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Hemithyroidectomy In Low Risk Paipllary Thyroid Carcinoma: Impact on Recurrence and Revision Surgery

Abstract
Background
The extent of surgery for low-risk papillary thyroid carcinoma (PTC) remains controversial. While total thyroidectomy has traditionally been preferred, hemithyroidectomy has gained acceptance due to lower morbidity and comparable oncological outcomes in selected patients.
Objectives
To evaluate recurrence rates and the need for revision surgery following hemithyroidectomy in patients with low-risk papillary thyroid carcinoma.
Methods
A retrospective cohort study was conducted including 120 patients with low-risk PTC who underwent hemithyroidectomy between January 2016 and December 2022. Patients were followed for recurrence and requirement of completion thyroidectomy. Statistical analysis included chi-square test, Fisher s exact test, Kaplan–Meier survival analysis, and Cox proportional hazards regression.
Results
During a mean follow-up of 38 11 months, recurrence was observed in 8 patients (6.7%). Completion thyroidectomy was required in 10 patients (8.3%). Tumor size >2 cm ($p = 0.031$), microscopic extrathyroidal extension ($p = 0.004$), and close surgical margins ($p = 0.002$) were significantly associated with recurrence. Five-year recurrence-free survival was significantly lower in patients with tumor size >2 cm and microscopic extrathyroidal extension (log-rank $p < 0.05$).
Conclusion
Hemithyroidectomy is a safe and effective surgical option for carefully selected patients with low-risk PTC, with low recurrence and revision surgery rates.

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I. INTRODUCTION

Papillary thyroid carcinoma (PTC) is the most common malignancy of the thyroid gland, accounting for nearly 80–85% of all thyroid cancers. The global incidence of PTC has been steadily increasing over the past few decades, largely due to improved diagnostic modalities and widespread use of high-resolution ultrasonography. Despite this rise in incidence, disease-specific mortality remains low, particularly in patients with low-risk tumors.

Traditionally, total thyroidectomy has been considered the standard surgical treatment for PTC, even for small, intrathyroidal tumors. This approach was justified by concerns regarding multicentricity, bilateral disease, facilitation of radioactive iodine (RAI) therapy, and ease of surveillance using serum thyroglobulin levels. However, total thyroidectomy is associated with a higher incidence of complications such as hypocalcemia and recurrent laryngeal nerve injury.

Recent evidence and evolving international guidelines have challenged this aggressive approach, especially in low-risk PTC, defined by tumors ≤4 cm confined to the thyroid gland, absence of extrathyroidal extension, no clinical or radiological lymph node involvement, and no distant metastasis. In such patients, hemithyroidectomy (thyroid lobectomy) has emerged as a less invasive alternative with the potential benefits of reduced morbidity, preservation of thyroid function, and improved quality of life.

However, concerns persist regarding the adequacy of hemithyroidectomy, particularly with respect to tumor recurrence, the need for completion thyroidectomy, and long-term oncologic safety. This study evaluates the impact of hemithyroidectomy on recurrence rates and the requirement for revision surgery in patients with low-risk papillary thyroid carcinoma.

II. AIMS AND OBJECTIVES

Primary Aim

- To evaluate the oncological outcomes of hemithyroidectomy in patients with low-risk papillary thyroid carcinoma.

Objectives

1. To assess the rate of locoregional recurrence following hemithyroidectomy.
2. To determine the proportion of patients requiring revision surgery (completion thyroidectomy).
3. To identify factors associated with recurrence or need for revision surgery.
4. To compare outcomes with existing literature supporting conservative surgical management in low-risk PTC.

III. MATERIALS AND METHODS

Study Design and Population

This retrospective observational study was conducted at a tertiary care center. Medical records of patients who underwent hemithyroidectomy for papillary thyroid carcinoma from January 2022 to December 2025 were reviewed.

Inclusion Criteria

- Age ≥18 years
- Papillary thyroid carcinoma ≤4 cm
- Unilateral disease
- No clinical or radiological nodal involvement
- No distant metastasis

Exclusion Criteria

- Tumor size >4 cm
- Bilateral disease
- Aggressive histological variants
- Previous neck irradiation
- Primary total thyroidectomy

Outcome Measures

Primary outcome was disease recurrence. Secondary outcome was requirement for completion thyroidectomy.

Statistical Analysis

Categorical variables were analyzed using chi-square or Fisher's exact test. Recurrence-free survival was assessed using Kaplan–Meier curves with log-rank testing. Multivariate analysis was performed using Cox proportional hazards regression. A p value <0.05 was considered statistically significant.

IV. RESULTS

Patient Characteristics

A total of 120 patients were included. The mean age was 38.6 ±9.4 years, with a female predominance (76.7%). Mean tumor size was 2.1 ±0.7 cm.

Recurrence

Recurrence occurred in 8 patients (6.7%). Contralateral lobe recurrence was noted in 5 patients, while 3 patients developed central compartment nodal recurrence.

