



## Outcomes of Thyroid Surgery Performed by Senior Residents at a General Surgery Training Program: How Do We Compare?

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### Abstract

Thyroidectomy is a commonly performed surgical procedure in that is considered to be relatively safe in the modern surgical era. In the United States, general surgery residents have some training in thyroid surgery, but this training requirement does not align with the increasing demands for thyroidectomy procedures that are being performed annually by surgical subspecialists. Surgeons who perform more thyroidectomy procedures annually are known to have superior outcomes when compared to their low-volume counterparts. Our institution reviewed 111 patient records who underwent either partial or total thyroidectomies in order to compare our complication rates to literature values. Senior general surgery residents at our institution had complication rates for hypocalcemia, hematoma, seroma formation, surgical site infection, and nerve injury that were lower than the reported literature, highlighting the fact that thyroidectomy procedures performed at academic residency programs are generally safe. There is a greater need for general surgery programs nationwide to increase exposure to thyroid procedures and endocrine surgery in order to best serve the increasing demand for these procedures while maintaining and increasing patient safety.

**Keywords:** Thyroid Surgery; Complication Rates; General Surgery; Patient Safety; Surgical Training

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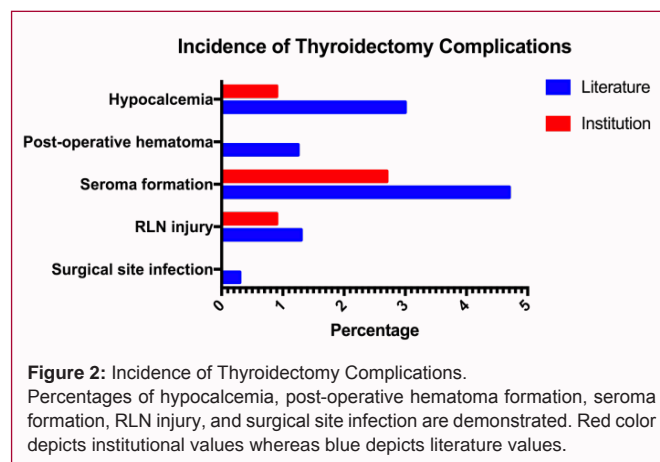
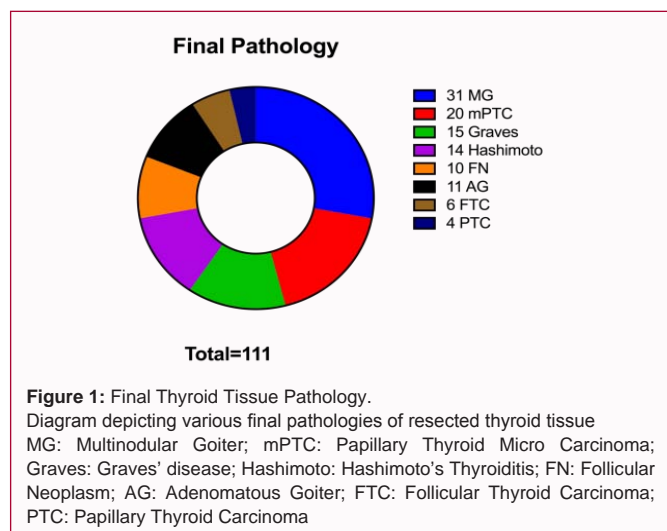
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### Introduction

Endocrine surgery remains an important part of General Surgery (GS) training in the United States. Graduation requirements placed by the Accreditation Council for Graduate Medical Education in 2017 require GS residents to perform 15 endocrine surgeries, including 10 cases logged as either thyroid or parathyroid surgeries [1]. Although this required experience serves as a satisfactory introduction to thyroid surgery, it does not align with the current trends in prevalence and projected caseload for a general surgeon in an era of surgical sub-specialization.

High volume surgeons performing thyroid surgery were performed by GS 68% of times in a study by Sosa et al., underscoring the continued need for GS residency training in this area [2]. However, graduating GS resident cases logs in thyroid surgery from the past 10 years have decreased [3]. While many potential reasons may explain this, one concern is that referring physicians may perceive an increased risk of complications when thyroid surgery is performed by general surgeons at teaching hospital programs. This perception may lead more thyroidectomy referrals to endocrine and otolaryngology - head and neck surgeons, thus reducing opportunities for residents at GS training programs to participate in thyroid surgeries and potentially contributing to low resident case numbers.

