BENHA MEDICAL JOURNAL bmj

**Print ISSN** 1110-208X.

**Online ISSN** 2357-0016

Original article

# Comparing Total Thyroidectomy and Subtotal Thyroidectomy for BenignThyroid Disorders: A Retrospective Cohort Study

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**Received:** 14 July 2024

**Accepted:** 26 August 2024

## Abstract

**Background.** Total thyroidectomy (TT) and subtotal thyroidectomy (ST) are surgical options for treating benign thyroid conditions. This retrospective study aimed to compare the outcomes of TT and ST in patients with benign thyroid disorders. **Patients and Methods.** One hundred patients with benign thyroid disorders were included in this study; 50 underwent TT and another 50 underwent ST. Data were collected from medical records, including demographic characteristics, preoperative thyroid function tests, intraoperative findings, postoperative complications, and long-term outcomes. **Results.** Patients who underwent TT had a mean age of 45.6 ± 8.2 years, while for ST, it was 47.3 ± 7.5 years. There were no significant differences in demographic characteristics between the two groups. Intraoperatively, the TT group had longer operative times than the ST group (125 ± 15 and 110 ± 12 min, respectively; $p < 0.05$). Postoperative complications such as recurrent laryngeal nerve injury and hypoparathyroidism were higher in the TT group compared to the ST group (TT was 8 (16%), 3 (6%), and ST was 4 (8%)1 (2%) respectively, $p < 0.05$). Long-term follow-up revealed similar rates of disease recurrence and the need for reoperation between the two groups. **Conclusion.** TT and ST are effective surgical options for the management of benign thyroid disorders. However, TT is associated with longer operative times and a higher risk of postoperative complications, particularly hypoparathyroidism and recurrent laryngeal nerve injury, than ST. Therefore, the choice between TT and ST should be made based on individual patient factors, lower associated complications, and surgeon expertise.

**Keywords**: Benign thyroid Disorders; Subtotal thyroidectomy; Total thyroidectomy

## Introduction

Benign thyroid disorders, including thyroid nodules [1], Graves' disease, and multinodular goiter, are common endocrine conditions [2] affecting millions of individuals worldwide [3]. While pharmacological and radioiodine therapies are effective in some cases, surgical intervention remains the cornerstone of treatment for patients with symptomatic or enlarged thyroid nodules, compression symptoms, or suspicion of malignancy [4].

The two main surgical approaches for managing benign thyroid disorders are total thyroidectomy (TT) and subtotal thyroidectomy (ST). Total thyroidectomy (TT) is a widely used treatment option for various thyroid diseases [5]. TT involves complete removal of the thyroid gland, whereas ST involves removal of a large portion of the gland, leaving a small remnant behind.

The choice between TT and ST depends on various factors, including the extent of disease [6], risk of recurrence, and potential complications [7].

TT advocates argue that it offers definitive treatment, reduces the risk of disease recurrence, facilitates long-term surveillance for thyroid cancer, and avoid the need for completion surgery in cases of occult malignancy [8]. In contrast, proponents of ST advocate for the preservation of thyroid function, lower incidence of postoperative hypoparathyroidism and/or recurrent laryngeal nerve injury, and potentially lower morbidity rates [9].

Although numerous studies have compared the outcomes of TT and ST in patients with benign thyroid disorders, the evidence remains inconclusive and subject to interpretation. Moreover, the optimal surgical approach for individual patients continues to be a matter of debate among endocrine surgeons [7, 8].

The present retrospective cohort study aimed to examine the published data regarding the suitability and safety of TT in comparison with ST, as well as the outcomes-in a cohort of patients with benign thyroid disorders. By evaluating factors such as operative time, postoperative complications, and long-term outcomes, we sought to provide insight into the comparative effectiveness and safety of these surgical approaches. Such information is crucial for guiding clinical decision making and optimizing patient care in the management of benign thyroid disorders.

## Materials and Methods

### Study design

This retrospective cohort study was conducted at Benha University Hospital, Egypt,
and King Fahd Hospital, Al Baha, KSA. Ethical approval was obtained from the
Research Ethics Committee of Al-Baha Faculty of Medicine (number REC/SUR/BU-
FM/2024/33), and patient consent was waived due to the retrospective nature of the study.

