Surgeon volume and adequacy of thyroidectomy for differentiated thyroid cancer

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Introduction. *We aimed to determine influence of surgeon volume on (1) frequency of appropriate initial surgery for differentiated thyroid cancer (DTC) and (2) completeness of resection.*
Methods. *We reviewed all initial thyroidectomies (Tx; lobectomy and total) performed in a health system during 2011; surgeons were grouped by number of Tx cases per year. For patients with histologic DTC ≥1 cm, surgeon volume was correlated with initial extent of the operation, and markers of complete resection including uptake on I^{123} prescan, thyrotropin–stimulated thyroglobulin levels, and I^{131} dose administered.*
Results. *Of 1,249 patients who underwent Tx by 42 surgeons, 29% had DTC ≥1 cm without distant metastasis. At a threshold of ≥30 Tx per year, surgeons were more likely to perform initial total Tx for DTC ≥1 cm (*P = *.01), and initial resection was more complete as measured by all 3 quantitative markers. For patients with advanced stage disease, a threshold of ≥50 Tx per year was needed before observing improvements in I^{123} uptake (*P = *.004).*
Conclusion. *Surgeons who perform ≥30 Tx a year are more likely to undertake the appropriate initial operation and have more complete initial resection for DTC patients. Surgeon volume is an essential consideration in optimizing outcomes for DTC patients, and even higher thresholds (≥50 Tx/year) may be necessary for patients with advanced disease. (Surgery 2014;156:1453-60.)*

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Differentiated thyroid cancer (DTC) accounts for the vast majority of all thyroid cancer (>90%), and mortality is rare with 5-year relative survival estimated at >97%.[1] Conventional staging systems rely on patient age, primary tumor size, extent of locoregional disease, and presence of distant metastasis.[2] Treatment is predominantly surgical with improved survival and prevention of local recurrence dependent on completeness of initial resection.[3]

The American Thyroid Association guidelines for DTC recommend total or near-total thyroidectomy (TTx) in all patients with DTC >1 cm with the goal of leaving <1 g of remnant thyroid tissue.[4] The rationale for initial TTx includes a risk of ≤10% of recurrence in the contralateral lobe when lobectomy alone is performed,[5] the sometimes aggressive nature of local recurrences,[6] the frequently multifocal nature of DTC (36–85%), and the improved ability to ablate residual thyroid tissue or metastatic disease with lower doses of radioactive iodine (RAI). Additionally, TTx facilitates postoperative surveillance with cervical ultrasonography, RAI whole body scan, and interpretation of serum thyroglobulin (Tg) levels.[7] However, DTC is not always diagnosed preoperatively by fine needle aspiration biopsy, and a number of clinical, radiographic, and molecular findings can increase the concern for malignancy and still prompt initial TTx, such as a history of radiation to the head or neck, a first-degree family member with DTC, the presence of suspicious sonographic nodule features, and detectable *BRAF* V600E mutation in the fine needle aspiration biopsy specimen.[4]

For patients who are at high risk of recurrence after the initial operation, radioiodine (I^{131}) is a useful adjunct to ablate any residual neoplastic and nonneoplastic tissue and its use improves disease-specific outcomes.[3] However, for patients

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with low-risk cancers, many currently advocate conservative use of I^{131} ablation, because the benefit on disease outcomes remains unproven.[8] In addition, the relevant risk of radiation injury to other organs and increased risk of secondary malignancies both need to be considered.[9] Tempered use of I^{131} also depends on the completeness of operative resection to allow reliable use of neck ultrasonography and serum Tg levels for long-term surveillance.

It has been well described that surgeon volume affects surgical outcomes.[10] This relationship has been demonstrated after cardiovascular, gastrointestinal, and oncologic operations, as well as in thyroid surgery.[10-12] Surgeons who perform more Tx per year have shorter durations of stay,[13] fewer postoperative complications including a lower risk of recurrent laryngeal nerve injury,[14] and lower patient costs.[12] Furthermore, operative outcomes may be more dependent on surgeon volume then variables such as experience or type of training. For example, Tuggle et al[15] analyzed Healthcare Cost and Utilization Project-Nationwide Inpatient Sample administrative data and found that pediatric patients who underwent thyroid/parathyroid surgery by a high-volume surgeon had decreased length of stay, fewer complications, and lower costs of care than patients who underwent an operation by low-volume surgeons, even if they were pediatric surgeons. Duclos et al[16] reported that complications after thyroid surgery were highest among surgeons who were either inexperienced (<5 years in practice) or highly experienced (≥20 years in practice), irrespective of surgeon volume. The threshold number of thyroid procedures that differentiates high-volume from low-volume surgeons varies and studies have found differences at 20, 30, and 100 cases per year.[10,12,13,17-19]

However, surgeon volume has only recently been examined for its impact on markers of initial completeness of resection in a study by Schneider et al.[19] With today's decreasing use of postoperative I^{131} and routine use of highly sensitive testing modalities for surveillance, completeness of initial surgery may be even more critical. The aims of this study are to determine the influence of surgeon volume on (1) the frequency of appropriate initial surgery for DTC and (2) additional quantitative measurements of completeness of resection.

METHODS

Patients. We retrospectively reviewed a clinical database containing all patients who underwent Tx (lobectomy or TTx) in a regional health system from January 1 to December 31, 2011 (University of Pittsburgh Medical Center QIIRB #1057). Surgeons were classified according to total number of thyroid surgeries performed during the year. In all patients with histologic DTC ≥1 cm, available clinical, pathologic, and radiologic data were evaluated. Excluded from analysis were patients who had incidental papillary microcarcinomas (DTC <1 cm), distant metastasis at presentation, or initial operation performed outside of our health system. After Tx, thyroid cancer patients were referred to endocrinologists who determined the need for RAI treatment as well as type and intensity of surveillance. Dose of I^{131} administered was determined by the endocrinologist and the nuclear medicine physician.

Evaluated outcomes. Appropriate initial operation for histologic DTC ≥1 cm was TTx.[4] Quantitative assessments of completeness of surgical resection included percentage uptake on initial thyrotropin (thyroid-stimulating hormone, TSH)-stimulated I^{123} pretreatment scan, pre-ablation TSH-stimulated Tg levels when Tg antibodies were undetectable, and dose of I^{131} administered. Initial unstimulated Tg levels when Tg antibodies were undetectable were also evaluated to evaluate patients who did not receive I^{131}ablation.

Surgical complications included permanent recurrent laryngeal nerve paralysis defined as an immobile vocal fold on direct laryngoscopy >6 months postoperatively, cervical hematoma requiring operative evacuation, and permanent hypocalcemia defined as need for rocaltrol and calcium supplementation >6 months postoperatively. Thyroid cancer recurrence in patients with >6 months follow-up was diagnosed by cytology or by histology after reoperation.

Statistics. Surgeon volume was initially evaluated using previously studied thresholds that distinguished low-volume from high-volume surgeons: 20, 30, and 100 thyroid operations performed per year.[10,12,13] To provide additional discrimination, we also evaluated whether differences were present at thresholds of 10, 25, and 50 thyroid operations per year. Statistical analysis was performed using Statistics Online Computational Resource (SOCR; available from http://www.SOCR.ucla.edu) with continuous variables expressed as a mean and analyzed using unpaired *t* test. Chi-square analysis was used to evaluate differences in categorical variables.

RESULTS

During 2011, 1,249 patients underwent Tx (lobectomy or TTx) by 42 surgeons in our health