The American Journal of Surgery 218 (2019) 695–699

Contents lists available at ScienceDirect

The American Journal of Surgery

journal homepage: www.americanjournalofsurgery.com

Completion thyroidectomy: A risky undertaking?

Kristina J. Nicholson, Cindy Y. Teng, Kelly L. McCoy, Sally E. Carty, Linwah Yip*

Division of Endocrine Surgery, Department of Surgery, University of Pittsburgh Medical Center, Kaufmann Building, Suite 101, 3471 Fifth Avenue, Pittsburgh, PA, 15213, United States

ARTICLE INFO

Article history:
Received 1 March 2019
Received in revised form
22 April 2019
Accepted 16 July 2019

Keywords:
Thyroidectomy
Complications
Completion thyroidectomy

ABSTRACT

Background: Completion thyroidectomy (cT) is sometimes necessary after thyroid lobectomy (TL), and it remains controversial whether 2-stage thyroidectomy adds operative risk. This study compares complication rates for TL, total thyroidectomy (TT), and cT.

Methods: Using a cohort design, we reviewed 100 consecutive cases each of TL, TT, and cT. Complications examined included reoperation for hematoma, temporary/permanent recurrent laryngeal nerve (RLN) dysfunction, and hypoparathyroidism.

Results: Two patients had reoperation for hematoma, both in the TT cohort ($p = 0.33$). No patients in any cohort had permanent hypoparathyroidism or RLN injury, but transient RLN paresis occurred in three (3%) TL, two (2%) TT, and no (0%) cT patients ($p = 0.38$). Transient hypoparathyroidism occurred in 3% following TT versus 0% after cT ($p = 0.12$). Overall complication rate was higher after TT (7%) compared to TL (3%) and cT (0%, $p = 0.02$).

Conclusions: At a high-volume center, the observed complication rates were equivalently low for TL, TT, and cT.

Summary: Completion thyroidectomy is occasionally needed after lobectomy, but its procedure-specific risks are not well characterized. In a cohort study at a high-volume center, operative outcomes for patients undergoing thyroid lobectomy, total thyroidectomy, and completion thyroidectomy were compared and equivalently low complication rates were observed for all 3 procedures.

Introduction

Pragmatically, the procedure-specific complications after thyroid surgery can be divided into two categories: anatomical and endocrine. In addition, complications after initial versus reoperative thyroidectomy may differ. Potential serious anatomical complications include injury to the recurrent laryngeal nerve (RLN) and cervical hematoma[1,2] while endocrine-related complications consist primarily of transient hypocalcemia, permanent hypoparathyroidism, and the very rare problem of thyroid storm. All of these complication rates are lower for experienced surgeons[3] with reported rates of RLN dysfunction, hematoma, and permanent hypoparathyroidism of 1–2%, <1%, and 1–5%, respectively.[4–6]

The potential need for reoperation is a specific risk of initial thyroid lobectomy and isthmusectomy (TL). In the management of indeterminate thyroid nodules and potentially low-risk malignancies, TL is often performed as the initial procedure and can be diagnostic, therapeutic, or both.[7] However, with a clinically significant histologic malignancy, subsequent completion thyroidectomy (cT) may be indicated to facilitate radioactive iodine treatment and/or surveillance.[8] Even if histology after TL is benign, delayed cT may be needed for contralateral nodules or other conditions. Conversely, initial total thyroidectomy (TT) may be selected for a variety of reasons including adverse sonographic features, molecular testing results, or other concurrent conditions.[7]

Compared to TT, two-stage thyroidectomy (initial TL and subsequent cT) is likely to add cost, time, and patient inconvenience to the surgical management of thyroid cancer. Some experts also maintain that it confers added risk (eg RLN dysfunction and hypoparathyroidism) because of reoperation through scar[9,10] but, there is a paucity of data to support or refute this concept, with the exception of one prior meta-analysis demonstrating similar complication rates for TT and cT.[11] Additionally, in the era of routine preoperative ultrasound, many experts avoid dissection or palpation of the contralateral lobe during initial TL specifically to

* Corresponding author.
E-mail addresses: nicholsonkj@upmc.edu (K.J. Nicholson), tengcy@upmc.edu (C.Y. Teng), mccoykl@upmc.edu (K.L. McCoy), cartyse@upmc.edu (S.E. Carty), yipl@upmc.edu (L. Yip).

https://doi.org/10.1016/j.amjsurg.2019.07.014
0002-9610/

facilitate safe cT if needed, but support is anecdotal. To directly examine this and better counsel thyroid patients about surgical intervention, the aim of this study was to compare the complication rates of TL, TT, and cT at a high-volume center.

