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Differences in long-term quality of life between hemithyroidectomy and total thyroidectomy in patients treated for low-risk differentiated thyroid carcinoma

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ABSTRACT

Background: The long-term health-related quality-of-life implications of treating low-risk differentiated thyroid cancer with total thyroidectomy or hemithyroidectomy is important to patients but remains poorly understood.

Methods: Using a cross-sectional mailed survey, we compared long-term health-related quality-of-life in low-risk differentiated thyroid cancer survivors treated with hemithyroidectomy to those treated with total thyroidectomy between 2005 and 2016 at a university hospital. European Organisation for Research and Treatment of Cancer Quality of Life core Questionnaire version 3.0, the supplementary Thyroid Cancer specific questionnaire module version 2.0, and the Assessment of Survivor Concerns (ASC) questionnaires were used. Our primary outcome was the global scale of quality of life. Exploratory outcomes included differences among other health-related quality-of-life items corrected for potential confounders in multivariable regression analyses.

Results: The response rate was 51.0% (270 of 529), of which 59 patients (21.9%) were treated with hemithyroidectomy. Main outcome score global quality of life did not differ between groups (76.9 hemithyroidectomy vs 77.7 total thyroidectomy, $P = .450$). Exploratory analyses showed hemithyroidectomy to be associated with more worry about recurrence on the Assessment of Survivor Concerns questionnaire (2.4 hemithyroidectomy vs 2.1 total thyroidectomy, $P = .021$).

Conclusion: Long-term quality of life was not significantly different between low-risk differentiated thyroid cancer patients treated with total thyroidectomy compared with hemithyroidectomy. In secondary analyses, worry about recurrence appeared to be higher in individuals treated with hemithyroidectomy. These data highlight previously unreported impact of surgical regimen to the health-related quality-of-life for low-risk differentiated thyroid cancer patients.

Introduction

Health-related quality of life (HRQoL) is a major concern for patients with differentiated thyroid cancer (DTC) given the excellent prognosis of this disease. In comparison with the general population, HRQoL deficiencies have been found in DTC patients in

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areas such as insomnia, fatigue, and limitations of daily functioning.[1,2] HRQoL parameters may continue to be negatively affected for up to 20 y after curative treatment.[3] Furthermore, the quality of life of those treated for DTC has been reported to be similar or worse than the quality of life of survivors of cancers with poorer prognoses.[4] Given the high long-term survival rates and rising incidence of DTC, additional focus must be directed toward strategies for improving quality of life.[5] The recent American Thyroid Association (ATA) Management Guidelines for Differentiated Thyroid Cancer highlight the importance of integrating long-term HRQoL outcomes into the treatment decision-making process of physicians.[6] The impaired HRQoL of this population may be rooted in the classic treatments for thyroid cancer, such as thyroid hormone replacement, radioactive iodine remnant ablation (RAI), and surgical complications, negatively affecting psychologic well-being and social functioning.[2,7] The ATA guidelines recommend hemithyroidectomy (HT) as an alternative treatment to a total thyroidectomy (TT) and RAI in low-risk DTC patients.[6] This new recommendation stems from findings that have shown no benefit of a TT and RAI over an HT in regard to the prevention of disease recurrence and associated mortality.[8,9] One possible strategy for improving HRQoL in patients with DTC may be the reduction in the extent of surgical treatment. A recent retrospective review of patients undergoing treatment for thyroid cancer in Australia suggested HT to be less detrimental compared with TT with respect to HRQoL in the immediate postoperative period.[10] Although research focusing on long-term HRQoL is for the most part absent from the literature, one may hypothesize that less aggressive surgery may lead to long-term improvement in HRQoL.

We sought to determine differences in long-term HRQoL of low-risk DTC patients who had undergone HT to those treated with TT by using both validated questionnaires and a new thyroid cancer-specific HRQoL questionnaire.

