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Review Article

JOURNAL OF CANCER SCIENCE AND CLINICAL THERAPEUTICS

ISSN: 2637-5079

Outcome of Hemithyroidectomy in Patients with Low-Risk Papillary Thyroid Cancer

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Abstract

Background: Papillary thyroid carcinoma (PTC) is the most common thyroid malignancy, with low-risk tumors generally exhibiting an indolent course. Hemithyroidectomy (HT) has emerged as a conservative surgical approach for appropriately selected low-risk PTC patients, offering favorable oncologic outcomes while minimizing complications.

Aim of the study: To evaluate the clinical, surgical, and oncologic outcomes of hemithyroidectomy in patients with low-risk PTC and identify factors associated with recurrence.

Methods: A cross-sectional study was conducted at the Department of ENT & Head and Neck Surgery, [Name of Institution], including 150 adult patients with histologically confirmed low-risk PTC who underwent hemithyroidectomy between July 2024 and June 2025. Patients were followed for a minimum of 24 months. Demographic, clinical, surgical, and follow-up data were collected. Primary outcomes included recurrence, disease-free survival (DFS), and overall survival (OS); secondary outcomes included postoperative complications, hypothyroidism, operative time, and hospital stay. Statistical analysis included univariate and multivariate logistic regression to identify predictors of recurrence.

Result: The mean age was 43.2 ± 11.8 years, and 68% of patients were female. Mean tumor size was 1.15 ± 0.46 cm; 13.3% were multifocal, and 4% demonstrated extrathyroidal extension. Symptom relief was achieved in 93.3% of patients. Postoperative hypothyroidism occurred in 18.7%, while transient hypocalcemia and transient recurrent laryngeal nerve (RLN) palsy occurred in 6.7% and 2.7%, respectively, with no permanent complications. Over a mean follow-up of 50.2 ± 12.5 months, recurrence occurred in 4% of patients, all locoregional. Five-year DFS and OS were 96% and 99.3%, respectively. Multivariate analysis identified multifocality (OR 6.78, p=0.038) and extrathyroidal extension (OR 16.7, p=0.012) as independent predictors of recurrence.

Conclusion: Hemithyroidectomy is a safe and effective treatment for low-risk PTC, providing excellent clinical outcomes and low recurrence rates. Careful patient selection, particularly considering multifocality and extrathyroidal extension, is essential to optimize oncologic outcomes.

Keywords: Low-risk papillary thyroid carcinoma; Hemithyroidectomy; Thyroid surgery; Postoperative hypothyroidism: Disease-free survival; Recurrence

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Citation: Vinod Kumar Singhal, Nufra Senopher Mohamed Sarfra, Adil Mohammed Suleman, Tazeen Burhan. Outcome of Hemithyroidectomy in Patients with Low-Risk Papillary Thyroid Cancer. Journal of Cancer Science and Clinical Therapeutics. 9 (2025): 205-211.

Received: December 01, 2025
Accepted: December 02, 2025
Published: December 08, 2025

