

# Long-term sequelae of the less than total thyroidectomy procedures for benign thyroid nodular disease

## Original Article

Michael Zarif Fahim Hanna<sup>a</sup>, Hesham A.A. El Deen<sup>a</sup>, Manal I. Salman<sup>b</sup>, Mohammed H.H. Elhemeily<sup>c</sup>, Nahla N.A. Zaki<sup>d</sup> and Ayman Hossam Eldin Abd El Monem<sup>a</sup>

Department of <sup>a</sup>General Surgery, <sup>b</sup>Pathology, <sup>c</sup>Radiology, <sup>d</sup>Endocrinology, Faculty of Medicine, Ain Shams University, Cairo, Egypt.

## ABSTRACT

**Background:** Nodular goiter, the most prevalent thyroid disorder, is increasing in frequency due to the availability of sensitive diagnostic tests in recent decades.

**Aim:** To assess long-term sequelae of the less than total thyroidectomy procedures as a technique of surgical management of nodular thyroid disease versus total thyroidectomy.

**Patients and Methods:** This retrospective observational study was conducted on a total of 150 patients who presented with benign nodular thyroid disease and divided into two groups; group A: 75 patients underwent less than thyroidectomy and group B: 75 patients underwent total thyroidectomy at tertiary care hospital at General surgery units in El-Demerdash and Ain Shams University Specialized Hospital (ASUSH) and performed.

**Results:** Our study results reported that recurrence was significantly more frequent in the total group than in the total group (20.0% vs. 0.0%, respectively,  $P < 0.001$ ). Hence, the time to recurrence was less than the total group than in the total group  $6.5 \pm 0.9$ , while management of recurrence (Medical/surgical: 13.3%/ 86.7%, respectively).

**Conclusion:** Total thyroidectomy is a safe and effective procedure for benign thyroid diseases, while less than total thyroidectomy is associated with high recurrence rates and associated risks. Total thyroidectomy offers advantages such as disease eradication, goiter prevention, and occult malignancy avoidance, but is associated with higher morbidity and lifelong hypothyroidism replacement therapy. Less than total thyroidectomy has a place in modern practice especially with unilateral single or more thyroid lesions.

**Key Words:** Less than total thyroidectomy, thyroid nodular disease, total thyroidectomy.

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**Corresponding Author:** Michael Zarif Fahim Hanna, MSc, Department of General Surgery, Faculty of Medicine, Ain Shams University, Cairo, Egypt. **Tel.:** 01225535889, **E-mail:** michaelzarif8619@gmail.com

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## INTRODUCTION

Thyroid disorders most commonly manifest as nodular goiter. The frequency has been increasing over the past few decades as a result of the greater accessibility of precise and sensitive diagnostic tests for cytology, radiology, and biology<sup>[1]</sup>. Thyroid cancer detection and diagnosis have been made easier by recent developments in fine-needle aspiration biopsy (FNAB) and ultrasonography screening<sup>[2,3]</sup>. Thyroid nodules and/or hyperthyroidism were the main conditions treated with procedures like less than total thyroidectomy (also known as lobectomy, partial, or subtotal thyroidectomy). Even in cases of differentiated thyroid carcinoma, less invasive thyroid surgery has drawn surgical interest recently<sup>[4]</sup>.

The use of such approaches is encouraged by serious consequences associated with total thyroidectomy, particularly in situations of benign thyroid illness, such

as damage to the recurrent laryngeal nerve (RLN) and hypocalcemia following surgery<sup>[5]</sup>.

There may be further restrictions on the utilization of complete thyroidectomy related to the lifetime requirement for thyroxine replacement and the resulting rise in overall healthcare costs. Malignancy is the primary reason for surgical treatment of thyroid nodules. Additionally, in cases of poisonous nodules, compressive symptoms, developing nodules, or patient worry related to the nodule, surgery is advised. According to 2016 guidelines published by the American College of Endocrinology (ACE), Associazione Medici Endocrinologi (AME), and American Association of Clinical Endocrinologists (AACE), lobectomy is the recommended surgical procedure for unimodular benign goiter. For multinodular goiter, depending on the patient's preference and the clinical presentation, lobectomy plus isthmectomy or near-total thyroidectomy is suggested<sup>[6]</sup>.

