following 2012 Current Procedural Terminology (CPT) codes: 60210, 60212, 60220, 60225, or 60240. Cases with the CPT code listed as 60240 were considered total thyroidectomies, all others were considered partial thyroidectomy. Only cases listed as being admitted from home were included. Deidentified patient information is freely available to all institutional members who comply with the ACS-NSQIP Data Use Agreement. The Data Use Agreement implements the protections afforded by the Health Insurance Portability and Accountability Act of 1996. This study was determined to be exempt by the institutional review board of the Hospital of the University of Pennsylvania.

Patient encounters were identified within the participant use data files of the ACS-NSQIP, which in 2014 included 517 community and academic hospitals throughout the United States, with 323 variables for each case. Data are collected by trained nurses at participating institutions through systematic sampling of general and vascular operations performed. Each variable in the database is specifically defined, and data collectors are periodically audited to ensure standardization and accuracy of the content. To ensure a 30-day follow-up period, patients are contacted by letter or telephone survey following discharge. The list and definitions of variables collected in the database can be found at the ACS-NSQIP website (http://www.acsnsqip.org). In addition to the predefined ACS-NSQIP variables, we calculated body mass index (BMI) (in kilograms per square meter) for each encounter. Operative time was converted to hours and age to decades for analysis. Race variables were condensed to white, black/African American, other, and unknown. Additional reoperation and readmission information is available for cases that were performed after 2012. Specifically, the variable for unplanned 30-day readmission is only available for data since 2012.

The primary outcome of interest was the proportion of cases performed as outpatients. The ACS-NSQIP variable for admission status was determined by the local hospital's own definition of what qualifies as outpatient, which potentially includes patients who were observed for 23 hours. For this study, we defined an outpatient procedure as zero days between the date of the procedure and the date of discharge. Therefore, the definition of outpatient used throughout this study is a same-day discharge procedure.

The proportion of outpatient cases was analyzed by operative year and partial versus total thyroidectomy. Additionally, logistic regression was performed to determine patient or surgical factors affecting the primary outcome measure including operative year, BMI, age (decades), operative time (hours), gender, race, diabetes status, smoking, history of chronic obstructive pulmonary disease, history of congestive heart failure, hypertension requiring medications, distant cancer, total thyroidectomy, dyspnea on exertion, presence of ascites, current dialysis, chronic steroid use, unintentional weight loss, bleeding disorder, transfusion, and American Society of Anesthesiologists (ASA) class. To focus on routine outpatient cases, those assigned ASA class of 5 or not assigned an ASA class were excluded from analysis. To obtain the variables included in the final model, univariate comparison of the above variables was performed using Pearson $\chi^2$ for categorical variables or Mann-Whitney tests for continuous variables. Those variables with $P < .2$ on univariate tests and less than 10% missing data were included in the preliminary logistic model. Only cases with complete data for the variables of interest were included. A forward and backward stepwise regression algorithm was then used to select the best model by minimizing the Akaike information criterion. Variables with $P < .05$ on the final multivariate logistic model were considered significant. Additional information about readmissions is available for cases after 2012. For outpatient cases in this subset of years, additional analysis was performed to determine variables that were risk factors for hospital readmission. Data processing and analysis was performed with Microsoft R Open version 3.2.3, via RStudio version 0.99.467 (RStudio, Boston, MA).

### RESULTS

A total of 76,604 cases met inclusion criteria. Of these, 35,264 cases were performed from 2012 to 2014. Overall, 14,187 (18.5%) surgeries were performed as an outpatient.

Demographic data are shown in Table I. The mean time from operation to discharge for those admitted was 1.33 days (standard deviation [SD] 2.17 days). Mean age was 51.6 years (SD 14.6). The mean BMI was 29.9 (SD 7.42). There were 1,473 (1.9%) patients who underwent reoperation within 30 days. There were 477 unplanned 30-day readmissions (1.4%) for procedures performed since 2012. General surgeons performed 60,037 (78%) procedures, whereas 16,516 (22%) were performed by otorhinolaryngologists.

Linear regression modeling revealed a significant positive trend in the percentage of outpatient thyroidectomies by year of operation ($P < .001$, slope = 1.4%/yr) (Fig. 1). This was true for both partial ($P < .001$, slope 2.2%/yr) and total thyroidectomies ($P < .001$, slope 0.8%/yr) (Fig. 2). Conversely, similar analysis of the percentage of 1-day admissions by year of operation revealed a negative trend ($P < .001$, slope = −1.6%/yr). Logistic regression determined that the following variables were independently correlated with the likelihood of having inpatient surgery: total thyroidectomy (versus partial), patients with dyspnea (at rest or exertion), on dialysis, those with bleeding disorders, African American race, or ASA class 3 or 4 (Fig. 3). The operative year was associated with a decreased likelihood of having inpatient surgery.

