


Ambulatory Surgery vs Overnight Observation for Total Thyroidectomy: Cost Analysis and Outcomes

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Abstract

Objective. To compare financial impact between patients undergoing ambulatory (same-day discharge) vs overnight admission after total thyroidectomy while showing associated surgical outcomes.

Study Design. Retrospective review.

Setting. University of Alabama at Birmingham Medical Center from October 2011 and July 2017.

Methods. Patients undergoing total thyroidectomy without concurrent procedures were selected for review. Demographics, comorbidities, admission status, postoperative outcomes including minor and major complications, charges, and costs were collected. Admission status was categorized as inpatient (admission to hospital ≥ 1 night) or outpatient (discharged from the postoperative recovery unit). Costs were obtained from all related hospital, clinic, and emergency department visits at the University of Alabama at Birmingham within 30 days of the original surgery. After statistical analysis, outcomes and costs were compared between inpatient and outpatient total thyroidectomy patients.

Results. Of 870 total thyroidectomy patients included for analysis, 367 (42.2%) met outpatient criteria. A total of 169 patients (19.4%) had a complication, and only hypocalcemia occurred significantly more in the inpatient group (14.3% vs 9.26%; $P < .05$). No complications occurred more frequently in the outpatient population. There were no mortalities. There was a statistically significant difference between the total cost of inpatient and outpatient thyroidectomies, with outpatient surgery costing on average \$2367.27 less per patient ($P < .0001$).

Conclusion. Outpatient total thyroidectomy can lead to cost reduction in highly selected patients who have few comorbidities while remaining safe for the patient.

Keywords

total thyroidectomy, cost analysis, ambulatory surgery

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Trends over the past 30 years have led to an increase in the utilization of ambulatory surgery. Ambulatory surgery has many benefits over inpatient surgery, including patient convenience, potential lower health care costs, less exposure to nosocomial organisms, and increased patient comfort when recovering in their home environment. The current body of literature has demonstrated that thyroid surgery can be done safely and effectively on an outpatient basis.¹⁻⁷ Furthermore, in recent years, there has been an increasing trend in outpatient thyroid surgeries performed, and this trend has recently expanded to include total thyroidectomy in addition to thyroid lobectomy.⁸ With this collective literature, Terris et al⁹ developed a statement in conjunction with the American Thyroid Association on outpatient thyroidectomy and admission/discharge criteria.

Outpatient partial thyroid surgery (thyroid lobectomy or completion thyroidectomy) has been shown to be associated with a low complication and rehospitalization rate.¹ Patients with a low comorbidity profile do very well following surgery without being hospitalized. Patients with multiple comorbidities, chronic diseases, bleeding disorders, or undergoing concomitant procedures are more appropriately managed in the inpatient setting.^{1,2,9} Most studies to date focus on the safety of all thyroid surgery types in an outpatient vs inpatient setting, with most cases representing partial thyroid surgery.^{1,2,4,5,8,10} Only a few have addressed the safety of a total thyroidectomy alone in an outpatient setting.^{7,11} This study provides new data that strictly involve total thyroid surgery, which inherently poses more risk and likely expense to the patient and health care system.

Although outpatient thyroid surgery has been proven to be safe,¹⁻⁷ patients undergoing a total thyroidectomy have a

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higher complication rate than those who undergo partial thyroid surgery. Complications include hypocalcemia, vocal cord paralysis, and hematoma formation.¹ These complications are often attributed to the longer surgical time, bilateral recurrent laryngeal nerve and parathyroid exposure, and broader dissection with potential for hematoma formation. These complications have the potential to place patients at increased morbidity and mortality, particularly if they occur outside of a monitored setting.⁴ They are also associated with greater health care costs, which include emergency department visits, additional clinic visits, emergency transportation from outside medical facilities, and hospital readmission.⁶

As medicine continues to move toward a more fiscally responsible model, it is crucial to determine where costs can and cannot be safely reduced. As the percentage of ambulatory thyroid operations increases, we must ensure that the benefit of convenience, reduced cost, and increased satisfaction does not come at the expense of patient safety. Through this study at University of Alabama at Birmingham (UAB), a large tertiary care medical center, we seek to examine cost-effectiveness of performing total thyroid surgery as an outpatient procedure while considering surgical outcomes.