Methods

Study design and eligibility criteria

A cross-sectional, self-administered survey of thyroid cancer patients was performed in parallel with a retrospective chart review. The targeted population consisted of a consecutive cohort of adults treated for DTC with ATA low-risk of recurrence between January 1, 2005, and June 30, 2016, at University Health Network in Toronto, ON, Canada. The patients identified from our institutional database and electronic medical records were reviewed for eligibility. ATA low-risk of recurrence was defined as differentiated thyroid carcinomas up to a diameter of 4 cm, without vascular invasion, extrathyroidal extension (ETE), gross positive resection margins, aggressive histologic variants (eg, tall cell, columnar cell, hobnail cell variants of papillary thyroid carcinoma), or distant metastasis.[6] Patients with benign indications for surgery with incidentally found papillary microcarcinoma and otherwise benign pathology were excluded. Preoperative diagnosis was based on fine-needle aspiration conclusion divided into nondiagnostic results, preoperative presumed benign (Bethesda II), indeterminate (Bethesda III–V), or malignant (Bethesda VI). The survey package and instructions were written in English and mailed to eligible patients in September of 2017, with a first reminder to nonresponders 3 weeks later and a second reminder after address verification via primary care physicians. A self-addressed, postage-paid envelope was provided for return of the survey, and patient consent was implied by return of the completed questionnaire. The participants were not reimbursed for their participation. The study was approved by the University Health Network Research Ethics Board.

Questionnaires description

The survey package included a coversheet explaining the study and the following components: the European Organisation for Research and Treatment of Cancer Quality of Life core Questionnaire version 3.0 (EORTC QLQ-C30), the supplementary Thyroid Cancer specific questionnaire module version 2.0 (EORTC QLQ-THY34), the Assessment of Survivor Concerns (ASC) questionnaire, and self-reported disease-related questions (last physician visit; self-reported disease status; active comorbidities; current use of thyroid hormone replacement medication; or calcitriol, a surrogate for hypoparathyrodism). The permission of developers was obtained for use of questionnaires where appropriate, and all questionnaires were scored as per the developers' instructions.

EORTC QLQ-C30 version 3.0

This is a widely used and validated quality-of-life questionnaire to evaluate HRQoL in oncology patients, including thyroid cancer patients.[11,12] This questionnaire incorporates a global quality-of-life scale, 5 functional scales (physical, role, cognitive, emotional, and social), 3 symptom scales (fatigue, pain, and nausea/vomiting), a number of single items assessing additional symptoms commonly reported by cancer patients (dyspnoea, loss of appetite, insomnia, constipation, and diarrhoea), and perceived financial impact of the disease. The time frame of the questions is the previous week, and each item is scored on a 4-point response scale ranging from 1, "not at all," to 4, "very much," with the exception of the global quality of life scale, which is scored on a seven-point modified linear analogue scale ranging from 1, "very poor" to 7, "excellent." After linear transformation, all scales and single-item measures range in score from 0 to 100, with 100 reflecting the best score possible for functioning scales and the worst score for symptom scales. The primary outcome of this study was chosen to be the global scale of quality of life of the EORTC QLQ-C30 questionnaire. For this scale, 10–15 points mean difference has been reported as a medium clinically relevant effect.[13]

EORTC QLQ-THY34 version 2.0

The Thyroid Cancer Module is a supplementary questionnaire module employed in conjunction with the QLQ-C30 for the evaluation of HRQoL in thyroid cancer patients. Thyroid cancer–related HRQoL items are combined in the following scales: discomfort in the head and neck, fatigue, fear, hair problems, restlessness, social support, swallowing, worry about important others, tingling or numbness, and voice concerns. Single-item scales include altered body image, cramps, dry mouth, altered temperature tolerance, impact on job or education, joint pain, and shoulder function problems. The time frame of the questions is the previous week, and each item is scored on a 4-point response scale ranging from 1, "not at all.," to 4, "very much." Following the EORTC QLQ-THY34 guidelines, raw scores were combined and transformed into scales (discussed earlier in this report) with standardized scores ranging from 0 to 100, with 100 presenting worst possible score for symptom scales.[14]

ASC

ASC is a questionnaire to evaluate cancer-related worry that has been used elsewhere in thyroid cancer survivors.[15,16] This questionnaire includes 3 items that focused on the construct of cancer worry (cancer worry subscale), specifically worries about the following: diagnostic tests, another type of cancer, or cancer coming back. The ASC also includes 2 items that focused on health

