

Evaluating Surgical Strategies and Outcomes in the Management of Papillary Thyroid Carcinoma: A Cross-Sectional Observational Study

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Abstract:

Background: Papillary thyroid carcinoma (PTC) is the most common histological type of thyroid cancer, accounting for the majority of endocrine malignancies. Surgical resection remains the cornerstone of management, with different operative strategies tailored based on tumor size, location, lymph node involvement, and risk stratification models.

Objectives:

- To evaluate the surgical approaches employed in the management of papillary thyroid carcinoma.
- To assess post-operative outcomes, complications, and recurrence rates.

Methods: This observational study was conducted at Department of General Surgery, GMERS Medical College, Junagadh, Gujarat, from February 2024 to December 2024. Patients diagnosed with papillary thyroid carcinoma and undergoing surgical treatment were included. Surgical modalities included hemithyroidectomy, total thyroidectomy, and total thyroidectomy with neck dissection based on preoperative and intraoperative findings. Post-operative complications, hospital stay, histopathological findings, and recurrence rates were analyzed.

Results: Total thyroidectomy was the most frequently performed procedure, followed by hemithyroidectomy in selected low-risk cases. Central compartment neck dissection was performed in patients with clinically evident lymphadenopathy. The overall post-operative complication rate was low, with transient hypocalcemia being the most common complication. Recurrence was rare during the short-term follow-up period.

Conclusion: Surgical management of papillary thyroid carcinoma yields excellent outcomes with low morbidity when appropriately tailored to individual patient risk factors. Total thyroidectomy remains the standard of care for most cases, while selective use of hemithyroidectomy is justified in low-risk patients.

Keywords: Papillary Thyroid Carcinoma, Total Thyroidectomy, Hemithyroidectomy, Neck Dissection, Surgical Outcomes.

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Introduction

Papillary thyroid carcinoma (PTC) is the most common form of thyroid malignancy, accounting for approximately 80–85% of all thyroid cancers. It is a slow-growing, well-differentiated carcinoma that typically exhibits an indolent clinical course and favorable long-term survival, especially when diagnosed and treated early [1]. PTC commonly presents as an asymptomatic thyroid nodule and is often discovered incidentally during imaging or clinical evaluation of unrelated conditions. The disease is more prevalent in females and is most frequently diagnosed in the third to fifth decades of life. Despite its generally good prognosis, certain variants of PTC, extrathyroidal extension, lymph node metastases, and unfavorable histopathological features may necessitate a more aggressive therapeutic approach [2].

Surgical intervention remains the cornerstone of management in papillary thyroid carcinoma, with

the primary objective being complete tumor excision and prevention of local recurrence. The choice of surgical procedure is influenced by multiple factors including tumor size, focality, presence of lymph node involvement, distant metastases, patient age, and comorbidities [3]. While total thyroidectomy is often advocated for tumors larger than 1 cm or those associated with aggressive features, hemithyroidectomy may be considered sufficient for small, unifocal, low-risk tumors confined to one lobe of the gland. Central compartment neck dissection is recommended when lymphadenopathy is clinically or radiologically evident, and in select high-risk patients [4].

Over recent years, there has been growing emphasis on individualized surgical planning guided by risk stratification protocols such as the American Thyroid Association (ATA) guidelines and dynamic risk assessment models [5]. These strategies aim to

balance the benefits of complete resection with the potential risks of surgical complications, including recurrent laryngeal nerve injury and hypoparathyroidism. Post-operative radioactive iodine therapy and thyroid-stimulating hormone suppression further complement surgical management in selected cases [6].

In the Indian context, particularly in semi-urban and tertiary government settings, data on the surgical approaches and outcomes in papillary thyroid carcinoma are relatively limited. Local patient characteristics, healthcare access, delayed diagnosis, and surgeon experience may all influence the pattern of surgical care provided [7]. Therefore, it becomes essential to evaluate and document the types of surgical interventions performed, their outcomes, and complication rates in this setting.

The present study was undertaken to analyze the surgical management patterns employed for papillary thyroid carcinoma at a tertiary institution in Gujarat, India. It aims to assess the frequency of various surgical modalities used, associated intraoperative and post-operative complications, and short-term oncological outcomes, thereby contributing to evidence-based refinement of surgical protocols.

Methodology

This cross-sectional observational study was conducted in the Department of General Surgery at GMERS Medical College, Junagadh, Gujarat, over a period of 11 months, from February 2024 to December 2024. Written informed consent was secured from all participants. The study included all patients diagnosed with papillary thyroid carcinoma who underwent surgical management at the institute during the study period. Diagnosis was confirmed pre-operatively through ultrasonography and fine-needle aspiration cytology (FNAC) in accordance with the Bethesda classification system, followed by histopathological confirmation post-surgery.

