

# Is Outpatient Thyroid Surgery for Everyone?

Dale Butler and Sarah Oltmann

Department of Surgery, University of Texas Southwestern Medical Center, Dallas, TX, USA.

Clinical Medicine Insights:  
Ear, Nose and Throat  
Volume 10: 1–6  
© The Author(s) 2017  
Reprints and permissions:  
sagepub.co.uk/journalsPermissions.nav  
DOI: 10.1177/1179550617724428



**ABSTRACT:** Thyroidectomy is a common surgical procedure. Traditionally, surgeons have performed thyroidectomy on an inpatient basis. However, consistent with current trends in surgery, some practices are transitioning thyroidectomy to an outpatient setting. Although concerns for hypocalcemia and postoperative bleeding exist regardless of surgeon experience, multiple studies demonstrate that outpatient thyroidectomy is safe in the hands of high-volume surgeons. Indeed, experienced thyroid surgeons who perform thyroidectomy in an outpatient setting experience excellent patient outcomes and reduced costs. However, outpatient thyroidectomy may not be suitable for all surgeons, hospitals, or patients. When evaluating whether to implement an outpatient thyroid program, a practice should consider a number of important factors including the team performing the procedure, the hospital, and the patient. With the appropriate staff education and experience, hospital setting, and patient selection, practices in a multitude of settings can successfully develop a safe, cost-effective outpatient thyroid program.

**KEYWORDS:** Outpatient, thyroidectomy, surgeon volume, tertiary center

**RECEIVED:** March 29, 2017. **ACCEPTED:** July 8, 2017.

**PEER REVIEW:** Four peer reviewers contributed to the peer review report. Reviewers' reports totaled 462 words, excluding any confidential comments to the academic editor.

**TYPE:** Review

**FUNDING:** The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: S.O. received funding support from the Dedman Family Scholar in Clinical Care, at University of Texas Southwestern Medical Center, Dallas, Texas.

**DECLARATION OF CONFLICTING INTERESTS:** The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**CORRESPONDING AUTHOR:** Sarah Oltmann, UT Southwestern Medical Center, 5323 Harry Hines Blvd, E6.104B, Dallas, TX 75390, USA. Email: Sarah.Oltmann@UTSouthwestern.edu

## Introduction

As surgical practices evolve, practices are transitioning more and more procedures traditionally performed on an inpatient basis to outpatient management. Today, for example, surgeons routinely perform elective laparoscopic cholecystectomy, inguinal hernia repair, and partial mastectomy in an outpatient setting.<sup>1–3</sup> At many institutions, surgeons commonly perform parathyroidectomy and thyroid lobectomy as day-surgery procedures requiring only a short period of observation in the recovery room, and some surgeons are even applying this management paradigm to total thyroidectomy.<sup>4</sup> Indeed, many high-volume surgeons are performing thyroidectomy in an outpatient setting (same-day surgery) as the rule rather than the exception. The potential benefits of this management strategy include improved patient recuperation, cost savings, and superior utilization of hospital resources.<sup>5</sup> With the appropriate staff education and experience, patient selection, and hospital setting, the transition to outpatient thyroidectomy can be made in multiple practice settings. However, as explained further herein, outpatient thyroidectomy may not be suitable for all surgeons, hospitals, or patients. Careful evaluation of a number of issues should factor into a practice's decision to develop an outpatient thyroidectomy program.

## Factors Relating to Staff Education and Experience

Low-volume surgeons, those who perform fewer than 10 thyroidectomies on an annual basis, perform most of the thyroidectomies in the United States.<sup>6</sup> However, high-volume surgeons, defined as those who perform anywhere from 25 to more than 100 thyroidectomies on an annual basis, generate

the data regarding outpatient thyroidectomy.<sup>6</sup> Often, these high-volume surgeons have a background in otolaryngology or general surgery with specific oncologic or endocrine-focused fellowship training.<sup>7</sup> In contrast, the low-volume and intermediate-volume surgeons often lack additional dedicated training on thyroid and/or parathyroid disease, with thyroid cases constituting a small fraction of their normal practice. Low-volume surgeons are known to experience higher complication rates than their high-volume counterparts.<sup>8</sup> Given the relationship between the volume of thyroidectomies a surgeon performs annually and the outcome of those procedures, low-volume and intermediate-volume surgeons should pause before adopting outpatient thyroidectomy to their practices. Data published on the practice of outpatient thyroidectomy—which are attributable to procedures performed by high-volume surgeons—do not necessarily translate to outcomes likely to be achieved by a low-volume or intermediate-volume surgeon.

