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ORIGINAL ARTICLE

Assessment of Thyroid Function Status and Serum Thyroglobulin after Total Thyroidectomy in Papillary Thyroid Carcinoma

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ABSTRACT

Background: *Papillary thyroid carcinoma (PTC) is the most prevalent type of thyroid cancer, showing rising rates and a favorable outlook. Total thyroidectomy facilitates monitoring through TSH suppression and thyroglobulin levels while requiring lifelong levothyroxine treatment. This research evaluated postoperative thyroid function and thyroglobulin levels to facilitate early detection of recurrence in an environment with scarce local data.* ***Methods & Materials:*** *This observational study involved 60 patients with papillary thyroid carcinoma who underwent total thyroidectomy in Dhaka from January to December 2023. Thyroid activity, serum thyroglobulin levels, and ultrasound results were evaluated at 3 and 6 months, with recurrence verified by thyroglobulin, FNAC or imaging studies. Data were examined with SPSS v26, and ethical approval along with informed consent was secured.* ***Results:*** *Sixty papillary thyroid carcinoma patients were followed after total thyroidectomy. The majority were women (70%) with an average age of 41.2 ± 11.8 years. Thyroid function stayed stable throughout the follow-up (p>0.05). At six months, 88.3% demonstrated thyroid bed clearance, whereas 11.7% exhibited abnormalities and were lymph node positive. Recurrence happened in 11.7% of cases, with an average time of 4.2 ± 1.1 months, and was linked to elevated serum thyroglobulin levels.* ***Conclusion:*** *The majority of patients with papillary thyroid carcinoma maintain stable thyroid function post-total thyroidectomy, yet a minority experiences early recurrence. The use of combined ultrasound and serum thyroglobulin monitoring is crucial for early identification and ongoing observation.*

Keywords: *Thyroid Function Status, Serum Thyroglobulin, Total Thyroidectomy, Papillary Thyroid Carcinoma.*

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INTRODUCTION

Papillary thyroid carcinoma (PTC) is the most prevalent form of thyroid cancer, making up approximately 80–85% of total cases. Its occurrence has demonstrated a significant rise over time, increasing from 4.8 to 14.9 per 100,000 in extensive population-based studies [1,2]. Although the incidence is rising, papillary thyroid carcinoma (PTC) shows an excellent outlook, with a long-term survival rate surpassing 90% when treated correctly. The standard treatment involves total thyroidectomy, with the selective addition of radioactive iodine ablation based on risk assessment [3,4].

Total thyroidectomy plays a crucial role in managing PTC, particularly in cases of multifocal disease or patients at higher risk. It lowers the chance of recurrence, facilitates postoperative monitoring of thyroglobulin levels, and necessitates lifelong levothyroxine treatment with TSH suppression to inhibit stimulation of remaining tumor cells [5,6]. Post-total thyroidectomy, patients need lifelong levothyroxine due to the halt in thyroid hormone production. The objective is to preserve standard thyroid activity while suitably lowering TSH according to the risk of recurrence. Precise dosing is crucial, as too much replacement can result in thyrotoxicosis (e.g., atrial fibrillation, bone loss) while too little can trigger hypothyroid symptoms and possibly heighten tumor stimulation. Constant observation of TSH and FT4 is thus necessary [7,8]. Serum thyroglobulin (Tg) serves as a distinct marker for persistent or returning thyroid cancer following thyroidectomy and ablation. Increasing or noticeable levels indicate disease continuation, while stimulated Tg enhances detection sensitivity. Nonetheless, outcomes might be influenced by anti-Tg antibodies and variability in assays,

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making TgAb monitoring and thorough interpretation crucial [9,10].

Following lobectomy, serum thyroglobulin stays detectable, which means individual values have limited significance. Worldwide research indicates that increasing Tg patterns forecast recurrence, while consistent or declining levels suggest a low risk. In general, monitoring Tg trends is beneficial for tracking papillary thyroid carcinoma [11,12].

Research conducted in Bangladesh discovered that low postoperative PTH levels shortly after surgery are strong indicators of hypocalcemia following total thyroidectomy, facilitating the early detection of patients at high risk [13].

In Bangladesh, there is scarce information regarding thyroid function status and serum thyroglobulin assessment following total thyroidectomy for papillary thyroid carcinoma, and a standardized follow-up for recurrence is lacking; thus, this study seeks to assess thyroid function and Tg levels post-surgery to enhance monitoring and early identification of recurrence.

