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Original Research Article

Prevalence and Outcome of Incidental Thyroid Nodules Detected on CT Scan

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Abstract: *Incidental thyroid nodules (ITNs) are increasingly detected during computed tomography (CT) scans performed for non-thyroid indications. While most ITNs are benign, a subset carries a risk of malignancy, necessitating appropriate evaluation. Data on prevalence and outcomes of ITNs in the Pakistani population remain limited.* ***Objective:*** *To determine the prevalence, radiological characteristics, and outcomes of incidental thyroid nodules detected on CT scans in adults undergoing imaging for unrelated indications.* ***Methods:*** *This descriptive cross-sectional study was conducted at the Department of Diagnostic Radiology, Tertiary Care Hospital Kharian, from March to May 2025. A total of 255 adult patients (18–65 years) undergoing CT scans for non-thyroid indications were included through non-probability consecutive sampling. Patients with a known history of thyroid disease were excluded from the study. Nodule characteristics—including size, location, calcification, margins, and associated lymphadenopathy—were documented. Patients with suspicious nodules underwent further evaluation using ultrasound and/or fine-needle aspiration cytology (FNAC), with histopathological confirmation when indicated. Data were analyzed using SPSS v23, with $p < 0.05$ considered statistically significant.* ***Results:*** *ITNs were detected in 46 of 255 patients, yielding a prevalence of 18.0%. The mean participant age was 44.8 ± 12.3 years, with a male-to-female ratio of 1.2:1. Most nodules measured <1 cm (45.6%), followed by 1–1.5 cm (30.4%) and >1.5 cm (24.0%). The right lobe was the most common location (52.1%). Calcification was present in 26.1%, and irregular/poorly defined margins in 39.1%. Associated cervical lymphadenopathy was noted in 15.2% of cases. Of the 46 patients, 29 (63.0%) underwent further evaluation; 27 (93.1%) had benign tumors and 2 (6.9%) had malignant tumors. The overall malignancy rate among all ITNs was 4.3%, with a higher, though statistically insignificant, frequency in nodules larger than 1.5 cm in diameter.*
Conclusion: *ITNs were prevalent in nearly one-fifth of patients undergoing CT imaging for unrelated reasons, with most being benign. Larger nodules demonstrated a higher malignancy rate, underscoring the importance of follow-up imaging and, when appropriate, cytological evaluation. Standardized local guidelines tailored to the Pakistani population are crucial for ensuring timely Diagnosis, preventing overtreatment, and optimizing resource utilization.*

Keywords: Thyroid Nodule, Incidental Findings, Tomography, X-Ray Computed, Prevalence, Pakistan, Fine-Needle Aspiration

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Introduction

Thyroid nodules, defined as discrete lesions within the thyroid tissue, are increasingly common incidental findings on computed tomography (CT) scans performed for unrelated medical evaluations. The rising prevalence of these nodules can largely be attributed to advancements in imaging technology, which have rendered more detailed and sensitive imaging modalities available for clinical use. Recent studies indicate that the incidence of incidental thyroid nodules detected via imaging can vary significantly, with reports suggesting frequencies ranging from 19% to 46%, depending on the population and the type of imaging conducted. Specifically, computed tomography (CT) demonstrates a notable ability to detect smaller nodules, thus amplifying the reported prevalence. (3,4)
The management of incidental thyroid nodules (ITNs) presents a clinical challenge, primarily due to the need to ascertain their nature—benign or malignant—without subjecting patients to unnecessary interventions. Incidence studies reveal that while a considerable number of thyroid nodules are benign, malignancy can be present in 10% to 64% of cases, depending on various factors, including nodule size, patient demographics, and imaging characteristics (5,6). For instance, a meta-analysis indicated a malignancy rate of approximately 3.90% among ITNs detected on thoracic CT scans, suggesting that specialized follow-up, including ultrasound, is crucial for accurate classification and management. (7,8)
The implementation of standardized guidelines for managing ITNs has been widely discussed (8). Various classification systems, like the Thyroid Imaging Reporting and Data System (TI-RADS), have been developed to assist radiologists in predicting the likelihood of malignancy based on imaging features (9). Despite the existence of these frameworks, a significant gap in consensus remains regarding the most appropriate management strategies, often leaving clinicians to rely on their clinical judgment to determine which patient-specific factors can influence treatment. (4,10) Notably, studies have indicated that features such as hypoechogenicity or irregular margins increase the likelihood of malignancy, emphasizing the role of detailed imaging evaluation (9,2).
In Pakistan, the prevalence of thyroid nodules may be amplified by factors such as dietary iodine deficiency and genetic predispositions towards thyroid diseases. Regions with iodine deficiency are known to exhibit higher incidences of thyroid anomalies, including nodules, thereby necessitating a focused regional analysis of incidentally detected thyroid nodules in the Pakistani population. A better understanding of the patterns and outcomes of ITNs in this specific demographic could guide more tailored screening and management strategies, thereby optimizing clinical care pathways while minimizing unnecessary procedures (11).