Although thyroidectomy is generally considered to be a safe surgical procedure, it has been demonstrated that the surgeon's experience with thyroidectomy operations significantly determines the complication rate. Surgeons that perform greater than 25 cases per year have improved patient outcomes [4]. However, it is important to note that the majority of thyroidectomies are performed by low-volume surgeons even at academic institutions, resulting in higher rates of preventable complications [5]. These results indicate that there is a growing need for general surgeons in training to accomplish a high yearly output of thyroid surgeries [6]. By doing so, these future surgeons can better meet the growing rate of thyroid surgeries and provide the public with the best surgical outcomes possible.



Endocrine surgery is and should continue to be a core aspect in GS training programs. Residents should continue to have increased exposure to thyroid surgeries in the residency curriculum in order to minimize adverse outcomes when they become practicing surgeons. We aim to highlight the rate of thyroidectomy complications such as hypocalcemia, post-operative hematoma, seroma formation, recurrent laryngeal nerve injury, and surgical site infection at our institution in order to compare those to literature benchmarks.

**Methods**

A retrospective chart review of patients who underwent partial or total thyroidectomy from 2014 to 2018 from our institution was performed to assess hypocalcemia, post-operative hematoma, seroma formation, nerve injury, and surgical site infection. Demographics of these patients were recorded prospectively including age, gender, and indication for surgery, including total versus partial thyroidectomy. Indication for surgery included thyroid nodules, hyperthyroidism, and compressive symptoms.

Thyroidectomy procedures were performed by senior GS residents with close attending surgeon supervision under general anesthesia with intraoperative nerve monitoring by neural integrity monitor endotracheal tube. The standard surgical procedure of thyroid tissue resection using harmonic scalpel and electro cautery was performed with intra-operative identification of Recurrent Laryngeal Nerve (RLN) and parathyroid glands. Operative notes were dictated by senior residents with attending surgeon review. Thyroid tissue specimens were sent for pathological analysis for definitive identification with recorded final surgical pathological reports.

Post-operative monitoring included clinical assessment for hypocalcemia, hematoma, seroma formation, surgical site infection, and nerve injury as performed by the same team of senior residents and attending surgeon that performed the operation. All patients were discharged on the first post-operative day unless a complication was identified.

Demographic data and complication rate data were assessed using Graph Pad Prism 7 software (Graph Pad Software, La Jolla, CA) to generate descriptive statistics and depiction with figures.

**Results**

Of 111 patients identified at our institution, 80 patients underwent

total thyroidectomy and 31 underwent partial thyroidectomy. Distribution of patients by gender included 100 females and 11 males with a mean age of 55 and 45, respectively. These patients were further organized by their indication for surgery, which included: 44 with thyroid nodules, 32 with hyperthyroidism, and 35 with compressive symptoms. Thyroid nodules were identified by Fine Needle Aspiration (FNA) using the Bethesda classification of thyroid cytopathology and recorded as 24 (III) AUS/FLUS, 15 (IV) FN/FSN, 4 (V) suspicious, and 1 (VI) malignant. Of the 32 hyperthyroidism patients, 15 had Graves' disease and 17 had either poorly controlled disease or desire to discontinue medication. Most common compressive symptoms included paroxysmal nocturnal dyspnea and dysphagia with choking sensation.

The unilateral RLN was identified 95% of times in partial thyroidectomy, and bilateral RLN were identified 80% of times in total thyroidectomies. In partial thyroidectomies, 2 parathyroid glands were identified 85% of times and 1 gland identification was 100%. For total thyroidectomies, rates of parathyroid gland identification are as follows: 70% for 4 glands, 85% for 3 glands, and 100% for two glands.

Final pathology of the thyroid tissue was recorded to be as follows: 4 Papillary Thyroid Carcinoma (PTC), 6 Follicular Thyroid Carcinoma (FTC), 10 Follicular Neoplasm (FN), 20 Papillary Thyroid Micro Carcinoma (mPTC), 15 Graves, 31 Multinodular Goiter (MG), 14 Hashimoto, and 11 Adenomatous Goiter (AG). All patients were discharged on the first post-operative day except for two. One patient had transient hypocalcemia requiring intravenous calcium infusion, and the other subsequently developed stridor with difficulty breathing and a 4-day hospital stay with complete recovery of vocal cord function after 4 weeks by ENT evaluation (Figures 1,2).

