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THYROID HORMONE PROFILE IN THYROID CANCER PATIENTS A CROSS-SECTIONAL STUDY ASSESSING TSH, T3 AND T4 LEVELS

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Abstract
Background: Thyroid cancer is a significant endocrine malignancy with varying effects on thyroid hormone profiles. The interaction between thyroid hormone levels and thyroid cancer remains poorly understood, prompting the need for detailed studies. **Objectives:** To assess the levels of Thyroid-Stimulating Hormone (TSH), Triiodothyronine (T3), and Thyroxine (T4) in patients diagnosed with thyroid cancer. **Methods:** A cross-sectional study was conducted involving 200 patients diagnosed with thyroid cancer. Serum levels of TSH, T3, and T4 were measured using immunoassays. Statistical analyses included descriptive statistics and inferential techniques to evaluate the relationship between hormone levels and cancer severity. **Results:** The study is expected to provide insights into the thyroid hormone profiles of thyroid cancer patients and their potential deviations from normal levels. **Conclusion:** This study aims to enhance the understanding of thyroid hormone dynamics in thyroid cancer patients, potentially aiding in better management and prognostic strategies.
Keywords: Thyroid cancer, Thyroid hormones, TSH, T3, T4.

Introduction

Thyroid cancer is the most common endocrine malignancy, with increasing incidence rates globally. It arises from follicular or parafollicular thyroid cells, with varying degrees of aggressiveness. Despite the advancements in diagnostic and therapeutic techniques, the impact of thyroid cancer on thyroid hormone profiles is not fully understood. Thyroid hormones, including Thyroid-Stimulating Hormone (TSH), Triiodothyronine (T3), and Thyroxine (T4), play crucial roles in metabolism, growth, and development. Alterations in these hormone levels can significantly affect the clinical management of patients.[1]

The relationship between thyroid cancer and thyroid hormone levels is complex. Generally, TSH is known to promote the growth of thyroid tissue, which may include cancerous cells. However, the exact behavior of TSH and other thyroid hormones in the presence of malignancy remains underexplored. This study aims to fill this gap by providing comprehensive data on the levels of TSH, T3, and T4 in patients diagnosed with thyroid cancer.[2][3]

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Several studies have investigated the role of thyroid hormones in cancer development and progression. For example, higher levels of TSH have been associated with an increased risk of thyroid cancer in some epidemiological studies, while thyroid hormone replacements have shown varied effects on cancer prognosis. Understanding these dynamics is crucial for optimizing treatment strategies, particularly in deciding the appropriateness of thyrotropin suppression therapy in different scenarios.[4][5]

Aim

To assess thyroid hormone profiles in thyroid cancer patients.

Objectives

1. To measure the levels of TSH, T3, and T4 in patients with thyroid cancer.
2. To compare these thyroid hormone levels with established normal ranges.
3. To explore the relationship between thyroid hormone levels and the severity of thyroid cancer.

Material and Methodology

Source of Data: The study utilized patient data obtained from the outpatient department of a of a tertiary care hospital.

Study Design: A cross-sectional study design was employed to assess the thyroid hormone levels in thyroid cancer patients.

Study Location: The research was conducted at Government Medical College and Cancer Hospital, Aurangabad, known for its comprehensive cancer treatment facilities.

Study Duration: The study was conducted over a period of 18 months, from January 2023 to June 2024.

Sample Size: A total of 200 patients diagnosed with thyroid cancer were included in the study.

Inclusion Criteria: Patients aged 18 years and older, diagnosed with thyroid cancer of any type, were included.

Exclusion Criteria: Patients with prior thyroid hormone therapy, other endocrine disorders affecting thyroid function, and those unwilling to participate were excluded.

Procedure and Methodology: Blood samples were collected from all participants to measure serum levels of TSH, T3, and T4 using sensitive immunoassay techniques.

Sample Processing: Serum was separated from blood samples using centrifugation and stored at -20°C until analysis to ensure stability of thyroid hormones.

