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The Pattern of Thyroid Function Test in Thyroid Carcinoma

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Abstract

Background: In the United States, thyroid cancer is estimated to be the 13th most commonly diagnosed cancer, accounting for nearly 44,000 new cancer diagnoses in 2022 (2.3% of the total), and the 6th most commonly diagnosed cancer among women. In Iraq, thyroid cancer showed a significantly elevated trend from 2007 to 2016, from 0.62 to 2.96/100 000. The male to female ratio was 2.5:1.

Methods: A cross-sectional, retrospective study was carried out in Al-Sadr teaching hospital, Al-Basrah. A total of (50) patients were recruited over a 12-month period, from the first of October 2022 through October 2023. A special data form was designed for the purpose of the study, was used and included selected patients' socio-demographic variables (such as age, gender, and address), any previous signs and symptoms such as tachycardia, tremors, weight changes, voice changes, presence of goiter, exophthalmos, respiratory difficulty, and other symptoms, and preoperative fine-needle aspiration (FNA) was done.

Results: Most prior investigations have demonstrated a favorable correlation between thyroid-stimulating hormone (TSH), the primary regulator of thyroid hormone, and the development of differentiated thyroid neoplasms mediated by TSH receptors. Our study showed thyroid function status among the studied patients. Overall, of the total 50 patients included in this study, 35 patients (70%) were euthyroid, while 8 patients (16%) had hypothyroidism, and the remaining 7 patients (14%) had hyperthyroidism.

Conclusion: Our study showed that the majority of the enrolled patients with thyroid cancer had normal thyroid function status, followed by hypothyroidism, while the minority had hyperthyroidism.

Keywords: Thyroid cancer, Fine-needle aspiration, Thyroid-stimulating hormone, Hypothyroidism, Hyperthyroidism

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Introduction

The thyroid is an endocrine gland, located in the inferior, anterior aspect of the neck and regulates the body's iodine balance in addition to the production and secretion of thyroid hormones [1]. About 90% of the inactive thyroid hormone, or thyroxine (T4), and 10% of the active thyroid hormone, or triiodothyronine (T3), are produced by the thyroid. Peripherally, inactive thyroid hormone is changed into either activated thyroid hormone or another kind of inactive thyroid hormone [2]. T3 influences numerous organs and tissues throughout the body, perhaps leading to an increase in protein synthesis and metabolic rate. The cells known as parafollicular cells, or C cells, are in charge of producing and secreting calcitonin [2].

A tumor of the thyroid parenchymal cells is called thyroid cancer. Thyroid follicular cells, which give rise to differentiated thyroid cancer (DTC), and parafollicular or C-cells, which give rise to medullary thyroid carcinoma (MTC), make up the two main cell types of the thyroid parenchyma. DTC includes follicular thyroid cancer (FTC), Hurthle cell cancer, and papillary thyroid carcinoma (PTC), which together make up 90 - 95% of thyroid cancer cases. Of all thyroid malignancies, anaplastic thyroid carcinoma makes up less than 1% while MTC makes up between 1% and 2% [3]. In the United States, thyroid cancer is estimated to be the 13th most commonly diagnosed cancer, accounting for nearly 44,000 new cancer diagnoses in 2022 (2.3% of the total), and the 6th most commonly diagnosed cancer among women [4]. In Iraq, thyroid cancer showed a significantly elevated trend from 2007 to 2016, from 0.62 to 2.96/100,000. The male to female ratio was 2.5:1 [5].

Methods

Across-sectional, retrospective study was carried out in Al-Sadr teaching hospital, Al-Basrah. A total of 50 patients were recruited over a12-month period, from the first of October 2022 through October 2023. A special data form was designed for the purpose of the study, was used and included selected patients' socio-demographic variables (such as age, gender, and address), any previous signs and symptoms such as tachycardia, tremor, weight changes, voice changes, presence of goiter, exophthalmos, respiratory difficulty, and other symptoms, and if preoperative FNA was done, appendix-1.The laboratory data were either collected from the patient's records or sent during their current visit as part of routine evaluation (by Rocheco base 411 analyzer machine).

The statistical analysis was carried out with the statistical package for social sciences. Descriptive statistics (frequency and percentage) were used to describe the studied groups. While for the quantitative data the means, standard deviation, and range were reported. Chi-Square statistics were and t-test were performed. The statistical significance is considered when the p-value is less than 0.05.