METHODS & MATERIALS

Study Design and Setting

This hospital-based prospective observational study was conducted in the Department of Otolaryngology and Head-Neck Surgery, National Institute of ENT, Tejgaon, Dhaka, Bangladesh, from January 2023 to December 2023. The study was designed to assess thyroid function status and serum thyroglobulin levels following total thyroidectomy in patients with papillary thyroid carcinoma and to evaluate their role in detecting postoperative recurrence.

Study Population

The study population comprised of patients diagnosed with papillary thyroid carcinoma who underwent total thyroidectomy in the Department of Otolaryngology and Head-Neck Surgery during the study period.

Sample Size and Sampling Technique

A total of 60 patients fulfilling the eligibility criteria were enrolled in the study using purposive sampling.

Eligibility Criteria

Inclusion Criteria

- Patients of either sex aged 18 years or above.
- Histopathologically confirmed papillary thyroid carcinoma.
- Patients who underwent total thyroidectomy with or without neck dissection.
- Patients willing to participate and provide written informed consent.
- Patients available for postoperative follow-up.

Exclusion Criteria

- Patients with other histological types of thyroid carcinoma.
- Patients with recurrent papillary thyroid carcinoma at presentation.
- Patients with distant metastasis at the time of diagnosis.
- Patients with severe systemic illness affecting thyroid function assessment.
- Patients lost to follow-up during the study period.

Data Collection Procedure

After obtaining informed written consent, demographic and clinical information including age, sex, clinical presentation, and operative findings were recorded in a predesigned data collection sheet. Histopathological confirmation of papillary thyroid carcinoma was obtained for all patients.

All enrolled patients underwent total thyroidectomy according to standard surgical protocols. Patients were followed up postoperatively at 3,6,9 and 12 months after surgery.

Assessment of Thyroid Function

Thyroid function was assessed by measuring serum free triiodothyronine (FT3), free thyroxine (FT4), and thyroid-stimulating hormone (TSH) levels at 3,6,9 and 12 months following surgery. Blood samples were collected under aseptic conditions and analyzed in the hospital laboratory using standard immunoassay techniques.

Assessment of Serum Thyroglobulin

Serum thyroglobulin levels were measured during follow-up as a biochemical marker of residual or recurrent disease. Patients with suspicious clinical or radiological findings underwent repeat thyroglobulin assessment at 3,6,9 and 12 months after surgery. Rising thyroglobulin levels during follow-up were considered suggestive of persistent or recurrent disease and were further investigated.

Ultrasonographic Evaluation

All patients underwent ultrasonographic examination of the thyroid bed and cervical lymph nodes at follow-up visits. Thyroid bed clearance, residual lesions, and cervical lymph node abnormalities were documented. Patients with suspicious lymph nodes or thyroid bed lesions underwent further diagnostic evaluation.

Confirmation of Recurrence

Patients with suspicious ultrasonographic findings and elevated serum thyroglobulin levels underwent fine-needle aspiration cytology (FNAC) of cervical lymph nodes when indicated. Computed tomography (CT) of the neck was performed in selected cases to assess locoregional disease recurrence. Tumor recurrence was defined as cytologically or radiologically confirmed locoregional disease detected during the follow-up period.

Outcome Measures

The primary outcome measures were:

- Changes in thyroid function status (FT3, FT4, and TSH) following total thyroidectomy.
- Changes in serum thyroglobulin levels during follow-up.

The secondary outcome measure was:

- Detection of locoregional recurrence based on ultrasonography, FNAC findings, imaging studies, and serum thyroglobulin levels.

Statistical Analysis

Data were processed and analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. Paired t-test was used to compare thyroid function parameters and serum thyroglobulin levels between follow-up visits. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

The study protocol was reviewed and approved by the appropriate Institutional Review Board/Ethical Review Committee of the National Institute of ENT, Dhaka. Written informed consent was obtained from all participants prior to enrollment. Confidentiality and anonymity of the participants were maintained throughout the study, and all procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki.

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RESULTS

A total of 60 patients with papillary thyroid carcinoma who underwent total thyroidectomy were included in the study. Thyroid function tests, ultrasonographic findings, and serum thyroglobulin levels were evaluated at 3, 6, 9, and 12 months after surgery.

Baseline Characteristics of the Study Patients

Table I shows that the majority of patients (28.3%) belonged to the 45–54 years age group, followed by 35–44 years (25.0%) and 25–34 years (20.0%). The mean age of the patients was 41.2±11.8 years, ranging from 18 to 64 years. Female patients predominated, accounting for 70.0% of the study population, while males constituted 30.0%, giving a male-to-female ratio of approximately 1:2.3.

