SHORT COMMUNICATION

Diagnostic value of the Wayne index in thyroid enlargement patients at Sultan Agung Islamic Hospital,Semarang, Indonesia

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Abstract

Hyperthyroidism, a prevalent metabolic disorder, poses diagnostic challenges due to variability in clinical presentations and access to laboratory tests. Given the clinical importance of hyperthyroidism and the challenges associated with timely and accessible laboratory testing for thyroid hormones, the evaluation of diagnostic tools, such as the Wayne index, is crucial. The current cross-sectional study, conducted from January to December 2022, evaluated the diagnostic performance of the Wayne index in detecting hyperthyroidism in 65 thyroid enlargement patients at the Sultan Agung Islamic Hospital, Indonesia. The Wayne index was assessed against thyroid stimulating hormone, free thyroxine, and total triiodothyronine. Sensitivity, specificity, predictive values, likelihood ratios, and area under the curve were calculated. Results showed sensitivity ranging from 86.1% to 92.6% and specificity from 66.7% to 79.3% for the Wayne Index across thyroid function tests, with an area under the curve ranging from 0.80 to 0.83. These findings suggested that the Wayne Index could serve as a reliable diagnostic tool for hyperthyroidism in clinical practice.

Keywords: Hyperthyroidism, Wayne index, Diagnostic accuracy, Thyroid hormones.

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Introduction

Hyperthyroidism as a prevalent metabolic disorder with significant clinical complications, including cardiovascular diseases, osteoporosis and metabolic dysregulation. The Wayne Index (WI) is a clinical scoring tool designed to facilitate the diagnosis of hyperthyroidism, particularly in resource-limited settings where access to laboratory tests may be restricted.[1] However, its diagnostic accuracy compared to standard laboratory tests, such as thyroid stimulating hormone (TSH), free thyroxine (FT4) and total triiodothyronine (TT3), remains underexplored. The current study was planned to assess the WI diagnostic accuracy compared to TSH, FT4 and TT3 in patients with thyroid enlargement.

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Methods, Results and Discussion

The analytical, observational, cross-sectional study was conducted at the Sultan Agung Islamic Hospital, Semarang, Indonesia, from January to December 2022, and data was collected from the medical records section after approval from the institutional ethical review committee.

Using consecutive sampling technique, data was retrieved for patients aged >18 years with thyroid enlargement, and records had complete TSH, FT4 and TT3 values. Patients with pregnancy and malignancy were excluded.

The WI value was calculated for each patient, and its diagnostic value was assessed against thyroid hormone levels using sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and positive or negative likelihood ratios (LR+ and LR-), while area under the curve (AUC) was noted through receiver operating characteristic (RIC) curve analysis. AUC value closer to 1.0 indicated excellent diagnostic accuracy, while a value closer to 0.5 suggested the element of chance in play. Data was analysed using SPSS 26.

Among the 65 patients, 51 (78.5%) patients were females, and the largest age group was of those aged 36-45 years {21 (32.3%) patients}. The predominance of female patients aligned with the well-documented higher prevalence of thyroid disorders in women, likely due to hormonal and immunological differences that increase susceptibility to conditions, such as Graves' disease and Hashimoto's thyroiditis. Additionally, the hormonal fluctuations during pregnancy and menopause could further predispose women to thyroid dysfunction.[2]

The diagnostic performance of the Wayne Index compared to thyroid function tests is summarised in

Table-1: Diagnostic value of Wayne Index compared to thyroid function tests (TFTs) in thyroid enlargement patients.

Wayne index	Se (%)	Sp (%)	PPV (%)	NPV (%)	LR (+)	LR (-)	AUC	P value
TSH	86,1	79,3	83,8	82,1	4,16	0,17	0,827	p = 0,0001; CI 95% 71,9%-93,6%
FT4	92,3	66,7	64,9	92,9	2,77	0,11	0,795	p = 0,0001; CI 95% 68,4%-90,6%
TT3	92,6	68,4	67,6	92,9	2,93	0,11	0,805	p = 0,0001; CI 95% 69,6%-91,4%

Se: Sensitivity, Sp: Specificity: PPV: Positive predictive value, NPV: Negative predictive value, LR+: Positive likelihood ratio, LR-: Negative likelihood ratio, AUC: Area under the curve, TSH: Thyroid stimulating hormone, FT4: Free thyroxine, TT3: Total triiodothyronine.

