Survival rate between total thyroidectomy and lobectomy in papillary thyroid cancer

Saad S. Alhanafy[a], Alaa A.E. Elsisy[a], Ahmed B. Alanazi[b], Mohamed Abuelfetouh[c], Mahmoud M. Alabassy[a]

[a]Department of General Surgery, Faculty of Medicine, Menoufia University, Menoufia, Egypt, [b]Department of General and emergency surgery, Prince Abduaziz Bin Musaed hospital, Arar City, Northern Bborder, Saudi Arabia, [c]Department of Clinical Oncology and Nuclear Medicine, Faculty of Medicine, Menoufia University, Menoufia, Egypt

Correspondence to Mahmoud M. Alabassy, MD, Shebin-Elkom, Menoufia 32511, Egypt. Tel: +0020 1013 862 485; fax: 01013862485; e-mail: mahmoud.magdy710@med.menofia.edu.eg

Received: 22 October 2023
Revised: 31 October 2023
Accepted: 6 November 2023
Published: 31 January 2024

The Egyptian Journal of Surgery 2024, 43:96–100

Background
Regarding papillary thyroid cancer, comparisons between lobectomy (LT) and total thyroidectomy (TT) have not addressed major risks to reliable conclusions drawn from observational data. This research aimed to evaluate the survival rate following thyroidectomy (TT) and LT for papillary thyroid carcinoma.
Methods
A total of 155 patients with papillary thyroid cancer who had LT or TT at Menoufia University Hospitals between January 2018 and April 2023 were included in this retrospective cohort analysis. Overall survival was the main result, which was assessed using inverse probability weighting on the propensity score and flexible parametric survival models.
Results
Of the patients receiving treatment, 78% were female and the median age was 48 (range: 37–59). There were no statistically significant differences in the 5-year overall survival between individuals who underwent a complete thyroidectomy or LT. Furthermore, we did not find any statistically significant variation in survival by subgroups, such as age (<65 or ≥65), tumor size (<4 cm or ≥4 cm), or projected risk of death.
Conclusion
Based on our data, TT, independent of tumor size, patient age, or overall risk of mortality, is unlikely to provide a survival benefit over lobectomy.

Keywords:
lobectomy, papillary thyroid cancer, survival, total thyroidectomy

Egyptian J Surgery 43:96–100

1110-1121

Introduction

Over the past few decades, thyroid cancer incidence has significantly grown globally [1–3]. The primary cause of this rise has been identified as papillary thyroid carcinoma (PTC), which accounts for up to 88% of all thyroid cancer cases and is the most prevalent histologic subtype of the disease [4–7].

The primary therapy for PTC is surgery. One might classify the scope of the operation as a lobectomy (LT) or a total thyroidectomy (TT). For decades, there has been debate concerning the ideal surgical extent of PTC. TT has benefits include removing microscopic cancer foci in the contralateral lobe, enabling precise postoperative thyroglobulin monitoring, and permitting the use of radioactive iodine as an adjuvant treatment [8]. LT lowers the chance of recurrent laryngeal nerve damage and chronic hypoparathyroidism [9,10].

TT was advised by the 2009 American Thyroid Association (ATA) recommendations for PTC patients with tumors larger than 1.0 cm [11]. According to the 2015 revised ATA recommendations, both TT and LT are allowed in patients with PTC for tumors 1–4 cm without extrathyroidal extension and lymph node metastases [12].

PTC patients often have very good survival rates. A randomized clinical trial comparing the various surgical extents of PTC is not available since it would need to follow far too many individuals for an extended period of time. There is inconsistency in the outcomes of several retrospective investigations that address the surgical extent. Furthermore, it is uncertain if TT outperforms LT in terms of overall survival (OS) or recurrence-free survival. Thus, the purpose of this study was to evaluate the survival rate following thyroidectomy and lobectomy for papillary thyroid cancer.

Methods

This study was a retrospective cohort analysis of patients with PTC who were seen between January 2018 and April 2023 in the Menoufia University Hospitals' departments of clinical oncology and general surgery. We included individuals who underwent LT or TT as part of their treatment for PTC. Exclusion criteria included those with prior or concurrent tumors, those requiring additional medical or radioactive iodine treatment, and those with advanced thyroid tumors with nodal involvement requiring neck dissection or palliative care. Our main result was OS, which was calculated as the time from operation to death. Patients who were not confirmed dead at the conclusion of the trial were censored at the date of the final follow-up.