Table I: Baseline characteristics of the study patients (*n*=60)

Variables	Number (%)
Age group (years)	
15–24	10 (16.7)
25–34	12 (20.0)
35–44	15 (25.0)
45–54	17 (28.3)
≥55	6 (10.0)
Mean age ± SD	41.2 ± 11.8
Range	18–64
Sex	
Male	18 (30.0)
Female	42 (70.0)

Serial Changes in Thyroid Function Tests during Follow-up

Table II demonstrates the serial changes in thyroid function tests at 3, 6, 9, and 12 months after total thyroidectomy. The mean FT3 level gradually decreased from 2.9±0.9 pg/ml at 3 months to 2.5±0.7 pg/ml at 12 months. Similarly, the mean FT4 level decreased from 1.6±0.4 ng/ml at 3 months to 1.3±0.3 ng/ml at 12 months. In contrast, the mean TSH level progressively increased from 2.8±1.3 mIU/ml at 3 months to 4.1±1.6 mIU/ml at 12 months. The overall changes in FT3, FT4, and TSH levels across the four follow-up periods were statistically significant ($p<0.05$).

Table II: Serial changes in thyroid function tests among study patients at different follow-up periods (*n*=60)

Thyroid function tests	3 months (Mean±SD)	6 months (Mean±SD)	9 months (Mean±SD)	12 months (Mean±SD)	P value
FT3 (pg/ml)	2.9±0.9	2.8±0.8	2.6±0.7	2.5±0.7	0.018s
FT4 (ng/ml)	1.6±0.4	1.5±0.4	1.4±0.3	1.3±0.3	0.011s
TSH (mIU/ml)	2.8±1.3	3.1±1.4	3.6±1.5	4.1±1.6	<0.001s

s = significant; P value reached from repeated-measures ANOVA

Serial Ultrasonographic Findings during Follow-up

Table III presents the serial ultrasonographic findings of the thyroid bed and cervical lymph nodes during follow-up. At 3 months, thyroid bed abnormalities were identified in 9 (15.0%) patients and cervical lymph node positivity was observed in 5 (8.3%) patients. The number of patients with thyroid bed abnormalities and lymph node positivity gradually increased during follow-up. At 12 months, thyroid bed abnormalities were detected in 7 (11.7%) patients, while cervical lymph node positivity was observed in 7 (11.7%) patients. Overall, the proportion of patients with abnormal ultrasonographic findings varied significantly across the follow-up periods ($p<0.05$).

Table III: Serial ultrasonographic findings of thyroid bed and cervical lymph nodes during follow-up (*n*=60)

Ultrasonographic findings	3 months, n (%)	6 months, n (%)	9 months, n (%)	12 months, n (%)	P value
Thyroid bed clearance	51 (85.0)	53 (88.3)	54 (90.0)	53 (88.3)	0.032s
Thyroid bed abnormality	9 (15.0)	7 (11.7)	6 (10.0)	7 (11.7)	
Lymph node positivity	5 (8.3)	6 (10.0)	7 (11.7)	7 (11.7)	0.041s
Lymph node negativity	55 (91.7)	54 (90.0)	53 (88.3)	53 (88.3)	

s = significant; P value reached from repeated-measures comparison

Serial Changes in Serum Thyroglobulin Level among Recurrent Patients

Table IV demonstrates the serial changes in serum thyroglobulin levels among the 7 patients who developed recurrence during follow-up. The mean serum thyroglobulin level increased progressively from 228.4±68.5 ng/ml at 3 months to 267.8±74.3 ng/ml at 6 months, 315.6±82.1 ng/ml at 9 months, and 368.9±91.7 ng/ml at 12 months. The progressive increase in serum thyroglobulin level across the follow-up periods was statistically significant ($p<0.001$).

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Table IV: Serial changes in serum thyroglobulin levels among recurrent patients (*n*=7)

Follow-up period	Mean (ng/ml)	±SD	P value
3 months	228.4	±68.5	
6 months	267.8	±74.3	
9 months	315.6	±82.1	
12 months	368.9	±91.7	<0.001s

s = significant; P value reached from repeated-measures ANOVA

Tumor Recurrence after Total Thyroidectomy

Table V shows the occurrence and timing of tumor recurrence during the 12-month follow-up period. At 3 months, recurrence was detected in 3 (5.0%) patients. The cumulative number of recurrent patients increased to 5 (8.3%) at 6 months, 6 (10.0%) at 9 months, and 7 (11.7%) at 12 months. The mean interval between surgery and detection of recurrence was 6.1±3.0 months, with a range of 3–12 months.