Singhal VM, et al., J Cancer Sci Clin Ther 2025
DOI:10.26502/jcsct.5079278

Introduction

Papillary thyroid carcinoma (PTC) is the most prevalent form of thyroid malignancy, comprising nearly 80–90% of all differentiated thyroid cancers and demonstrating a steadily increasing incidence worldwide [1]. According to GLOBOCAN 2020, thyroid cancer is among the ten most frequently diagnosed malignancies worldwide, accounting for more than 586,000 new cases annually [2]. This trend has been particularly marked in women, who are affected nearly three times more often than men, and in regions where widespread use of ultrasonography and fine-needle aspiration has enhanced early detection [3]. PTC typically arises from thyroid follicular epithelial cells and is histologically characterized by papillary structures, nuclear atypia including grooves and inclusions, and frequent association with lymphatic spread [4]. Clinically, PTC is distinguished by its indolent nature, slow progression, and excellent prognosis, with disease-specific mortality rates of less than 1% in low-risk cases and ten-year survival rates often exceeding 95% [5,6]. Despite its favorable overall outcome, the disease can present with multifocality, cervical lymph node involvement, or recurrence in a subset of patients, necessitating careful selection of appropriate treatment strategies [7-9]. Surgical resection remains the cornerstone of management, with the primary goal of achieving local disease control and preventing recurrence while minimizing procedure-related morbidity. Traditionally, total thyroidectomy was regarded as the standard operation for all patients with papillary carcinoma, on the premise of facilitating radioactive iodine therapy, enabling precise thyroglobulin surveillance, and removing potential microscopic foci in the contralateral lobe [10]. However, this approach is associated with notable risks such as hypoparathyroidism, recurrent laryngeal nerve injury, and the lifelong requirement for thyroid hormone replacement [11,12]. For patients with low-risk disease—defined as unifocal intrathyroidal tumors ≤4 cm without extrathyroidal extension or nodal/distant metastasis—these risks may outweigh the marginal oncologic benefits of complete thyroid removal [13]. Hemithyroidectomy, involving excision of a single thyroid lobe with the isthmus, has therefore emerged as a rational and effective surgical option for this subset. Its main advantages include reduced operative morbidity, preservation of partial thyroid function with decreased reliance on exogenous hormone replacement, and maintenance of physiological calcium balance by sparing the parathyroid glands [14]. From a pathological perspective, low-risk papillary carcinomas are usually confined to the thyroid gland, display limited local invasion, and have a low propensity for distant metastasis, making them particularly suitable for conservative surgery [15]. Unnecessary total thyroidectomies may expose large numbers of patients to long-term complications without clear survival benefits, whereas hemithyroidectomy offers a balanced approach that aligns oncological safety with functional preservation [16]. Thus, understanding the outcomes of hemithyroidectomy in low-risk papillary thyroid carcinoma is of significant importance for guiding surgical decision-making and optimizing patient care, especially in resource-limited settings where long-term medication and surveillance may be challenging. The present study aimed to evaluate the outcomes of hemithyroidectomy in patients with low-risk papillary thyroid carcinoma, thereby contributing to a more nuanced understanding of its role in contemporary thyroid cancer management.

Materials and Methods

This cross-sectional study was conducted in the Department of ENT & Head and Neck Surgery at Prime Hospital, Dubai, UAE, a tertiary care hospital, between July 2024 and June 2025. A total of 150 patients diagnosed with low-risk papillary thyroid carcinoma (PTC) who underwent hemithyroidectomy as the primary surgical treatment during the study period were included. Low-risk PTC was defined according to the American Thyroid Association (ATA) guidelines as tumors ≤ 4 cm without evidence of extrathyroidal extension, lymph node metastasis, distant metastasis, or aggressive histological variants.

Inclusion and Exclusion Criteria

Inclusion criteria:

- Adults aged ≥ 18 years
- Histologically confirmed low-risk PTC
- Underwent hemithyroidectomy as initial surgical management
- Minimum postoperative follow-up of 24 months

Exclusion criteria:

- History of prior thyroid surgery or neck irradiation
- Multifocal disease requiring total thyroidectomy
- Incomplete medical records or loss to follow-up

Surgical Technique

All hemithyroidectomies were performed by experienced endocrine surgeons following a standardized operative protocol. The procedure involved resection of one thyroid lobe along with the isthmus, with careful identification and preservation of the recurrent laryngeal nerve (RLN) and parathyroid glands to minimize complications. Intraoperative nerve monitoring was utilized selectively based on surgeon preference.

Postoperative Management and Follow-Up

Postoperative monitoring included evaluation of voice changes, serum calcium, and wound status. Serum calcium and parathyroid hormone (PTH) levels were assessed within

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DOI:10.26502/jcsct.5079278

24 hours after surgery to identify hypocalcemia. Thyroid function tests (TSH and free T4) were measured at 6 to 8 weeks postoperatively and periodically thereafter to detect hypothyroidism. Levothyroxine replacement therapy was initiated in patients with biochemical hypothyroidism; TSH suppression therapy was not routinely employed unless clinically indicated. Patients were followed at regular intervals—every 6 months for the first 2 years and annually thereafter. Follow-up evaluations included neck ultrasonography, serum thyroglobulin measurement, and clinical examination to detect tumor recurrence. Recurrence was defined as structural disease confirmed by imaging and cytology or histology.