According to American Thyroid Association (ATA) guidelines, lobectomy is recommended for solitary, indeterminate nodules; however, a total thyroidectomy may be recommended for nodules that are greater than 4 cm in size, cytologically suspicious for malignancy, or that are linked to a high-risk of malignancy based on the results of sonographic or molecular testing<sup>[7]</sup>. This study compared the long-term effects of partial thyroidectomies against whole thyroidectomies as a surgical procedure for nodular thyroid disease management.

#### **PATIENTS AND METHODS:**

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This retrospective observational study was conducted at tertiary care hospital at General surgery units in El-Demerdash and Ain Shams University Specialized Hospital (ASUSH) and performed on a total of 150 patients who presented with benign nodular thyroid disease and divided into two groups; group A: 75 patients underwent the less than thyroidectomy and group B: 75 patients underwent total thyroidectomy. The medical records of the patients who underwent total or less than total thyroidectomy of the previous 6 years from June 2017 to June 2023 were reviewed and the patients were followed-up after the surgery.

#### **Ethical approval:**

The ethical committee accepted the study, and patients gave their informed consent.

#### **Inclusion criteria:**

Single nodule, multinodular goiter, recurrent Graves' disease, follicular proliferation/indeterminate cytology were the reasons for a less than complete thyroidectomy and bilateral thyroid benign lesion for total thyroidectomy.

#### **Exclusion criteria:**

Report on malignant histology, follow-up of fewer than 5 years, and thyroidectomy because of volume remnant of less than 1 ml.

#### **Study procedure:**

Thyroid stimulating hormone levels in all study participants were within the normal range (0.4–4.5  $\mu$ IU/ml). When individuals had lobectomies, the residual lobe was sonographically normal and had undergone preoperative testing. Thyroid nodule development and nodule size as determined by follow-up neck ultrasonography.

Follow-up time was the amount of time that passed between surgery and the last documented endocrinological assessment. The period between surgery and the first positive postoperative thyroid ultrasonography (new nodule occurrence) was used to define the time to recurrence<sup>[8]</sup>.

Recurrence of nodule was also observed. Recurrence was defined as the occurrence of nodule(s) of any size in the thyroid remnant greater than 1 ml on at least one postoperative ultrasound for subtotal thyroidectomy and as the occurrence of new nodule(s) greater than 1 cm in the residual lobe(s) for lobectomy or partial thyroidectomy<sup>[9]</sup>.

#### **All participants were subjected to the following:**

**Preoperative:** Full medical history (MEN syndrome), complete physical examination and local examination of neck swelling, cervical lymph nodes, vocal cord examination, and laboratory investigations

#### **Postoperative**

**While admitted:** Assessment for pressure symptoms (pain, dysphagia, dyspnea), local thyroid examination, and vocal Cords examination.

**Early postoperative:** Monitoring of vital data and airway patency, good analgesia, assessment of vocal cords function and assessment for serum calcium.

**Late postoperative:** Neck ultrasounds as well as any eventual FNAB.

#### **Statistical analysis**

Using IBM SPSS statistics (Statistical Package for Social Sciences) software version 28.0, IBM Corp., Chicago, USA, 2021, the gathered data were coded, tabulated, and statistically evaluated. The Shapiro–Wilk test was used to check for normalcy in quantitative data. The data was then described as mean $\pm$ SD and the minimum and highest values within the range. An independent t-test was used to compare the results. Number and percentage descriptions of qualitative data are compared using the  $\chi^2$  test and, for variables with tiny predicted numbers, Fisher's exact test. When the *P value* was less than 0.050, it was considered significant; otherwise, it was considered nonsignificant.

#### **RESULTS:**

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Table 1 showed that: no statistically significant differences between the total group and total group regarding demographic characteristics; age (33.1 $\pm$ 3.5 vs. 32.3 $\pm$ 3.2, respectively, *P*=0.173), sex (male/female: 21.3%/78.7% vs. 25.3%/ 74.7%, respectively, *P*=0.562) and time from operation (7.9 $\pm$ 1.2 vs. 7.7 $\pm$ 1.4, respectively, *P*=0.351).

Table 2 showed that: multinodular goiter was the most frequent (72.0%) indication of surgery in less than total group, followed by single nodule (20.0%), then recurrent Graves' disease (5.3%) and follicular profanation/indeterminate cytology (2.7%).

Table 3 showed that: permanent RLN paralysis was nonsignificantly less frequent in less than total group than in total group (1.3% vs. 6.7%, respectively,  $P=0.209$ ). Permanent hypothyroidism was significantly less frequent in than total group than in the total group (4.0% vs. 26.7%, respectively,  $P<0.001$ ). The need for thyroxin supplementation was significantly less frequent in less than the total group than in the total group (74.7% vs. 88.8%, respectively,  $P=0.036$ ).