Even with significant experience, many high-volume surgeons hesitate to adopt routine outpatient thyroidectomy.<sup>9</sup> The likelihood of postoperative hematoma following outpatient thyroidectomy is very low (<2% in most studies).<sup>10</sup> However, there is a high risk of morbidity from potential airway compromise with hematoma.<sup>10,11</sup> Clinically significant postoperative hematomas can occur during any anterior neck operation. Data vary on time to onset of postoperative hematoma. Although most postoperative hematomas will become clinically apparent in the immediate postoperative period (less than 6 hours), up to 25% of postoperative hematomas may form within 6 to 24 hours after operation.<sup>12,13</sup> If a patient undergoes outpatient thyroidectomy,



the chance of a postoperative hematoma occurring while the patient is at home is very high.<sup>14</sup> With the proximity of compressible structures in the neck, any postoperative bleeding can quickly evolve into a life-threatening airway compromise.<sup>15</sup> As a hematoma forms, it compromises venous flow, causing outflow obstruction and edema in the surrounding laryngeal tissue. The risk of a postoperative hematoma may be mitigated by meticulous attention to hemostasis; however, despite best efforts, postoperative hematomas may still occur.<sup>10</sup> Bipolar and monopolar electrocautery, the LigaSure (Covidien Medtronic, Minneapolis, MN, USA) sealing device, and the harmonic scalpel (Ethicon, Somerville, NJ, USA) are valuable tools for the modern surgeon to facilitate control of the thyroid vasculature.<sup>16,17</sup> The choice of instrument is within the surgeon's discretion, and complications do not vary among the devices. Loose approximation of the strap muscles, or leaving a gap at the bottom of the strap closure, may assist in decompression of the deep cervical space into the subplatysmal space. Should a postoperative hematoma occur, loose approximation of the strap muscles may afford a patient additional time to seek medical attention before the postoperative hematoma results in clinically significant tracheal compression. Drains have not been shown to be of value in preventing postoperative hematoma; however, their placement may be an indicator of surgeon concern and less likely a serious attempt to decompress a postoperative hematoma.<sup>18</sup>

Another potential complication from outpatient thyroidectomy is recurrent laryngeal nerve (RLN) injury, which is less prevalent in the hands of experienced surgeons.<sup>19</sup> Many high-volume surgeons have adopted the use of nerve monitoring as part of the standard of care for their operations. Previous data did not show a decreased rate of nerve injury with the use of nerve monitoring.<sup>20–22</sup> However, more recent studies have shown some benefit.<sup>20</sup> Although the practice may not prevent an injury from occurring, nerve monitoring will allow the surgeon to pause before continuing on to the other side. In situations where a unilateral nerve injury has occurred, this pause will prevent a bilateral injury and potential airway crisis on extubation. Nerve monitoring is an additional tool in the surgeon's armamentarium to ensure a smooth operation and same-day discharge. Although most of the tertiary centers have instituted nerve monitoring as standard of care, the practice is less prevalent in smaller practices. The data that nerve monitoring provides are not binary. The surgeon is responsible for interpreting the data to make it useful. Only those surgeons with appropriate training and continuous use will benefit from these devices. It may not make economic sense for low-volume surgeons or hospitals to invest in nerve monitoring devices. The adoption or lack of use of nerve monitoring could have broad implications for which surgeons choose to pursue outpatient thyroidectomy. Noting that nerve monitoring is used by more experienced surgeons, it only follows that they will have improved identification of injuries. This information is invaluable when planning to continue the operation as an outpatient

procedure versus admitting the patient. Thorough documentation of the patient's preoperative vocal function is critical in this case. This information can inform the surgeon as to whether the patient will benefit from laryngoscopy to further investigate any vocal changes. Evidence of preoperative vocal cord dysfunction will place the patient in a higher risk category and exclude them from an outpatient thyroidectomy.