Results

The study included 50 patients with thyroid cancer, whose sociodemographic characteristics are detailed in table 1. The age distribution shows that the largest group of patients was aged 50 years and older (42%), followed by those aged 30 - 39 years (32%), 40 - 49 years (20%), and 20 – 29 years (6%). The mean age of the participants was 46.90 years (SD ± 14.555). Most of the patients were male (74%), and the predominant residency was in Basra (82%). Regarding employment status, 28% were employed, while 72% were not.

Figure 1 presents the distribution of different thyroid cancer types among the studied patients, showing that the majority had PTC (74%), followed by FTC (14%), PTC with lymph node involvement (PTC+LN) (10%), and Hurthle cell carcinoma (2%).

The relationship between patients' age and different types of thyroid cancer: figure 2 and table 2 analyze the distribution of cancer types across different age groups. The mean age for patients with PTC was 45.51 years (SD ± 13.692), while those with PTC+LN had a mean age of 42.20 years (SD ± 12.458). Hurthle cell carcinoma had a mean age of 50.00 years, and FTC had a mean age of 46.29 years (SD ± 15.575). The p-value of 0.938 indicates no significant difference in mean age among the different cancer types.

Thyroid function test among enrolled patients

Table 3 details the thyroid function tests among the different cancer types. The mean TSH levels were 1.936 (SD ± 1.2) for PTC, 2.24 (SD ± 0.43) for PTC+LN, 0.97 (SD ± 0.53) for Hurthle, and 3.4 (SD ± 1.47) for follicular, with a p-value of 0.519 indicating no significant difference. The mean free T3 levels varied significantly (p-value 0.005) among the groups, with PTC at 5.91 (SD ± 1.34), PTC+LN at 9.36 (SD ± 2.56), Hurthle at 19.72 (SD ± 8.34), and follicular at 3.84 (SD ± 0.63). The free T4 levels showed a near- significant difference (p-value 0.067), with means of 18.78 (SD ± 2.154) for PTC, 27.02 (SD ± 8.66) for PTC+LN, 33.0 (SD ± 9.24) for Hurthle, and 12.98 (SD ± 2.15) for follicular (Figure 3).

Table 1: Sociodemographic features of the studied cases.

Variable		No. (n = 50)	Percentage (%)
Age groups (years)	20 - 29	3	6
	30 - 39	16	32
	40 - 49	10	20
	50 +	21	42
Sex	Male	37	74
	Female	13	26
Residency	Basra	41	82
	Another governorate	9	18
Occupation	Employed	14	28
	Not employed	36	72
Age (mean ± SD) in years		46.90 ± 14.555	

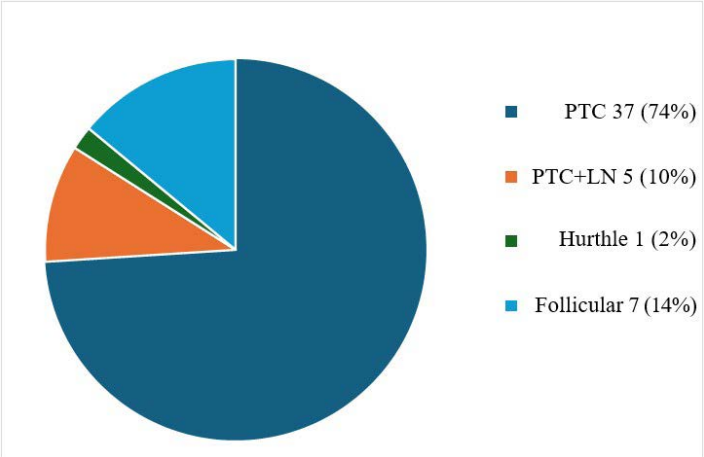

Figure 1: Thyroid cancer types among the patients studied.

Table 2: Mean age groups among different cancer types.