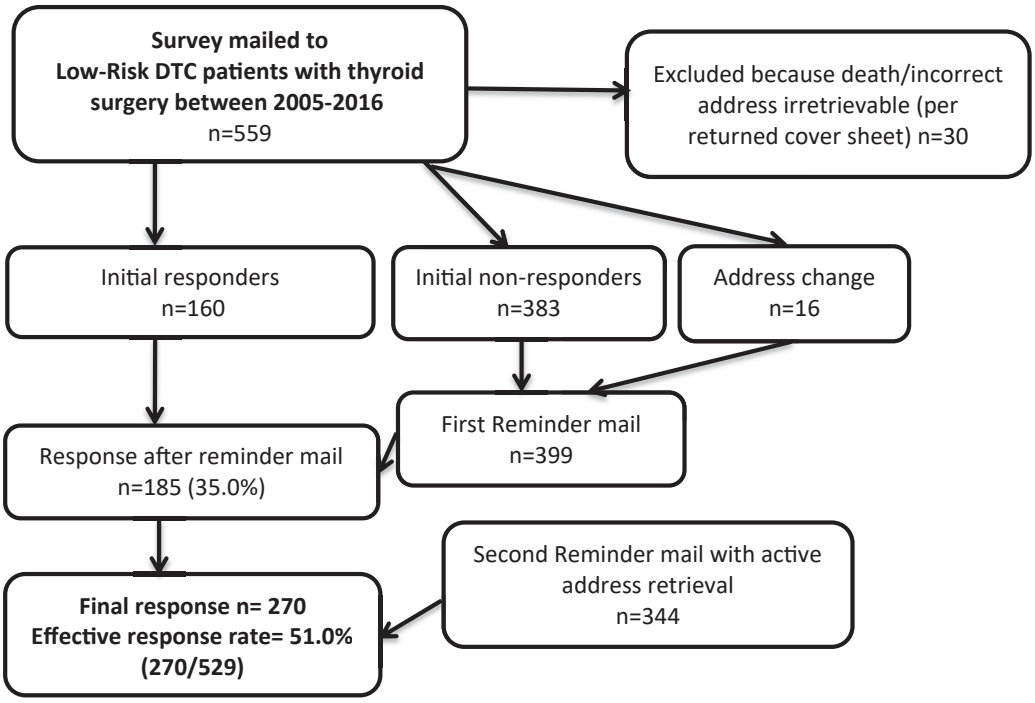

Figure. Study flow.

worry (health worry subscale), specifically addressing worries about dying and personal health. An item regarding child's health worry was removed as per the developers' recommendations. ASC questions are scored on a Likert scale of agreement, with responses for individual items ranging from 1 (least worry) to 4 (most worry). Results for cancer worry and health worry subscales are calculated by summing the scores of all questions in their respective categories. Similarly, the overall ASC score is calculated by summing the results of all questions. Aside from the validated subsets, we included single items of the ASC in the analysis.

Data collection and entry

Two investigators (P.B. and C.G.) conducted retrospective chart review to collect demographic, clinical, and pathologic data. Data collected from the chart review and questionnaire data were entered in an Excel spreadsheet. Duplicate entry of a random sample (10%) was checked for accuracy by a third study member (R.H.). Incomplete questionnaires were handled as per the developers' recommendations.[12,17]

Statistical analyses

Descriptive demographic and clinic data were summarized according to extent of thyroidectomy. Univariate comparisons according to surgical treatment group were conducted using the Mann-Whitney *U* test for nonparametric data and the Student's t test for parametric data. Potential demographic and clinicopathologic confounders were identified by univariate analysis for each HRQoL domain that differed between HT and TT, using a criterion of $P < .10$. To understand the adjusted influence of surgical strategy on HRQoL domains, a multivariable regression analysis was performed with the covariates that were identified as potential confounders. To have a robust model, we performed backward stepwise selection procedure of the covariates starting with removal of variables with the highest nonsignificant *P* value, until only true confounders in the model ($P \leq .05$) remained. Bootstrapping with 1,000 times sampling was performed given the nonparametric nature of the data. Because other studies have shown that quality of life may continue to improve years after cancer diagnosis, we analysed cancer survivorship between 1 and 5 years after initial surgery as "early," and those $\geq$ 5 years after initial surgery as "late."[2,15] Statistical analyses were performed using SPSS version 24 (IBM Corporation, Armonk, NY, USA).