Another reason some surgeons elect not to transition to an outpatient thyroidectomy program is hypocalcemia. Given the proximity of the parathyroid glands and their blood supply to the capsule of the thyroid, even with meticulous, subcapsular dissection, a parathyroid can become compromised. If a parathyroid is found on the thyroid specimen, or if a parathyroid appears devascularized within the surgical field, autotransplantation is appropriate. At the end of an operation, a surgeon's judgment regarding the viability of a parathyroid is not perfect. As a result, many surgeons advocate use of postoperative parathyroid hormone (PTH) measurement to predict the patients who are at a higher risk for developing hypocalcemia.<sup>23</sup> Based on the PTH level, calcium and/or vitamin D is prescribed by protocol.<sup>24</sup> Patients are weaned from calcium and vitamin D in the outpatient setting based on the patient's report of symptoms.<sup>25,26</sup> High-volume surgeons have decreased rates of hypocalcemia.<sup>6</sup> Episodes of hypocalcemia can have nontrivial downstream effects and cause higher rates of readmission. Patients must be informed of the signs and symptoms of hypocalcemia to help ensure successful management of this issue as an outpatient. Patients need to understand the importance of taking their medications as prescribed. Patients also need to be aware of the early warning signs of hypocalcemia. By identifying the early signs of hypocalcemia, a patient can take additional calcium doses rather than waiting until the symptoms progress to a more dramatic level. An alternative strategy to address hypocalcemia is to have patients present for laboratory evaluation of calcium levels 3 to 4 days postoperatively. Calcium dosing can then be adjusted as needed based on the results.

An experienced anesthetist can help prevent complications in outpatient thyroidectomy. For a successful outcome, any increased arterial or venous pressure in the neck must be avoided. An anesthetist can prevent swings in the patient's blood pressure, and, at the conclusion of the case, the anesthetist can provide a smooth extubation for the patient. A rough emergence from anesthesia, with bucking, coughing, or retching, can result in a significant increase in both arterial and venous pressure in the neck. This may dislodge clips, ties, or seals from previously controlled vessels, resulting in immediate hematoma. A smooth emergence from anesthesia, however, is more likely to result in stable control of blood pressure as patients are moved to the postoperative recovery unit.<sup>27</sup> Preemptive use of antiemetics and avoidance of noxious gases or narcotics during the case can minimize the severity of postoperative nausea. Vomiting or retching in the recovery room can also result in venous hypertension in the

neck, with concerns for increased risk for postoperative hematoma formation.<sup>27</sup>

A checklist for the recovery unit personnel will highlight any concerning symptoms and ensure safe discharge. However, even with monitoring of symptoms in the recovery unit, many patients will not manifest symptoms for some time. Surgeons should maintain a low threshold to observe patients, should they exhibit any concerning signs or symptoms.

### Factors Relating to Hospital Setting

Generally, high-volume centers have instituted outpatient thyroidectomy programs.<sup>19</sup> The implementation of an outpatient thyroidectomy program requires a commitment not only from surgeons performing the procedure but also from hospital administration and nursing.<sup>28</sup> Patients undergoing outpatient thyroidectomy will require a longer stay in the recovery unit and, as a result, the nursing staff who will care for the patient must be familiar with the procedure.<sup>29</sup> Nurses should, therefore, be educated to recognize the signs and symptoms of a postoperative hematoma. And, nurses should be familiar with the discharge instructions for patients. Nurses can reemphasize to patients the importance of taking medications as prescribed and review with patients the early warning signs of a postoperative complication, such as hypocalcemia.

Although implementation of an outpatient thyroidectomy program requires a significant initial investment, hospitals stand to benefit greatly.<sup>5,30</sup> With the adoption of any outpatient procedure, the total number of beds needed in a hospital for a day of operations will decrease. Cost savings associated with the decreased need for hospital beds are passed on to the hospital. In the early stages of outpatient thyroidectomy implementation, cost savings may be limited by the number of revisits and readmissions by patients.<sup>31,32</sup> The revisit and readmission rates may be higher on initial adoption but should steadily decrease as the hospital and its staff become more accustomed to the procedure. Regardless, with reported revisit rates of 7% and readmission rates of 2%, revisit and readmission of a patient are a relatively rare event.<sup>33</sup> Finally, data suggest that outpatient thyroidectomy can be successfully implemented at tertiary centres.<sup>34</sup> However, the likely return on investment for a low-volume surgeon or center is unknown. In addition, the increased likelihood of complications in low-volume environments should give pause for implementation at any location other than high-volume centers with a high-volume surgeon.