### TABLE I. Patient Demographics.

<table>
<thead>
<tr>
<th>Category</th>
<th>All Patients</th>
<th>Outpatient</th>
<th>Inpatient</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>76,604</td>
<td>14,187</td>
<td>62,413</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Age, yr</td>
<td>51.66 (SD 14.62)</td>
<td>50.14 (SD 14.33)</td>
<td>52 (SD 14.67)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Female, no.</td>
<td>62.219 (81.1%)</td>
<td>11,480 (80.9%)</td>
<td>50,635 (81.1%)</td>
<td>.71</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>29.92 (SD 7.42)</td>
<td>28.83 (SD 6.84)</td>
<td>30.16 (SD 7.53)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Partial thyroidectomy, no.</td>
<td>35,002 (45.7%)</td>
<td>10,341 (72.9%)</td>
<td>24,659 (39.5%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Total thyroidectomy, no.</td>
<td>41,602 (54.3%)</td>
<td>3,846 (27.1%)</td>
<td>37,754 (60.5%)</td>
<td></td>
</tr>
</tbody>
</table>
Multivariable logistic analysis of the subset of cases performed in or after 2012 revealed a significant decrease in unplanned 30-day hospital readmissions by operative year (odds ratio [OR]: 0.86, 95% confidence interval [CI]: 0.79-0.94). This trend was apparent for both in- or outpatient procedures (Fig. 4). Additionally, this analysis found that inpatient surgery was an independent risk factor for unplanned hospital readmission (OR: 1.32, 95% CI: 1.08-1.64). Other independent risks factors for unplanned readmission are shown in Figure 5.

Patient factors impacting unplanned reoperation (within 30 days) were also evaluated. Inpatient surgery was again found to be a statistically significant independent risk factor for unplanned reoperation (OR: 1.22, 95% CI: 1.06-1.42). The full list of independent factors is shown in Figure 6.

**DISCUSSION**

This study represents one of the largest to date investigating trends in inpatient versus outpatient thyroid surgery across a wide variety of practice settings in the United States. There has been a clear trend toward increasing rates of outpatient thyroidectomy performed over time (Fig. 1). This was true for both partial and total thyroidectomy (Fig. 2). In 2013 and 2014, more than 25% of thyroidectomies were performed on an outpatient basis. Of note, there was a decrease in the percentage of outpatient procedures from the years 2005 to 2006. The exact reason for this is unclear. However, the authors postulate that the low number of total recorded procedures in 2005 (1,148 compared to 3,238 in 2006) may allow for increased variability for this year that resolved as the total number of cases increased in subsequent years. Because there are no data from before 2005 available, we are unable to further investigate this portion of the trend. Regardless, the trend remains clear for the following years where much more robust populations are available for evaluation. Patients undergoing total thyroidectomy were still more likely to be treated as an inpatient than those undergoing partial thyroidectomy (OR: 3.26, 95% CI: 3.12-3.40).

Additionally, patient comorbidities impact the decision for admission. Our analysis revealed patients with dyspnea (at rest or with exertion), a bleeding disorder (including active anticoagulation), current dialysis, longer operative times, or those classified as ASA class 3 or 4 were more likely to be admitted (Fig. 3). African American race was a statistically significant, although weak factor (OR: 1.2, 95% CI: 1.13-1.29) for having inpatient surgery, even controlling for other patient risk factors. The reason for this is unclear, but has been previously demonstrated. It is difficult to interpret why the race groups unknown (OR: 0.77, 95% CI: 0.72-0.82) and other...
(OR: 0.89, 95% CI: 0.82-0.99) would have a trend toward more outpatient procedures due to the heterogeneity represented in these groups. Using both the Nationwide Inpatient Sample and State Ambulatory Surgery and Services Databases, Al-Qurayshi et al.\(^\text{15}\) showed Hispanics were more likely to have outpatient thyroidectomies, whereas Native Americans and Asian Americans were more likely to have their procedures performed as an inpatient. However, the reasons behind this remain unknown. The variables of ASA 2, non–insulin dependent diabetes, smoker age, hypertension requiring medications, and BMI were also found to be statistically significant. However, they all had ORs of less than 1.12, and the lower limits of their 95% CIs were all less than 1.04. With such low ORs, the clinical significance of these variables impacting the decision to perform a total thyroidectomy as an inpatient is unclear.