Results

Characteristics of the study population

The survey was mailed to 559 individuals. Of these individuals, 30 were excluded because of either an incorrect, irretrievable address or because the patient had died from causes unrelated to thyroid cancer. The effective response rate was 51.0% (270/529), as present in the Figure. Of the respondents, 59 (21.9%) underwent an HT and 211 (78.1%) a TT as definitive treatment. Table I demonstrates the demographic characteristics and differences between the HT and TT respondents. A total of 35 (59.3%) of the patients treated with a HT and 57 (27.0%, $P < .001$) of the patients treated with a TT were early survivors, meaning that they completed the survey 1–5 years after initial surgery. The TT group consisted of 69 (32.7%) patients who underwent a 2-staged thyroidectomy. Of respondents with a history of a TT, 43.6% received RAI as part of initial treatment. More respondents that underwent a HT had T1a tumors (62.7% HT vs 24.6% TT, $P = .001$). Compared with TT, a fewer but still a significant number of patients received chronic thyroxine supplementation after a HT (66.0% HT vs 100% TT, $P < .001$). Long-term calcitriol supplementation, likely indicating permanent hypoparathyroidism, was not seen after HT, but was seen in 6.2% of participants after a TT ($P = .001$). Recurrence rates were 3.4% (2 of 59) in the HT group and 1.9% (4/211, $P = .4$) in the TT group. All underwent additional surgery and did not have evidence of disease at the time of the survey.

Table I
Demographic statistics of study participants

Characteristics	Respondents with hemithyroidectomy* $n = 59$	Respondents with total thyroidectomy* $n = 211$	P value†
Female sex	50 (84.7)	178 (84.4)	.942
Age, y			.259
≤30	6 (10.2)	8 (3.8)	
31–49	22 (37.3)	91 (43.1)	
50–65	24 (40.7)	85 (40.3)	
>65	7 (11.9)	27 (12.8)	
History of neck radiation	2 (3.4)	12 (5.7)	.294
Family history of thyroid cancer	3 (5.1)	15 (7.1)	.582
Income < 90,000CAD/y	24 (40.7)	38 (18.4)	< **.001**
Time since first surgery for thyroid cancer, years			< **.001**
1–2	10 (16.9)	5 (2.4)	
2–5	25 (42.4)	52 (24.6)	
5–10	15 (25.4)	102 (48.3)	
> 10	9 (15.3)	52 (24.6)	
Preoperative diagnosis			.651
Nondiagnostic	4 (6.8)	13 (6.2)	
Presumed benign	5 (8.5)	28 (13.3)	
Indeterminate	23 (39.0)	89 (42.2)	
Malignant	27 (45.8)	81 (38.4)	
pT-stage			< **.001**
Ia	37 (62.7)	52 (24.6)	
Ib	15 (25.4)	82 (38.9)	
II	7 (11.9)	77 (36.5)	
Histologic subtype			.124
Papillary thyroid carcinoma	28 (47.5)	71 (33.6)	
Follicular thyroid carcinoma	0 (0.0)	2 (0.9)	
Follicular variant of PTC	31 (52.5)	138 (65.4)	
Thyroiditis present in resection specimen	25 (42.4)	96 (45.5)	.670
Central neck dissection/node sampling	5 (8.5)	28 (13.3)	.336
Admission > 2 d	1 (1.7)	47 (22.3)	< **.001**
RAI	0 (0.0)	92 (43.6)	< **.001**
Recurrent disease	2 (3.4)	4 (1.9)	.491
On thyroxine replacement medication	39 (66.0)	211 (100.0)	< **.001**
On calcitriol supplementation	0 (0.0)	13 (6.2)	**.051**
Persistent laryngeal nerve damage	0 (0.0)	0 (0.0)	—
Self-reported active comorbities at time of survey			
Other cancer	1 (1.7)	15 (7.2)	.117
Cardiovascular	1 (1.7)	15 (7.2)	.117
Pulmonary	2 (3.4)	14 (6.7)	.344
Mental health	8 (13.6)	26 (12.5)	.829

CAD, Canadian dollar; *RAI*, radioactive iodine remnant ablation.
* Presented as number (%).
† P value based on χ^2 test.

Health-related quality-of-life differences between HT and TT

HRQoL scores for HT and TT groups are presented in Table II. The number of missing responses to single questions ranged from 0.0% to 2.6%. The primary outcome, the global quality-of-life score of the EORTC QLQ-C30, did not differ between HT and TT groups (mean 76.9 [SD 16.2] and 77.7 [SD 19.1], respectively, P =.450). Subanalysis within the TT group showed no difference between patients who underwent a 1-stage thyroidectomy or 2-stage thyroidectomy (mean 77.1 [SD 19.3] and 78.9 [SD 18.6], respectively, P = .537]. The EORTC QLQ-C30 domains that showed significant or trends toward significant differences related to surgical strategy were cognitive functioning (75.6 HT versus 82.1 TT, P = .022) and social functioning (84.2 HT versus 90.0 TT, P = .094). In the EORTC QLQ-THY34 questionnaire trends were seen for the domains altered body image (16.4 HT vs 10.9 TT, P = .078), fear (21.3 HT vs 16.1 TT, P = .062), and impact on job (18.1 HT vs 7.4 TT, P = .098). For the ASC questionnaire, worry about cancer recurrence significantly differed between HT (mean 2.4, SD 1.0, answered range 1–4) and TT (mean 2.1, SD 1.0, answered range 1–4, P = .021). Trends were seen for the item worry about their health (2.6 HT vs 2.3 TT, P = .089), the cancer worry subscale score (7.2 HT vs 6.5 TT, P = .062), and the ASC overall score (11.7 HT vs 10.6 TT, P = .069).