Complications can occur in any setting. Therefore, a 24-hour emergency department (ED) within distance to the patient is required. Ideally, the ED would be at the same institution as the operating surgeon. If a surgeon elects to perform outpatient thyroidectomy at a freestanding surgery center, it is imperative that the surgeon be affiliated with at least one of the neighboring hospitals to ensure continuity of care should the patient need unanticipated overnight observation or

admission. The surgical team also must be able to advise patients should any questions or concerns arise. Many complications do not occur until several hours following outpatient thyroidectomy. As a result, the operating surgeon, or a knowledgeable representative, must have a means of communication by which they can interact with patients. For example, this can be a telephone or answering service. Patients must understand those symptoms that are emergent and should be reported immediately. Many hospitals now allow patients to communicate with physicians through the electronic medical record systems. Patients should not use the electronic medical record system for emergent contact.

Certainly, many hospital factors cannot be controlled. A large hospital in an urban setting may find the accrual of patients relatively simple. But a smaller rural hospital likely will find patient accrual more difficult. Despite plans to begin an outpatient thyroidectomy program, the population surrounding hospital may not support its implementation. A hospital performing few thyroidectomies on an annual basis is unlikely to benefit from the institution of outpatient thyroidectomy.

### Factors Relating to Patient Selection

Aside from physician and hospital factors, practices also must account for a multitude of patient factors before offering outpatient thyroidectomy. If outpatient thyroidectomy may be safely offered to the patient, potential benefits are numerous. First, patients face a decreased risk of nosocomial infection and iatrogenic injuries.<sup>35</sup> Second, patients may benefit financially with reduced insurance co-pays.<sup>36</sup> Third, patients enjoy the benefit of an at-home recovery in a familiar setting. Finally, data show that outpatient thyroidectomy is not inferior to inpatient thyroidectomy. In fact, several studies have demonstrated a decreased rate of hospital acquired morbidity associated with outpatient thyroidectomy.<sup>28</sup> However, confounding biases may explain these findings. Specifically, based on available information, it is not clear whether these findings are due to the particular patient population who is offered outpatient thyroidectomy or the procedure itself. The studies do not clearly differentiate between patients undergoing outpatient thyroidectomy versus patients undergoing traditional thyroidectomy and an associated inpatient stay.

A patient's baseline health is a critical consideration. Most often, surgeons offer outpatient thyroidectomy to patients with one or fewer comorbidities. The American Thyroid Association's published guidelines provide absolute and relative contraindications to outpatient thyroidectomy (Table 1).<sup>35</sup> However, chronic obstructive pulmonary disease (COPD) is the only comorbidity predictive of complications. This becomes clear as COPD's sequelae manifest. Moreover, increased rates of tobacco use inevitably lead to more cough and increased intrathoracic pressure.

Patient pathology is important in deciding whether to offer outpatient thyroidectomy. Benign conditions tend to make up

**Table 1.** Patient factors which may preclude the option of outpatient thyroidectomy.

COMORBID CONDITIONS	SOCIOECONOMIC	PATHOLOGY
Uncompensated cardiac or respiratory disease	Great distance from facility	Large goiter
Dialysis for renal failure	Lack of family/home support	Substernal goiter
Anticoagulant use	Lack of reliable transportation	Locally advanced cancer
Seizures	Barriers in communication/education	Difficult hemostasis
Severe anxiety	Patient preference	Difficult surgery with underlying Hashimoto's or Graves' disease
Obstructive sleep apnea		
Hearing loss		
Visual impairment		
Mental impairment		
Pregnancy		

Adapted from ATA (American Thyroid Association) Guidelines.<sup>35</sup>

most of the outpatient thyroidectomy cases.<sup>37</sup> Surgeons have been less likely to offer outpatient thyroidectomy to patients with malignant conditions when a lymph node dissection remains a possibility. The glands in malignant disease may be larger or have substernal extension. Larger thyroid glands have been shown to have an increased risk of bleeding.<sup>10</sup> Graves' disease is the least likely diagnosis to be treated with outpatient thyroidectomy. Graves' glands have increased vascularity and perithyroidal inflammation. During surgery, these large glands require manipulation to increase exposure. This manipulation can increase hormone release causing greater risk of cardiovascular side effects.<sup>38</sup> In addition, patients with Graves' disease are at higher risk for issues with postoperative hypocalcemia which may require additional monitoring and intervention.<sup>39,40</sup>