Materials and methods

Using a single center case cohort study design (QIIRB 1212), we retrospectively reviewed post-operative complications of thyroidectomies performed prior to 7/31/2017 by selecting for study the most recent 100 consecutive cases of each of the following: TL, TT, and cT. In this study, cT was specifically defined as contralateral TL in the setting of previous TL and isthmusectomy, conducted without documented violation of the cT operative field described in the prior TL operative report. All surgeries were performed by 1 of 4 endocrine surgeons. Patients were excluded if they had any other prior neck surgery or if the studied operation included formal lymph node dissection (45 patients in TT, 2 in TL, and 7 in cT groups) or planned parathyroid exploration. No patient was classified into more than one cohort.

Demographic data were obtained from medical records, including age, sex, prior regional radiation, fine needle aspirate cytology results, operative data, post-TL hypothyroidism, final histology, and tissue types in the surgical specimen. Nodule size ≥4 cm was routinely considered an indication for surgery regardless of FNA category,[12] and when such patients had an additional reason for surgery such as indeterminate cytology, the indication was classified as nodule size. Remote cT was defined as cT > 1 year after TL.

Coded post-operative complications included hematoma, RLN dysfunction, hypoparathyroidism, and thyroid storm. Post-operative hypothyroidism was defined as the new requirement for supplemental levothyroxine as determined by TSH levels drawn 6–8 weeks following thyroid lobectomy. Hematoma was defined by suspicion for bleeding requiring return to the operating room. Temporary (<6 months) and permanent (>6 months) RLN dysfunction were defined as new postoperative vocal cord immobility on direct laryngoscopy in patients presenting with voice changes. For this analysis, we defined transient hypoparathyroidism by use of post-operative calcitriol that was discontinued within six months of surgery, although this may be a broad definition as a short course of subclinical calcitriol may sometimes be initiated if there was intraoperative concern for parathyroid stunning. Permanent hypoparathyroidism was defined by the need for post-operative calcitriol supplementation persisting >6 months. TT and cT patients were routinely discharged with supplemental calcium which was discontinued shortly after the first post-operative visit in the absence of hypocalcemic symptoms.

Statistical analyses were performed using Stata SE, version 14.0 (College Station, TX). Continuous variables were analyzed using analysis of variance (ANOVA). Categorical variables were analyzed using Fisher's exact test. Two-sided p-values of less than 0.05 were considered significant.

Results

By design, a total of 300 patients were included in analysis. To identify 100 consecutive patients in each cohort, the surgery dates spanned 0.87, 0.59, and 3.7 years in the TL, TT, and cT groups, respectively. Overall, the mean age was 52.7 ± 15.6 years ($p = 0.43$) and the mean BMI was 30.99 ± 7.44 ($p = 0.60$), with 77% female patients ($p = 0.75$). There were no significant demographic differences between the three groups (Table 1). Use of RLN monitoring was infrequent (15%) and was equivalent among the different procedures (TL 7% vs. TT 7% vs. cT 1%, $p = 0.06$).

Not surprisingly, surgical indications were different between operation types (Table 1, $p < 0.001$). The most common indication for TL was an indeterminate nodule (48%), followed by size ≥4 cm (44%), toxic nodule (4%), and compressive unilateral goiter (4%, $p < 0.001$). Malignancy in the index nodule was histologically diagnosed in 34% of TL patients; 82% were papillary thyroid cancer (PTC), 11.8% follicular thyroid carcinoma (FTC), 2.9% metastatic renal cell carcinoma (mRCC), and 2.9% both PTC and FTC. TT was most frequently performed for indeterminate cytology (35%) and hyperthyroidism (33%). Histologic malignancy was diagnosed in 45% of all TT patients, of whom 37.7% had indeterminate cytology. Among those with malignancy diagnosed in the biopsied nodule, 95.6% had PTC, 2.2% had anaplastic thyroid cancer, and 2.2% had mRCC. Surgical indications for cT differed from those for TL ($p = 0.04$), with indeterminate cytology being the most frequent cause for surgery (60.7%). Remote cT (>1 year from initial TL) occurred in 29% of all cT. One patient with biopsy-proven malignancy at the time of cT had TL performed 40 years earlier for benign disease (Fig. 1). All patients with preoperative malignant cytology had thyroid cancer diagnosed histologically after the index operation.

