

Examination of the Hormonal Relationship of Thyroid Lesions through Fine Needle Aspiration Cytology

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Received: 20-09-2020 / Revised: 30-09-2020 / Accepted: 15-10-2020

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Conflict of interest: Nil

Abstract:

Background and Objectives: Thyroid gland is superficial, highly accessible in position and an ideal tissue for fine needle aspiration cytology (FNAC). FNAC in conjunction with hormonal assay is a very effective procedure in evaluation of thyroid swellings of differing biologic significance pre operatively. Present study was done with following objective: To assess the level of T3, T4 and TSH in various thyroid lesions, to evaluate role of thyroid hormone profile (T3, T4, & TSH) in different thyroid lesions and to assess the sensitivity, specificity and diagnostic accuracy of FNAC as an initial diagnostic modality for thyroid lesions.

Material and Methods: The 160 cases of apparent thyroid lesions from tertiary care centre were selected in present study. The case history with relevant clinical signs and symptoms of the patient and provisional diagnosis given by the clinician referred to cytopathology section of Pathology department for FNAC. Thyroid hormonal estimation of patient had been done by ELISA method in Biochemistry department and thyroid hormonal assay data was collected. Diagnostic accuracy was calculated by using sensitivity and specificity.

Results: Amongst various thyroid lesions, majority of cases were nonneoplastic (92.5%). Among non-neoplastic condition, colloid goitre was most commonly occurring lesion followed by adenomatous goitre. The role of thyroid hormone profile is significant for thyroiditis, primary hyperthyroidism and granulomatous thyroiditis. Amongst neoplastic lesion of thyroid, majority of cases (66.6%) were euthyroid. Thyroid hormonal assessment by ELISA technique is sufficiently sensitive to separate the serum T3, T4 and TSH values in hyperthyroidism and hypothyroidism from subclinical or nonthyroidal illness.

Conclusion: FNAC is widely recognised as the preferred initial diagnostic method for evaluating thyroid swellings due to its notable specificity and accuracy. The Fine Needle Aspiration Cytology (FNAC) technique is a straightforward, reliable, economical, and minimally intrusive diagnostic method employed to evaluate patients with thyroid nodules prior to surgery. Histopathological evaluation is the sole definitive approach to exclude the presence of malignancy.

Keywords: Hypothyroidism, Hyperthyroidism, Malignancy, TSH.

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Introduction

In an adult, the thyroid is a little gland that weighs about 25 g. Kendall [3] was the first to isolate thyroxine, the primary hormone of the thyroid gland. The thyroid contains thyroxine as well as other substances such as monoiodothyronine, 35-diiodotyrosine, and 3'5'3-triiodotyrosine. Only thyroxine (T4) and 3',5',3-triiodotyrosine (T3) are physiologically active. Despite the fact that the former is more abundant in the blood's circulation, the latter has activity that is roughly 5–10 times larger than thyroxine the majority of thyroid conditions can be treated medically or surgically, making them extremely important. They include

conditions linked to an overproduction of thyroid hormone (hyperthyroidism), those linked to an underproduction of thyroid hormone (hypothyroidism), and thyroid mass lesions. [3-5] Indirect tests like protein-bound iodine or butanol-extracted iodine have almost entirely been supplanted by direct, precise measurements of serum thyroxine (T4) and (T3) concentrations. [6,7] With the development of the TSH assay, there has been a shift away from radioimmunoassay (RIA) approaches and towards immunometric techniques (two-site assays), which make use of monoclonal antibodies and a number of non-radioactive labels.

[8] As a result, a reference range for serum TSH concentration has been established, allowing researchers to distinguish between the normal amounts in euthyroid patients and the suppressed or undetectable concentrations seen in thyrotoxicosis. TSH measurement can be utilised as an initial test to assess thyroid function due to the newly established enhanced sensitivity of contemporary TSH assays. [9] The thyroid gland is a perfect tissue for fine needle aspiration cytology (FNAC) since it is situated in a superficial and readily accessible location. A highly efficient approach for assessing thyroid swellings of varying biologic significance prior to surgery is FNAC in combination with hormonal tests. In the general adult population, the prevalence of thyroid enlargement ranges from 4% to 7%, while in children; it ranges from 0.2% to 1.8%. The necessity to rule out thyroid cancer, which can occur in 7% to 15% of cases depending on age, sex, radiation exposure, family history, and various other factors, is what gives thyroid nodule diagnosis its clinical significance. To prevent unnecessary surgery, it is crucial to identify benign lesions prior to surgery. [10]