Methods

After University of Alabama at Birmingham Institutional Review Board approval, the database was collected and completed. *Current Procedural Terminology (CPT)* codes for thyroidectomy were used to identify patients for our study. The population was operated on between October 2011 and July 2017, at the University of Alabama at Birmingham Medical Center (Birmingham, Alabama). Inclusion criteria included patients who underwent total thyroidectomy and had available medical records, operative reports, and financial data. Patients who underwent lobectomy (partial, subtotal, or completion), concurrent neck dissection, or other additional procedures were excluded. After accounting for duplicates and missing data, a total of 870 patients were included in the final study population.

A retrospective chart review was performed to complete the database. Demographics recorded included admission status, surgical indication, age, sex, body mass index (BMI), antiplatelet therapy (including 81 mg aspirin), anticoagulation therapy, tobacco use (within past 6 months), alcohol use (within past 6 months), select comorbidities, and American Society of Anesthesiologists (ASA) status. Admission status was recorded as inpatient (admission to hospital or remaining in postoperative recovery unit overnight) or outpatient (discharged from the postoperative recovery unit) on the same day as surgery. The admission decision was ultimately made at the surgeon's discretion, but adherence to guidelines similar to those set forth in the statement created by Terris et al⁹ was generally employed. Admission was decided postoperatively in all patients, and none was deemed a "planned admission" preoperatively. Comorbidities recorded in our study were chronic obstructive pulmonary disease (COPD), diabetes mellitus (DM), hypertension (HTN), chronic kidney disease (CKD), dialysis dependence, coronary artery disease

(CAD), congestive heart failure (CHF), cardiac arrhythmia, and chronic steroid use. Presence of a surgical drain was noted. When available, preoperative thyroid ultrasound (US) parameters, final surgical pathology dimensions, and thyroid mass were recorded.

Perioperative complications and mortality were extracted from patient documentation. Complications included were recurrent laryngeal nerve (RLN) injury, hypoparathyroidism/hypocalcemia (both biochemical and symptomatic), neck hematoma, surgical site infection, return to the operating room (ROR), and other (defined as any medical or surgical complication not otherwise listed above that led to further hospitalization or provider intervention). RLN injury was categorized as "paresis" or "paralysis" based on postoperative office flexible fiber-optic laryngoscopy. Patients were designated with "paresis" if any diminished movement was found and "paralysis" if this persisted 6 months after surgery. Postoperative follow-up varied but occurred within 14 days of the primary surgery in all patients. Hypoparathyroidism/hypocalcemia was categorized into 3 broad categories based on likely financial impacts: symptomatic, hospitalized, and persistent. "Symptomatic" required an abnormal lab value (normal serum calcium: 8.4-10.4; normal ionized calcium: 1.12-1.32) and documentation of 1 or more of the following symptoms: cramping, muscle weakness, numbness, paresthesia, confusion, fatigue, and seizures and was documented. "Hospitalized" patients met "symptomatic" criteria but were also admitted to the hospital for at least an overnight stay at any point within 30 days of surgery. "Persistent" hypocalcemia involved "symptomatic" criteria lasting greater than 30 days from surgery. Outpatients were not discharged with specific calcium supplementation, and inpatients were only given calcium supplementation if hypoparathyroidism/hypocalcemia was a concern based on symptoms and/or laboratory values.

Finally, charges and cost were obtained from all hospital, clinic, and emergency department visits at the UAB within 30 days of the patient's original surgery. A "charge" refers to the original bill or request for money from the hospital system while a "cost" represents the actual money exchanged for services from the payor to the hospital system. The charges and cost of the original surgical encounter were included. Once collected, these encounters were reviewed to determine their relevance to the original thyroidectomy. Encounters were excluded if they pertained to an unrelated medical or surgical issue.

Statistical Analysis

Statistical analyses were performed using SPSS (version 26; SPSS, Inc) and included independent *t* tests, χ^2 tests, and 1-way analyses of variance (ANOVAs) to evaluate potential relationships between costs, diagnoses, comorbidities, and complication rates between inpatient and outpatient populations. In addition, χ^2 goodness of fit was used to analyze differences in comorbidities and complications within the inpatient group. Statistical significance was defined as *P* values less than .05.