All patients will have a baseline risk for complications from thyroidectomy. There are several factors that can increase a patient's risk for incurring a complication. Hematoma formation can be exacerbated by several underlying conditions which must be taken into account. Respiratory diseases (eg, COPD, tobacco use) may cause coughing. The subsequent increase in intrathoracic pressure is relayed to the neck and may cause previously sealed vessels to bleed. Patients may require anticoagulation due to other medical conditions as well. Use of anticoagulants is associated with higher rates of hematoma formation.<sup>10</sup>

Hypocalcemia is more prevalent in patients with certain comorbid conditions. Many patients with malignancy will require central neck dissections, putting them at greater risk of inadvertent parathyroid injury.<sup>41</sup> Graves' disease can lead to higher rates of hypocalcemia due to increased bone metabolism.<sup>40</sup> Any deficiencies found preoperatively must be corrected. Patients who are noncompliant with supplementation and have vitamin D deficiency will be at risk for hypocalcemia. In addition, patients with previous gastric bypass or

malabsorptive weight loss surgery may have an unrecognized hypocalcemia and vitamin D deficiency, which can be difficult to manage in the postoperative period.<sup>42</sup>

Recurrent laryngeal nerve injury is a dreaded complication of thyroidectomy. Patients with large goiters (with or without substernal extension) or malignant lesions are at greater risk of RLN injury.<sup>22</sup> Preoperative laryngoscopy is necessary for any patient with signs or symptoms of RLN malfunction (voice change, hoarseness, or stridor). Being aware of whether a patient has a benign goiter or malignant lesion will allow the surgeon to develop the best approach and determine whether the patient remains a candidate for outpatient thyroidectomy.

Aside from patient medical factors, there are several socioeconomic factors that should also be considered. A patient will require conveyance to and from the hospital with a responsible party waiting to transport him or her home. A patient needs access to a reliable means of transportation back to the hospital should a complication arise at home. Those patients without reliable transportation, or who are without a stable living situation, may not be safe for outpatient thyroidectomy. These situations may more commonly occur among the lower socioeconomic classes. In addition, for those patients who travel great distances for medical care, a planned stay at a local hotel may be a safe alternative to an overnight hospital stay.

Patient education is a major factor in successful outpatient management. The patient should be educated about "what to expect" and "what to watch for." This information must be explained in a manner the patient can understand and comprehend. The decision to offer or perform outpatient thyroidectomy may be affected by the patient's underlying level of education. Language barriers can also pose a problem to patient education. Important nuances may be lost in translation, which may result in a patient's misinterpretation of discharge instructions. Interpreters—whether physically present



or remote—must be available to enable communication between the staff and the patient. The patient must know what to expect and what to watch for following surgery to identify signs of impending complications.

Disparity exists in many fields of medicine. Low-volume surgeons are more likely to perform thyroid operations on patients from high health risk communities.<sup>37</sup> Women and African Americans are affected disproportionately, and, unfortunately, this results in higher complication rates.<sup>43</sup> NSQIP (National Surgical Quality Improvement Program) data have shown that most of the patients offered outpatient thyroidectomy have private insurance. The decision to offer outpatient thyroidectomy to a patient may be due to the patient's higher socioeconomic stratum and closer proximity to tertiary centers in urban areas. However, the decision also may reflect a surgeon's sound judgment due to the previously mentioned variables that may affect the patient's ability to promptly obtain medical help in the event of a postoperative complication occurring at home. The surgeon may determine that if an individual faces difficulties in accessing the medical system, that patient would be better served with an overnight observation in the hospital. Likewise, a patient who lacks support at home may not be a good candidate for outpatient thyroidectomy.

## Discussion

Thyroid surgeons have noninferior patient outcomes and reduced costs from outpatient thyroidectomy.<sup>5</sup> This success, however, may not translate to all surgeons, hospitals, or patients. When evaluating whether to implement an outpatient thyroidectomy program, a practice should consider a number of important factors including the team performing the procedure, the patient, and the hospital.