Histopathological type	Mean age	p-value
PTC	45.51±13.692	0.938
PTC+LN	42.20±12.458	
Hurthle	50.00	
Follicular	46.29±15.575	

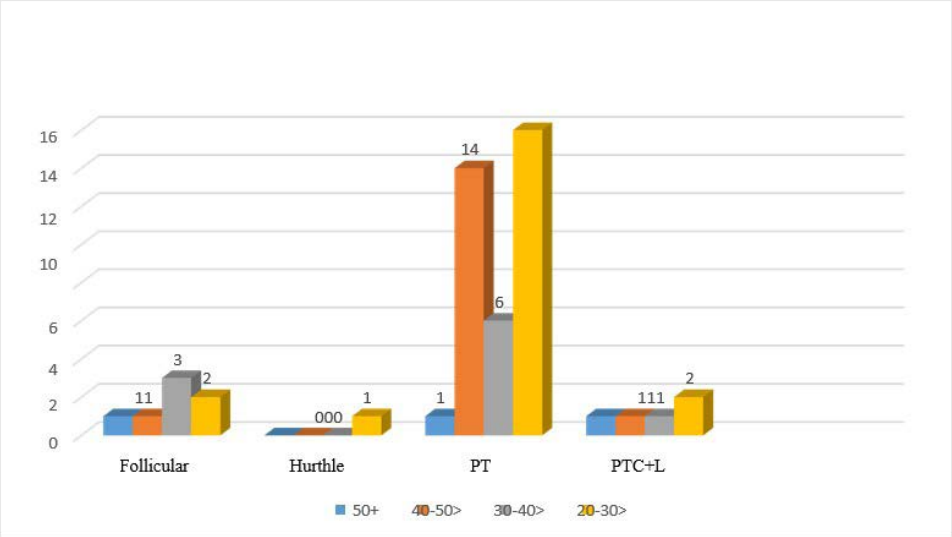

Figure 2: Distribution of different cancer types in the age groups.

Table 3: Thyroid function test among different types of cancer.

Variables (number)	PTC (37)	PTC+LN (5)	Hurthle (1)	Follicular (7)	p-value
TSH (mean ± SD)	1.936 ± 1.2	2.24 ± 0.43	0.97 ± 0.53	3.4 ± 1.47	0.519
Free T3 (mean ± SD)	5.91 ± 1.34	9.36 ± 2.56	19.72 ±8.34	3.84 ± 0.63	0.005
Free T4 (mean ± SD)	18.78 ± 2.15	27.02 ± 8.66	33.0 ± 9.24	12.98 ± 2.15	0.067

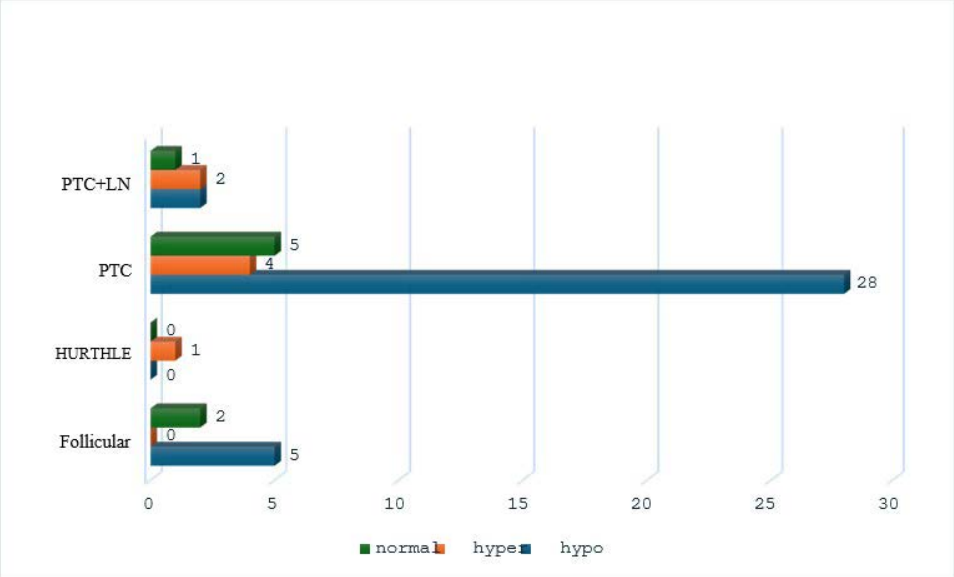

Figure 3: Thyroid function test among the enrolled patient.

Table 4: FNA findings for different histopathological subtypes of thyroid lesions.

