

Correlation between Serum TSH Levels and Clinicopathological Features in Patients with Thyroid Nodules

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Abstract:

Background: Thyroid nodules, common endocrine disorders, have various cancer risks. The potential for the use of serum Thyroid-Stimulating Hormone (TSH) to predict nodule features and progression is promising. This study examined how blood TSH levels affect clinical and pathological characteristics in patients with thyroid nodule.

Methods: The prospective observational study was conducted in Konaseema Institute of Medical Sciences and Research Foundation, Amalapuram, Andhra Pradesh from December 2022 to December 2023 in 100 patients with thyroid nodule. Serum TSH levels, ultrasonography and histological findings were collected.

Results: 82% of participants were women. The mean serum TSH level was 2.27 ± 0.80 mU/L. Patients with malignant nodules had significantly higher TSH levels (2.72 ± 1.20 mU/L) compared with patients with non-cancerous nodules (1.78 ± 1.40 mU/L) ($p < 0.05$). More malignancies occurred in nodules beyond 4 cm. Serum TSH levels positively correlated with thyroid nodule size and malignancy.

Conclusion: Higher serum TSH levels were associated with larger, malignant thyroid nodules, suggesting that serum TSH may be a useful thyroid cancer biomarker. These findings emphasise the importance of serum TSH in thyroid nodule diagnosis and management and suggest for further research to confirm and explain these findings.

Keywords: Thyroid Nodules, Serum TSH, Clinical-Pathological Attributes, Thyroid Cancer, Biomarker.

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Introduction

The thyroid gland, situated in the neck, is pivotal for regulating metabolism, energy production, and hormonal equilibrium, primarily via its synthesis of the thyroid hormones, thyroxine (T4) and triiodothyronine (T3) [1]. The pituitary gland secretes Thyroid-Stimulating Hormone (TSH), which predominantly governs the synthesis and secretion of these hormones. Consequently, TSH concentrations in the blood serve as a crucial measure of thyroid functionality, with irregular levels indicating potential thyroid issues [2].

Thyroid nodules, which are growths within the thyroid gland, can be either benign (noncancerous) or malignant (cancerous) and are often identified during routine health checks or incidentally through imaging tests for unrelated conditions [3]. The incidence of these nodules rises with age and is

more prevalent in females than in males. Although the majority of nodules are symptom-free and benign, a minority may be malignant, necessitating thorough evaluation [4].

Serum TSH levels play a vital role in diagnosing thyroid nodules, with high TSH concentrations linked to hypothyroidism (an underactive thyroid) and low levels to hyperthyroidism (an overactive thyroid) [5]. In the realm of thyroid nodules, TSH levels can affect their growth and functionality. An increase in TSH levels may promote the expansion of both benign and malignant thyroid tissues, indicating a possible association between TSH and thyroid cancer risk [6].

Pathologically, the analysis of thyroid nodules encompasses the examination of their cellular

makeup, structure, and potential for malignancy. This process often involves a histopathological assessment via biopsy, where nodule samples are scrutinized microscopically to detect cancerous cells, identify their type, and gauge their severity [7].

The clinicopathological investigation of thyroid nodules examined the link between serum TSH levels and clinical symptoms, histopathology, and prognosis. Researchers want to know if TSH levels can predict thyroid nodule features, malignancy, and treatment [8]. This endocrinology, pathology, and oncology issue seeks to understand how serum TSH levels connect with thyroid nodule features to improve diagnostics, predict malignancy risk, and guide treatment [9].

The current study examines the relationship between blood Thyroid-Stimulating Hormone (TSH) levels and thyroid nodule clinicopathology. It examines how serum TSH levels affect nodule size, type (benign or malignant), and growth dynamics. Additionally, the study will test blood TSH levels' capacity to distinguish benign from malignant thyroid nodules as a biomarker. It also examines how TSH levels affect thyroid nodule patients' clinical outcomes and prognoses to improve management and treatment. This research seeks to better understand the pathophysiological relationship between TSH and thyroid nodules to improve patient diagnosis and treatment.

Material and Methodology

Research Design and Location: This forward-looking observational study was conducted from December 2022 to December 2023 at the Konaseema Institute of Medical Sciences and Research Foundation in Amalapuram, Andhra Pradesh.