To develop a successful outpatient thyroidectomy program, a practice must assemble a qualified team capable of performing the procedure. Most importantly, the primary surgeon must have the necessary skills and training. She or he must be comfortable operating in the neck, perform a high volume of thyroidectomies on an annual basis, and employ the use of nerve monitoring and other techniques to reduce the likelihood of intraoperative complications.

The remainder of the team is essential to preventing and handling any postoperative complications. The anesthesia team should be familiar with the procedure to reduce the time a patient is under anesthesia and to prevent anesthetic-related complications that can result in airway edema or hemorrhage. Nursing staff should be educated to identify postoperative hematoma and hypocalcemia. The facility should have operating rooms and staff capable of speedy turnover to maximize throughput and limit delays. The facility also should be equipped with a 24-hour ED to handle any postoperative complications.

A practice also must evaluate its setting. Smaller hospitals serving less densely populated areas should carefully evaluate

the cost of implementing an outpatient thyroidectomy program. These hospitals are unlikely to see a large throughput of patients who qualify for outpatient thyroidectomy and, as a result, they are unlikely to recover the cost of implementing an outpatient thyroidectomy program.

A practice also should give careful consideration to its patient population. Qualifying patients should be American Society of Anesthesiologists (ASA) 1 or 2, with isolated thyroid pathology. Surgeons should not attempt outpatient thyroidectomy on those patients with multiple medical conditions or poor functional status. The pathology should be limited to benign conditions without extremely large goiter and/or hyperthyroidism or small isolated malignant nodules. Those patients who have a more extensive medical history or who may require a more significant dissection will benefit from an inpatient stay postoperatively. In addition, those glands found to be hypervascular, which is often the case in hyperthyroidism, may be patients who would benefit from overnight observation as their risk for a postoperative hematoma is slightly higher.

Some controversy does exist within the literature regarding the qualifications of surgeons attempting outpatient thyroidectomy. Small studies have shown that outpatient thyroidectomy may be safe in lower volume hospitals with intermediate volume surgeons operating.<sup>34</sup> However, even in those studies, it is acknowledged that the operating surgeon must maintain a sufficient case volume to feel comfortable performing this thyroidectomy on an outpatient basis. Moreover, outpatient thyroidectomy has not been recommended in all countries. Some international studies do not recommend outpatient thyroidectomy due to the risk of postoperative hematoma.<sup>9,14</sup> Those studies point out that most postoperative hematomas do not develop until more than 6 hours after the operation and, as a result, overnight observation is mandatory. However, other studies have shown that a postoperative hematoma may occur several days postoperatively. This demonstrates that an inpatient observation period is not a panacea for postoperative hematoma identification prior to discharge.<sup>10</sup> Moreover, the risk of a postoperative hematoma decreases significantly 24 hours after the procedure.

Ultimately, the decision to perform outpatient thyroidectomy must be made by the surgeon, hospital, and patient. With adequate operative experience and careful patient selection, hospitals and patients stand to benefit from total thyroidectomy as an outpatient procedure.

## Author Contributions

Conceived and designed the review: SO. Analyzed the literature: DB. Wrote the first draft of the manuscript: DB. Contributed to the writing of the manuscript: SO. Jointly developed the structure and arguments for the paper: SO and DB. Made critical revisions and approved the final version: SO. All authors reviewed and approved the final manuscript.