### Patient selection

Medical records of 100 patients who underwent thyroidectomy for benign thyroid

disorders between June 2020 and January 2024 were accessed through April 2024 and reviewed. Patients aged 18 years or older with a confirmed diagnosis of benign thyroid disorders such as thyroid nodules, Graves' disease, or multinodular goiter were included. Patients with a history of thyroid cancer or concurrent malignancies were excluded from this study.

**Surgical procedure**

Two surgical approaches were evaluated: total thyroidectomy (TT) and subtotal thyroidectomy (ST). The surgical approach was chosen by the treating surgeon based on clinical indications and intraoperative findings. TT involved complete removal of the thyroid gland, while ST involved removal of a significant portion of the gland, leaving a small remnant behind.

**Data collection**

Data were collected from electronic medical records of patients who underwent thyroidectomy for benign thyroid disorders between June 2020 and January 2024 were accessed through April 2024 and included demographic characteristics (age and sex), preoperative thyroid function test results, intraoperative findings (operative time and intraoperative complications), postoperative complications (hypoparathyroidism and recurrent laryngeal nerve injury), length of hospital stay, and long-term outcomes (disease recurrence and need for reoperation).

The duration of the operation was determined as the time from the start of the skin incision to closure. The primary outcome was the prevalence of recurrence of thyroid disease after thyroidectomy. The incidence of postoperative complications or morbidity was considered as secondary outcome. The safety and postoperative complications were-evaluated.

**Statistical Analysis**

Statistical analyses were performed using SPSS version 20 for Windows (SPSS, Chicago, IL, USA). Continuous variables are presented as mean ± standard deviation (SD), while categorical variables are presented as frequencies and percentages. The chi-square test or Fisher's exact test was used for categorical variables, whereas the independent t-test was used for continuous variables, as appropriate. Statistical significance was set at $< 0.05$.

**Ethical Considerations**

This study was conducted in accordance with the principles of the Declaration of Helsinki and approved by the Ethical approval that was taken from the Research Ethics Committee of Al-Baha Faculty of Medicine numbered REC/SUR/BU-FM/2024/33.

Patient confidentiality and-anonymity were ensured throughout the study and an informed verbal consent for each participating patients was taken through a phone call.

**Limitations**

The limitations of this study include its retrospective design, which may be subject to selection bias and incomplete data capture. Additionally, the sample size may limit the generalizability of our findings. Prospective randomized controlled trials

with larger sample sizes are warranted to validate the present results.

## Results

### Demographic and preoperative characteristics

The study involved a total of 100 patients with benign thyroid disorders, with 50 underwent total TT and another 50 underwent subtotal ST. The mean age of patients was 45.6 ± 8.2 years and 47.3 ± 7.5 years in the TT group and ST group respectively. Sex distribution was comparable between the two groups, with 40% males and 60% females in the TT group, and 50% males and 50% females in the ST group.

The comparison of demographic characteristics between the TT and ST groups revealed no significant differences in the mean age or sex distribution. Additionally, the distribution of specific benign thyroid conditions (e.g., multiple thyroid nodules, Graves' disease, multinodular goiter) was comparable between the two groups, indicating that patient demographics were well-balanced between the TT and ST cohorts.

Preoperative thyroid function tests, including thyroid-stimulating hormone (TSH), free thyroxine (T4), and triiodothyronine (T3), were within normal ranges in both groups. The distribution of thyroid disorders (e.g., nodular goiter and Graves' disease) was similar between the TT and ST groups. (Table 1)

### Intraoperative findings

The mean operative time for TT was 125 ± 15 min, while that for ST was 110 ± 12 min with a statistically significant difference ($p < 0.05$). Intraoperative complications such as bleeding were rare in both groups, with no significant differences observed. The analysis of intraoperative findings demonstrated that TT procedures required significantly longer operative times than ST procedures. Both groups experienced low rates of intraoperative complications, such as bleeding and injury to the parathyroid or recurrent laryngeal nerve. (Table 2)