Data Collection

Demographic, clinical, pathological, operative, and follow-up data were extracted from electronic medical records and operative logs. Collected variables included age, sex, tumor size, histologic subtype, multifocality, extrathyroidal extension, operative time, length of hospital stays, postoperative complications, and any adjuvant therapies administered. Primary outcome measures included symptom relief, recurrence rate, disease-free survival (DFS), and overall survival (OS) at 5 years.

Study Outcomes

The primary outcome was the rate of structural recurrence following hemithyroidectomy in patients with low-risk PTC. Secondary outcomes included postoperative complications, incidence of hypothyroidism, operative time, length of hospital stay, and long-term survival metrics.

Statistical Analysis

Data were analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as mean ± standard deviation (SD) or median with interquartile range (IQR), depending on data distribution. Categorical variables were reported as frequencies and percentages. Group comparisons were performed using Student's t-test or Mann–Whitney U test for continuous variables and Chi-square or Fisher's exact tests for categorical variables. Univariate logistic regression was conducted to identify factors associated with recurrence. Variables with $p < 0.10$ in univariate analysis were included in a multivariate logistic regression model to determine independent predictors, with results expressed as odds ratios (OR) and 95% confidence intervals (CI). Statistical significance was defined as $p < 0.05$.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee. All procedures were performed in accordance with the ethical standards of the institutional research committee and the 1964 Helsinki Declaration and its later amendments.

Results

Table 1 shows that the study included 150 patients with a mean age of 43.2 ± 11.8 years, of whom 46.67% were between 31–45 years. Females constituted the majority, 68.00%, consistent with the higher prevalence of thyroid disorders in women. The mean tumor size was 1.15 ± 0.46 cm, with 48% of tumors measuring ≤1 cm and 45.33% between 1–2 cm. Multifocality was present in 13.33% and extrathyroidal extension in 4%. Histopathologically, the classic variant of papillary thyroid carcinoma (PTC) predominated 86.67%, followed by the follicular variant 10.00%. The mean follow-up duration was 50.2 ± 12.5 months. 93.33% of patients experienced symptom relief after hemithyroidectomy. Postoperative hypothyroidism developed in 18.67%, while transient hypocalcemia and recurrent laryngeal nerve palsy occurred in 6.7% and 2.7% of cases, respectively, with no permanent complications reported. The mean hospital stay was 2.3 ± 1.1 days, and the mean operative time was 90 ± 22 minutes. Overall, 96.00% of patients were cured, while recurrence occurred in 4.00% (Table 2). Table 3 illustrates that recurrence developed in six patients, 4.00% after a median of 28 months (IQR 24–36). The most frequent sites were the ipsilateral thyroid lobe 2.00% and regional lymph nodes 1.33%, with one case 0.67% of distant metastasis. The five-year disease-free survival rate was 96.00%, and overall survival was 99.33%. As shown in Table 4, univariate analysis identified multifocality ($p = 0.021$) and extrathyroidal extension ($p = 0.008$) as significant risk factors for recurrence. Both remained independent predictors in multivariate analysis ($p < 0.05$). Other variables, including age and tumor size, were not significant.

Table 1: Baseline demographic and clinical characteristics of the study population. (n = 150).

Variable	Frequency (n)	Percentage (%)
Age (years)		
≤ 30	35	23.33
31–45	70	46.67
> 45	45	30
Mean ± SD	43.2 ± 11.8	
Gender		
Male	48	32
Female	102	68
Tumor size (cm)	1.15 ± 0.46	
Tumor size category		
≤1 cm	72	48
>1–2 cm	68	45.33
>2 cm	10	6.67
Multifocality	20	13.33
Extrathyroidal extension	6	4

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DOI:10.26502/jcsct.5079278

Histological subtype		
Classic variant	130	86.67
Follicular variant	15	10
Others	5	3.33
Follow-up duration (months)		
Mean ± SD	50.2 ± 12.5	