Results

In total, 870 patients were included. The average age was 48 (47.86 ± 15.53) years. The population was predominantly female (81%). Patient populations had a similar BMI (30.69 ± 7.56), 17.8% (155) were active smokers, and 22.4% (195) of the patients drank alcohol. Analysis of the ASA physical status classification scores revealed an average score of 2.59 ± 0.57 , with the mode score being 3 ($n = 495$). Population characteristics are summarized in **Table 1**. Hypertension was the most common comorbidity, with 377 (43.3%) patients diagnosed at the time of surgery followed by diabetes mellitus at 14.3%. Almost all comorbid conditions were associated with a higher likelihood of inpatient admission with the exceptions of dialysis and chronic steroid use. The comorbidities of the patients are listed with frequencies within our cohort in **Table 2**.

There were 503 (57.8%) inpatients based on the criteria described above while 367 (42.2%) fell into the outpatient category. Thyroidectomies were performed on 40.6% of patients for multinodular goiters, 26.2% for hyperthyroidism, 17.5% for thyroid nodules, 14.4% for biopsy-proven thyroid malignancy (90.4% papillary thyroid carcinomas), 0.5% for amiodarone-induced thyrotoxicosis, and 0.3% for multiple endocrine neoplasia type 2A. Drains were placed in 51.7% ($n = 450$) of patients after their thyroidectomy. Of these 450 patients, 441 (98.0%) were inpatients, and only 9 patients were discharged with drains. From the available data, the mean preoperative thyroid US volume was $90.02 \pm 87.49 \text{ cm}^3$ (**Table 1**).

Postoperative complications are summarized in **Table 3**. Hypoparathyroidism/hypocalcemia was the most common postoperative complication, affecting 12.2% ($n = 106$) of all patients. This was significantly more common in the inpatient group than the outpatient cohort (14.3% vs 9.3%; $P = .027$). Recurrent laryngeal nerve injury was the second most common complication, occurring in 4.0% ($n = 35$) of patients. There was no significant difference in rate of RLN injury in the 2 populations. The rates of neck hematoma, infection, and ROR were 1.7%, 0.1%, and 1.4%, respectively, and no significant difference was found between admission status cohorts. There were no deaths within 30 days of surgery in our population.

The average cost for a total thyroidectomy and subsequent related visits within 30 days of surgery was $\$8526.16 \pm \6805.51 , regardless of admission status. When comparing averaged costs between the admission status cohorts (**Figure 1**), inpatient status cost significantly more ($\$9525$ vs $\$7158$; $P < .001$). The mean difference in costs between these groups was $\$2367$. Comorbidities associated with statistically significant increased costs were CHF ($\$11,871$ vs $\$8373$; $P = .028$) and arrhythmias ($\$13,517$ vs $\$8215$; $P = .048$). Total cost increased with progressive increases in ASA scores ($P < .001$) and the placement of a drain had a statistically significant association with total costs ($\$9639$ vs $\$7334$; $P < .001$). Analyzing total costs in the setting of postoperative complications revealed significant differences with hypoparathyroidism/hypocalcemia ($\$9952$ vs $\$8328$;

Table 1. Demographics and Clinical Variables (N = 870).^a

Patient characteristics	Value
Age, mean (SD), y	47.86 (15.53)
Sex	
Male	165 (19)
Female	705 (81)
BMI, mean (SD), kg/m ²	30.70 (7.56)
ASA status	2.59 (0.57)
1	17 (1.95)
2	342 (39.3)
3	495 (56.9)
4	17 (1.95)
Tobacco use	155 (17.8)
Alcohol use	195 (22.4)
Anticoagulation	13 (1.6)
Antiplatelet therapy	154 (17.7)
Diagnosis	
Multinodular goiter	353 (40.6)
Nodule	152 (17.5)
Hyperthyroidism	228 (26.2)
Papillary thyroid carcinoma	113 (13)
Medullary thyroid carcinoma	7 (0.81)
Amiodarone-induced thyrotoxicosis	4 (0.46)
Follicular neoplasm	3 (0.35)
MEN syndrome	2 (0.23)
Hurthle cell neoplasm	2 (0.23)
Hashimoto's thyroiditis	1 (0.12)
Other	6 (0.69)
Drain	450 (51.7)
Inpatient	440 (97.8)
Outpatient	10 (2.22)
Preoperative US volume, mean (SD), cm ³	90.02 (87.49)
Admission status	
Inpatient	503 (57.8)
Outpatient	367 (42.2)

Abbreviations: ASA, American Society of Anesthesiologists; BMI, body mass index; MEN, multiple endocrine neoplasia; US, ultrasound.

^aValues are presented as number (%) unless otherwise indicated.

$P = .021$), neck hematomas ($\$12,911$ vs $\$8449$; $P = .012$), and ROR ($\$20,789$ vs $\$8355$; $P = .020$) (**Figure 2**).