Potential confounders

Potential demographic and clinicopathologic confounders of the relationship between surgical strategy and HRQoL domains were identified when $P < .10$ in the univariate analysis, as presented in Table III. Potential confounders included for HRQoL domain "cognitive function" tumor stage, and time since first surgery; for "social functioning"—RAI; for "body image altered"—calcitriol supplementation at time of survey, RAI and time since first surgery; for "fear"—time since first surgery; for "impact on job"—RAI and time since first surgery; for "worry about recurrence"—time since first surgery; for ASC Health Worry subscale—days of hospital admission at initial treatment; and for ASC Overall Score—days of hospital admission at initial treatment. After backward stepwise selection procedure of these potential confounders and bootstrapping method, the final multivariable model showed that the ASC single-item score regarding "worry about recurrence" was significantly influenced by the surgical strategy (P = .021). For survivors who underwent an HT, the score for "worry about

Table II
HRQoL domains: Mean differences between hemithyroidectomy and total thyroidectomy

		Hemithyroidectomy* $n = 59$	Total Thyroidectomy* $n = 211$	P value†
EORTC QLQ-C30‡ (range 0-100)	Global scale for quality of life	76.9 (16.2)	77.7 (19.1)	.450
	Physical functioning	91.6 (11.6)	91.7 (13.4)	.630
	Role functioning	88.5 (19.3)	91.1 (17.6)	.341
	Emotional functioning	73.6 (24.7)	77.4 (21.9)	.279
	Cognitive functioning	**75.6 (23.4)**	**82.1 (21.7)**	**.022**
	Social functioning	**84.2 (26.6)**	**90.0 (21.6)**	**.094**
	Fatigue	27.0 (24.8)	22.8 (21.5)	.333
	Nausea/vomiting	3.2 (7.9)	4.4 (12.0)	.704
	Pain	10.5 (18.0)	12.5 (20.1)	.493
	Dyspnoe	9.2 (20.5)	9.5 (19.2)	.729
	Sleep disturbances	37.4 (35.4)	29.0 (29.4)	.139
	Appetite loss	6.3 (19.2)	5.8 (16.4)	.817
	Constipation	14.3 (24.5)	13.7 (25.2)	.795
	Diarrhea	7.6 (17.8)	7.9 (16.3)	.653
	Financial difficulties	12.1 (28.4)	7.3 (20.1)	.333
EORTC THY34‡ (range 0-100)	Fatigue	28.2 (26.4)	23.2 (22.4)	.246
	Discomfort neck	11.5 (16.9)	8.7 (13.5)	.230
	Voice concerns	9.0 (15.9)	9.4 (17.0)	.920
	Hair problems	16.1 (26.3)	18.6 (28.3)	.648
	Swallowing	5.9 (13.8)	7.4 (17.1)	.715
	Dry mouth	20.3 (29.7)	20.9 (27.7)	.725
	Temperature intolerance	31.1 (33.3)	24.9 (28.9)	.241
	Body image altered	**16.4 (26.5)**	**10.9 (22.1)**	**.078**
	Restlessness	18.9 (20.2)	17.8 (19.3)	.765
	Shoulder functioning	6.2 (15.8)	4.5 (13.9)	.368
	Fear	**21.3 (20.3)**	**16.1 (18.5)**	**.062**
	Joint pain	26.6 (27.5)	30.8 (30.1)	.365
	Tingling/numbness	12.1 (18.8)	12.3 (16.7)	.665
	Cramps	22.0 (28.1)	25.8 (27.8)	.277
	Worry about important others	25.7 (27.2)	17.8 (21.4)	.169
	Impact on job	**18.1 (21.7)**	**7.4 (21.0)**	**.098**
	Social support	**67.0 (29.9)**	**73.7 (29.7)**	**.076**
ASC‡,§	Cancer worry (3–12)	**7.2 (2.6)**	**6.5 (2.5)**	**.062**
	• future tests (1–4)	2.2 (0.9)	2.0 (0.9)	.201
	• new cancer (1–4)	2.6 (1.0)	2.4 (0.9)	.234
	• recurrence (1–4)	**2.4 (1.0)**	**2.1 (1.0)**	**.021**
	General health worry (2–8)	4.5 (1.7)	4.1 (1.6)	.151
	• death (1–4)	1.9 (0.9)	1.9 (0.9)	.589
	• health (1–4)	**2.6 (0.9)**	**2.3 (0.8)**	**.089**
	Overall (5–20)	**11.7 (4.0)**	**10.6 (3.8)**	**.069**