## REFERENCES

- Vaughan J, Gurusamy KS, Davidson BR. Day-surgery versus overnight stay surgery for laparoscopic cholecystectomy. *Cochrane Database Syst Rev*. 2013;7:CD006798.
- Palumbo P, Amatucci C, Perotti B, et al. Outpatient repair for inguinal hernia in elderly patients: still a challenge? *Int J Surg*. 2014;12:S4–S7.
- Cordeiro E, Jackson T, Cil T. Same-day major breast cancer surgery is safe: an analysis of short-term outcomes using NSQIP data. *Ann Surg Oncol*. 2016;23:2480–2486.
- Clark N, Schneider DF, Vrabcic S, Bauer PS, Chen H, Sippel RS. Increased efficiency of endocrine procedures performed in an ambulatory operating room. *J Surg Res*. 2013;184:200–203.
- Marino M, Spencer H, Hohmann S, Bodenner D, Stack BC Jr. Costs of outpatient thyroid surgery from the University HealthSystem Consortium (UHC) database. *Otolaryngol Head Neck Surg*. 2014;150:762–769.
- Meltzer C, Klau M, Gurusanthaiah D, et al. Surgeon volume in thyroid surgery: surgical efficiency, outcomes, and utilization. *Laryngoscope*. 2016;126:2630–2639.
- Krishnamurthy VD, Gutnick J, Slotcavage R, et al. Endocrine surgery fellowship graduates past, present, and future: 8 years of early job market experiences and what program directors and trainees can expect. *Surgery*. 2017;161:289–296.
- Adam MA, Thomas S, Youngwirth L, et al. Is there a minimum number of thyroidectomies a surgeon should perform to optimize patient outcomes? *Ann Surg*. 2017;265:402–407.
- Sorensen KR, Klug TE. Routine outpatient thyroid surgery cannot be recommended. *Dan Med J*. 2015;62:A5016.
- Campbell MJ, McCoy KL, Shen WT, et al. A multi-institutional international study of risk factors for hematoma after thyroidectomy. *Surgery*. 2013;154:1283–1289;discussion 1289–1291.
- Oltmann SC, Alhefthi AY, Rajaei MH, Schneider DF, Sippel RS, Chen H. Antiplatelet and anticoagulant medications significantly increase the risk of postoperative hematoma: review of over 4500 thyroid and parathyroid procedures. *Ann Surg Oncol*. 2016;23:2874–2882.
- Burkey SH, Van Heerden JA, Thompson GB, Grant CS, Schleck CD, Farley DR. Reexploration for symptomatic hematomas after cervical exploration. *Surgery*. 2001;130:914–920.
- Perera M, Anabell L, Page D, Harding T, Gnaneswaran N, Chan S. Risk factors for post-thyroidectomy haematoma. *J Laryngol Otol*. 2016;130:S20–S25.
- Lang BH, Yih PC, Lo CY. A review of risk factors and timing for postoperative hematoma after thyroidectomy: is outpatient thyroidectomy really safe? *World J Surg*. 2012;36:2497–2502.
- Liu J, Li Z, Liu S, Wang X, Xu Z, Tang P. Risk factors for and occurrence of postoperative cervical hematoma after thyroid surgery: a single-institution study based on 5156 cases from the past 2 years. *Head Neck*. 2016;38:216–219.
- Lang BH, Ng SH, Lau LL, Cowling BJ, Wong KP. A systematic review and meta-analysis comparing the efficacy and surgical outcomes of total thyroidectomy between harmonic scalpel versus ligasure. *Ann Surg Oncol*. 2013;20:1918–1926.
- Revelli L, Damiani G, Bianchi CB, et al. Complications in thyroid surgery. Harmonic Scalpel, Harmonic Focus versus Conventional Hemostasis: a meta-analysis. *Int J Surg*. 2016;28:S22–S32.
- Samraj K, Gurusamy KS. Wound drains following thyroid surgery. *Cochrane Database Syst Rev*. 2007;4:CD006099.
- Liang TJ, Liu SI, Mok KT, Shi HY. Associations of volume and thyroidectomy outcomes: a nationwide study with systematic review and meta-analysis. *Otolaryngol Head Neck Surg*. 2016;155:65–75.
- Bergenfelz A, Salem AF, Jacobsson H, Nordenström E, Almquist M; Steering Committee for the Scandinavian Quality Register for Thyroid, Parathyroid and Adrenal Surgery (SQRTPA). Risk of recurrent laryngeal nerve palsy in patients undergoing thyroidectomy with and without intraoperative nerve monitoring. *Br J Surg*. 2016;103:1828–1838.
- Vasileiadis I, Karatzas T, Charitoudis G, Karakostas E, Tseleni-Balafouta S, Kouraklis G. Association of intraoperative neuromonitoring with reduced recurrent laryngeal nerve injury in patients undergoing total thyroidectomy. *JAMA Otolaryngol Head Neck Surg*. 2016;142:994–1001.