Discussion

The cost impact and safety of ambulatory thyroid surgery have been a recent area of investigation among the endocrine surgical community.^{1-8,12} However, most of the current literature includes partial thyroid surgery (ie, lobectomy, completion thyroidectomy) rather than isolating total thyroidectomies with respect to cost analysis. While safety takes precedent in patient care, these outcomes were not the primary purpose of our investigation. Our study provides the largest report of the financial impact of outpatient of total thyroidectomy to date.

Compared to thyroid lobectomy, total thyroidectomy carries increased perioperative risk with bilateral neck space

Table 2. Comorbidities and Admission Status.

Comorbidity	No. (% total)	Inpatient, No. (%)	Outpatient, No. (%)	P value ^a
Hypertension	377 (43.3)	240 (63.7)	137 (36.3)	<.001
Diabetes mellitus	123 (14.3)	90 (73.2)	34 (27.6)	<.001
COPD/asthma	79 (9.1)	49 (62.0)	30 (38.0)	.033
Coronary artery disease	54 (6.2)	45 (83.3)	9 (16.7)	<.001
Arrhythmias	51 (5.9)	42 (82.4)	3 (17.6)	<.001
Chronic heart failure	38 (4.4)	35 (92.1)	3 (7.9)	<.001
Chronic kidney disease	23 (2.6)	18 (78.3)	5 (21.7)	.007
Chronic steroid use	21 (2.4)	14 (66.7)	7 (33.3)	.127
Dialysis	7 (0.8)	7 (100)	0 (0.0)	

Abbreviations: COPD, chronic obstructive pulmonary disease.

^aP values bolded are significant (< 0.05).

Table 3. Postoperative Complications.

Complications	Total, No. (% total)	Inpatient, No. (%)	Outpatient, No. (%)	P value ^a
RLN injury	35 (4)	24 (68.6)	11 (31.4)	.188
Paresis	29 (3.3)	20 (69.0)	9 (31.0)	
Paralysis	6 (0.7)	4 (66.7)	2 (33.3)	
HPTH/HCA	106 (12.2)	72 (67.9)	34 (32.1)	.027
Symptomatic	85 (9.8)	52 (61.2)	33 (38.8)	
Hospitalized	15 (1.7)	14 (93.3)	1 (6.7)	
Persistent	6 (0.7)	6 (100)	0 (0.0)	
Hematoma	15 (1.7)	12 (80.0)	3 (20.0)	.079
Infection	1 (0.1)	1 (100)	0 (0.0)	1
ROR	12 (1.4)	9 (75.0)	3 (25.0)	.225
Death	0 (0.0)	0 (0.0)	0 (0.0)	

Abbreviations: HPTH/HCA, hypoparathyroidism/hypocalcemia; RLN, recurrent laryngeal nerve; ROR, return to operating room.

^aP values bolded are significant (< 0.05).

exposure and potential injury to the corresponding neck structures (parathyroids, recurrent laryngeal nerve, etc). Understandably, this leads to more frequent inpatient observation of total thyroidectomy patients postoperatively^{1,2,5} and subsequently a higher cost.

Sun et al⁸ estimated savings of \$63.6 million yearly between 1997 and 2006 as trends transitioned toward outpatient endocrine surgery. More recently, using the American College of Surgeons National Surgical Quality Improvement Program database, McLaughlin et al¹ showed continued increase in the frequency of outpatient thyroidectomies from 2005 to 2014; more than 25% of thyroidectomies occur on an outpatient basis. Several other studies have shown this can be done safely.²⁻⁷ However, all but 2 of these studies included partial thyroid surgery in their analysis. One study³ focused on total thyroidectomies in only patients with Grave's disease and had a relatively small cohort (n = 41) while the other⁷ had a larger population but was less than half the size of our current study (n = 410 vs 870). Neither study evaluated the financial impact of their interventions. Forty-two percent (n = 367/870) of total thyroidectomies were performed on an outpatient basis, enabling comparison of the correlating pecuniary effect.

