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SCINTIGRAPHY EVALUATION OF HYPERTHYROIDISM, HYPOTHYROIDISM, AND EUTHYROIDISM AND ITS CORRELATION WITH BIOCHEMICAL PROFILES

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ABSTRACT

Background:

Thyroid disorders, including hyperthyroidism, hypothyroidism, and euthyroid functional states, are considered major endocrine health problems worldwide. Due to lacking the definite differentiation of various conditions, management will differ according to etiology. Biochemical profiles using TSH, T3, T4 are extensively used but often cannot define the exact functional pattern. Thyroid scintigraphy is a functional imaging test that represents how the thyroid gland works by evaluating how much tracer it takes in. It helps doctors pinpoint abnormal areas based on increased or decreased uptake.

Objective:

To assess thyroid scintigraphy findings in patients with suspected thyroid dysfunction and correlate imaging patterns with biochemical thyroid markers to enhance diagnostic accuracy.

Methods:

A retrospective cross-sectional study was conducted using data from 93 patients who experience thyroid scintigraphy and thyroid function tests at diagnostic centers in Punjab, Pakistan. Hormonal values (TSH, T3, T4) were examine to group patients biochemically. Scintigraphy uptake patterns (increased, normal, reduced, absent) were compared with biochemical status. Descriptive and cross-tabulated analysis was performed.

Results:

Biochemically, 48 patients were euthyroid, 23 hypothyroid, and 22 hyperthyroid. Scintigraphy classified 34 as euthyroid, 32 hypothyroid, and 27 hyperthyroid. Hyperthyroid patients show remarkably increased tracer uptake with suppressed TSH (mean 0.18 μIU/mL) and elevated T3 (4.30 ng/mL) and T4 (215.77 ng/dL). Hypothyroid patients demonstrated reduced or absent uptake with high TSH (10.51 μIU/mL). Although 48 patients were biochemically euthyroid, 14 of them showed abnormal scintigraphy, indicating subclinical or structural disease. The overall correlation between scintigraphy and biochemical results are approximately 85%.

Conclusion:

Thyroid scintigraphy provides important functional information that supplement biochemical testing and increases diagnostic accuracy. It is particularly helpful for differentiating Graves' disease, toxic nodular goiter, thyroiditis, and detecting subclinical abnormalities in euthyroid patient. Combined evaluation should be included in routine thyroid assessment for precise classification and optimal management.

Keywords: *Thyroid scintigraphy, hyperthyroidism, hypothyroidism, euthyroid, TSH, Tc-99m pertechnetate, radioactive iodine*

INTRODUCTION

Thyroid dysfunction is one of the most widespread endocrine conditions worldwide, with significant metabolic and systemic consequences. Assessment typically depends on biochemical thyroid function tests (TFTs) including TSH, T3, and T4. Although blood tests are essential, they are not always enough to diagnose the exact thyroid disease. Different diseases like thyroiditis, Graves' disease, and autonomous nodules can present corresponding blood test results, but their causes and treatments are not similar.

Thyroid scintigraphy provides functional imaging by assessing radiotracer uptake and distribution using Tc-99m pertechnetate or iodine isotopes. Increased uptake is characteristic of hyperfunctioning tissue, reduced uptake indicates destructive or autoimmune disease, and normal uptake represents physiologic thyroid function. Combining scintigraphy with biochemical findings improves the accuracy of diagnosing thyroid disorders. This study evaluates the correlation between biochemical results and scintigraphy patterns in patients with suspected thyroid dysfunction.

Methods

A retrospective cross-sectional study was regulated using 93 patient records collected from nuclear medicine and diagnostic laboratories in Punjab, Pakistan. Data comprising thyroid function tests (TSH, T3, T4) and scintigraphy reports performed with Tc-99m pertechnetate or iodine isotopes.

Inclusion criteria:

Adults aged 18–70 years who received both scintigraphy and biochemical testing.

Exclusion criteria:

Incomplete reports, previous thyroid surgery, radioiodine therapy, or use of thyroid-altering medications.

Patients were classified biochemically into hyperthyroid, hypothyroid, or euthyroid groups. Scintigraphy uptake was recorded as increased, reduced/absent, or normal. Correlation was evaluated through descriptive comparison and pattern matching.