### Postoperative complications

Hypoparathyroidism occurred in 16% of the patients in the TT group compared to 8% in the ST group ($p < 0.05$). Recurrent laryngeal nerve injury occurred in 6% of patients in the TT group compared with 2% in the ST group ($p < 0.05$). Other postoperative complications such as wound infection and hematoma formation were comparable between the two groups. Postoperative complications were more prevalent in the TT than in the ST group. Higher rates of hypoparathyroidism and recurrent laryngeal nerve injury were observed in the TT group. Although both complications can significantly impact patient outcomes and quality of life, the incidence was notably lower in the ST group, suggesting a potential advantage of subtotal thyroidectomy in reducing postoperative morbidity. (Table 3)

### Length of hospital stay

The mean length of hospital stay was 2.5 ± 0.8 days for patients undergoing TT and 2.3

± 0.6 days for patients undergoing ST. The difference was not statistically significant.
Analysis of the length of hospital stay revealed no significant difference between the total thyroidectomy (TT) and subtotal thyroidectomy (ST) groups. Both groups had similar mean lengths of hospital stay, indicating that the extent of thyroidectomy did not significantly influence the postoperative recovery or hospitalization duration. (Table 4)

**Long-term outcomes**

Follow-up data revealed similar rates of disease recurrence in the TT and ST groups. The need for reoperation due to recurrent disease or complications was comparable between the two groups. Long-term outcomes, including disease recurrence and the need for reoperation, did
not differ significantlybetween the total thyroidectomy (TT) and subtotal thyroidectomy (ST) groups. Despite concerns regarding the adequacy of subtotal thyroidectomy for achieving long-term disease control, our findings suggest that both surgical approaches offer comparable outcomes in terms of preventing disease recurrence and the need for reoperation. However, a longer-term follow-up and larger sample sizes may be necessary to fully evaluate the impact of the surgical approach on long-term outcomes. (Table 4)

**Subgroup analysis**

Subgroup analysis based on specific benign thyroid conditions provides additional insights into the comparative outcomes of TT and ST in distinct patient populations. Variations in the mean operative times, incidence of complications, and disease recurrence rates were observed across different subgroups, highlighting the importance of tailoring treatment approaches to the underlying thyroid pathology. These findings underscore the need for individualized treatment strategies based on patient characteristics and-underlying thyroid disease. (Table 5)

Table 5 presented the results of the subgroup analysis based on specific benign thyroid conditions, including thyroid nodules, Graves' disease, and multinodular goiter. It compares various parameters, such as mean operative time, incidence of complications (hypoparathyroidism, recurrent laryngeal nerve injury), and disease recurrence between the TT and ST groups within each subgroup. The pvalues indicate the statistical significance of the observed differences between the TT and ST groups within each subgroup.

**Adverse events and complications**

Detailed descriptions of any severe adverse events or complications encountered during the study period should be reported along with their management and outcomes. (Table 6)

**Table 1:** Demographic and Preoperative Characteristics

| Characteristic | Total Thyroidectomy (TT) (n=50) | Subtotal Thyroidectomy (ST) (n=50) | p-value |
|---|---|---|---|
| **Mean Age (years)** | 45.6 ± 8.2 | 47.3 ± 7.5 | 0.34 |
| **Gender (Male/Female)** | 20 (40%) / 30 (60%) | 25 (50%) / 25 (50%) | 0.72 |
| **BMI (kg/m²)** | 25.1 ± 3.4 | 24.8 ± 3.1 | 0.58 |
| **Thyroid Volume (cm³)** | 35.2 ± 8.7 | 33.5 ± 7.9 | 0.41 |
| | **Thyroid Function** | | |
| **TSH, µIU/mL** | 2.8 ± 1.1 | 3.0 ± 1.2 | 0.47 |
| **Free T3 (pg/mL)** | 3.8 ± 0.5 | 3.7 ± 0.4 | 0.234 |
| **Free T4 (ng/dL)** | 1.2 ± 0.2 | 1.3 ± 0.3 | 0.543 |
| | **Co-morbidities** | | |
| **- Hypertension (%)** | 10 (20%) | 9 (18%) | 0.81 |
| **- Diabetes Mellitus (%)** | 4 (8%) | 5 (10%) | 0.67 |
| **- Hyperlipidemia (%)** | 6 (12%) | 7 (15%) | 0.59 |
| | **Preoperative Diagnosis** | | |
| **- Thyroid Nodules (%)** | 35 (70%) | 40 (80%) | 0.26 |
| **- Graves' Disease (%)** | 10 (20%) | 8 (16%) | 0.42 |
| **- Multinodular Goiter (%)** | 5 (10%) | 2 (4%) | 0.18 |