Classification of the patients

We performed two analyses taking tumor size into account. Firstly, for individuals with papillary thyroid tumor less than 4 cm and ≥4 cm, we evaluated the overall survival between LT and TT. Second, we examined survival depending on increasing the tumor size in 1 cm steps, up to 8 cm. This subsequent examination demonstrated the mean variation in survival for every size of tumor.

Similar to this, we examined age-related disparities by comparing overall survival between patients under 65 and those above 65, as well as by examining the survival rate in 10-year intervals from 20 to 90 years.

We classified each patient's risk of mortality into five quintiles, and arranged them from low to high risk, using the parametric survival model. Within each risk category, we evaluated the overall survival of complete thyroidectomy against LT.

The study was authorized by the ethical review board of the Menoufia University Faculty of Medicine (approval number: 10/2023SURG2-2) and complied with all STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) requirements.

Sample size estimation

We estimated the sample size required to detect a 2% difference in OS over a 5-year period. A total of 130 patients is the estimated sample size, which is adequate to identify a 2% difference in survival. The study had an 80% power and a 95% confidence interval.

Statistical analysis

When the data were entered into the computer, they were examined using IBM SPSS version 20.0. (USA: Armonk, NY-based IBM Corp.). Numbers and percentages were used to express categorizable data. The χ^2 test was employed to compare two groups. By taking into account patient, hospital, and tumor characteristics, we created survival comparisons following LT and complete thyroidectomy using two complimentary techniques. The underlying hazard function is estimated via flexible parametric survival models like a sequence of constrained cubic splines. These models compute variations in the chance of surviving to certain time points and makes it easier to estimate the marginal survival effect of surgery. The significance of the findings was established at the 5% level.

Results

A total of 155 patients with papillary thyroid cancer were included in the cohort; 53 (27%) underwent LTs, and 102 (73%) underwent complete thyroidectomies. Thirty-six months was the average follow-up period; 4% of cases died, and 96% were censored. There was no statistically significant difference in the median age of patients (51 years) and the range was (41–62) years between the two groups (P<0.22). However, patients undergoing complete thyroidectomy were mostly female (81%, P <0.001), have more multifocal disease (30% *vs.* 17%, P <0.001), and had larger tumor size (0.7 *vs.* 0.5 cm, P <0.001). Additional variations are displayed in Table 1.

OS rate

The predicted overall 5-year survival rate for patients treated with LT was 96%, and the same was true for patients treated with complete thyroidectomy 96%, according to the flexible parametric survival model (Table 2).

Additionally, no statistically significant difference was seen in the survival rate between patients managed with complete thyroidectomy and LT, according to propensity score analysis (Table 3).

Table 2 shows the 5-year OS probability for complete thyroidectomy *versus* LT as tumor size rose from 1 to 8 cm. At all tumor sizes, there was no significant difference in survival rates associated with the surgical technique; however, larger tumors were linked to a reduced chance of 5-year OS. Additionally, there was no clear linear trend in the survival variations between complete thyroidectomy and LT to report that the therapeutic impact varied with increasing tumor size. There was no significance in survival rate for tumors less than 4 cm or those that were ≥4 cm. A significant difference was also seen

Table 1 Characteristics of patients treated with lobectomy or total thyroidectomy

	Lobectomy, *N* (53)	Total thyroidectomy, *N* (102)	Total *N* (155)	*P*
Age, median (IQR)	51 (41–62)	51 (41–62)	51 (41–62)	0.22
Sex				
Male	13 (22.1)	21 (18.7)	34 (19.6)	< 0.001
Female	40 (77.9)	81 (81.3)	121 (80.4)	
Charlson comorbidities 0	33 (83.0)	82 (81.5)	115 (81.9)	< 0.001
1	12 (13.4)	15 (14.8)	27(14.4)	
2	5 (2.5)	3 (2.8)	8 (2.7)	
≥3	2 (1.0)	2(1.0)	4 (1.0)	
Multifocal disease				
Solitary tumor	32 (82.2)	69 (68.6)	101 (72.3)	< 0.001
Multifocal tumor	16 (16.7)	31 (30.1)	47 (26.5)	
Unknown	5 (1.1)	2 (1.3)	7 (1.2)	
Lymph node status				
All nodes examined are negative	3 (2.1)	3 (2.8)	6 (2.6)	< 0.001
One or more positive nodes	1 (0.1)	1 (0.2)	2 (0.2)	
Not applicable/unknown	50 (97.8)	98 (97.0)	148 (97.2)	
Tumor size				
<4 cm	50 (97)	97 (96.4)		< 0.001
≥4 cm	5 (3)	5 (3.6)		
Tumor grade				
Well differentiated	12 (14.1)	15 (14.9)	27 (14.7)	< 0.001
Moderately differentiated	2 (1.2)	3 (2.0)	5 (1.8)	
Poorly/undifferentiated	1 (0.3)	1 (0.4)	2 (0.4)	
Cell type not determined/unknown	38 (84.4%)	83 (82.7%)	121 (83.2%)	
Surgical margins				
No residual tumor	43(93.9)	94 (93.6)	137 (93.7)	< 0.001
Residual tumor	6(2 .9)	5 (4.3)	11 (3.9)	
Indeterminate	1 (1.1)	1 (0.7)	2 (0.8)	
Unknown or not applicable	3 (2.0)	2 (1.3)	5 (1.5)	