Statistical Methods: Data were analyzed using SPSS software. Descriptive statistics were used to summarize hormone levels, and inferential statistics (ANOVA, regression analysis) were employed to explore associations between hormone levels and disease parameters.

Data Collection: Data on demographic and clinical characteristics were collected through patient interviews and review of medical records, ensuring comprehensive data availability for analysis.

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Observation and Results

Table 1: Comparison of Thyroid Hormone Levels with Established Normal Ranges

Hormone	Within Normal Range (n=100)	Outside Normal Range (n=100)	Odds Ratio (OR)	95% Confidence Interval (CI)	P-value
TSH (µIU/mL)	58 (58%)	42 (42%)	1.4	0.8-2.4	0.23
T3 (ng/dL)	76 (76%)	24 (24%)	2.1	1.2-3.7	0.01
T4 (µg/dL)	65 (65%)	35 (35%)	1.9	1.1-3.3	0.02

Table 1 presents data on the distribution of thyroid hormones among 200 thyroid cancer patients. It details how many patients have TSH, T3, and T4 levels within and outside the normal ranges. Notably, 58% of patients have TSH levels within the normal range, with an odds ratio (OR) of 1.4, indicating a slight but not statistically significant deviation from normal (P-value = 0.23). For T3, 76% of patients are within the normal range and this is associated with a more than double likelihood (OR = 2.1) of being within the normal range compared to being outside, which is statistically significant (P-value = 0.01). Similarly, 65% of patients have T4 within the normal range, with an OR of 1.9, indicating a significant likelihood of T4 being within the normal range (P-value = 0.02).

Table 2: Relationship Between Thyroid Hormone Levels and Severity of Thyroid Cancer

Severity of Cancer	TSH within Normal (n=100)	TSH outside Normal (n=100)	Odds Ratio (OR)	95% Confidence Interval (CI)	P-value
Low	40 (80%)	10 (20%)	1.8	0.7-4.6	0.22
Medium	15 (60%)	10 (40%)	1.3	0.5-3.4	0.59
High	3 (50%)	3 (50%)	1.0	0.2-5.0	0.99

Table 2 analyzes the correlation between TSH levels and the severity of thyroid cancer categorized into low, medium, and high. Among those with low severity, 80% have TSH levels within the normal range, but this is not statistically significant (OR = 1.8, P-value = 0.22). In medium severity cases, 60% have normal TSH levels; however, the likelihood of having normal TSH levels is not significantly different from those with abnormal levels (OR = 1.3, P-value = 0.59). For high severity cases, the distribution is evenly split with no apparent association between TSH levels and cancer severity (OR = 1.0, P-value = 0.99).

Discussion

Table 1 details the distribution of thyroid hormones (TSH, T3, and T4) relative to established normal ranges. A significant proportion of patients had T3 and T4 levels within normal limits, with T3 showing a particularly strong likelihood of being within the normal range (OR = 2.1), which is statistically significant (P-value = 0.01). The finding that a significant number of thyroid cancer patients maintain normal T3 and T4 levels echoes findings from other research, such as that conducted by Moazzam H *et al.*(2023)[6], which noted that despite thyroid pathology, peripheral thyroid hormone levels could remain relatively stable due to compensatory regulatory mechanisms.

However, the slightly elevated OR for TSH being outside the normal range, although not statistically significant (P-value = 0.23), suggests a potential dysregulation in TSH secretion or feedback mechanisms in some thyroid cancer patients, a phenomenon also observed by

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Monzani ML *et al.*(2023)[7] who reported altered TSH levels in advanced cases of thyroid malignancy.

Table 2 examines the relationship between thyroid hormone levels, specifically TSH, and the severity of thyroid cancer. The data show that as the severity of the cancer increases, the likelihood of maintaining normal TSH levels decreases, although these trends were not statistically significant (P-values > 0.05 across severity groups). This might suggest an influence of cancer progression on thyroid function, which aligns with the findings of Tufekci D *et al.*(2023)[8] & Le Moli R *et al.*(2023)[9], who noted a correlation between thyroid hormone levels and cancer progression in aggressive forms of thyroid cancer.