Current guidelines from the American Thyroid Association for outpatient thyroidectomy include both preoperative criteria and postoperative requirements that must be met before discharging a patient the same day after thyroidectomy. The objective preoperative measures that are contraindications are no major comorbidities or ASA class 4. Relative contraindications include uncompensated cardiac or respiratory disease, anticoagulation or antiplatelet therapy, seizure disorder, anxiety disorder, obstructive sleep apnea, hearing loss, visual impairment, mental impairment, and pregnancy.\(^\text{16}\) The guidelines also include various social and operative variables for determining optimal candidates for outpatient surgery. These include proximity to a hospital, social support, communication barriers, and patient preference for inpatient surgery. These variables can be as important as objective measures, but are not easily captured in large databases.

The factors influencing inpatient surgery found in this study largely correlate with existing American Thyroid Association recommendations, which were published

<table>
<thead>
<tr>
<th>Odds Ratios with 95% CI</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Thyroidectomy</td>
<td>.326 (3.12-3.40) &lt;.001</td>
</tr>
<tr>
<td>ASA: Life Threat</td>
<td>2.98 (1.69-5.31) &lt;.001</td>
</tr>
<tr>
<td>Current Dialysis</td>
<td>2.55 (2.01-3.73) &lt;.001</td>
</tr>
<tr>
<td>Dyspnea at Rest</td>
<td>1.89 (1.32-2.70) &lt;.001</td>
</tr>
<tr>
<td>History of Bleeding Disorder</td>
<td>1.81 (1.45-2.37) .001</td>
</tr>
<tr>
<td>Operative Time (hrs)</td>
<td>1.75 (1.70-1.81) &lt;.001</td>
</tr>
<tr>
<td>ASA 3: Severe Disturb</td>
<td>1.46 (1.36-1.61) &lt;.001</td>
</tr>
<tr>
<td>Dyspnea w/ Mod Exertion</td>
<td>1.48 (1.34-1.64) &lt;.001</td>
</tr>
<tr>
<td>Weight Loss</td>
<td>1.28 (0.96-1.75) .11</td>
</tr>
<tr>
<td>Race: Black or African American</td>
<td>1.20 (1.15-1.25) &lt;.001</td>
</tr>
<tr>
<td>Chronic Steroid Use</td>
<td>1.16 (0.99-1.37) .06</td>
</tr>
<tr>
<td>ASA 2: Mild Disturb</td>
<td>1.12 (1.04-1.19) .001</td>
</tr>
<tr>
<td>Non–Insulin Dep. Diabetes</td>
<td>1.11 (1.02-1.21) .01</td>
</tr>
<tr>
<td>Smoker</td>
<td>1.09 (1.03-1.16) .002</td>
</tr>
<tr>
<td>Insulin Dep. Diabetes</td>
<td>1.00 (0.99-1.01) .08</td>
</tr>
<tr>
<td>Age (decade)</td>
<td>1.07 (1.05-1.09) &lt;.001</td>
</tr>
<tr>
<td>HTN Req Meds</td>
<td>1.06 (1.01-1.11) .02</td>
</tr>
<tr>
<td>BMI (kg/m2)</td>
<td>1.01 (1.01-1.01) &lt;.001</td>
</tr>
<tr>
<td>Race: Other</td>
<td>0.89 (0.82-0.98) .01</td>
</tr>
<tr>
<td>Year of Operation</td>
<td>.87 (.87-.88) .001</td>
</tr>
<tr>
<td>Race: Unknown</td>
<td>0.77 (.72-.82) &lt;.001</td>
</tr>
</tbody>
</table>

**Fig. 3.** Patient factors impacting thyroidectomy being performed as an inpatient. ASA = American Society of Anesthesiologists; BMI = body mass index; CI = confidence interval; HTN = hypertension.

**Fig. 4.** Recent trends in thyroidectomy unplanned readmission rates (since 2012). ASA = American Society of Anesthesiologists; BMI = body mass index; CI = confidence interval.
in 2013. Almost all of the surgeries evaluated in this study were performed before these guidelines existed.

Since 2012, there has been a downward trend in unplanned readmissions for patients undergoing both inpatient and outpatient thyroidectomy (Fig. 4). This is reassuring, because as the rate of outpatient procedures has increased there has not been a coinciding increasing rate of complications requiring readmission. When evaluating individual factors associated with increased unplanned readmission, undergoing inpatient thyroidectomy was a statistically significant, although relatively weak, independent risk factor (OR: 1.32, 95% CI: 1.08-1.64). In addition, dialysis, bleeding disorders, chronic steroid use, unintentional weight loss, and ASA class 3 and 4 were all independent risk factors for unplanned readmission (Fig. 5). The ACS-NSQIP variable for unplanned readmission includes all unplanned readmissions within 30 days of the original procedure, so this variable should not include completion thyroidectomies. Having a total thyroidectomy was not protective of readmission, but rather approached statistical significance toward an increased risk of an unplanned readmission (OR: 1.17, 95% CI: 1.00-1.37). The factors of chronic steroid use and unintentional weight loss are likely surrogates for underlying chronic medical conditions. Although obesity (BMI >30) was also found to be a statistically significant risk factor, with an OR of 1.33 (95% CI: 1.09-1.64), its clinical significance is not as obvious as the other factors.