Results

Biochemical Classification

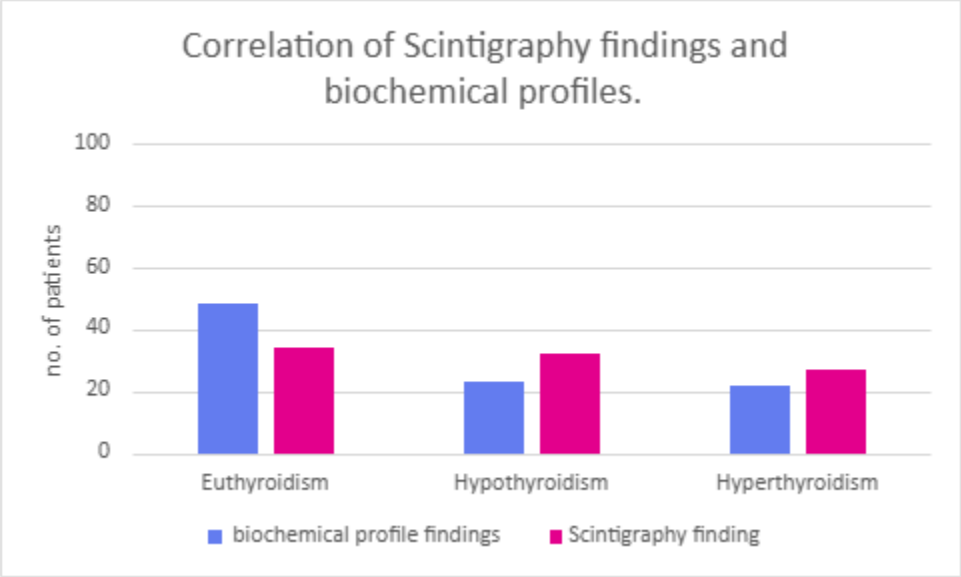
Biochemical Status	Number of Patients	Percentage
Euthyroid	48	51.6%
Hypothyroid	23	24.7%
Hyperthyroid	22	23.7%

Scintigraphy Classification

Scintigraphy Uptake	Number of Patients	Percentage
Normal / Euthyroid	34	36.6%
Reduced / Hypothyroid	32	34.4%
Increased / Hyperthyroid	27	29.0%

Correlation between Scintigraphy findings and biochemical profiles

Thyroid state	No. of patients on biochemical profile	No. of patients on scintigraphy
Euthyroidism	48	34
Hypothyroidism	23	32
Hyperthyroidism	22	27



Hormonal Patterns

Hyperthyroid patients: Mean TSH 0.18 µIU/mL, T3 4.30 ng/mL, T4 215.77 ng/dL; increased tracer uptake.

Hypothyroid patients: Mean TSH 10.51 µIU/mL, T3 and T4 low; reduced or absent uptake.

Euthyroid patients: Normal biochemical ranges; however, 14 showed abnormal scintigraphy indicating subclinical disease.

Correlation Analysis

- Increased uptake correlates strongly with hyperthyroidism (Graves' disease or toxic nodules).
- Reduced or absent uptake correlated with hypothyroidism due to autoimmune or destructive causes.
- Normal uptake mostly reflected euthyroid function, but scintigraphy detected undiagnosed or subclinical abnormalities in 14 patients.

Overall correlation between biochemical and scintigraphy results: 85%

Discussion

Thyroid scintigraphy noticeably enhances diagnostic precision when combined with thyroid hormone testing. Hyperthyroid patients often manifest increase uptake patterns assisting diagnoses such as Graves' disease or toxic nodular goiter. Hypothyroid patients showed reduced or absent uptake related to devastating disorders, including Hashimoto's thyroiditis or subacute thyroiditis.

A notable finding is that several biochemically euthyroid individuals indicate abnormal scintigraphy, highlighting the ability to detect early functional or structural thyroid abnormalities. Varying cases present that relying only on biochemical testing may lead to misdiagnosis. Scintigraphy is particularly important in differentiating etiology of thyrotoxicosis, detecting

non-functioning nodules, and guiding treatment decisions such as radioiodine therapy.

Conclusion

Thyroid scintigraphy is a reliable and vital diagnostic tool that goes with biochemical thyroid testing. The strong correlation seen in this study confirms that combined assessment enhances diagnostic accuracy, differentiates disease causes and identifies undiagnosed abnormalities unnoticed by biochemical testing alone. Routine amalgamation of scintigraphy with biochemical tests is recommended for accurate diagnosis and guidance of thyroid disorders.

REFERENCES

Cooper, D. S. (2003). Hyperthyroidism. *The Lancet, 362*(9382), 459–468. https://doi.org/10.1016/S0140-6736(03)14073-1

Brent, G. A. (2012). Mechanisms of thyroid hormone action. *The Journal of Clinical Investigation, 122*(9), 3035–3043. https://doi.org/10.1172/JCI60047

De Groot, L. J., & Jameson, J. L. (Eds.). (2016). *Endocrinology: Adult and Pediatric*. Elsevier.