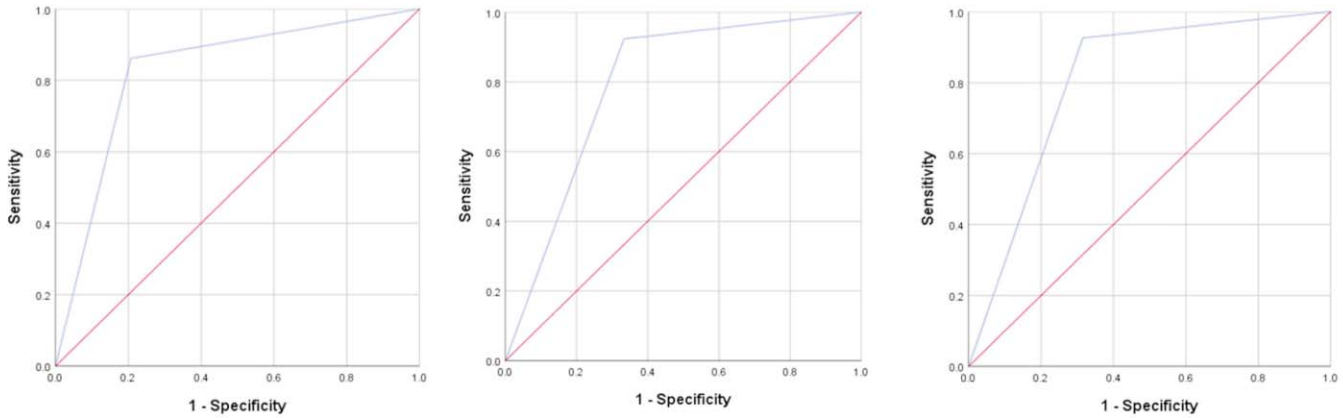

Figure-1: Receiver operating characteristic (ROC) curve of Wayne Index compared to TSH, FT4, TT3 (from left to right).
TSH: Thyroid stimulating hormone, FT4: Free thyroxine, TT3: Total triiodothyronine.

Table 1. The WI demonstrated high diagnostic accuracy, with a sensitivity of 86.1% for TSH, 92.3% for FT4, and 92.6% for TT3. Specificity ranged from 66.7% to 79.3%, while the PPV and NPV values ranged from 64.9% to 83.8%, and 82.1% to 92.9%, respectively. The receiver operating characteristic (ROC) curves in Figure 1 demonstrate the strong diagnostic accuracy of the Wayne Index against thyroid function parameters. The AUC values ranged between 0.80 and 0.83, indicating good discriminatory power.

The results provided valuable insights into thyroid function assessment, particularly in the context of hyperthyroidism. The high WI sensitivity indicated its effectiveness in identifying hyperthyroidism. The sensitivity of the index reflected its ability to accurately identify patients with elevated thyroid hormone levels, which can result from various pathophysiological mechanisms.[3–5]

Conversely, the specificity of the index, although slightly lower compared to its sensitivity, remained clinically relevant, indicating the the WI's capacity to correctly identify individuals without hyperthyroidism, which is essential for ruling out false-positive results and preventing unnecessary diagnostic evaluations or treatments.[6,7] Moreover, the index's PPV and NPV provided valuable insights into the likelihood of accurate diagnosis with positive and negative test results, respectively. These values reflected the clinical utility of WI in guiding patient management decisions, particularly in the context of hyperthyroidism-associated complications, such as thyrotoxicosis or thyroid storm.[8–11]

Furthermore, the WI's LR+ and LR- values provided information that is crucial for clinicians in interpreting test results and making informed decisions regarding patient care and treatment strategies.

Additionally, the strong discriminatory power of the index, as indicated by its high AUC values, underscored its reliability as a diagnostic tool for hyperthyroidism. The AUC values reflected the WI's ability to distinguish between individuals with and without hyperthyroidism.

The WI offers a cost-effective and accessible alternative for the preliminary diagnosis of hyperthyroidism, particularly in healthcare settings where advanced thyroid testing, such as TSH, FT4 and TT3 assays, may not be readily available. Its high sensitivity ensures that most cases of hyperthyroidism are accurately identified, minimising missed diagnoses in resource-constrained environments. Furthermore, the simplicity of the index allows for its implementation by clinicians and healthcare workers with minimal training, making it a valuable tool in primary care or rural settings.

Compared to biochemical markers, the WI provides a practical clinical scoring system that avoids the cost and logistical challenges associated with laboratory tests. While TSH remains the gold standard for hyperthyroidism diagnosis due to its high sensitivity and specificity, the WI's high sensitivity and strong AUC (0.80-0.83) values underscored its reliability in distinguishing between hyperthyroid and non-hyperthyroid patients.

The current study has limitations owing to a modest sample size, which may have affected the generalisability of the findings. Additionally, the sample primarily had patients with diagnosed hyperthyroidism, which may have introduced a selection bias. As the data was collected retrospectively from medical records, there is also a potential of information bias due to incomplete or inconsistent documentation. Future research with larger and more diverse populations is necessary to validate the clinical utility of the WI.

Conclusion

The WI showed a good diagnostic accuracy in identifying hyperthyroidism in patients with thyroid enlargement, offering a cost-effective and efficient alternative for preliminary hyperthyroidism screening in clinical practice.

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Conflict of Interest: None.

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NACS, TS, MTS & SI: Concept, design, data acquisition, analysis, interpretation, drafting, revision, final approval and agreement to be accountable for all aspects of the work.