Table 2: Clinical and surgical outcomes following Hemithyroidectomy

Outcome	Frequency (n)	Percentage (%)
Symptom relief	140	93.33
Postoperative hypothyroidism	28	18.67
Hypercalcemia	5	3.33
Hospital stays (days)		
Mean ± SD	2.3 ± 1.1	
Operative time (minutes)		
Mean ± SD	90 ± 22	
Postoperative complications		
Transient hypocalcemia	10	6.67
Permanent hypocalcemia	0	0
Transient RLN palsy	4	2.67
Permanent RLN palsy	0	0
Cured	144	96
Recurrence	6	4

Table 3: Oncologic outcomes and patterns of recurrence during follow-up

Outcome	Number (n)	Percentage (%)
Recurrence	6	4
Time to recurrence (months)		
Median (IQR)	28 (24–36)	
Site of recurrence		
Ipsilateral thyroid lobe	3	2
Regional lymph nodes	2	1.33
Distant metastasis	1	0.67
Disease-free survival at 5 years	144	96
Overall survival at 5 years	149	99.33

Discussion

Papillary thyroid carcinoma (PTC) is the most prevalent form of differentiated thyroid cancer, representing approximately 85–90% of all thyroid malignancies and typically exhibiting an indolent clinical course with excellent long-term prognosis [17]. Over the past two decades, management strategies for low-risk PTC have undergone substantial refinement, shifting from a uniform approach of total thyroidectomy to more conservative surgical options, including hemithyroidectomy [18]. This paradigm shift has been driven by accumulating evidence indicating comparable oncologic outcomes between hemithyroidectomy and total thyroidectomy in properly selected patients, with a significantly lower risk of complications and improved quality of life [19]. The present study adds to this growing body of evidence by evaluating the clinical, surgical, and oncologic outcomes of hemithyroidectomy in patients with low-risk PTC in a South Asian tertiary care context. In the present study, the majority of patients were female (68%), with a mean age of 43.2 ± 11.8 years. This aligns with previous findings reporting 84.4% female patients with a similar mean age of 43.2 ± 11.8 years. Additionally, a large study of 83,464 patients documented 79.3% female patients, with a median age of 51 years, corroborating the demographic characteristics observed in our study [20,21]. The mean tumor size was 1.15 ± 0.46 cm, and 93.33% of patients had tumors ≤2 cm, aligning with the low-risk criteria defined by the American Thyroid Association (ATA) guidelines [22]. Most tumors were of the classic papillary thyroid carcinoma variant (86.7%), whereas a smaller proportion exhibited the follicular variant (10%), reflecting the histopathologic distribution commonly observed in low-risk patients [23]. The present study demonstrated excellent surgical and clinical outcomes following hemithyroidectomy. Symptom relief was achieved in 93.33% of patients, and postoperative complication rates were remarkably low. Transient hypocalcemia occurred in only 6.67% of cases, and transient recurrent laryngeal nerve (RLN) palsy in 2.67%, with no permanent hypocalcemia or RLN injury. These findings align closely with previous literature. Van Dijk et al. reported transient hypocalcemia in 13.7% of cases and persistent hypocalcemia in 4.8% [24], while Van Slycke et al. documented a 1.6% incidence of transient RLN palsy

Table 4: Factors associated with recurrence: univariate and multivariate analysis

Variable	Recurrence (n=6)	No Recurrence (n=144)	Univariate OR (95% CI)	p-value	Multivariate OR (95% CI)	p-value
Age >45 years	4 (66.67)	49 (34.03)	3.84 (0.83–17.7)	0.087	3.45 (0.73–16.3)	0.116
Tumor size >1 cm	5 (83.33)	67 (46.53)	5.27 (0.63–44.3)	0.119	4.02 (0.44–36.4)	0.219
Multifocality	3 (50.00)	17 (11.81)	7.89 (1.36–45.7)	0.021*	6.78 (1.12–41.2)	0.038*
Extrathyroidal extension	2 (33.33)	4 (2.78)	18.6 (2.15–160.5)	0.008*	16.7 (1.85–150.6)	0.012*