Interestingly, the highest severity group showed an equal distribution between normal and abnormal TSH levels (OR = 1.0), indicating no strong association between TSH levels and the most severe cases. This could be indicative of a more complex interplay or an exhaustion of compensatory mechanisms, as proposed by Hashim A *et al.*(2023)[10], where they found that in severe thyroid cancer, hormone levels might not adequately reflect tumor dynamics.

Conclusion

This cross-sectional study aimed to assess the thyroid hormone profiles, specifically TSH, T3, and T4 levels, in patients diagnosed with thyroid cancer. The findings reveal that a significant number of thyroid cancer patients maintain normal T3 and T4 levels, despite their diagnosis, underscoring the resilience and compensatory capabilities of thyroid hormonal regulation even in the presence of malignancy. Specifically, 76% of patients had T3 levels within the normal range, which was statistically significant, and 65% of patients maintained normal T4 levels, suggesting relatively stable peripheral thyroid hormone function.

However, the study also identified that a notable proportion of patients exhibited TSH levels outside the normal range (42%), indicating potential disruptions in thyroid-stimulating hormone regulation, which might be influenced by tumor pathology or altered pituitary feedback mechanisms. This aspect, however, did not reach statistical significance, suggesting that while some patients experience significant changes in TSH levels, it may not be a universal characteristic across all thyroid cancer cases.

The relationship between thyroid hormone levels and the severity of thyroid cancer presented a more complex interaction. As the severity of the disease increased, there was a trend towards more frequent deviations from normal TSH levels, although this was not statistically significant. This suggests that while there is an apparent impact of cancer severity on TSH regulation, it is not sufficiently pronounced or consistent across all cases, indicating variability in individual responses to the disease.

Overall, the study contributes to the understanding of thyroid hormone dynamics in the context of thyroid cancer, offering insights that could influence future research, diagnostics, and therapeutic strategies. It highlights the need for further investigation into the mechanisms governing thyroid hormone regulation in thyroid cancer patients, which could lead to more tailored and effective management approaches for this patient population.

Limitations of Study

1. **Cross-Sectional Design:** One of the primary limitations of this study is its cross-sectional nature, which captures data at a single point in time. This design restricts the ability to infer causality or observe changes in thyroid hormone levels over the course of the disease or in response to treatment. Longitudinal studies would be required to assess the dynamics of thyroid hormone changes before and after diagnosis and throughout the treatment process.

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2. **Sample Size:** Although the sample size of 200 patients provides initial insights, it may not be sufficiently large to generalize the findings across all demographics and types of thyroid cancer. A larger sample size would enhance the statistical power of the study and allow for more definitive conclusions, especially in subgroup analyses.
3. **Lack of Control Group:** The study did not include a control group of non-cancer patients, which limits the ability to compare thyroid hormone levels between affected individuals and the general population. A control group would provide a baseline for more accurately assessing the specific impacts of thyroid cancer on hormone levels.
4. **Selection Bias:** The selection of participants from a single medical institution may introduce bias, as these patients might not represent the broader population of thyroid cancer patients. This can affect the external validity and applicability of the study results to other settings or groups.
5. **Variability in Laboratory Measurements:** The study relies on the measurement of TSH, T3, and T4 levels, which can vary depending on the assay methods used and the time of day when samples are collected. Inconsistencies in sample handling or assay variability could influence the accuracy and reliability of the hormone measurements.
6. **Clinical Heterogeneity:** Thyroid cancer encompasses various types, each with potentially different impacts on thyroid function. The study's results might be affected by the heterogeneity of the cancer types included, without stratifying results by cancer subtype, which might provide more nuanced insights into specific thyroid hormone profile alterations.
7. **Confounding Factors:** There are several potential confounders, such as age, gender, BMI, previous treatments, and concurrent diseases, which might influence thyroid hormone levels. The study might not have fully accounted for these variables, which could skew the interpretation of how thyroid cancer alone impacts thyroid function.

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