The rate of cT immediately after TL was 12.3% over the studied period, although patients who underwent cT were excluded from the TL cohort. The majority of cT patients (71%) had immediate (<1 year from initial TL) reoperation. Of these, TL was performed for indeterminate cytology results in 81.7%, and large nodule size in 11.3%. As expected, 91.5% had malignancy on histology (83.1% PTC, 15.4% FTC, 1.5% medullary thyroid cancer). Four patients who underwent immediate cT (5.6%) had a planned two-stage thyroidectomy for bilateral symptomatic goiter and 1 patient (1.4%) had papillary thyroid carcinoma diagnosed on FNA, but due to invasive features on pathology required cT. For patients who had immediate cT, the median time to cT was 63 days (range 8–343), with peaks at 2 and 10 weeks after TL.

In examination of the procedure-specific risks by type of surgery, we observed that risks were low for each of the studied groups and there were no significant differences in risk by type of thyroidectomy (Table 2). Two patients in the TT group required return to the operating room for hematoma while there were no

Table 1
Demographics and surgical indications. TL = lobectomy, TT = total thyroidectomy, cT = completion thyroidectomy, TN = toxic nodule.

	Overall (n = 300)	TL (n = 100)	TT (n = 100)	CT (n = 100)	p-value
Age, mean ± s.d.	52.70 ± 15.56	54.30 ± 15.84	52.30 ± 16.39	51.50 ± 14.42	0.43
BMI, mean ± s.d.	30.99 ± 7.44	30.05 ± 7.43	30.99 ± 7.79	31.93 ± 7.04	0.60
Female sex, n (%)	231 (77)	74 (74)	79 (79)	78 (78)	0.75
Indication, n (%)					
Goiter	15 (5)	4 (4)	4 (4)	7 (7)	0.67
Indeterminate cytology	159 (53)	48 (48)	35 (35)	76 (76)	<0.001
Hyperthyroidism/TN	38 (12.7)	4 (4)	33 (33)	1 (1)	<0.001
Size ≥4 cm	74 (24.7)	44 (44)	16 (16)	14 (14)	<0.001
Malignancy	14 (4.7)	0 (0)	12 (12)	2 (2)	<0.001

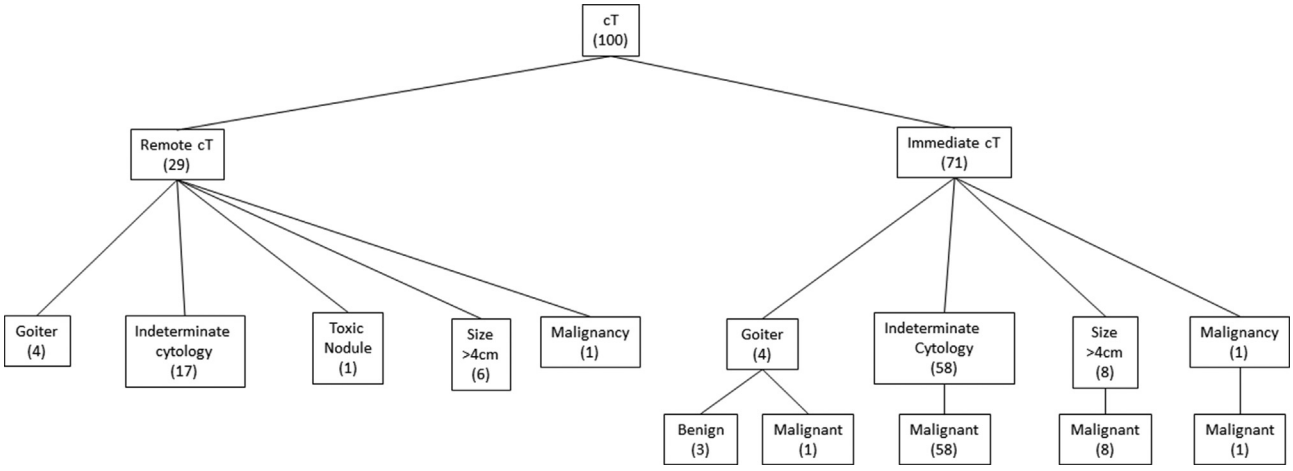

Fig. 1. Indications for completion thyroidectomy by timing; remote (>1 year after initial lobectomy) vs immediate. cT: completion thyroidectomy.