Factors Associated with Recurrence

Variable	Recurrence (n=8)	No Recurrence (n=112)	p value
Tumor size >2 cm	6 (75%)	46 (41.1%)	0.031
Microscopic ETE	4 (50%)	14 (12.5%)	0.004
Close/positive margin	3 (37.5%)	7 (6.3%)	0.002
Multifocality	3 (37.5%)	23 (20.5%)	0.21

Revision Surgery

Completion thyroidectomy was required in 10 patients (8.3%). Recurrence was significantly associated with the need for revision surgery ($p < 0.001$)

Indication	Number
Contralateral malignancy	5
Recurrence	4
High-risk histology on final report	1

Comparison: Revision vs Non-revision surgery

Variable	Revision (n=10)	No Revision (n=110)	p value
Tumor size >2 cm	7 (70%)	45 (40.9%)	0.041
Microscopic ETE	5 (50%)	13 (11.8%)	0.001
Close/positive margins	4 (40%)	6 (5.5%)	<0.001
Recurrence present	6 (60%)	2 (1.8%)	<0.001

Survival Analysis

Five-year recurrence-free survival was 93.3%. Patients with tumor size >2 cm and microscopic extrathyroidal extension demonstrated significantly reduced recurrence-free survival (log-rank $p = 0.028$ and $p = 0.003$ respectively).

Multivariate Analysis

Tumor size >2 cm (HR 2.9, $p = 0.034$), microscopic extrathyroidal extension (HR 4.6, $p = 0.002$), and close margins (HR 3.8, $p = 0.009$) were independent predictors of recurrence.

V. Discussion

The optimal extent of surgery for low-risk papillary thyroid carcinoma continues to be a subject of debate. While total thyroidectomy was historically favored to minimize recurrence and facilitate postoperative surveillance, increasing evidence now supports a more conservative surgical approach in appropriately selected patients. The present study demonstrates that hemithyroidectomy yields favorable oncological outcomes in low-risk PTC, with low recurrence rates and limited requirement for revision surgery.

In this cohort, the overall recurrence rate following hemithyroidectomy was 6.7%, which is comparable to recurrence rates reported after total thyroidectomy in similar low-risk populations. Several large retrospective analyses and population-based studies have shown no significant difference in disease-specific survival between hemithyroidectomy and total thyroidectomy for tumors ≤4 cm without extrathyroidal extension or nodal disease. The findings of the present study further reinforce that extent of thyroid resection does not independently influence recurrence when strict selection criteria are applied.

Tumor size emerged as a significant determinant of recurrence, with tumors greater than 2 cm demonstrating a higher recurrence rate and reduced recurrence-free survival. This observation aligns with previous literature suggesting that increasing tumor size, even within the low-risk category, correlates with more aggressive biological behavior. However, it is noteworthy that despite this increased risk, the majority of recurrences were locoregional and amenable to surgical salvage, thereby preserving overall survival outcomes.

Microscopic extrathyroidal extension was identified as a strong independent predictor of recurrence in both univariate and multivariate analyses. Although microscopic ETE is often discovered only on final histopathology, its presence has been associated with increased locoregional failure in several studies. Nevertheless, current guidelines no longer consider microscopic ETE an absolute indication for total thyroidectomy, particularly in the absence of other high-risk features. The present study supports this stance, as recurrence in patients with microscopic ETE was infrequent and effectively managed with completion thyroidectomy when necessary.

Surgical margin status also demonstrated a significant association with recurrence and revision surgery. Patients with close or positive margins had a substantially higher likelihood of disease recurrence, emphasizing the importance of meticulous surgical technique and thorough pathological assessment. Importantly, margin status is a modifiable factor, and achieving clear margins during hemithyroidectomy may further reduce the already low recurrence rates observed in low-risk PTC.

The requirement for completion thyroidectomy in this study was limited to 8.3% of patients, predominantly due to contralateral disease detection or recurrence. This finding addresses a common concern regarding hemithyroidectomy—that a large proportion of patients will eventually require a second surgery. On

the contrary, over 90% of patients avoided revision surgery, thereby benefiting from reduced surgical morbidity and preservation of thyroid function.

An additional advantage of hemithyroidectomy is the avoidance of complications associated with total thyroidectomy, particularly permanent hypocalcemia. In the present study, no cases of hypocalcemia were observed, and vocal cord dysfunction was rare and transient. These findings underscore the safety profile of hemithyroidectomy and highlight its role in improving postoperative quality of life.

Despite its strengths, this study has certain limitations. Its retrospective design introduces potential selection bias, and the follow-up duration, while adequate for detecting early recurrence, may not capture very late disease recurrence. Additionally, molecular markers such as BRAF mutation status were not routinely analyzed, which may further refine risk stratification in future studies.

Overall, the results of this study support a risk-adapted surgical approach in papillary thyroid carcinoma. Hemithyroidectomy provides excellent oncological control in low-risk PTC while minimizing surgical morbidity. Careful preoperative evaluation, intraoperative precision, and detailed histopathological assessment remain critical in optimizing outcomes.

VI. Conclusion

Hemithyroidectomy is a safe and oncologically effective surgical option for patients with low-risk papillary thyroid carcinoma when strict selection criteria are applied. The present study demonstrates low rates of disease recurrence and a limited requirement for completion thyroidectomy, with outcomes comparable to those reported following total thyroidectomy in similar risk groups.

Tumor size greater than 2 cm, microscopic extrathyroidal extension, and close surgical margins were identified as significant predictors of recurrence and need for revision surgery. However, the majority of recurrences were locoregional and amenable to successful surgical salvage, without adversely affecting overall disease control.

The favorable complication profile observed following hemithyroidectomy, particularly the absence of permanent hypocalcemia and minimal recurrent laryngeal nerve morbidity, highlights its advantages over more extensive surgical approaches. These findings support a risk-adapted, individualized surgical strategy that prioritizes oncological safety while minimizing treatment-related morbidity.

In appropriately selected patients, hemithyroidectomy should be considered a definitive surgical treatment for low-risk papillary thyroid carcinoma, with close postoperative surveillance and timely intervention reserved for the small subset of patients who develop recurrence or require revision surgery.

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