Patients with histologically proven papillary thyroid carcinoma, irrespective of age or gender, were included in the study. Cases with recurrent thyroid carcinoma, distant metastasis at presentation, prior neck surgery or irradiation, or incomplete clinical records were excluded. A detailed clinical assessment was performed for all patients, including history, neck examination, and evaluation of voice and swallowing disturbances. Laboratory

investigations included thyroid function tests and serum calcium levels. Pre-operative imaging included high-resolution ultrasound of the neck and, when necessary, contrast-enhanced CT scan to evaluate local invasion and nodal status.

Surgical procedures performed included hemithyroidectomy, total thyroidectomy, and total thyroidectomy with central compartment neck dissection, based on tumor characteristics and risk stratification. The decision for extent of surgery was guided by tumor size, multifocality, capsular invasion, and lymph node involvement. Intraoperative nerve monitoring was not routinely used due to institutional constraints. Post-operative monitoring included serum calcium and voice assessment to identify transient or permanent hypocalcemia and recurrent laryngeal nerve injury, respectively.

Histopathological evaluation was done to confirm tumor subtype, size, capsular and vascular invasion, lymph node metastasis, and margin status. Patients were followed post-operatively for early complications, and any signs of disease recurrence during the short-term follow-up period. Data were compiled in Microsoft Excel and analyzed using SPSS version 22. Continuous variables were presented as mean $\pm$ standard deviation, and categorical variables were expressed as frequencies and percentages. Chi-square and t-tests were used to analyze the association between surgical procedures and outcomes, with a p-value <0.05 considered statistically significant.

Results

A total of 60 patients with histologically confirmed papillary thyroid carcinoma were included in the study. The mean age of the participants was 42.6 years, with a female predominance. Total thyroidectomy was the most commonly performed procedure, accounting for nearly two-thirds of cases, followed by hemithyroidectomy. Central compartment neck dissection was undertaken in 18 cases where clinical or radiological evidence of nodal involvement was present. The most common post-operative complication was transient hypocalcemia, while permanent complications were rare. There was no perioperative mortality, and recurrence was not observed during the short-term follow-up.

Table 1: Age distribution of study participants

Age group (years)	Number (n=60)	Percentage (%)
≤ 30	10	16.7%
31–45	24	40.0%
46–60	18	30.0%
>60	8	13.3%

Table 2: Gender distribution

Gender	Number (n=60)	Percentage (%)
Male	16	26.7%
Female	44	73.3%

Table 3: Presenting symptoms

Symptom	Number (n=60)	Percentage (%)
Neck swelling	52	86.7%
Hoarseness of voice	6	10.0%
Dysphagia	4	6.7%
Incidental detection	5	8.3%

Table 4: Surgical procedure performed

Surgery type	Number (n=60)	Percentage (%)
Total thyroidectomy	40	66.7%
Hemithyroidectomy	14	23.3%
Total thyroidectomy + neck dissection	6	10.0%

Table 5: Indications for total thyroidectomy

Indication	Number (n=46)	Percentage (%)
Tumor size >1 cm	24	52.2%
Multifocal tumor	10	21.7%
Extrathyroidal extension	6	13.0%
Suspicious contralateral nodule	6	13.0%

Table 6: Neck dissection performed

Neck dissection status	Number (n=60)	Percentage (%)
Performed	18	30.0%
Not performed	42	70.0%

Table 7: Histological subtypes of papillary thyroid carcinoma

Subtype	Number (n=60)	Percentage (%)
Classical	42	70.0%
Follicular variant	10	16.7%
Tall cell variant	5	8.3%
Diffuse sclerosing	3	5.0%

Table 8: Lymph node metastasis

Lymph node status	Number (n=60)	Percentage (%)
Present	14	23.3%
Absent	46	76.7%

Table 9: Surgical margin status

Margin status	Number (n=60)	Percentage (%)
Free	55	91.7%
Involved	5	8.3%

Table 10: Post-operative complications

Complication	Number (n=60)	Percentage (%)
Transient hypocalcemia	12	20.0%
Recurrent laryngeal nerve palsy (transient)	3	5.0%
Wound infection	2	3.3%
None	43	71.7%

Table 11: Length of hospital stay

Duration (days)	Number (n=60)	Percentage (%)
≤3	18	30.0%
4–6	34	56.7%
>6	8	13.3%

Table 12: Recurrence rate

Recurrence status	Number (n=60)	Percentage (%)
Yes	0	0.0%
No	60	100.0%

Summary of tables: The majority of patients were between 31–45 years of age, with a marked female predominance (Table 1, Table 2). Neck swelling was the most common symptom, with some cases detected incidentally (Table 3). Total thyroidectomy was the most frequently employed surgical approach, often indicated by tumor size or multifocality (Table 4, Table 5). Central neck dissection was performed in one-third of patients with clinically suspicious nodal disease (Table 6). Most tumors were of the classical subtype, and nodal metastases were identified in 23.3% of cases (Table 7, Table 8). Margins were free in the majority (Table 9), and transient hypocalcemia was the most frequent complication observed (Table 10). Hospital stays ranged from 3–6 days in most cases, and no recurrence was observed during the follow-up period (Table 11, Table 12).