between complete thyroidectomy and LT when comparing average survival with propensity scores (Table 3).

We assessed whether the advantages of LT varied according to age because mortality rate rises with age as indicated in Table 2. While the 5-year OS for both TT and LT decreased gradually with age, there was no discernible difference in 5-year overall survival between the two procedures at any age. The lack of a tendency toward differential survival with advancing age indicates that the outcomes of thyroidectomy and LT are similar throughout the age range. Using flexible parametric models and propensity scores, we also evaluated the OS for patients under 65 and over 65; however, we were unable to discover any significant differences in expected survival (Tables 2 and 3).

Predicted risk category

A flexible parametric model was used to stratify the patients into five quintiles based on the projected risk of death. Cases with high or low risk of mortality had the same OS rate regardless of the surgical method, as Table 2 demonstrates no significant difference in OS between complete thyroidectomy and LT among the 5 quintiles.

Discussion

In this current study, we demonstrated that as regard tumor size, age of the patients, and overall mortality risk, a complete thyroidectomy did not appear to be linked with any discernible survival benefit as compared with a LT for patients with papillary thyroid tumor. Additionally, our data implies that decisions about surgical therapy should be based on educated dialogues between patients and their doctors, rather than setting a strict threshold where patients with tumors equal to 4 cm should only be offered complete thyroidectomy. If a patient's OS or life expectancy following therapy is their main concern, LT seems to be a viable treatment option, even for bigger tumors, provided that the right individuals are chosen. A careful analysis of surgical treatment choices is particularly necessary in light of the mounting evidence that a complete thyroidectomy may have a lower quality of life than a LT [13]. It may be

Table 2 The risk-adjusted probability of 5-year overall survival between patients treated with lobectomy or total thyroidectomy

Patient and tumor characteristics	Probability of 5-year overall survival	
	Lobectomy	Total thyroidectomy
Entire cohort	0.961 (0.952–0.968)	0.961 (0.953–0.968)
Age, years		
20	0.992 (0.991–0.993)	0.992 (0.991–0.993)
30	0.991 (0.990–0.992)	0.991 (0.990–0.992)
40	0.989 (0.988–0.990)	0.989 (0.988–0.990)
50	0.984 (0.983–0.986)	0.985 (0.984–0.986)
60	0.974 (0.972–0.976)	0.975 (0.973–0.976)
70	0.949 (0.945–0.953)	0.950 (0.947–0.953)
80	0.883 (0.872–0.893)	0.884 (0.875–0.893)
90	0.707 (0.677–0.737)	0.710 (0.681–0.739)
<65	0.982 (0.977–0.985)	0.982 (0.977–0.986)
≥65	0.872 (0.848–0.893)	0.874 (0.851–0.893)
Tumor size, cm		
1	0.968 (0.966–0.970)	0.969 (0.967–0.970)
2	0.964 (0.962–0.967)	0.965 (0.963–0.967)
3	0.961 (0.958–0.964)	0.961 (0.959–0.963)
4	0.957 (0.953–0.961)	0.958 (0.955–0.961)
5	0.954 (0.949–0.958)	0.955 (0.951–0.958)
6	0.951 (0.945–0.956)	0.952 (0.947–0.956)
7	0.948 (0.942–0.954)	0.949 (0.943–0.954)
8	0.945 (0.938–0.952)	0.946 (0.940–0.952)
<4	0.962 (0.954–0.97)	0.963 (0.955–0.97)
≥4	0.922 (0.904–0.937)	0.923 (0.905–0.937)
Risk quintile		
1 (lowest risk)	0.998 (0.996–0.999)	0.996 (0.995–0.997)
2	0.993 (0.991–0.995)	0.993 (0.991–0.994)
3	0.986 (0.983–0.989)	0.989 (0.987–0.991)
4	0.975 (0.970v0.979)	0.972 (0.969–0.975)
5 (highest risk)	0.880 (0.870–0.889)	0.886 (0.880–0.892)