Table 2
Complications by surgery type. TL = lobectomy, TT = total thyroidectomy, cT = completion thyroidectomy, RLN = recurrent laryngeal nerve.

	Overall (n = 300)	TL (n = 100)	TT (n = 100)	cT (n = 100)	p-value
Hematoma/seroma			2	0	0.331
Temporary RLN dysfunction	5	3	2	0	0.377
Permanent RLN dysfunction	0	0	0	0	–
Temporary hypoparathyroidism	3	0	3	0	0.109
Permanent hypoparathyroidism	0	0	0	0	–
Total complications	10	3	7	0	0.020

occurrences of hematoma following TL or cT ($p = 0.33$). Three (3%) patients had temporary RLN paresis after TL, compared to two (2%) after TT and none after cT ($p = 0.38$). When the rate of temporary RLN paresis was considered based on nerves at risk (TL 3%, TT 1%, cT 0%), there was still no difference ($p = 0.16$). There were no instances of permanent RLN dysfunction. Calcitriol supplementation was transiently required in 3% of patients after TT, and none after cT ($p = 0.62$). One of the three was prophylactically started on calcitriol post-operatively following autotransplantation of two parathyroid glands, while the other two were prescribed calcitriol after the onset of hypocalcemia symptoms. There was no association between transient hypoparathyroidism and the incidental resection of parathyroid tissue (18.0%, $p = 0.15$) and surgery type was not associated with incidental resection of parathyroid tissue either ($p = 0.28$). No patient had thyroid storm.

The rates of having any complication were 3% for TL, 7% for TT, and 0% for cT ($p = 0.02$), with a lower complication rate observed for cT compared to TT ($p = 0.007$). There were no differences in specific complication rates between surgeons (hematoma, $p = 0.343$; temporary hypoparathyroidism, $p = 0.221$; temporary RLN paresis, $p = 0.665$). One percent of patients had a history of prior external beam radiation exposure, which was not associated with complications ($p = 0.59$). Histologic malignancy was diagnosed in 52.6% of all patients and was also not associated with complication risk ($p = 0.24$). On multivariable logistic regression, the type of surgery remained a significant predictor of overall complications ($p < 0.001$) but was insignificant for each complication individually.

Post-TL hypothyroidism (TSH >5 mIU/mL) was observed on laboratory testing in 39% of TL patients; one patient refused levothyroxine therapy, thus 38% of TL patients were started on levothyroxine supplementation post-operatively. A history of toxic nodule not requiring medical therapy was observed pre-operatively in 5.1% of TL patients with post-operative hypothyroidism. All patients who had TT and cT were started on thyroid replacement immediately after surgery.

Discussion

In today's age of de-escalated thyroid surgery (whenever possible), a detailed understanding of complication rates is critical for patient counseling and surgical planning. While life-threatening complications are rare,[13] procedure-specific complications can certainly be morbid and affect long-term quality of life.[14] Here, we examined a series of 300 consecutive patients who had either TL, TT, or cT with standard surgical indications. Interestingly, while we set out to discover whether two-stage surgery, in fact, has a higher complication rate than initial TT, the data from our high-volume, single institution study show that all three surgical approaches have low procedure-specific complication rates. In fact, no complications at all were seen in any of the 100 patients in the cT group.

TL is often the initial procedure offered for patients with cytologically indeterminate thyroid nodules that require definitive diagnosis, moreover, current recommendations for initial extent of surgery have recently been broadened to include consideration or initial TL for patients with seemingly low-risk thyroid cancer (e.g. size 1–4 cm without evident lymph node metastasis).[7] Not only is radioactive iodine ablation less frequently indicated today but population-level data have suggested that TL may result in equivalent oncologic outcomes compared to TT, although this remains controversial for some PTC subtypes[15,16] In analysis of the Nationwide Inpatient Sample, TT has been associated with an increased risk of complications compared to TL, however the difference was less pronounced for high-volume surgeons (>99 thyroidectomies per year).[17] We similarly observed that although the overall complication rate for TT was low (7%), it was still higher than for TL or cT alone.