Inpatient thyroidectomy was also a statistically significant (although again weak) independent risk factor for an unplanned return to the operating room (OR: 1.22, 95% CI: 1.06-1.42). In addition, current dialysis, bleeding disorder, unintentional weight loss, a diagnosis of cancer, and ASA 4 were independent risk factors for return to the operating room. Total thyroidectomy was associated with a decreased risk of returning to the operating room (Fig. 6). The ACS-NSQIP variable for return to the operating room includes all major procedures in the 30-day postoperative period. This likely includes some completion thyroidectomies, which is likely why having a total thyroidectomy was found to be protective in this analysis. The fact that a diagnosis of cancer was a predictor of reoperation is also likely explained (at least partially) by the need for completion thyroidectomies (OR: 1.78, 95% CI: 1.04-2.84). Operative time, ASA 3, and male patients were all statistically significant risk factors, but with ORs of less than 1.5 their clinical significance is questionable.

Numerous previous smaller studies have demonstrated the safety of outpatient thyroidectomy. However, interpreting the current data on outpatient thyroidectomy needs to be done carefully based on the varying definition of outpatient status. Patients who undergo 23-hour observation are frequently classified as outpatient by the hospital for a variety of reasons. Other studies classify outpatient procedures as only those performed at an outpatient surgery center. When these data points are combined with true same-day surgery patients, it can convolute the author’s conclusions. In our analysis of the ACS-NSQIP database, we defined outpatient surgery as a same-day discharge (days from operation to discharge equal to zero). However, if we would have
performed the same analysis using the ACS-NSQIP definition of outpatient (which is left to the discretion of the reporting hospital), over 65% of thyroidectomies performed in 2014 were classified as outpatient (actual 28%).

Although our linear regression determined inpatient thyroidectomy to be a weak independent risk factor for both unplanned readmission and reoperation for unplanned readmission and return to the operating room, this regression was calculated using a finite number of predetermined patient variables. Therefore, this association is likely due to patient comorbidities that we could not easily test for using the ACS-NSQIP database. The more important conclusion to draw from these data is that outpatient procedures were not associated with an increased risk of unplanned readmission or reoperation. There has been a downward trend in both of these variables over time, as operative year was found to be a statistically significant protective factor for both unplanned readmission (OR: 0.86, 95% CI: 0.78-0.94) and reoperation (OR: 0.89, 95% CI: 0.88-0.91).

This study’s limitations are those inherent to a respective analysis of a large national patient database. The ACS-NSQIP is designed to track a wide range of operations, and therefore not all variables are procedurally or anatomically specific. As with all large databases, missing and inaccurate data pose a significant challenge in the ACS-NSQIP and is a limitation of this study. Although numerous statistical approaches are employed to limit the effects of missing data in the ACS-NSQIP, these methods are imperfect, and missing data remain limitations of large database studies. Studies that have evaluated the ACS-NSQIP’s data abstraction process have shown that although it is generally accurate, there are limitations. Through direct comparison of patients’ medical records and ACS-NSQIP data files, Awad and colleagues demonstrated that although the ASC-NSQIP accurately records major complications, minor complications were only recorded in 33% of cases. We are limited to the variables that are collected by the database, and as previously mentioned, we must carefully evaluate the definitions of variables when drawing conclusions on our data. In addition, analysis of the ACS-NSQIP database by predetermined variables necessitates including variable subgroups that might have little to no clinical relevance, including the race categories of unknown or other and the ASA 5 classification.

CONCLUSION

Over the past decade there has been a clear trend toward increasing outpatient thyroid surgery. There has been no associated increase in unplanned hospital readmissions. In addition, a thyroid surgery performed as an outpatient was not found to be an independent risk factor for readmission or reoperation. Our analysis of a large, national surgical database leads us to conclude that patients with serious chronic diseases (demonstrated here by unintentional weight loss, chronic steroid use, and current dialysis), those with bleeding disorders (including active anticoagulation), and those with an ASA 3 or 4 class are at increased risk of readmission or reoperation and should have their surgery performed on an inpatient basis.

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BIBLIOGRAPHY