Table 4 time to recurrence and management of recurrence among less than total thyroidectomy group.

Table 5 Subgroups of less than total thyroidectomy group.

**Table 1:** Demographic characteristics between the studied groups

Variables	Measures	Less than total thyroidectomy (Total=75)	Total thyroidectomy (Total=75)	<i>P</i> value
Age (years)	Mean±SD	33.1±3.5	32.3±3.2	^0.173
	Range	26.0–42.0	25.0–40.0	
Sex ( <i>n</i> , %)	Male	16 (21.3)	19 (25.3)	#0.562
	Female	59 (78.7)	56 (74.7)	
Time from operation (years)	Mean±SD	7.9±1.2	7.7±1.4	^0.351
	Range	5.0–10.0	5.0–11.0	

^Independent t-test.

#Chi square test.

**Table 2:** Indication of surgery and subgroups in less than total group

	<i>n</i> (%)
Indication of surgery	
Single nodule	15 (20.0)
Multinodular goiter	54 (72.0)
Recurrent Graves' disease	4 (5.3)
Follicular profanation/indeterminate cytology	2 (2.7)
Subgroups	
Lobectomy (hemithyroidectomy)	22 (29.3)
Partial	14 (18.7)
Subtotal	39 (52.0)

Total=75.

**Table 3:** Permanent recurrent laryngeal nerve paralysis, permanent hypothyroidism, need for thyroxin supplementation, hyperparathyroidism, and recurrence between the studied groups

Findings	Less than total thyroidectomy (Total=75) [ <i>n</i> (%)]	Total thyroidectomy (Total=75) [ <i>n</i> (%)]	<i>P</i> value
Permanent RLN paralysis	1 (1.3)	5 (6.7)	§0.209
Permanent hypothyroidism	3 (4.0)	20 (26.7)	#<0.001*
Need to thyroxin supplementation	56 (74.7)	66 (88.0)	#0.036*
Transient hyperparathyroidism	7 (9.3)	0	§0.013*
Permanent hyperparathyroidism	3 (4.0)	0	§0.245
Recurrence	15 (20.0)	0	#<0.001*

RNL, recurrent laryngeal nerve.

§Fisher's Exact test.

# $\chi^2$ , Chi square test.

\*Significant.

**Table 4:** Time to recurrence and management of recurrence among less than total thyroidectomy group

Measures	Mean±SD	Range
Time to recurrence (years)	6.5±0.9	5.0–8.0
	<i>n</i> (%)	
Management		
Medical	2 (13.3)	
Surgical	13 (86.7)	

Total=15.

**Table 5:** Subgroups of less than total thyroidectomy group

Subgroups	<i>n</i> (%)
Lobectomy (hemithyroidectomy)	22 (29.3)
Partial	14 (18.7)
Subtotal	39 (52.0)

#Chi square test.

\*Significant.

Table 5 showed that: Lobectomy, Partial and Subtotal thyroidectomy were in 29.3, 18.7, and 52.0%.

## DISCUSSION

No statistically significant differences between the total group and total group regarding demographic characteristics; age (33.1±3.5 vs. 32.3±3.2, respectively,  $P=0.173$ ), sex (male/female: 21.3%/78.7% vs. 25.3%/74.7%, respectively,  $P=0.562$ ) and time from operation (7.9±1.2 vs. 7.7±1.4, respectively,  $P=0.351$ ).

As regards the indications of the surgery, our current research study revealed that Multinodular goiter was the most frequent (72.0%) indication of surgery in less than total group, followed by single nodule (20.0%), then recurrent Graves' disease (5.3%) and follicular profanation/indeterminate cytology (2.7%).

These results are consistent with earlier research. Boutzios and colleagues carried out a single-center retrospective study comprising 154 patients who underwent less-than-total thyroidectomy procedures for nodular disease and/or hyperthyroidism. The study's goal was to evaluate the long-term effects of these procedures. They found that 132 of the patients were female (85.7%) and that their average age was 65.1±12.91 years. The average duration of follow-up was 26.89±13.1 years. The histology revealed that all of the individuals had benign thyroid disease<sup>[10]</sup>.