Pre-operative FNA		Histopathology				Total (50)
		Follicular	Hurthle	PTC	PTC+LN	
Follicular neoplasm	Count	7	0	9	0	16
	%	100%	0.0%	24.3%	0.0%	32.0%
Atypia of undetermined significance	Count	0	0	8	5	13
	%	0.0%	0.0%	21.6%	100%	26.0%
Benign	Count	0	1	20	0	21
	%	0.0%	100%	54.1%	0.0%	42.0%

Preoperative FNA in the studied patients

The provided table 4 summarizes the results of preoperative FNA for different histopathological subtypes, for FTC, 7 out of 16 cases (32%) were accurately identified preoperatively as follicular neoplasm by FNA. PTC had 37 cases by histopathology, FNA showed that 9 cases (24.3%) identified as follicular neoplasm, 8 cases (21.6%) as atypia of undetermined significance, and 20 (54.1%) as benign. For PTC+LN, all 5 cases (100%) were accurately identified as atypia of undetermined significance. While the only case for Hurthle cell carcinoma resulted as benign by FNA.

Discussion

Most prior investigations have demonstrated a favorable correlation between TSH, the primary regulator of thyroid hormone, and the development of differentiated thyroid neoplasms mediated by TSH receptors [6]. Regarding thyroid function tests among the different types of cancer. The mean TSH levels were 1.936 (SD ± 1.2) for PTC, 2.24 (SD ± 0.43) for PTC+LN, 0.97 (SD ± 0.53) for Hurthle, and 3.4 (SD ± 1.47) for follicular. The mean free T3 levels varied significantly (p-value 0.005) among the groups, with PTC at 5.91 (SD ± 1.34), PTC+LN at 9.36 (SD ± 2.56), Hurthle at 19.72 (SD ± 8.34), and follicular at 3.84 (SD ± 0.63). The free T4 levels showed a near-significant difference (p-value 0.067), with means of 18.78 (SD ± 2.154) for PTC, 27.02 (SD ± 8.66) for PTC+LN, 33.0 (SD ± 9.24) for Hurthle, and 12.98 (SD ± 2.15) for follicular.

Recent research has highlighted the significance of TSH levels as a malignancy predictor in thyroid nodule evaluation, indicating that individuals with nodular goiter may be at higher risk of developing various thyroid malignancies due to elevated serum TSH concentrations. Certain studies have linked elevated TSH levels, even when they fall within normal ranges, to an increased risk of thyroid cancer [7]. Smith et al. [8] studied 1,500 consecutive patients without overt thyroid dysfunction. There was also a higher risk for males, younger individuals, and those with clinically isolated nodules, prevalence of malignancy were significantly higher in subjects with serum TSH 1.0 - 1.7 mU/L compared to TSH less than 0.4 mU/L, with further increases being evident in those with TSH 1.8 - 5.5 mU/L.

Our study showed thyroid function status among the studied patients. Overall, of the total 50 patients included in this study, 35 patients (70%) were euthyroid, while 8 patients (16%) had hypothyroidism, and the remaining 7 patients (14%) had hyperthyroidism.

In particular, for patients with PTC, 28 patients (75.7%) had euthyroid, while 5 (13.5%) patients had hypothyroidism, and the remaining 4 (10.8%) patients had hyperthyroidism, while in FTC, 5 (71.4%) patients had euthyroid, while 2 (28.6%) patients had hypothyroidism, and none of them (0.0%) had hyperthyroidism. As for PTC+LN, 2 (40%) patients had euthyroid, while 2 (40%) patients had hyperthyroidism, and only one patient (20%) had hypothyroidism. In terms of being the only patient with Hurthle cell carcinoma, he was found to have hyperthyroidism.

In this study, FNA results of the 50 patients with histologically proven thyroid cancer revealed that 21 patients (42%) had benign cytology. In particular, FNA showed that for FTC, 7 out of 16 cases (32%) were accurately identified preoperatively as follicular neoplasm.

As for PTC, FNA showed that 9 cases (24.3%) identified as follicular neoplasms, 8 cases (21.6%) as atypia of undetermined significance, and 20 (54.1%) as benign. The overlap in cytological features suggests difficulty in accurately diagnosing PTC with FNA. For PTC+LN, all 5 cases (100%) were accurately identified as atypia of undetermined significance. While the only case for Hurthle cell carcinoma resulted as benign by FNA.

Conclusion

Our study showed that the majority of enrolled patients with thyroid cancer had normal thyroid function status, followed by hypothyroidism, while the minority had hyperthyroidism.

Acknowledgements

None.

Conflict of Interest

None.

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