- Dralle H, Sekulla C, Haerting J, et al. Risk factors of paralysis and functional outcome after recurrent laryngeal nerve monitoring in thyroid surgery. *Surgery*. 2004;136:1310–1322.
- Park J, Frank E, Simental A Jr, et al. Management of completion and total thyroidectomy patients based on 1-hour postoperative parathyroid hormone. *Am Surg*. 2016;82:881–884.
- Wang TS, Cheung K, Roman SA, Sosa JA. To supplement or not to supplement: a cost-utility analysis of calcium and vitamin D repletion in patients after thyroidectomy. *Ann Surg Oncol*. 2011;18:1293–1299.
- Perera AH, Patel SD, Law NW. Thyroid surgery as a 23-hour stay procedure. *Ann R Coll Surg Engl*. 2014;96:284–288.
- Rutledge J, Siegel E, Belcher R, Bodenner D, Stack BC Jr. Barriers to same-day discharge of patients undergoing total and completion thyroidectomy. *Otolaryngol Head Neck Surg*. 2014;150:770–774.
- Morton RP, Vandal AC. Postoperative systolic blood pressure as a risk factor for haematoma following thyroid surgery. *Clin Otolaryngol*. 2015;40:462–467.
- Snyder SK, Hamid KS, Roberson CR, et al. Outpatient thyroidectomy is safe and reasonable: experience with more than 1,000 planned outpatient procedures. *J Am Coll Surg*. 2010;210:575–582, 582–574.
- Segel JM, Duke WS, White JR, Waller JL, Terris DJ. Outpatient thyroid surgery: safety of an optimized protocol in more than 1,000 patients. *Surgery*. 2016;159:518–523.
- Narayanan S, Arumugam D, Mennona S, Wang M, Davidov T, Trooskin SZ. An evaluation of postoperative complications and cost after short-stay thyroid operations. *Ann Surg Oncol*. 2016;23:1440–1445.
- Orosco RK, Lin HW, Bhattacharyya N. Ambulatory thyroidectomy: a multi-state study of revisits and complications. *Otolaryngol Head Neck Surg*. 2015;152:1017–1023.
- Khavanin N, Mlodinow A, Kim JY, Ver Halen JP, Samant S. Predictors of 30-day readmission after outpatient thyroidectomy: an analysis of the 2011 NSQIP data set. *Am J Otolaryngol*. 2014;35:332–339.
- Khavanin N, Mlodinow A, Kim JY, Ver Halen JP, Antony AK, Samant S. Assessing safety and outcomes in outpatient versus inpatient thyroidectomy using the NSQIP: a propensity score matched analysis of 16,370 patients. *Ann Surg Oncol*. 2015;22:429–436.
- Ayala MA, Yench MW. Outpatient thyroid surgery in a low-surgical volume hospital. *World J Surg*. 2015;39:2253–2258.
- Terris DJ, Snyder S, Carneiro-Pla D, et al; American Thyroid Association Surgical Affairs Committee Writing Task Force. American Thyroid Association statement on outpatient thyroidectomy. *Thyroid*. 2013;23:1193–1202.
- Terris DJ, Moister B, Seybt MW, Gourin CG, Chin E. Outpatient thyroid surgery is safe and desirable. *Otolaryngol Head Neck Surg*. 2007;136:556–559.
- Al-Qurayshi Z, Srivastav S, Kandil E. Comparison of inpatient and outpatient thyroidectomy: demographic and economic disparities. *Eur J Surg Oncol*. 2016;42:1002–1008.
- Akalin A, Colak O, Alatas O, Efe B. Bone remodelling markers and serum cytokines in patients with hyperthyroidism. *Clin Endocrinol (Oxf)*. 2002;57:125–129.
- Oltmann SC, Brekke AV, Schneider DF, Schaefer SC, Chen H, Sippel RS. Preventing postoperative hypocalcemia in patients with Graves disease: a prospective study. *Ann Surg Oncol*. 2015;22:952–958.
- Pesce CE, Shiue Z, Tsai HL, et al. Postoperative hypocalcemia after thyroidectomy for Graves' disease. *Thyroid*. 2010;20:1279–1283.
- Cho JN, Park WS, Min SY. Predictors and risk factors of hypoparathyroidism after total thyroidectomy. *Int J Surg*. 2016;34:47–52.
- Chereau N, Vuillermet C, Tilly C, et al. Hypocalcemia after thyroidectomy in patients with a history of bariatric surgery. *Surg Obes Relat Dis*. 2017;13:484–490.
- Al-Qurayshi Z, Randolph GW, Srivastav S, Aslam R, Friedlander P, Kandil E. Outcomes in thyroid surgery are affected by racial, economic, and healthcare system demographics. *Laryngoscope*. 2016;126:2194–2199.