After initial TL, patients may require a second operation for cT if

aggressive features are seen histologically, and the risk of requiring cT should certainly be discussed with patients prior to surgery. The rate of cT required under the new ATA Guidelines is unclear; recent single institution retrospective studies have suggested that a large proportion (20–50%) of patients with histologic thyroid cancer may require cT after initial TL was performed for what was thought to be low-risk cancer.[8,18,19] The risks of reoperation in a previously operated field are high[20,21] and this scenario is avoidable. The contralateral neck should not be explored or violated during initial TL. Here, we confirm that utilizing a 'no touch' technique for the contralateral lobe does allow for safe immediate or remote cT.

Compared to TT, cT has been associated with similar rates of RLN palsy,[22,23] and lower rates of hypoparathyroidism.[23–25] But study cohorts are heterogeneous and some include cases of cT which required reoperation in a previously operated field, while in other studies, cT was not always compared directly to TT.[26–31] For example, increased temporary hypocalcemia was observed in one study after cT, yet this study analyzed cT done primarily following subtotal thyroidectomy.[28] Another study reviewing 74 cT found an 8% rate of permanent hypoparathyroidism, which is much higher than the rate observed here; but these patients had also undergone bilateral central compartment lymph node dissection,[24] a population which we specifically excluded so as to instead examine the more typical clinical scenario.

As reported in other studies, we also observed that TT risks are higher than TL which is logical since TT is a bilateral operation. Although there are oncologic reasons to have initial TT, many patients may be adequately treated with TL, and preoperative risk stratification using patient-specific, sonographic, cytologic, and molecular characteristics contributes to shared decision-making. Another issue to consider in two-stage thyroidectomy is possible additional risk associated with a second anesthetic and consideration of cardiac- or pulmonary-related risk factors. Finally, the added costs associated with a cT should be balanced with the costs of potentially overtreatment with TT, and a well-executed cost-effectiveness study inclusive of longitudinal follow-up and accurate thyroid-specific quality of life considerations would be informative.

The study has several limitations. First, analysis is susceptible to type II error and the study size may be underpowered for comparison of the outcome measures. Nevertheless, the study premise that complication rates are higher in cT than in TL or TT, was not obviously proven. In fact, we were surprised to find that no complications were observed in the cT cohort despite reviewing almost 4 years of cases. Further study of a larger institutional cT cohort is impractical as these procedures are not being performed commonly. Use of population-level databases is unfortunately limited as the Collaborative Endocrine Surgery Quality Improvement Program (CESQIP) does not include cT as a procedure type and NSQIP does not assess long-term endocrine-specific complications. Second, although the primary reason to conduct cT is a diagnosis of significant malignancy after TL, in this study, we included thyroidectomies for all indications. In some series, surgical complications are higher in malignancy[14,32] and in others, complication rates are not associated with the indication for surgery.[33] In subset analysis, we observed no association between histologic malignancy and surgical complications. Third, the clinically important question is whether two-stage thyroidectomy is safe and as a surrogate, we selected patients who had cT. Temporary complications from initial TL are not captured and it is possible that patients who were intended to have two-stage thyroidectomy had permanent complications after initial surgery and were not further referred for cT thus, the operative risks reported here are underestimated. Additionally, rates of RLN palsy may be underestimated in all surgical groups in this study, as it is our practice to perform selective post-operative laryngoscopy in patients with new onset voice changes. Finally, our study was a single institution series from a high-volume specialty practice thus generalizability to other surgical practices may be limited.[22–24]

Conclusions

We postulated that the rate of surgical complications would be higher with cT compared to initial TT, but in fact not only was the observed rate of thyroidectomy-specific complications low for all studied groups, but the risk of temporary hypoparathyroidism was also lower. In the absence of other medical, cost, or patient-related considerations and when clinically warranted, cT appears to be a safe and reasonable option.

Disclosures

The authors have no conflicts of interest or financial disclosures to report.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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