* Data presented as mean (SD).
† Boldface type when $P < .10$.
‡ Number of missing answers ranged between 0-7 per domain scale.
§ Range of each domain scale is presented between brackets behind its name.

recurrence" was estimated to be 0.3 points higher (95% CI 0.1–0.6) than survivors who underwent a TT, on the 1–5 Likert scale, with 5 being the most worry. The extent of surgery did not remain significantly associated with other HRQoL domains of this survey. The following covariates remained as confounders in the final multivariable regression model: (1) supplementation of calcitriol at time of the survey for the EORTC QLQ-C30 domain "body image altered" (beta coefficient −10.9, [95% CI −14.6 to −7.5], $P = .001$) and (2) hospital admission of > 2 days for the ASC subscale Health Worry (beta coefficient −0.3, [95% CI −0.06 to −0.01], $P = .048$).

Discussion

From this cross-sectional survey, we found that the type of surgery performed, namely HT or TT, for patients with low-risk DTC does not seem to influence general quality of life in the long-term. In an exploratory analysis of a wide range of HRQoL domains, single-item worry about recurrence appeared to be significantly higher for those undergoing hemithyroidectomy.

Quality of life is an especially important outcome measure of thyroid cancer treatment because the number of thyroid cancer survivors increases and the long-term prognosis is excellent.[18] From an oncologic standpoint, HT and TT are both viable treatment options for low-risk DTC. Given the results of this study, from the perspective of long-term global quality of life, both of these treatment options seem acceptable.

Although other studies have reviewed HRQoL differences between HT and TT, our study is among the first with extended follow-up in a population of low-risk DTC patients.[10,19,20] Nickel et al[10] reported better HRQoL outcomes in patients treated with HT, although median time between diagnosis and interview was less than 6 months and the study population was not limited to those with ATA low-risk DTC. Similarly, a Korean study with shorter follow-up after thyroid cancer treatment, found that the global quality-of-life scores of the EORTC QLQ-C30 questionnaire were better for those who were treated with HT.[19] Of note, the compared baseline global quality of life score for their patients was significantly lower (mean 57.9) than in our population (mean 77.5). Possible explanations for this difference may be that the Korean

Table III
Univariate analysis of associations between clinicopathologic characteristics and the outcomes of HRQoL domains

	EORTC-QLQ-C30		EORTC-QLQ-THY34				ASC			
	Cognitive functioning	Social functioning	Body image altered	Fear	Impact on job	Social support	Cancer worry	Worry about recurrence	Health worry	Overall
Income > 90,000 CAD*	4.1	2.5	−2.4	−1.0	−1.5	5.1	0.2	0.1	0.1	0.4
	$P = .207$	$P = .569$	$P = .633$	$P = .593$	$P = .389$	$P = .349$	$P = .559$	$P = .696$	$P = .440$	$P = .443$
Admission > 2 d†	5.8	4.4	−0.4	0.3	−0.9	4.2	−0.6	−0.2	−0.3	−1.1
	$P = .173$	$P = .168$	$P = .816$	$P = .699$	$P = .600$	$P = .364$	$P = .136$	$P = .129$	$\mathbf{P = .020}$	$\mathbf{P = .070}$
RAI‡	5.2	5.2	−4.6	−2.5	−5.2	5.0	−0.3	−0.1	−0.2	−0.7
	$P = .114$	$\mathbf{P = .075}$	$\mathbf{P = .013}$	$P = .275$	$\mathbf{P = .015}$	$P = .228$	$P = .345$	$P = .269$	$\mathbf{P = .025}$	$P = .145$
T-stage Ib/II§	7.0	5.6	−0.4	0.3	−2.7	5.4	−0.1	−0.1	−0.2	−0.4
	$\mathbf{P = .054}$	$P = .196$	$P = .303$	$P = .847$	$P = .530$	$P = .128$	$P = .778$	$P = .657$	$\mathbf{P = .042}$	$P = .425$
< 5 y time since first surgery¶	−5.7	−4.1	6.9	5.1	7.2	−3.7	0.4	0.2	0.1	0.6
	$\mathbf{P = .009}$	$P = .169$	$\mathbf{P = .003}$	$\mathbf{P = .024}$	$\mathbf{P = .011}$	$P = .326$	$P = .226$	$\mathbf{P = .068}$	$P = .211$	$P = .205$
Thyroxine suppletion‖	4.1	6.1	−0.3	−3.3	−5.7	4.5	−0.5	−0.1	−0.2	−0.7
	$P = .285$	$P = .253$	$P = .445$	$P = .269$	$P = .681$	$P = .246$	$P = .425$	$P = .633$	$P = .354$	$P = .472$
Calcitriol supplementation#	5.5	6.4	−12.7	−4.6	-9.0	9.4	0.2	0.1	−0.3	−0.2
	$P = .281$	$P = .586$	$\mathbf{P = .029}$	$P = .573$	$P = .116$	$P = .411$	$P = .772$	$P = .975$	$P = .110$	$P = .859$