Material and Methods

For this investigation, instances of apparent thyroid lesions from tertiary care facilities were chosen between November 2017 and November 2019. The patient's clinical signs and symptoms, along with

the clinician's provisional diagnosis, were pertinent to the case history, and the pathology department's cytopathology division was sent to perform FNAC. The biochemistry department, where thyroid hormonal assay data was gathered, used the ELISA method to estimate patients' thyroid hormone levels. Data on histopathological correlation was gathered from the pathology department's histopathology division. All patients, regardless of age or gender, who arrived at the cytology department with a referral for thyroid fine needle aspiration cytology were included in the study. Patients who underwent a repeat FNAC for any reason were not included in the research.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). For all tests, confidence level and level of significance were set at 95% and 5% respectively.

Results

Under the master chart, various thyroid lesions' states were tallied as they were seen cytologically. Cystic lesions, thyroiditis, colloid goitre, adenomatous goitre, primary hyperplasia (Grave's disease), and neoplastic lesions are the types that make up the most common thyroid lesions. Numerous lesions' hormonal status was also tallied.

Table 1: Hormonal Status in Various Lesions of Thyroid

Lesion of Thyroid	Euthyroid n (%)	Hyperthyroid n (%)	Hypothyroid n (%)	Total
Cystic Lesion	19(76%)	3(12%)	3(12%)	25(15.6%)
Thyroiditis	10(43.5%)	9(39.1%)	4(17.4%)	23(14.4%)
Colloid goiter	40(70.2%)	12(21.0%)	5(8.8%)	57(35.6%)
Adenomatous goiter	20(58.8%)	8(23.5%)	6(17.7%)	34(21.3%)
Primary Hyperplasia	-	9(100%)	-	9(5.6%)
Neoplastic Lesion	8(66.6%)	2(16.7%)	2(16.7%)	12(7.5%)
Total	97	43	20	160

Plan of Data Analysis

True positivity was considered when the lesion was found to be malignant on both FNAC and evaluation of post-surgical specimen. False positive were those cases wherein cytology was reported as malignant but on evaluation histopathologically the lesion turned out to be of benign nature. True negative (TN) were benign on both cytology and histopathology. False negative (FN) were negative on cytology but positive for malignancy on histopathology. Sensitivity was the detection of disease when it was actually present and was a measure of detection of thyroid cancer by FNAC in our study. Similarly specificity was defined by the

ability of FNAC to exclude malignancy, that is diagnose benign lesions. Diagnostic accuracy was calculated by using sensitivity and specificity.

Discussion

Blood samples from 160 patients presenting with thyroid enlargement were obtained for thyroid hormone estimation and clinically and cytopathologically correlated.

The obtained results were compared to those of previous studies conducted by eminent researchers in this field, and the significant differences and similarities between the two sets of results are discussed below.

Table 2: Frequency of Various Lesions of Thyroid in Case

Author	Cystic lesion	Thyroiditis	Colloid goiter	Adenomatous goiter	Primary hyperplasia	Neoplastic lesion
Basu Mitra et al. (2002)	26%	12%	28%	17%	10%	7%
Present study	15.6%	14.4%	35.6%	21.3%	5.6%	7.5%

Out of the total of 160 cases, 25 (15.6%) were found to have cystic goitres of the thyroid, 23 (14.4%) cases were found to have thyroiditis, 12 (7.5%) cases were found to have neoplastic lesions, 57 (35.6%) cases were found to have colloid goitres, 34 (21.3%) cases were found to have

adenomatous goitres, and 9 (5.6%) cases were found to have primary hyperplasia (Grave's disease).

In the current study consisting of 160 instances, it was discovered that colloid goitre (n=57) was the lesion that occurred the most frequently.