Ross, D. S. (2011). Diagnostic approach to and treatment of thyroid nodules. *The Journal of Clinical Endocrinology & Metabolism, 96*(12), 3593–3601. https://doi.org/10.1210/jc.2011-1770

Baskin, H. J. (2004). Radioiodine treatment of hyperthyroidism. *The American Journal of Medicine, 117*(11), 904–905. https://doi.org/10.1016/j.amjmed.2004.05.045

Bahn, R. S., et al. (2011). Hyperthyroidism and other causes of thyrotoxicosis: Management guidelines. *Thyroid, 21*(6), 593–646. https://doi.org/10.1089/thy.2010.0417

Silverman, M. L., & Lerman, J. Z. (2009). The utility of nuclear medicine in thyroid disorders. *Seminars in Nuclear Medicine, 39*(2), 81–90. https://doi.org/10.1053/j.semnuclmed.2008.10.003

Wartofsky, L., & Dickey, R. A. (2005). The evidence for a narrower thyrotropin reference range is compelling. *The Journal of Clinical Endocrinology & Metabolism, 90*(9), 5483–5488. https://doi.org/10.1210/jc.2005-0455

Hegedüs, L. (2001). The thyroid nodule. *New England Journal of Medicine, 351*(17), 1764–1771. https://doi.org/10.1056/NEJMra031430

Jameson, J. L., & Weetman, A. P. (2001). Disorders of the thyroid gland. In *Harrison's Principles of Internal Medicine* (15th ed.). McGraw-Hill.

Sisson, J. C. (1998). Diagnostic imaging and treatment of thyroid diseases using radioiodine. *Thyroid, 8*(10), 871–876. https://doi.org/10.1089/thy.1998.8.871

Khan, A. A., & Khan, Y. (2020). A comparative study of thyroid function test by ELISA and CLIA methods. *Journal of Clinical and Diagnostic Research, 14*(3), BC01–BC04. https://doi.org/10.7860/JCDR/2020/45623.13583

IAEA. (2018). *Nuclear Medicine Resources Manual* (2nd ed.). International Atomic Energy Agency.

Demers, L. M., & Spencer, C. A. (2002). Laboratory medicine practice guidelines: Laboratory support for the diagnosis and monitoring of thyroid disease. *Thyroid, 12*(1), 3–30. https://doi.org/10.1089/105072502753451974

Roberts, C. G. P., & Ladenson, P. W. (2004). Hypothyroidism. *The Lancet, 363*(9411), 793–803. https://doi.org/10.1016/S0140-6736(04)15696-1

Kahaly, G. J., & Diana, T. (2017). Thyrotropin-receptor antibodies: Relevance for diagnosis and therapy of Graves' disease. *Best Practice & Research Clinical Endocrinology & Metabolism, 31*(3), 365–375. https://doi.org/10.1016/j.beem.2017.05.010

Vanderpump, M. P. J. (2011). The epidemiology of thyroid disease. *British Medical Bulletin, 99*(1), 39–51. https://doi.org/10.1093/bmb/ldr030

Pearce, S. H. S., Brabant, G., Duntas, L. H., Monzani, F., Peeters, R. P., Razvi, S., & Wemeau, J. L. (2013). 2013 ETA Guidelines: Management of subclinical hypothyroidism. *European Thyroid Journal, 2*(4), 215–228. https://doi.org/10.1159/000356507

Cooper, D. S., & Biondi, B. (2012). Subclinical thyroid disease. *The Lancet, 379*(9821), 1142–1154. https://doi.org/10.1016/S0140-6736(11)60276-6

Taylor, P. N., et al. (2014). Global epidemiology of hyperthyroidism and hypothyroidism. *Nature Reviews Endocrinology, 10*(5), 276–284. https://doi.org/10.1038/nrendo.2014.24

Wiersinga, W. M. (2014). Paradigm shifts in thyroid hormone replacement therapies for hypothyroidism. *Nature Reviews Endocrinology, 10*(3), 164–174. https://doi.org/10.1038/nrendo.2013.258

De Leo, S., Lee, S. Y., & Braverman, L. E. (2016). Hyperthyroidism. *The Lancet, 388*(10047), 906–918. https://doi.org/10.1016/S0140-6736(16)00278-6

Bahn, R. S. (2010). Graves' ophthalmopathy. *The New England Journal of Medicine, 362*(8), 726–738. https://doi.org/10.1056/NEJMra0905750

Garber, J. R., et al. (2012). Clinical practice guidelines for hypothyroidism in adults: Cosponsored by the American Association of Clinical Endocrinologists and the American Thyroid Association. *Thyroid, 22*(12), 1200–1235. https://doi.org/10.1089/thy.2012.0205