Data are expressed as difference between mean scores of each group, *P* value of Mann-Whitney *U* test (for EORTC QLQ-C30 and EORTC QLQ-THY34 domains). Student's *t* test used with unequal variances assumed (for ASC domains). Boldface type when $P < .10$.
CAD, Canadian dollars; *RAI*, radioactive iodine remnant ablation; *FU*, follow-up.
* Compared with ≤ 90,000 CAD yearly income.
† Compared with ≤ 2 days of postoperative admission.
‡ Compared with no RAI.
§ Compared with T1a stage.
¶ Compared with ≥ 5 y time since first surgery.
‖ Compared with no self-reported thyroid replacement therapy.
Compared with no self-reported calcitriol supplementation therapy.

study population contained a portion of higher-risk disease and that their patients were surveyed closer to their date of surgery. With regard to our primary outcome, the global quality-of-life score of our study was similar to the scores of a large Dutch cohort of long-term thyroid cancer survivors.[2] Unfortunately, this cohort did not analyze HRQoL outcomes by surgical intervention.

As seen in this and other similar studies, thyroid cancer survivors may carry an increased worry about cancer recurrence that persists through long-term follow up.[16] In a study conducted by Hedman et al,[21] only 7% of thyroid cancer patients had disease recurrence, but as many as 48% of the patients experienced concerns about recurrence and had significantly affected HRQoL outcomes. This was confirmed by a Canadian study on worry among thyroid cancer survivors.[16] Our explorative results suggest that there is a relationship between the extent of surgery performed in thyroid cancer patients and future concern of recurrence. This phenomenon has been suggested, however quantitative data comparing different surgical strategies is lacking. Most of the research that has been conducted on the association between extent of treatment and the worry about disease recurrence has been done in the field of early-stage breast cancer. For breast carcinoma, although there is support for the relationship between many patient factors and fear of recurrence, the association with less extensive treatment, such as breast conserving surgery, has not been universally supported by evidence.[22,23] International surveys of thyroid cancer survivors have indicated that the care of almost half of the respondents could be improved and worry reduced by introducing patients to a patient support group or by referring them to a psychologist.[24,25]

A strength of this study was the use of a relatively homogenous cohort from a high-volume endocrine surgery center with a substantial portion of patients having HT. In addition, HT had been employed at this center for low-risk DTC before the release of the most recent ATA guidelines, which has allowed for the long-term follow-up of patients after an HT. Another strength of this study design is the use of a thyroid cancer specific questionnaire that helps to standardize language and provides a structure for further discussion in this area of thyroid cancer research.

The limitations of this study include the moderate response rate of 51.0%, and the potential bias of the study population, given that individuals with more HRQoL complaints might have been more likely to respond to the survey. A possible reason for the low response rate that we observed may lie in the nature of mailing a survey to patients after a long period of follow-up for a low-risk disease without providing any personal benefit or compensation for their participation. The EORTC QLQ-C30 is commonly used to evaluate HRQoL in various types of cancer, but because of a lack in validation for a low-risk differentiated thyroid cancer population as well as a lack in specific reference values, our conclusions should be interpreted with caution. In comparison with reference data from a validated group of all head and neck cancers, which included a small number of thyroid cancers, the global scale for quality of life from the EORTC QLQ-C30 had lower values (mean 64.1, SD 22.7) than our study population (mean 77.5, SD 18.5). Our study size was adequate for medium-sized effects, although it may have been underpowered for smaller effects with less clinical relevance.