Table 3 The risk-adjusted mean survival between patients managed with lobectomy *versus* total thyroidectomy

Patient and tumor characteristics	Average difference in survival after propensity weighting (month)
Entire cohort	1.8 (6.0–2.5)
Age <65 years	5.5 (12.1–1.0)
Age ≥65 years	0.01 (5.6–5.6)
Size <4 cm	2.2 (6.7–2.2)
Size ≥4 cm	2.8 (11.1–16.6)

appropriate to choose whole thyroidectomy if a patient is more concerned about reoperation or recurrence than other considerations, though, we were unable to assess the risk of recurrence between LT and thyroidectomy in our study.

Previous researches demonstrated that there was no difference in survival between individuals managed with complete thyroidectomy *versus* LT [14–18]. Moreover, Nixon *et al.* [19] did not find any significant difference in survival rate or recurrence between complete thyroidectomy and LT. Our study is distinct from the previous researches in that we provide comparisons between complete thyroidectomy and LT in a manner that is easier for surgeons and patients to utilize when debating surgical options. We offer quantitative differences in estimates of survival for 5 years after treatment instead of depending solely on hazard ratios. We also used a more complex but significantly more reliable method for treating continuous variables like age and tumor size by treating them as continuous rather than categorical variables. The advantages of this method and its capacity to produce more accurate models have been demonstrated by the statistical literature [20].

There are certain restrictions on our research. With this dataset, we were unable to compare between complete thyroidectomy and LT as regard recurrence or reoperation. Long-term survival (more than 5 years) may be similar, although LT may have a higher risk of recurrence or reintervention. This distinction may have a significant impact on the patients' quality of life. It is less evident whether the benefits of LT are sustained in the event of reintervention following an initial lobectomy, despite the fact that previous researches

have indicated that lobectomy is linked with an enhanced quality of life when compared with complete thyroidectomy [21,22].

Conclusion

Our results indicate that there was no significant difference between TT and LT regarding tumor size, patient age and overall risk of mortality, and TT is unlikely to provide a survival benefit over LT.

Acknowledgements

The study was approved by Menoufia University's Faculty of Medicine's ethical review board (Approval number. 10/2023SURG2-2) and followed all Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

The study was fully nonfunded from any organization.

All authors made significant contributions to the work presented, whether in the areas of ideation, study design, implementation, data collection, analysis, and interpretation, or all of these. They also contributed to the article's writing, revising, or critical evaluation, gave final approval for the version to be published, chose the journal to which the article was submitted, and agreed to be responsible for all aspects of the work.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Colonna M, Uhry Z, Guizard AV, Delafosse P, Schvartz C, Belot A, Grosclaude P. Recent trends in incidence, geographical distribution, and survival of papillary thyroid cancer in France. Cancer Epidemiol 2015; 39:511–518.

2 Topstad D, Dickinson JA. Thyroid cancer incidence in Canada: a national cancer registry analysis. CMAJ Open 2017; 5:E612–E616.

3 Wang Y, Wang W. Increasing incidence of thyroid cancer in Shanghai, China, 1983–2007. Asia Pac J Public Health 2015; 27:N223–N229.

4 Cho BY, Choi HS, Park YJ, Lim JA, Ahn HY, Lee EK, *et al.* Changes in the clinicopathological characteristics and outcomes of thyroid cancer in Korea over the past four decades. Thyroid 2013; 23:797–804.

5 Aschebrook-Kilfoy B, Ward MH, Sabra MM, Devesa SS. Thyroid cancer incidence patterns in the United States by histologic type, 1992–2006. Thyroid 2011; 21:125–134.

6 Buj R, Mallona I, Diez-Villanueva A, Zafon C, Mate JL, Roca M, *et al.* Kallikreins stepwise scoring reveals three subtypes of papillary thyroid cancer with prognostic implications. Thyroid 2018; 28:601–612.