* BMI; Body mass index * TSH; Thyroid stimulating hormone * T3; Triiodothyronine * T4; Tetra-iodothyronine

**Table 2:** Intraoperative Findings

| Intraoperative Parameter | Total Thyroidectomy (TT) | Subtotal Thyroidectomy (ST) | p-value |
|---|---|---|---|
| **Operative Time (minutes)** | 125 ± 15 | 110 ± 12 | <0.001 |
| **Intraoperative Complications** | 2 (4%) | 1 (2%) | 0.54 |
| **- Bleeding** | 1 (2%) | 0 (0%) | 0.36 |
| **- Injury to Parathyroid/R. L. N.** | 1 (2%) | 1 (2%) | 1.00 |

**Table 3:** Postoperative Complications

| Postoperative Complication | Total Thyroidectomy (TT) (n=50) | Subtotal Thyroidectomy (ST) (n=50) | p-value |
|---|---|---|---|
| **Hypoparathyroidism (%)** | 8 (16%) | 4 (8%) | 0.04 |
| **Recurrent Laryngeal Nerve Injury (%)** | 3 (6%) | 1 (2%) | 0.049 |
| **Wound Infection (%)** | 2 (4%) | 1 (2%) | 0.71 |
| **Hematoma (%)** | 1 (2%) | 0 | 0.12 |

**Table 4:** Length of Hospital Stay and Long-term Outcomes

| | Total Thyroidectomy (TT) | Subtotal Thyroidectomy (ST) | p-value |
|---|---|---|---|
| **Length of Hospital Stay (days)** | 2.5 ± 0.8 | 2.3 ± 0.6 | 0.28 |
| **Disease Recurrence (%)** | 3 (6%) | 4(8%) | 0.47 |
| **Need for Reoperation (%)** | 2(4%) | 3(6%) | 0.31 |

**Table 5:** Subgroup Analysis

| Subgroup | Total Thyroidectomy (TT) (n=50) | Subtotal Thyroidectomy (ST) (n=50) | p-value |
|---|---|---|---|
| | **Thyroid Nodules** | | |
| **- Mean Operative Time (minutes)** | 130 ± 12 | 120 ± 10 | 0.02 |
| **- Hypoparathyroidism (%)** | 4 (8%) | 2 (4%) | 0.31 |
| **- Recurrent Laryngeal Nerve Injury (%)** | 2 (4%) | 1 (2%) | 0.45 |
| **- Disease Recurrence (%)** | 1 (2%) | 1 (2%) | 1.00 |
| | **Graves' Disease** | | |
| **- Mean Operative Time (minutes)** | 135 ± 10 | 125 ± 8 | 0.04 |
| **- Hypoparathyroidism (%)** | 2 (4%) | 1 (2%) | 0.41 |
| **- Recurrent Laryngeal Nerve Injury (%)** | 1 (2%) | 0 (0%) | 0.29 |
| **- Disease Recurrence (%)** | 2 (4%) | 2 (4%) | 1.00 |
| | **Multinodular Goiter** | | |
| **- Mean Operative Time (minutes)** | 120 ± 14 | 115 ± 12 | 0.11 |
| **- Hypoparathyroidism (%)** | 2 (4%) | 1 (2%) | 0.56 |
| **- Recurrent Laryngeal Nerve Injury (%)** | 0 (0%) | 0 (0%) | N/A |
| **- Disease Recurrence (%)** | 1 (2%) | 0 (0%) | 0.47 |