Our study has demonstrated similar results to the above-cited literature; total thyroidectomies can be performed safely as an outpatient (ambulatory surgery) when patients are risk stratified into high- and low-risk groups. This is typically done at the surgeon's discretion and takes into account ASA, comorbidities, and intraoperative findings. In our analysis, the only complication that had a statistically significant difference between the cohorts was hypoparathyroidism/hypocalcemia, with this being more common in the inpatient group (14.3% vs 9.3%; *P* = .027). This is likely subject to some bias as inpatients were more likely to have lab studies drawn, revealing transient or chronic levels of hypocalcemia that may not have otherwise led to symptoms or intervention. The frequency of hypoparathyroidism/hypocalcemia in the groups combined was 12.2% (n = 106). Recent systematic reviews have noted this to range from 0.0% to 49%,^{13,14} with one addressing the huge variation in the definition of "postoperative hypoparathyroidism" among previously published literature on the subject.¹⁴ Given the wide range and lack of universal definition, it is difficult to interpret these data with confidence. However, our cohort's frequency of hypoparathyroidism/hypocalcemia does fall within this range. This was determined through

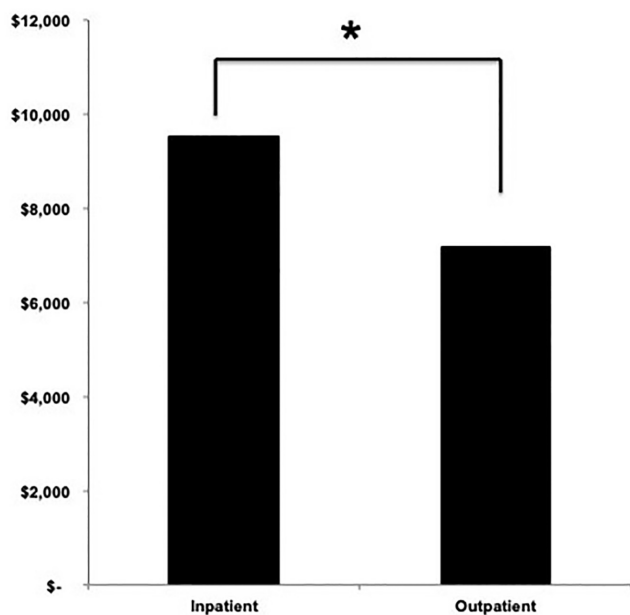


Figure 1. Comparison of admission status cost. * $P < .05$.

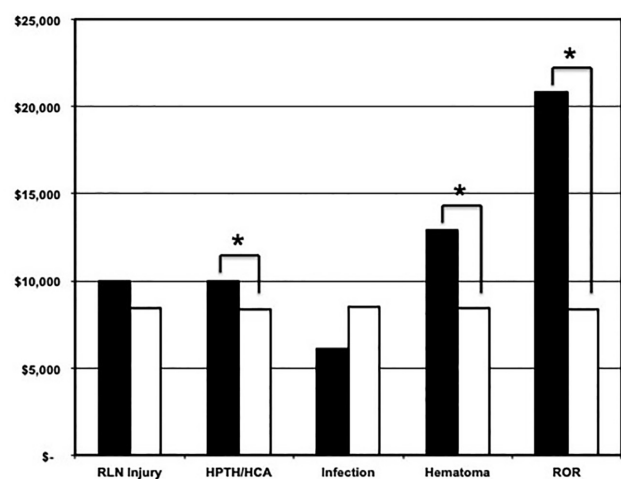


Figure 2. Comparison of cost associated with complications. HPTH/HCA, hypoparathyroidism/hypocalcemia; RLN, recurrent laryngeal nerve; ROR, return to operating room. * $P < .05$.

chart review and laboratory data analysis (when available) by 2 independent reviewers. Most patients with hypoparathyroidism/hypocalcemia fell into the category of “symptomatic” (80.2%, $n = 85/106$), which is likely to have the lowest financial impact of the 3 categories as these patients achieved symptom resolution with simple per os (PO) calcium supplementation (most commonly calcium carbonate 1250 mg twice daily) and no readmission. Overall, hypoparathyroidism/hypocalcemia led to higher costs to the health care system, with a ~\$1,600 increase in the average actual monetary exchange between providers and payers. When looked at more closely, hypoparathyroidism/hypocalcemia among inpatients resulted in \$2837.81 in increased total costs when compared to outpatients (\$10,861.97 vs \$8024.16; $P = .007$), suggesting that this group of inpatients

