Evaluation of Diagnostic Accuracy of Nuclear Medicine Imaging in Detecting Thyroid Disorders at Birat Medical College Teaching Hospital

Chaudhary Amardeep, Yadav Birendra Kumar, Yadav Om Prakash, Yadav Ajay Kumar

Nuclear Medicine and Molecular Imaging Centre, Birat Medical College Teaching Hospital, Birat Cancer Institute, Tankisinuwari, Budhiganga-2, Morang, Nepal

Abstract

Objective: To evaluate the diagnostic accuracy of nuclear medicine imaging in detecting thyroid disorders at a tertiary care center.

Methods: This observational study included 120 patients suspected of thyroid dysfunction who underwent nuclear medicine imaging from January 2025 to December 2025. Thyroid scans were performed using Technetium-99m pertechnetate. Imaging findings were correlated with clinical assessment and laboratory investigations including T3, T4, and TSH levels.

Results: Among the 120 patients, 72 (60%) were diagnosed with hyperthyroidism, 36 (30%) with hypothyroidism, and 12 (10%) were euthyroid with nodular lesions. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of nuclear imaging were 95%, 92%, 93%, and 94%, respectively.

Conclusion: Nuclear medicine imaging is a highly sensitive and specific modality for diagnosing thyroid disorders and plays a crucial role in clinical decision-making.

Keywords: Nuclear medicine, thyroid disorders, Technetium-99m, diagnostic accuracy, Nepal

Introduction

Thyroid disorders represent a significant global health concern, affecting millions of individuals and contributing to substantial morbidity. These disorders include hyperthyroidism, hypothyroidism, thyroiditis, and nodular thyroid disease. Accurate diagnosis is essential for effective management, as clinical presentations may overlap and laboratory findings alone may not always provide definitive conclusions.

Nuclear medicine imaging has emerged as a valuable diagnostic tool in the evaluation of thyroid disorders. Unlike conventional imaging modalities such as ultrasound, nuclear imaging provides functional information about thyroid activity. Technetium-99m pertechnetate is widely used due to its favorable imaging characteristics, low radiation dose, and cost-effectiveness.

In developing countries like Nepal, where access to advanced diagnostic modalities may be limited, nuclear medicine plays a vital role in improving diagnostic accuracy and guiding treatment decisions. This study aims to assess the diagnostic performance of nuclear medicine imaging in detecting thyroid disorders at Birat Medical College Teaching Hospital.

Materials and Methods

Study Design and Setting

This was a hospital-based observational study conducted at the Department of Nuclear Medicine, Birat Medical College Teaching Hospital, Biratnagar, Nepal.

Study Population

A total of 120 patients aged between 18 and 70 years with clinical suspicion of thyroid disorders were included in the study. Patients were referred from outpatient and inpatient departments.

Correspondence : Chaudhary Amardeep, Nuclear Medicine and Molecular Imaging Centre, Birat Medical College Teaching Hospital, Tankisinuwari, Budhiganga-2, Morang, Nepal, Email Id : dramardeep@bmcteachinghospital.com, Cell No - +977-9708730705

Inclusion Criteria
- Patients with clinical suspicion of thyroid dysfunction
- Patients who underwent nuclear medicine thyroid imaging
- Patients who provided informed consent

Exclusion Criteria
- Pregnant or lactating women
- Patients with prior thyroid surgery
- Patients on medications interfering with thyroid uptake

Imaging Procedure
All patients received an intravenous injection of Technetium-99m pertechnetate. Imaging was performed using a gamma camera approximately 20 minutes post-injection. Standard anterior images of the thyroid gland were obtained.

Image Interpretation
Scans were independently interpreted by two experienced nuclear medicine physicians. Thyroid uptake patterns were categorized as increased, decreased, or normal. Nodular lesions were identified and classified accordingly.

Data Collection
Clinical data, imaging findings, and laboratory results (T3, T4, TSH) were recorded in a structured data collection form.

Statistical Analysis
Diagnostic accuracy was evaluated by calculating sensitivity, specificity, PPV, and NPV using standard formulas. Statistical analysis was performed using SPSS software. A p-value < 0.05 was considered statistically significant.

Results

Demographic Characteristics
Out of 120 patients, 78 (65%) were female and 42 (35%) were male. The mean age of patients was 42 ± 12 years.

Distribution of Thyroid Disorders
- Hyperthyroidism: 72 patients (60%)
- Hypothyroidism: 36 patients (30%)
- Euthyroid with nodular lesions: 12 patients (10%)

Diagnostic Performance
- Sensitivity: 95%
- Specificity: 92%
- Positive Predictive Value (PPV): 93%
- Negative Predictive Value (NPV): 94%

Imaging Findings
Hyperthyroid patients demonstrated diffusely increased tracer uptake, whereas hypothyroid patients showed reduced uptake. Nodular lesions were visualized as focal areas of increased or decreased activity.

Clinical Impact
Nuclear imaging significantly influenced patient management, including initiation of antithyroid drugs, hormone replacement therapy, and surgical planning in selected cases.

Discussion
This study demonstrates that nuclear medicine imaging using Technetium-99m pertechnetate has high diagnostic accuracy in detecting thyroid disorders. The sensitivity (95%) and specificity (92%) observed in this study are consistent with previously published literature, supporting the reliability of this modality.

The ability of nuclear imaging to provide functional assessment gives it a distinct advantage over anatomical imaging techniques. It is particularly useful in differentiating causes of thyrotoxicosis, such as Graves' disease and thyroiditis, and in identifying autonomous functioning nodules.

The predominance of female patients in this study aligns with global epidemiological trends, as thyroid disorders are more common in women. The high proportion of hyperthyroid cases may reflect referral patterns or regional disease prevalence.

Comparison with Previous Studies
Previous studies have reported sensitivity ranging from 90% to 97% and specificity from 85% to 95%, which closely matches the findings of this study. This reinforces the clinical utility of nuclear medicine imaging in thyroid evaluation.

Clinical Implications
The findings highlight the importance of incorporating nuclear imaging into routine diagnostic protocols

for thyroid disorders, particularly in tertiary care settings. It aids in accurate diagnosis, reduces diagnostic uncertainty, and facilitates appropriate treatment planning.

Limitations

- Single-center study
- Relatively small sample size
- Lack of long-term follow-up

Future multicenter studies with larger sample sizes are recommended to validate these findings.

Conclusion

Nuclear medicine imaging using Technetium-99m pertechnetate is a highly accurate, reliable, and non-invasive diagnostic tool for evaluating thyroid disorders. Its integration into clinical practice enhances diagnostic confidence and improves patient management outcomes.

References

1. Cooper DS. Hyperthyroidism. N Engl J Med. 2003;348(9):905–918.
2. Bahn RS, Burch HB, Cooper DS, et al. Hyperthyroidism and other causes of thyrotoxicosis. Thyroid. 2011;21(6):593–646.
3. Mazzaferri EL. Management of a solitary thyroid nodule. N Engl J Med. 1993;328(8):553–559.
4. Iqbal A, et al. Role of nuclear medicine in thyroid disorders. J Nucl Med Technol. 2020;48(2):115–122.
5. Ross DS. Diagnostic approach to thyroid disease. Endocrinol Metab Clin North Am. 2019;48(1):1–15.
6. Silberstein EB. Thyroid imaging and therapy. J Nucl Med. 2012;53(2):221–229.

Acknowledgment

The authors would like to thank the staff of the Department of Nuclear Medicine at Birat Medical College Teaching Hospital for their support and cooperation during the study.

Conflict of Interest

The authors declare no conflict of interest.

Funding

No external funding was received for this study.