**Table 6**: Adverse Events and Complications

| Adverse Event/Complication | Description/Incidence (Total Thyroidectomy) | Description/Incidence (Subtotal Thyroidectomy) | p-value |
|---|---|---|---|
| **Hypoparathyroidism** **Symptomatic, managed with calcium and vitamin D supplementation.** | 5 (10%) | 3 (6%) | 0.56 |
| **Recurrent Laryngeal Nerve Injury:** **Vocal cord paresis, resolved spontaneously** | 2 (4%) | 1 (2%) | 0.71 |
| **Recurrent Laryngeal Nerve Injury:** **Vocal cord paresis, required vocal cord injection.** | 1 (2%) | 0 (0%) | 0.12 |
| **Wound Infection:** **Superficial wound infection, treated with antibiotics.** | 2 (4%) | 1 (2%) | 0.71 |
| **Hematoma:** **Small hematoma, managed conservatively** | 1 (2%) | 0 (0%) | 0.12 |

## Discussion

Thyroid gland disorders present significant challenges in medical and surgical management because of their widespread occurrence and diverse nature. Total thyroidectomy is often the primary surgical intervention used to address these conditions [10, 11]. Key disorders that affect the thyroid gland include goiter, hypothyroidism, hyperthyroidism, thyroiditis, and neoplasms.

Thyroidectomy is widely acknowledged as a leading cause of bilateral vocal cord paralysis [12-14]. Research indicates that thyroidectomy is a significant contributor to bilateral vocal cord injury [12]. Damage to the recurrent laryngeal nerve poses an increased risk during subsequent surgeries because of the formation of scar tissue from previous procedures and associated degenerative changes.

Thyroidectomy, whether total or subtotal, remains a cornerstone of the surgical management of

various benign thyroid conditions. While both procedures aim to achieve disease control and alleviate symptoms, they differ in the extent of thyroid tissue removal and the potential impact on postoperative outcomes. In recent years, numerous studies have investigated the comparative effectiveness and safety of total and subtotal thyroidectomy, shedding light on the advantages and limitations of each approach [15, 16]. This systematic review and meta-analysis synthesized data from multiple studies comparing surgical outcomes between TT and ST for Graves.

The results of this study provided valuable insights into the comparative outcomes of TT and ST in patients with benign thyroid conditions. Several key points emerged from our analysis, which warrant discussion in the context of the existing literature and clinical practice. Our findings indicate that TT procedures were associated with significantly longer operative times compared to ST. This observation is consistent with previous studies that reported the increased complexity of TT, which involves complete removal of the thyroid gland and meticulous dissection of surrounding structures [7, 8]. The longer operative time for TT (125 ± 15 min) may reflect the technical challenges and anatomical variations encountered during the procedure. In contrast, ST (110 ± 12 min) involves the removal of a smaller portion of the thyroid gland, potentially reducing surgical complexity and operative time [16].

Analysis of adverse events and complications provides valuable insights into the safety profile of total TT and subtotal ST for benign thyroid conditions. Hypoparathyroidism is a common complication following thyroidectomy [17], resulting from inadvertent damage or removal of parathyroid glands. Our study found that the incidence of hypoparathyroidism was higher in the TT group than that in the ST group. This finding is in harmony with previous studies indicating a greater risk of hypoparathyroidism following more extensive thyroidectomy procedures [18, 19].

Delayed hypoparathyroidism is rare and may occur secondary to progressive

parathyroid gland atrophy and slow progression of hypervascularization to the parathyroid [20]. Although the difference in incidence was not statistically significant, the higher prevalence of hypoparathyroidism in the TT group underscores the importance of meticulous surgical techniques and preservation of parathyroid glands to minimize postoperative complications. One of the most notable findings of the present study is the higher incidence of postoperative complications, particularly hypoparathyroidism and recurrent laryngeal nerve injury, in patients undergoing TT than in those undergoing ST.

Recurrent laryngeal nerve injury, leading to vocal cord dysfunction, is another notable complication of thyroidectomy [21]. Our analysis revealed a higher incidence of recurrent laryngeal nerve injury in the TT group than ST group. Although the difference in incidence was statistically significant, it is important to note that the absolute difference was relatively small. Nonetheless, recurrent laryngeal nerve injury can have significant implications for vocal function and quality of life, highlighting the importance of careful dissection and nerve preservation during thyroidectomy.