As regards the postoperative complications, our study results revealed that permanent RLN paralysis was nonsignificantly less frequent in less than total group than in total group (1.3% vs. 6.7%, respectively,  $P=0.209$ ), while permanent hypothyroidism was significantly less frequent in less than total group than in total group (4.0% vs. 26.7%, respectively,  $P<0.001$ ). Consequently, the need to thyroxin supplementation

was significantly less frequent in less than total group than in total group (74.7% vs. 88.8%, respectively,  $P=0.036$ ). However, it is not a complication but a normal sequel of permanent hypothyroidism post total thyroidectomy.

In agreement with our results, Ahmed and colleagues revealed that there was no significant difference between both groups as regards the development of postoperative complications. Transient and permanent RLN injury occurred in one patient of the total thyroidectomies group compared with none of the ST group ( $P$  value= 1.000)<sup>[11]</sup>.

Boutzios and colleagues found that the rate of surgical complications in primary surgery was a modest 1.3% (2/154), which is consistent with our data. One patient had irreversible hypocalcemia, whereas the other had RLN injury. There were no surgical complications in the individuals who underwent additional surgery (0/17). 89.6% of the patients, or 138 out of 154, required long-term thyroxine supplementation<sup>[10]</sup>.

As regards the recurrence, our study results reported that recurrence was significantly more frequent in less than total group than in the total group (20.0% vs. 0.0%, respectively,  $P<0.001$ ). Hence, the time to recurrence was in less than the total group than in the total group 6.5±0.9, while management of recurrence (Medical/surgical: 13.3%/86.7%, respectively).

Kamel A. A. and Kamel, M., in agreement with our findings, showed a greater incidence in subtotal over total in the overall incidence of recurrence with a statistically significant  $P$  value less than 0.001. Since

a whole thyroidectomy removes all residual tissue, the partial thyroidectomy had a lower significant recurrence rate than a total thyroidectomy<sup>[12]</sup>.

This is in line with earlier research by Delbridge, who noted that subtotal thyroidectomy has been performed for benign thyroid disease for over a century and that it may lessen the associated risk of postoperative hypocalcemia and RLN palsy. Ozbas *et al.* reported that the incidence rate of recurrence of MNG after bilateral subtotal thyroidectomy ranges between 1.2%<sup>[13]</sup>. The majority of surgeons continue to debate whether total thyroidectomies (TT) have more potential risks than advantages<sup>[14]</sup>.

According to Boutzios and colleagues the primary drawback of a less than total thyroidectomy is the possibility of nodular recurrence, which necessitates a completion reoperation. These findings are consistent with our findings. Reoperations for nodule recurrence in the remaining gland were conducted primarily because the patients were anxious. The extended follow-up period in the study, which was 26.89 years, compared with our study's follow-up period of around 7 years, is the cause of the high rate of nodular recurrence<sup>[10]</sup>.

One of the significant complications, is hypoparathyroidism (transient or permanent).

After total thyroidectomy, the incidence of postoperative transient hypocalcemia ranges from 8.9% to 53% with zero to 25% of permanent hypocalcaemia<sup>[13]</sup>.

The contributing factors of transient hypocalcemia are: devascularization of parathyroid glands, removal of one or more thyroid glands, and hematoma formation<sup>[15]</sup>.

Less than total thyroidectomy hypocalcemia is relatively rare and usually asymptomatic, it is resolved in a few days<sup>[16]</sup>.

### **Strength points of this study**

The strength points of this study are that its setting at two tertiary care centers, the inclusion and evaluation of two different surgical methods and having no patients lost to follow-up during the study period. Its relatively larger sample size relative to the previous studies, being a multicentric study and this represents a significantly low risk of publication bias.

### **Limitations of the study**

The limitations of the study are worthy of mention, firstly, by its retrospective nature which

can be associated with missed clinical information of patients. Secondly, the relatively short-term follow-up of patients postoperatively as Boutzios *et al.*,<sup>[10]</sup> tracked the outcomes for 26 years postoperatively, which may underestimate the incidence of recurrence, or malignancy transformation in our study.

### **Recommendations**

Total thyroidectomy has a significant advantage over less than total thyroidectomy and is strongly recommended especially in the hands of expert surgeons. The present study can burden the knowledge and shed some light on future prospective studies that are recommended with larger sample sizes demonstrating the long-term follow-up and the risk of malignancy in less than total thyroidectomy, subtotal thyroidectomy, and lobectomy.