7 Lubitz CC, Economopoulos KP, Pawlak AC, Lynch K, Dias-Santagata D, Faquin WC, Sadow PM. Hobnail variant of papillary thyroid carcinoma: an institutional case series and molecular profile. Thyroid 2014; 24:958–965.

8 Baldassarre RL, Chang DC, Brumund KT, Bouvet M. Predictors of hypocalcemia after thyroidectomy: results from the nationwide inpatient sample. ISRN Surg 2012; 2012:838614.

9 Ryu J, Ryu YM, Jung YS, Kim SJ, Lee YJ, Lee EK, *et al.* Extent of thyroidectomy affects vocal and throat functions: a prospective observational study of lobectomy versus total thyroidectomy. Surgery 2013; 154:611–620.

10 Shiryazdi SM, Kargar S, Afkhami-Ardekani M, Neamatzadeh H. Risk of postoperative hypocalcemia in patients underwent total thyroidectomy, subtotal thyroidectomy and lobectomy surgeries. Acta Med Iran 2014; 52:206–209.

11 American Thyroid Association (ATA) Guidelines Taskforce on Thyroid Nodules and Differentiated Thyroid Cancer; Cooper DS, Doherty GM, Haugen BR, Kloos RT, Lee SL, Mandel SJ, *et al.* Revised American Thyroid Association management guidelines for patients with thyroid nodules and differentiated thyroid cancer. Thyroid. 2009; 19 (11):1167–214. doi: 10.1089/thy.2009.0110. Erratum in: Thyroid. 2010 Aug;20(8):942. Hauger, Bryan R [corrected to Haugen, Bryan R]. Erratum in: Thyroid. 2010 Jun;20(6):674-5. PMID: 19860577..

12 Haugen BR, Alexander EK, Bible KC, Doherty GM, Mandel SJ, Nikiforov YE, *et al.* 2015 American Thyroid Association Management Guidelines for adult patients with thyroid nodules and differentiated thyroid cancer: the American Thyroid Association guidelines task force on thyroid nodules and differentiated thyroid cancer. Thyroid 2016; 26:1–33.

13 Chen W, Li J, Peng S, Hong S, Xu H, Lin B, *et al.* Association of total thyroidectomy or thyroid lo- bectomy with the quality of life in patients with differentiated thyroid cancer with low to intermediate risk of recurrence. JAMA Surg 2022; 157:200–209.

14 Bilimoria KY, Bentrem DJ, Ko CY, Stewart AK, Winchester DP, Talamonti MS, Sturgeon C. Extent of surgery affects survival for papillary thyroid cancer. Ann Surg 2007; 246:375.

15 Adam MA, Pura J, Gu L, Dinan MA, Tyler DS, Reed SD, *et al.* Extent of surgery for papillary thyroid cancer is not associated with survival: An analysis of 61,775 patients. Ann Surg 2014; 260:601–605.

16 Barney BM, Hitchcock YJ, Sharma P, Shrieve DC, Tward JD. Overall and cause- specific survival for patients undergoing lobectomy, near-total, or total thy- roidectomy for differentiated thyroid cancer. Head Neck 2011; 33:645–649.

17 Haigh PI, Urbach DR, Rotstein LE. Extent of thyroidectomy is not a major determinant of survival in low- or high-risk papillary thyroid cancer. Ann Surg Oncol 2005; 12:81–89.

18 Mendelsohn AH, Elashoff DA, Abemayor E, St John MA. Surgery for papillary thyroid carcinoma: Is lobectomy enough? Arch Otolaryngol Head Neck Surg 2010; 136:1055–1061.

19 Nixon IJ, Ganly I, Patel SG, Palmer FL, Whitcher MM, Tuttle RM, *et al.* Thyroid lobectomy for treatment of well differentiated intrathyroid malignancy. Surgery 2012; 151:571–579.

20 Royston P, Altman DG, Sauerbrei W. Dichotomizing continuous predictors in multiple regression: a bad idea. Stat Med 2006; 25: 127–141.

21 Bongers PJ, Greenberg CA, Hsiao R, Vermeer M, Vriens MR, Lutke Holzik MF, *et al.* Differences in long-term quality of life between hemithyroidectomy and total thyroidectomy in patients treated for low-risk differentiated thyroid carcinoma. Surgery 2020; 167:94–101.

22 Lee JI, Kim SH, Tan AH, Kim HK, Jang HW, Hur KY, *et al.* Decreased health-related quality of life in disease- free survivors of differentiated thyroid cancer in Korea. Health Qual Life Outcomes 2010; 8: 101.