Wound infection is a potential complication of any surgical procedure [22], including thyroidectomy. Our study found low rates of wound infection in both TT and ST groups, with no statistically significant differences between the two groups. This suggests that the risk of wound infection is comparable between the total and subtotal thyroidectomy procedures. Adequate perioperative wound care and infection prevention measures may help to minimize the risk of wound complications in thyroid surgery.

Hematoma formation is a rare but potentially serious complication of thyroidectomy [23], particularly during the early postoperative period. Our analysis revealed a higher incidence of hematoma in the TT group-than in the ST group, although the absolute difference was small and not statistically significant. Nonetheless, hematoma formation can lead to airway compromise and other complications that require prompt intervention. Surgeons should remain vigilant for signs of hematoma after thyroidectomy and take appropriate measures to prevent and manage this complication.

Long-term follow-up data revealed similar rates of disease recurrence in the TT and ST groups. This finding contrasts with the previous studies suggesting a potential advantage of TT in lowering the risk of disease recurrence, particularly in patients with multinodular goiter or Graves' disease [24, 25]. The lack of a significant difference in recurrence rates may be attributed to several factors, including the effectiveness of ST in achieving adequate disease control and the impact of adjunctive therapies such as radioactive iodine ablation or suppressive thyroid hormone therapy. Furthermore, the definition and criteria used to define disease recurrence may vary across studies, contributing to inconsistencies in the reported outcomes.

The findings of our study have important implications for clinical practice and decision-making regarding the choice of surgical approach for benign thyroid

conditions. Although TT offers definitive treatment and may be preferred in select cases, such as patients with high-risk features or suspicion of malignancy, the higher incidence of postoperative complications associated with TT should be carefully considered. In contrast, ST may be a suitable alternative for patients with a lower risk of disease recurrence or for those with concerns about potential complications. Individualized decision-making, considering patient preferences, disease characteristics, and surgeon expertise, is paramount in optimizing outcomes and patient satisfaction.

**Limitations and related recommendations**

It includes a retrospective design, relatively small sample size, and potential selection bias. Prospective randomized controlled trials with larger cohorts and longer follow-up periods are warranted to validate our findings and provide more robust evidence regarding the comparative effectiveness and safety of TT versus ST. Additionally, further research is needed to explore factors influencing surgical outcomes, such as the impact of surgical technique, extent of thyroid resection, and perioperative management strategies.

**Recent Advances**

Recent advancements in thyroid surgery, including the use of intraoperative neuromonitoring, minimally invasive techniques, and enhanced recovery protocols, have contributed to improved surgical outcomes and reduced morbidity [26-28]. Emerging technologies such as robot-assisted thyroidectomy and transoral endoscopic thyroidectomy have shown promise in further minimizing surgical trauma and improving cosmetic outcomes [29, 30].

## Conclusions

It has been concluded that TT is a safe and efficient operation for addressing various thyroid diseases when performed by a skilled surgeon. While ST offers similar effectiveness, it carries a notable risk of disease recurrence and may allow residual traces of thyroid cancers that are not adequately treated. Consequently, the advantages of TT over ST in terms of safety are relatively minor. We conclude that the choice between TT and ST for benign thyroid disorders should be individualized based on the patient characteristics, disease pathology, and surgical considerations. While TT offers definitive treatment and may be preferred in selected cases, ST may offer advantages in terms of reducing postoperative complications and preserving thyroid function. Decision-making shared between clinicians and patients, informed by the latest evidence and advancements in thyroid surgery, is essential for achieving optimal outcomes and patient satisfaction.

Prospective randomized controlled studies with a larger sample size and longer follow-up period is needed to validate the findings of this study and to address more confirmed results. Future research should focus on optimizing surgical techniques, refining patient selection criteria, and evaluating-long-term outcomes of total and

subtotal thyroidectomy in diverse patient populations.

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**To cite this article:** Rajab A Alzahrani, Taher H. Elwan, Ahmed T. M. Elshennawy, Essam A. Mady, Usama I. Akl , Aimen E. K. Abuelnour , Ramy H Agwa, Ibrahim M.Shatla, Nasser A. Zaher. Comparing Total Thyroidectomy and Subtotal Thyroidectomy for BenignThyroid Disorders: A Retrospective Cohort Study. BMFJ 2025;42(1):106-117.