Table 3: Neoplastic Lesions: Hormonal Status in Cases of Neoplastic Lesions

Author	No. of cases	Follicular neoplasia n(%)	PTC n (%)	Medullary carcinoman(%)	Anaplastic carcinoma n(%)	Metastasis n(%)
Devi J et al. (2014)	10	3 (30%)	4 (40%)	1 (10%)	2 (20%)	0 (0%)
Ritica Chaudhari et al. (2014)	9	2 (22.2%)	2 (22.2%)	1 (11.1%)	1 (11.1%)	3 (33.4%)
Chowdari B et al. (2018)	31	12 (38.8%)	18 (58%)	1 (3.2%)	0 (0%)	0 (0%)
Present study	12	4 (33.3%)	5(41.7%)	1 (8.3%)	0 (0%)	2 (16.7%)

The majority of the 10 neoplastic cases, 4 (40%) cases of papillary thyroid cancer, were found by Devi J et al [11] followed by 3 (30%) cases of follicular neoplasia, 2 (20%) cases of anaplastic carcinoma, and 1 (10%) case of medullary carcinoma of the thyroid. Among the 9 neoplastic instances, Ritica Chaudhari et al (2014) [12] found the majority of cases to be 3(33.4%) of metastasis, equal numbers of cases to be 2(22.2%) of papillary thyroid cancer and Follicular neoplasia, 1(11.1%) of anaplastic cancer, and 1(11.1%) to be medullary

cancer of the thyroid. Out of 31 neoplastic cases, Chowdari B et al.[13](2018) reported 18 (58%) cases of papillary thyroid cancer, followed by 12 (38.8%) cases of follicular neoplasia and 1 (3.2%) cases of medullary thyroid cancer.

Most cases were found in the current study. Out of 12 neoplastic cases, 5 (41.7%), or papillary thyroid cancer, followed by 4 (33.3%), or follicular cancer, 2 (16.7%), or medullary cancer of the thyroid, is comparable to other studies.

Table 4: Cytohistological Correlation and Statistical Analysis

Author	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Piomalli et al.[14](1992)	95%	98%	95%	97%	-
Sheela et al.[15](2015)	90%	96%	-	-	94%
Inamullah et al.[16](2010)	75%	96%	81%	95%	93%
Rupam et al.[17](2014)	82.1%	86.8%	65.7%	94.0%	83.6%
Lewis et al.[18](2009)	-	-	-	93%	-
Siddegowda MS et al.[19](2016)	87.5%	91.7%	93%	85%	89.3%
Bakhos et al.[20](2000)	93.0%	96%	-	-	-
Present study	91.7%	94.4%	91.7%	94.4%	93.3%

Conclusion

The majority of thyroid lesions observed in this study were nonneoplastic, accounting for 92.5% of cases. Among non-neoplastic conditions, colloid goitre was the most often observed lesion, followed by adenomatous goitre. Papillary thyroid carcinoma was the predominant malignant lesion, accounting for the highest proportion (41.7%) among the examined cases. In this study examining a range of thyroid abnormalities, it was shown that the majority of cases (60.6%) exhibited euthyroidism.

All instances of primary hyperplasia, specifically Grave's disease, were characterised by hyperthyroidism.

The thyroid hormone profile plays a crucial role in the context of Hashimoto's thyroiditis, primary hyperthyroidism, and granulomatous thyroiditis. The role of thyroid hormone profile varies in all other lesions. Among the malignant lesions of the thyroid, significant proportions (66.6%) of cases were found to be euthyroid. The ELISA approach for assessing thyroid hormones is highly sensitive

and capable of distinguishing between serum T3, T4, and TSH readings in cases of hyperthyroidism and hypothyroidism, as well as differentiating them from subclinical or nonthyroidal illnesses. A strong positive connection between cytohistological findings was reported in 28 out of 30 instances. In light of this, FNAC is widely recognised as the preferred initial diagnostic method for evaluating thyroid swellings due to its notable specificity and accuracy. The Fine Needle Aspiration Cytology (FNAC) technique is a straightforward, reliable, economical, and minimally intrusive diagnostic method employed to evaluate patients with thyroid nodules prior to surgery. Histopathological evaluation is the sole definitive approach to exclude the presence of malignancy.

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