Rates of hypocalcemia were noted to be 25% transient in nature, with one patient (0.9%) developing permanent hypocalcemia following central cervical node dissection for metastatic papillary cancer. No hematomas were observed on post-operative monitoring. Seroma formation occurred in 3 patients (2.7%) that were clinically noticeable without compressive symptoms. These were aspirated during clinic follow-up without any further complications. One patient developed nerve injury (0.9%) that was likely attributed to traction injury with large Hashimoto thyroid gland. Of note, this same patient had the aforementioned prolonged hospital course. No surgical site infections were noted on post-operative monitoring.

**Discussion**

The volume of endocrine surgery being performed is continuing

to increase, as is the need for thyroidectomy procedures in the United States. As a commonly performed surgical procedure, thyroidectomy is generally regarded to be a safe operation in our modern surgical era. However, surgical complications do occur, with rates documented in the literature as follows: permanent hypocalcemia at 3% [7], hematoma formation at 1.25% [8], seroma formation at 4.7% [9], recurrent laryngeal nerve injury at 1.3% [10], and surgical site infection at 0.3% [11]. Performance at our institution surpassed these literature benchmarks despite the great variety of surgical indications and final thyroid tissue pathology results. Of particular note our rates for post-operative hematoma and surgical site infection among the 111 patients were zero. In comparison to literature norms our seroma formation rate was around half as common at a rate of 2.7% and hypocalcemia occurred less than half as often (0.9%) as what has been documented in previous literature. The only complication that was comparable to previous literature was our recurrent laryngeal nerve injury at a rate of 0.9%, which still was below the previously reported value of 1.3%. The results of this study demonstrate that the performance of thyroidectomy procedures at an academic institution by GS residents does not result in increased rates of complications. More importantly, this study elucidates another important example of the great need for GS residency programs to seek greater surgical volume for its residents in order to provide greater surgical competency in thyroid and endocrine operations. With the growing need for surgeons to perform thyroid and parathyroid procedures it is ever important to increase the training case load that GS residents should perform to be adequately prepared to meet the need.

In order to reduce complication rates, it is important to identify key structures that need to be preserved. The recurrent laryngeal nerve and parathyroid glands are of particular importance as they result in nerve injury and subsequent hoarseness or hypocalcemia, respectively. Rates of RLN and parathyroid gland identification were good among the GS residents at this program with at least one parathyroid gland identified 100% of the time in either partial or total thyroidectomies. This high rate of identification translates to having a low rate of post-operative hypocalcemia in our patients. The rates of identifying the recurrent laryngeal nerve were also good with 95% success for partial thyroidectomy and 80% success with bilateral nerve identification in total thyroidectomies. While the rate of recurrent laryngeal nerve injury was comparable to the literature, it was still low with an incidence of 1 of our 111 patients. With regard to both hypocalcemia and recurrent laryngeal nerve injury, complications that occurred in our patients were lower than literature rates. This lower rate may be due to the high rates of successful identification of parathyroid glands and recurrent laryngeal nerves during operations.

Other points of interest and possible limitations in this study included the retrospective nature of chart review, and a disproportionately large female sample in comparison to males undergoing thyroid surgery. Of our patient population, 100 were female patients comprising around 90% of our patient pool. We also underwent a larger proportion of total thyroidectomies in comparison to partial; with 72% of thyroidectomy cases performed being total thyroidectomies. Interestingly enough, even with a larger proportion of total thyroidectomies being performed, the complication rates overall were still lower than reported literature values.

Our surgical residents as well as others nationwide should gain greater exposure to thyroid and parathyroid procedures based upon

these surgical outcomes demonstrated in this study. The value of endocrine surgery in the GS residency curriculum should not be undervalued. More studies demonstrating comparable or superior outcomes in thyroid and endocrine procedures as performed in GS residency programs should be demonstrated. Endocrine surgery should be investigated and highlighted in the current GS residency curriculum. In doing so, programs should increase opportunities for greater case volume in order to meet the demands of the constantly increasing need for thyroid and parathyroid procedures. These GS residents and future general surgeons can not only maintain, but even improve patient safety outcomes in an era of increasing thyroid and endocrine procedures being performed by low volume surgeons and subspecialists.

## Conclusion

Senior general surgery residents at our institution had thyroidectomy complication rates that were lower than previously reported literature. There should be a greater emphasis on thyroid and endocrine training in general surgery residency programs in order to meet the increasing need for thyroidectomy procedures.

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