### **CONCLUSION**

The study reveals that total thyroidectomy is a safe and effective procedure for benign thyroid diseases, while less than total thyroidectomy is associated with high recurrence rates and associated risks. Total thyroidectomy offers advantages such as disease eradication, prevention of recurrent goiter, and avoidance of completion surgery for occult malignancy. However, it is associated with higher morbidity and lifelong replacement therapy for hypothyroidism. Less than total thyroidectomy has a place in modern practice specially with unilateral single or more thyroid lesions.

### **CONFLICT OF INTEREST**

There are no conflicts of interest.

### **REFERENCES**

1. Arrangoiz R, Cordera F, Caba D, Moreno E, de Leon EL, Muñoz M. Management approach to thyroid nodules. *Int J Otolaryngol Head Neck Surg* 2018; 7:214–227.
2. Singh A, Prasad P, Singh A. Pediatric Thyroid Lesions: Synergistic Role of Clinical and Cytological Features in Diagnosis. *Discoveries* 2023; 11:1.
3. Todsen T, Bennedbæk FN, Kiss K, Hegedüs L. Ultrasound-guided fine-needle aspiration biopsy of thyroid nodules. *Head & Neck* 2021; 43:1009–1013.
4. Noussios G, Chatzis I, Konstantinidis S, Filo E, Spyrou A, Karavasilis G, Katsourakis A. The anatomical relationship of inferior thyroid artery

- and recurrent laryngeal nerve: a review of the literature and its clinical importance. *J Clin Med Res* 2020; 12:640.
5. Potenza AS, Araujo Filho VJ, Cernea CR. Injury of the external branch of the superior laryngeal nerve in thyroid surgery. *Gland surg* 2017; 6:552.
  6. Babu RD, Paul D. Laryngeal Nerves and Voice Change in Thyroid Surgery. *Indian J Surg Oncol* 2022; 13:99–108.
  7. Ahmadi S, Herbst R, Oyekunle T, Strickland K, Roman S, Sosa JA. Using the ATA and ACR TI-RADS sonographic classifications as adjunctive predictors of malignancy for indeterminate thyroid nodules. *Endocrine Practice* 2019; 25:908–917.
  8. Cirocchi R, Trastulli S, Randolph J, Guarino S, Di Rocco G, Arezzo A, et al. Total or near-total thyroidectomy versus subtotal thyroidectomy for multinodular non-toxic goitre in adults. *Cochrane Database Syst Rev.* 2015 Aug 7;2015(8):CD010370.
  9. Yilmaz H, Akkus C, Damburaci N, Adibelli Z, Duran C. Sonoelastographic Evaluation of Recurrent Thyroid Nodules in Patients with Operated Recurrent Nodular Goiters. *Ultrasound Med Biol* 2022; 48:209–216.
  10. Boutzios G, Tsourouflis G, Garoufalia Z, Alexandraki K, Kouraklis G. Long-term sequelae of the less than total thyroidectomy procedures for benign thyroid nodular disease. *Endocrine* 2019; 63:247–251.
  11. Ahmed FAE, Abdallah AB, Eltayeb AA, Hassan RA. Total versus subtotal thyroidectomy in benign goiter. *Клиническая и экспериментальная хирургия* 2020; 8:104–109.
  12. Kamel AA, Kamel M. Total thyroidectomy versus subtotal thyroidectomy in treatment of multinodular goiter: a meta-analysis. *Egypt J Otolaryngol* 2024; 40:3.
  13. Ozbas S, Kocak S, Aydintug S, Cakmak A, Demirkiran MA, Wishart GC. Comparison of the complications of subtotal, near total and total thyroidectomy in the surgical management of multinodular goitre. *Endocr J* 2005; 52:199–205.
  14. Delbridge L. Total thyroidectomy: the evolution of surgical technique. *ANZ J Surg* 2003; 73:761–768.
  15. Asari R, Passler C, Kaczirek K, Scheuba C, Niederle B. Hypoparathyroidism after total thyroidectomy. *Arch Surg* 2008; 143:132–7.
  16. Yamashita H, Noguchi S, Murakami T, Watanabe S, Uchino S, Ohshima A, et al. Seasonal changes in calcium homeostasis affect the incidence of postoperative tetany in patients with Graves' disease. *Surg* 2000; 127:377–82.
  17. Zambudio AR, Rodriguez J, Riquelme J, Soria T, Canteras M, Parrilla P. Prospective study of postoperative complications after total thyroidectomy for multinodular goiters by surgeons with experience in endocrine surgery. *Ann Surg* 2004; 240:18–25.