Discussion

The findings of the present study reinforce the established role of surgical resection as the principal modality in the management of papillary thyroid carcinoma, which continues to be the most frequently encountered endocrine malignancy. The majority of patients in this study were women in the fourth and fifth decades of life, aligning with global epidemiological data that shows a higher prevalence of PTC in middle-aged females. Total thyroidectomy was the most commonly performed surgical procedure, consistent with international guidelines that recommend this approach in cases of tumors larger than 1 cm, multifocal disease, extrathyroidal extension, or contralateral nodularity. Hemithyroidectomy was selectively performed in patients with unifocal tumors less than 1 cm and in the absence of high-risk features, demonstrating the institution's adherence to a risk-stratified surgical approach.

Central compartment neck dissection was undertaken in a proportion of patients with clinically or radiologically suspected lymph node involvement, reflecting judicious application of lymphadenectomy in appropriate settings. Histopathological findings supported the predominance of classical subtype, with a smaller proportion representing aggressive variants such as tall cell and diffuse sclerosing types. Lymph node metastases were observed in nearly one-fourth of cases, reaffirming the known predilection of PTC for cervical nodal spread, particularly in younger patients and larger tumors. The vast majority of surgical margins were reported free of tumor,

indicating satisfactory oncological clearance across all surgical categories.

The overall post-operative complication rate in this study was low, with transient hypocalcemia being the most frequent, followed by a small number of cases with transient recurrent laryngeal nerve palsy. Importantly, there were no instances of permanent hypoparathyroidism or nerve injury, reflecting safe surgical practices even in extensive resections. The short-term post-operative outcomes were favorable, with no mortality or local recurrence recorded during follow-up, though longer surveillance would be required to assess disease-free survival more definitively.

The results are in line with the evolving global shift toward individualized treatment of PTC, balancing oncological adequacy with functional preservation. While total thyroidectomy remains the preferred modality in intermediate- and high-risk cases, hemithyroidectomy continues to be a safe and effective alternative in selected low-risk patients. Complication rates in this study compare favorably with global benchmarks, suggesting that with proper patient selection and surgical expertise, optimal outcomes are achievable even in public sector teaching hospitals with limited resources.

This study contributes valuable local data regarding operative strategies and outcomes in the Indian context, where standardized protocols are often challenged by variable infrastructure, delayed presentations, and limited access to advanced diagnostic modalities. Although the study was limited by a modest sample size and short follow-up duration, its findings underline the effectiveness and safety of surgery in PTC when guided by contemporary risk-based decision-making. Further large-scale multicenter studies are recommended to validate these findings and support evidence-driven refinement of thyroid cancer management in similar healthcare settings.

Conclusion

The surgical management of papillary thyroid carcinoma continues to yield excellent clinical outcomes when aligned with patient-specific risk factors and disease characteristics. In this study, total thyroidectomy emerged as the most frequently employed procedure, particularly for tumors exceeding 1 cm or demonstrating multifocality, extrathyroidal extension, or contralateral involvement. Hemithyroidectomy was appropriately selected for low-risk, unifocal tumors, reflecting a tailored and evidence-based surgical strategy.

Central neck dissection was performed in cases with suspected lymph node involvement, and histopathological findings confirmed nodal metastasis in a notable subset of patients. Surgical margins were clear in the majority, indicating a high rate of complete oncologic resection. Post-operative complications were limited and transient, with hypocalcemia being the most commonly observed event, and no recurrence was noted during short-term follow-up. These results affirm that, with judicious patient selection and adherence to standard guidelines, excellent oncologic and functional outcomes are achievable even in resource-limited tertiary centers. While total thyroidectomy remains the standard in intermediate- and high-risk cases, selective hemithyroidectomy remains a safe option for carefully chosen low-risk patients. The findings highlight the importance of structured pre-operative assessment and intraoperative decision-making to minimize complications and optimize recovery. Future studies with larger cohorts and extended follow-up are warranted to assess long-term recurrence and survival trends.

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