Table V: Tumor recurrence and time interval of recurrence after surgery during 12-month follow-up (*n*=60)

Variables	Value
Recurrence at 3 months, n (%)	3 (5.0)
Recurrence at 6 months, n (%)	5 (8.3)
Recurrence at 9 months, n (%)	6 (10.0)
Recurrence at 12 months, n (%)	7 (11.7)
No recurrence at 12 months, n (%)	53 (88.3)
Mean interval to recurrence (months), Mean±SD	6.1±3.0
Range (min–max)	3–12

Overall, thyroid function showed a gradual change during the 12-month follow-up period, with a progressive reduction in FT3 and FT4 levels and an increase in TSH levels. Ultrasonographic abnormalities were observed in a small proportion of patients, while tumor recurrence increased progressively during follow-up. Among patients who developed recurrence, serum thyroglobulin levels demonstrated a significant and progressive rise from 3 to 12 months, suggesting its potential value as a marker of persistent or recurrent disease.

DISCUSSION

The present study demonstrated a clear female predominance among patients with papillary thyroid carcinoma (PTC), with 70.0% being female and the highest proportion of patients belonging to the 35–54-year age groups. The mean age was 41.2±11.8 years. This demographic pattern is consistent with findings from a Bangladeshi tertiary care hospital, where thyroid cancer, particularly PTC, was reported more frequently among middle-aged women [14]. The observed female predominance and middle-age distribution therefore appear consistent with the epidemiological pattern of PTC in the regional population.

Serial assessment of thyroid function revealed significant changes over the 12-month postoperative follow-up. FT3 and FT4 levels showed a gradual decline, whereas TSH levels progressively increased from 3 to 12 months. Although these changes were relatively modest, their statistical significance indicates the importance of continued monitoring of thyroid hormone status following total thyroidectomy. Previous evidence has suggested that thyroid function can remain relatively stable after total thyroidectomy with appropriate hormone replacement, although longitudinal changes may occur depending on replacement adequacy and treatment targets [15]. The progressive TSH elevation observed in the present study may therefore warrant periodic assessment and adjustment of postoperative thyroid hormone therapy when clinically indicated.

Postoperative ultrasonography demonstrated satisfactory findings in the majority of patients, with thyroid bed clearance observed in most cases throughout follow-up. Nevertheless, thyroid bed abnormalities and cervical lymph node positivity were identified in a small proportion of patients. These findings are consistent with previous reports showing that most patients have no sonographic evidence of residual disease after total thyroidectomy, while a minority may demonstrate persistent or suspicious thyroid bed or cervical lymph node findings requiring continued surveillance [16]. Importantly, serum thyroglobulin levels among recurrent patients increased progressively from 228.4±68.5 ng/ml at 3 months to 368.9±91.7 ng/ml at 12 months, with a statistically significant overall increase. This finding supports previous evidence that serially elevated serum thyroglobulin is associated with persistent or recurrent PTC and may serve as an important biochemical marker during postoperative surveillance [17].

By 12 months, recurrence was identified in 7 (11.7%) patients, increasing progressively from 5.0% at 3 months to 8.3% at 6 months and 10.0% at 9 months. The mean time to recurrence was 6.1±3.0 months. Although the majority of patients remained disease-free, the occurrence of recurrence during the relatively short follow-up period emphasizes the need for continued postoperative surveillance. This finding is consistent with previous evidence indicating that although recurrence after treatment of PTC occurs in a minority of patients, it may become clinically apparent during the early postoperative period [18]. Overall, the findings support a structured follow-up strategy incorporating thyroid function tests, neck ultrasonography, and serial serum thyroglobulin measurement to facilitate early detection of persistent or recurrent disease following total thyroidectomy.

CONCLUSION

Total thyroidectomy was associated with generally favorable short-term outcomes among patients with papillary thyroid carcinoma during the 12-month follow-up period. However, serial assessment demonstrated gradual changes in thyroid function, characterized by declining FT3 and FT4 levels and increasing TSH levels over time. Ultrasonographic evaluation identified persistent or newly developed thyroid bed abnormalities and cervical lymph node involvement in a small proportion of patients. Tumor recurrence was detected in 11.7% of patients by 12 months, with serum thyroglobulin

levels showing a significant progressive increase among recurrent cases. These findings highlight the importance of regular postoperative surveillance using thyroid function tests, neck ultrasonography, and serum thyroglobulin measurement for early detection of persistent or recurrent disease following total thyroidectomy for papillary thyroid carcinoma. Longer-term follow-up with a larger patient population is recommended to further evaluate recurrence patterns and long-term treatment outcomes.

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