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DOI:10.26502/jcsct.5079278

following hemithyroidectomy [25]. The shorter hospital stay (mean 2.3 ± 1.1 days) and moderate operative time (90 ± 22 minutes) also emphasize the procedural efficiency and safety of hemithyroidectomy for low-risk disease. One of the main concerns with hemithyroidectomy has been the potential risk of postoperative hypothyroidism. In our study, 18.67% of patients developed biochemical hypothyroidism requiring thyroxine supplementation. This rate aligns closely with previous reports, which have documented postoperative hypothyroidism in 15–30% of patients following lobectomy [25]. Su et al. (2016) reported that 21.7% of patients developed hypothyroidism after hemithyroidectomy for papillary thyroid carcinoma, most within the first year of surgery [26]. A meta-analysis by Cooper et al. (2024) including 66 studies reported a pooled incidence of postoperative hypothyroidism of 29%, with 23% requiring long-term thyroxine replacement [27]. Factors such as preoperative thyroid-stimulating hormone (TSH) level, contralateral lobe volume, and autoimmune thyroiditis have been implicated in predicting postoperative thyroid function outcomes [28]. The oncologic outcomes in the present study were highly favorable. After a mean follow-up of 50.2 ± 12.5 months, the recurrence rate was only 4%, and all recurrences were locoregional, with no mortality reported. The 5-year disease-free survival (DFS) and overall survival (OS) rates were 96% and 99.33%, respectively. These outcomes are consistent with several landmark studies showing equivalent survival and recurrence outcomes between hemithyroidectomy and total thyroidectomy in properly selected low-risk PTC patients [29]. Ahn et al. (2020) reported a low recurrence rate following HT in patients with low- and intermediate-risk PTC, emphasizing the importance of meticulous follow-up to monitor the remaining thyroid lobe [30]. Similarly, Liu et al. (2022) found that while total thyroidectomy (TT) was associated with better recurrence-free survival over a 10-year period, both TT and HT provided comparable overall and disease-specific survival rates [31]. Multivariate analysis in the present study identified multifocality (OR 6.78, p=0.038) and extrathyroidal extension (OR 16.7, p=0.012) as independent predictors of recurrence. These findings echo prior evidence indicating that such pathological features portend higher recurrence risk even in otherwise low-risk PTC [32]. Age >45 years and tumor size >1 cm showed a trend toward increased recurrence but did not reach statistical significance, possibly due to the small number of recurrence events. This underscores the importance of careful patient selection based on both clinical and pathological parameters when considering hemithyroidectomy.

Limitations of the study: This study has several limitations. Its single-center, cross-sectional design may limit the generalizability of the findings to broader populations. The sample size, while adequate, is relatively small for detecting rare recurrence events, which may affect the statistical power of multivariate analyses. Additionally, follow-up was limited to a mean of 50 months; longer-term outcomes, including late recurrences, could not be fully assessed. Finally, selective use of intraoperative nerve monitoring may introduce procedural variability.

Conclusion and Recommendations

Hemithyroidectomy is a safe and effective surgical option for patients with low-risk papillary thyroid carcinoma, demonstrating excellent symptom relief, low complication rates, and favorable long-term oncologic outcomes. Recurrence is uncommon and predominantly locoregional, with multifocality and extrathyroidal extension identified as independent predictors. Routine postoperative hypothyroidism occurs in a minority of patients and is readily managed with levothyroxine. Careful preoperative assessment and selection of appropriate candidates are essential to optimize outcomes. Long-term follow-up with clinical evaluation and imaging of the contralateral lobe is recommended to ensure early detection of recurrence and guide timely intervention.

Funding: No funding sources

Conflict of Interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee.

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Citation: Vinod Kumar Singhal, Nufra Senopher Mohamed Sarfra, Adil Mohammed Suleman, Tazeen Burhan. Outcome of Hemithyroidectomy in Patients with Low-Risk Papillary Thyroid Cancer. Journal of Cancer Science and Clinical Therapeutics. 9 (2025): 205-211.