Participant Demographics: The institution included 100 thyroid nodule patients from the outpatient and inpatient divisions, including both genders, to study blood TSH levels in diverse clinicopathological situations.

Inclusion Criteria:

- Individuals with confirmed diagnoses of thyroid nodules via ultrasound and/or Fine Needle Aspiration Cytology (FNAC).
- Age of 18 years or older.
- Participants who had not undergone any thyroid hormone treatments or surgical procedures related to the thyroid nodule before TSH testing.

Exclusion Criteria:

- Individuals with a history of thyroidectomy or radioactive iodine therapy.

- Those undergoing thyroid hormone suppression or anti-thyroid medications.

- Pregnant individuals or those with established thyroid conditions other than nodules, like Graves' disease or Hashimoto's thyroiditis.

Data Collection Method: Patient-specific information, such as demographic details, medical history, physical examination outcomes, and thyroid nodule characteristics (size, placement, ultrasound features), was systematically gathered using a structured form. Serum TSH levels were determined through chemiluminescent immunoassay (CLIA) and included in the patient's biochemical record.

Diagnostic Process: Participants were subjected to comprehensive thyroid function evaluations, including serum TSH, Free T4 (FT4), and Free T3 (FT3) measurements. Neck ultrasounds were conducted to detail the nodule's size, count, and echogenicity. FNAC was performed as needed, guided by clinical assessment and ultrasound results, to classify the cytological profile of the nodules.

Statistical Methodology: Statistical programs were used to analyze the data, displaying statistics as mean \pm standard deviation and qualitative information as frequencies and percentages. Pearson's correlation coefficient determined the relationship between blood TSH levels and thyroid nodule pathology, with a p-value < 0.05 indicating statistical significance.

Ethical Compliance: The Konaseema Institute of Medical Sciences and Research Foundation's Institutional Ethics Committee sanctioned the study's protocol. Informed consent was procured from all study participants before their involvement.

Results

Thyroid nodules were more common in women (82%) than men (18%) in a study of 100 people. Participants' ages ranged from 18 to 70, with an average age of 39.06 ± 12.03 years. Solitary thyroid nodules (STN) were seen in 65% and multinodular goiter in 35%. 32% of nodules were larger than 4 cm and 35% were 3–4 cm. The nodules were mostly on the right (42%), bilateral (35%), and left (23%). The nodules were usually hypoechoic and solid on ultrasound.

The cohort had an average serum TSH value of 2.27 ± 0.80 mU/L. Cancerous thyroid nodules were associated with higher TSH levels (2.72 ± 1.20 mU/L) compared to benign nodules (1.78 ± 1.40 mU/L), with a significant correlation ($p < 0.05$). Thyroid cancer was found in 20% of cases after surgery and biopsy, with papillary carcinoma appearing most often. Histopathological

classification differed across STN and MNG instances, however papillary carcinoma was more prevalent.

A substantial positive correlation was seen between blood TSH levels and thyroid nodule size ($p <$

0.05). Higher TSH levels increased nodule size and cancer risk. TSH levels were also linked to aggressive histology in malignant thyroid nodules.

Table 1: Demographic Profile of Patients with Thyroid Nodules

Gender	Number of Patients	Percentage
Male	18	18%
Female	82	82%
Total	100	100%

Table 2: Distribution of Thyroid Nodules Based on Size

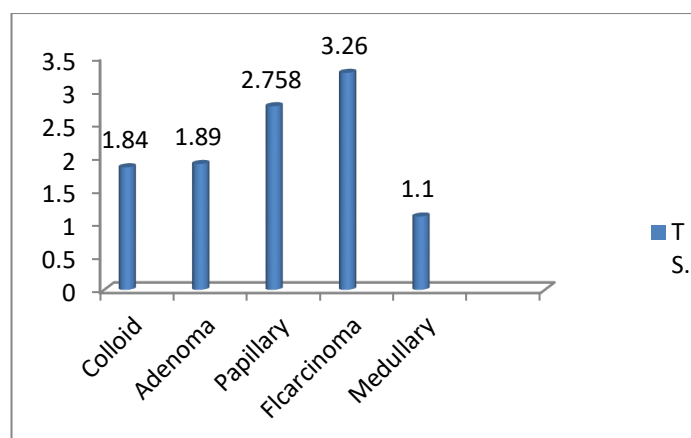
Nodule Size	Number of Cases
≤2 cm	8
3 cm	24
4 cm	35
>4 cm	32