was likely deemed as “high risk” by the surgeon and admitted for observation. The incidence of the other complications did not occur significantly more or less between inpatients and outpatients, but neck hematomas and ROR resulted in even greater disparities in costs when they occurred (\$4461+ and \$12,434+, respectively). It is also worth noting the high percentage of thyroidectomies performed for hyperthyroidism (26.2%) in our cohort. Hyperthyroidism is a less common etiology for thyroidectomy in other studies, ranging from 2% to 9%,^{4,6} and likely less common in the general population. A higher complication rate in this population likely increases the readmission rate and therefore costs of their care. Potentially, this could translate to an even larger decrease in costs as most surgeons will more infrequently perform total thyroidectomies for hyperthyroidism. Drain placement was associated with increased costs because almost all patients with drains placed were monitored overnight, but drain placement was not predetermined or the sole reason for admission. This more likely represents concern for postoperative bleeding due to the extent of dissection and intraoperative bleeding or the preference of the surgeon. The number of thyroidectomies discharged the same day with drains was low ($n = 9$), and therefore a comparison and statistical analysis were not performed.

Finally, our data show a statistically significant reduction in costs when patients are discharged the same day as surgery (\$7157.49 vs \$9524.79; $P < .001$). Previous studies assessing the financial impact of ambulatory thyroid surgery do not isolate the total thyroidectomy population.^{5,6,8} Two of these studies^{5,6} only compared charges, not actual costs. Charges are based on hospital/facility-specific algorithms that lead to decreased ability to generalize when applying to the overall impact on the country’s health care system.¹⁵⁻¹⁷ We felt it important to analyze actual costs when assessing financial impact as this provides a better representation of the financial picture involved in the patient’s care. Furthermore, we distinguished total from partial thyroidectomy patients, as cost would expect to be different given longer operative time, more frequent inpatient admissions, and a higher complication rate. When looking at our investigation broadly, discharging a patient after total thyroidectomy results in an average savings of \$2367.27 to the health care system. Totaling these savings within our cohort amounts to \$868,788.09. We understand this may not be completely applicable to the US health care system as a whole, but it does provide an objective financial value for providers to reference when counseling patients.

Patients with comorbidities and drains were more likely to be admitted and cost more. While comorbidities certainly create higher costs during an inpatient stay, patients without comorbidities were also admitted and resulted in higher costs compared to otherwise healthy patients who were discharged. Drain placement also led to a significant number of admissions, but the drain itself added little additional cost compared to the cost of providing a hospital room, nursing staff, medications, and so on.

Patient safety should always take precedence over financial concerns, and our findings only provide information for

physicians to make safe and fiscally responsible decisions. The surgeon should critically assess the need for admission for each patient on an individual basis, taking into account their disease process, comorbidities, medications, and so on. Again, our investigation's primary focus was not safety outcomes but the financial impact of ambulatory total thyroid surgery on health care. Safety outcomes were reported to ensure a significant difference between our cohort and the current literature did not exist. It is important to understand when complications occurred; they were associated with significant increases in cost, regardless of admission status. Discharging a patient who should have been admitted would likely lead to even higher costs.

There are several limitations of this study. It is a retrospective data review, and therefore data can be inaccurate, absent, and subject to reviewer and selection bias. A prospective study would be preferred. This also might help prevent a significant selection bias that is likely to occur from the discretion of the surgeon to admit a patient postoperatively. In addition, most parameters were limited to a 30-day window from surgery. Longer-term analysis may influence outcomes. The added costs of out-of-system encounters, prescriptions called in after discharge, and other unaccounted expenditures were not included given a lack of documentation in most cases. One must assume these events occurred, but unfortunately, these costs were unable to be reliably quantified and thus were not included. Finally, the cost values calculated in our report would unlikely exactly match that of another institution with a similar population due to regional differences in standard of living, hospital-specific contracts with payers and suppliers, and provider billing methods. Multicenter, prospective studies are needed to further validate our findings.

Conclusion

In view of this study, outpatient total thyroidectomy can lead to cost reduction in highly selected patients who have few comorbidities. Complications do create a higher overall cost when they occur. Furthermore, patient safety is paramount, and the financial benefit of outpatient total thyroidectomies should not influence prudent and informed decisions. Our study provides actual monetary values that providers may reference when considering outpatient surgery cost-savings at their institutions.

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Author Contributions

Philip Rosen, design, data collection and analysis, manuscript author; **Luke Bailey**, data collection, manuscript author; **Sudhir Manickavel**, statistical computation and analysis; **Christopher Gentile**, data collection, manuscript review; **Jessica Grayson**, cosenior author, manuscript review; **Erin Buczek**, cosenior author, design, data analysis, manuscript review.

Disclosures

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