In summary, in this cross-sectional patient survey, individuals with low-risk DTC had similar scores for HRQoL whether they had been treated with a TT or an HT. In our hypothesis-generating secondary analyses, there appeared to be more worry about recurrence in individuals treated with HT compared with individuals treated with TT. Although further independent confirmation is required, these data highlight the previously unreported impact of a surgical regimen to the long-term quality of life for low-risk DTC patients.

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Conflict of interest/Disclosure

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Discussion

Dr Lawrence Kim (Chapel Hill, NC): I have two questions for you. First, as you are probably aware, there's a paper from Italy in 2016 showing a big difference in fatigue between total thyroidectomy and hemithyroidectomy. Of the total thyroidectomy patients, 34% had significant fatigue as did 1% of the lobectomy patients. I was wondering if you had any thoughts as to why that experience differs from your results.

You also mentioned in your abstract that you used the Multidimensional Fatigue Symptom Inventory, and I didn't see any data about that. Do you have those data?

Dr Pim J. Bongers: That's absolutely correct. There was a fourth questionnaire that we added. For this presentation, we decided to leave that one out of our results because there were no differences. Also, fatigue had been assessed already by two domains of the EORTC questionnaire, and we did not see a difference.

What might be an explanation is the length of follow-up. Also, I am not aware if that study was in low-risk patients alone.

Dr Ashok R. Shaha (New York, NY): It's a very interesting study, and I am really impressed that you had 50% of patients responding to your mailed survey request. That is pretty good.

Whenever we treat cancer, we expect that the patient is going to be worried. Every patient with cancer is worried. "Am I going to die? Am I going to have a recurrence?" It's our responsibility to convince the patient that there are two roads and whichever they take, they are probably going to be successful.

In the hemithyroidectomy group, you made a big point that they were always worried. That may mean that as surgeons, we didn't do a good job in telling them that they were likely to be cured. Were you involved in discussions with these patients? As a group, did you convince them that this treatment is as good as anything else, or that this treatment provides a better quality of life? With the help of the endocrinologists, did you convince them that they wouldn't need radioactive iodine anyway? One of the major concerns of patients undergoing hemithyroidectomy is that they are not going to get a radioiodine scan.

Dr Pim J. Bongers: Thank you. If I may repeat, the question is whether we adequately informed our patients about the differences. First of all, some patients were treated more than 10 years ago by Dr Rotstein, Dr Pasternak, or others. We did give them the options for extent of surgery, and we used the data that were appropriate at that moment in time. I'm not sure that we actively convinced them to do hemithyroidectomy instead. I absolutely do agree with you that with these data, we should inform our patients that there may be an influence on the quality of life.

Dr Nancy Cho (Boston, MA): Thanks so much for sharing your data with us.

Going along with what Dr Shaha said, we have recently reviewed our institutional practices since the 2015 guidelines, and we have shown that our completion rates have actually gone down about 50%, but there's still a quarter of patients who undergo completion after hemithyroidectomy. I know you were alluding to the fact that some of this has to do with the patient's concern about their cancer.

I am curious about how much the patients are driving the decision versus the endocrinologists or the surgeons. Could you comment on that?

Dr Pim J. Bongers: We did look at the number of completion thyroidectomies. We considered them in the total thyroidectomy group, by the way. There was no difference between those two subgroups regarding quality-of-life outcomes.

Regarding how we inform the patients of the risks of completion thyroidectomy, I think what we try to give the complete story about risks and benefits. Some patients may ultimately want a completion, which may not be absolutely medically necessary.

Dr Emad Kandil (New Orleans, LA): Great study. Going back to the first question, for the patient who underwent thyroid lobectomy, did you do a subanalysis looking for who required hormone replacement versus not? Because I think it's different if the patient is required to be on thyroid hormone versus not. We know that we can predict who will be on hormone or not from the preop TSH level or antibodies for example. I wonder if you did this analysis.

Dr Pim J. Bongers: As you can see, the hemithyroidectomy group was still relatively small, about 59 patients, and of them two-thirds still required thyroxine replacement. We didn't see a difference in quality of life between those 2 groups. We did do a subanalysis, but still I think those groups are too small to conclude anything about that.