Table 3: Histopathological Findings in Thyroid nodules

Histopathology	Number of Cases
Benign Adenoma	33
Colloid nodule	24
Nodular Hyperplasia	23
Papillary Carcinoma	17
Follicular Carcinoma	2
Medullary Carcinoma	1

Table 4: Average Serum TSH Levels in Different Histopathological Types of Thyroid Nodules

Histopathology	Average TSH (uIU/ml)
Colloid nodule	1.84
Adenoma	1.89
Papillary Carcinoma	2.75
Follicular Carcinoma	3.26
Medullary Carcinoma	1.10



Graph 1: Showing the relation of TSH levels with post-operative biopsy results.

These tables summarize research participants' statistics, nodule size distribution, histology findings, and TSH-thyroid pathology type correlation. The graphs show how serum TSH

levels affect thyroid nodule clinicopathology and thyroid cancer histology.

Discussion

Serum Thyroid-Stimulating Hormone (TSH) levels and thyroid nodule clinicopathological features were examined. Females had a greater prevalence and solitary thyroid nodules were prevalent. Previous investigations have found a gender-specific tendency in thyroid nodules and related disorders [10]. This study found a link involving elevated serum TSH levels and thyroid nodules, particularly malignant ones, suggesting that TSH may promote thyroid cell development and malignancy. The elevated TSH levels in malignant nodules support the idea that TSH may stimulate thyroid cancer cell proliferation, supporting past findings relating TSH levels to differentiated thyroid cancer risk [11]. The association of higher TSH levels with features of thyroid nodules, including size and malignancy, underscores the potential utility of serum TSH as an important biomarker in evaluating thyroid nodules [12]. This could have significant implications for clinical decision-making, helping in the risk assessment and determination of the need for additional diagnostic measures like fine-needle aspiration cytology (FNAC) or surgery. Particularly, individuals with higher TSH levels may necessitate more comprehensive diagnostic and treatment strategies, regardless of benign appearances on ultrasound [13].

This study's outcomes are in harmony with previous findings, such as those by Haymart et al., which also demonstrated a positive relationship between TSH levels and thyroid cancer risk. The identification of a notable correlation with even slightly elevated TSH levels extends the knowledge of the TSH range associated with increased malignancy risk [14]. Nevertheless, the limitations of this study, including its single-center scope and small sample size, may affect the broad applicability of the findings. Further investigations with larger, more varied cohorts are needed to enrich the understanding. Additionally, delving into the molecular mechanisms behind the TSH-thyroid nodule pathology connection could unveil new targets for thyroid cancer treatment. Finally, this study shows that blood TSH levels are linked to thyroid nodule clinicopathology, particularly malignancy. These findings suggest including blood TSH levels in thyroid nodule evaluation and treatment [15].

Conclusion

This study found that increasing serum TSH levels are associated with more thyroid nodules and a higher risk of cancer. Notably, the study demonstrates that even small TSH spikes may increase thyroid cancer risk. The increased occurrence of thyroid nodules in women matches thyroid disease gender trends. The correlation of

elevated TSH levels with nodule size and malignancy suggests that serum TSH may be a biomarker for thyroid nodule risk assessment and clinical decision-making. Despite its insights, the study's limitations, such as the smaller sample size and its single-center nature, necessitate a cautious approach to interpreting the findings. Nevertheless, these results lay a solid groundwork for subsequent research. Future investigations with broader and more varied participant groups are essential to validate these outcomes and delve into the mechanisms that tie TSH levels to the development and malignancy of thyroid nodules. To sum up, the levels of serum TSH seem to play a critical role in assessing and managing thyroid nodules, offering possible benefits for enhancing the precision of thyroid cancer risk evaluation and the efficacy of therapeutic approaches.

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