Methodology

The present study was designed as a descriptive cross-sectional analysis conducted in the Department of Diagnostic Radiology at Tertiary Care

Hospital Kharian, over three months from March 2025 to May 2025, following approval from the Institutional Review Committee (IRC) and the College of Physicians and Surgeons Pakistan (CPSP). The target population comprised adult patients undergoing CT scans for indications unrelated to thyroid disease. A non-probability consecutive sampling technique was employed to recruit eligible participants until the required sample size was achieved. Sample size estimation was based on the World Health Organization sample size calculator, using a 95% confidence interval and expected prevalence of incidental thyroid nodules derived from reference studies, which reported a prevalence of approximately 8.3%. This yielded a minimum sample size of 255 patients, considered adequate to ensure statistical reliability and account for possible dropouts or exclusions.

Inclusion criteria specified patients between 18 and 65 years of age undergoing CT imaging for non-thyroid indications. Patients with a prior history or Diagnosis of thyroid disease, including thyroid cancer, were excluded to avoid confounding. Similarly, patients whose nodules could not be further evaluated due to loss of follow-up or premature discharge from the hospital were excluded from the outcome analysis. All eligible participants, or their guardians where appropriate, provided written informed consent before enrollment, and the study was conducted in accordance with the principles of ethics throughout.

Data were collected using a pre-designed pro forma that captured demographic details, including age, gender, and comorbid conditions, such as hypertension and diabetes mellitus. The radiological characteristics of incidental thyroid nodules were recorded directly from the CT images. Nodules were identified incidentally when discovered during imaging performed for unrelated reasons, without prior suspicion or clinical Diagnosis of thyroid pathology. For each nodule, the maximum diameter was measured on axial CT images and categorized into three groups: <1 cm, 1–1.5 cm, and >1.5 cm. Additional morphological features were documented, including the anatomical location of the nodule (right lobe, left lobe, or isthmus), presence or absence of calcification, shape (round, oval, irregular), and margin definition (well-defined, irregular, or poorly defined). Evidence of cervical lymphadenopathy was also noted as a potential marker of malignant transformation.

Follow-up outcomes were evaluated in patients with suspicious nodules based on imaging features. These patients underwent further assessment, either through ultrasound examination or fine-needle aspiration cytology (FNAC), at the discretion of the attending physician. Histopathological confirmation was performed whenever FNAC suggested malignancy or when surgical excision was indicated. Nodules were classified as benign, malignant, or not evaluated depending on the availability of confirmatory results. The malignancy rate was calculated as the percentage of nodules confirmed malignant out of the total number of incidental nodules detected.

Data analysis was performed using IBM SPSS Statistics version 23. Descriptive statistics were computed for both qualitative and quantitative variables. Categorical variables such as gender, presence of nodules, nodule size categories, calcification, margins, and malignancy outcomes were expressed as frequencies and percentages. Continuous variables, including patient age and nodule size in millimeters, were summarized as means with standard deviations. To assess the associations between demographic and radiological characteristics and malignancy risk, chi-square tests were used. A p-value of <0.05 was considered statistically significant.

Results

A total of 255 patients undergoing CT scans for non-thyroid indications were included. The mean age of participants was 44.8 ± 12.3 years (range 18–65 years). Out of these, 142 (55.7%) were males and 113 (44.3%) were females, giving a male-to-female ratio of approximately 1.2:1 (Table 1).I ncidental thyroid nodules (ITNs) were identified in 46 out of 255 patients, giving a prevalence of 18.0% (Table 2).

Table 1. Demographic profile of study participants (N = 255)

Variable	Frequency (n)	Percentage (%)
Age (years)		
18–30	58	22.7
31–45	92	36.1
46–60	78	30.6
>60	27	10.6
Mean ± SD	44.8 ± 12.3	–
Gender		
Male	142	55.7
Female	113	44.3
Comorbidities		
Hypertension	74	29.0
Diabetes Mellitus	62	24.3
Both HTN & DM	28	11.0
None	91	35.7

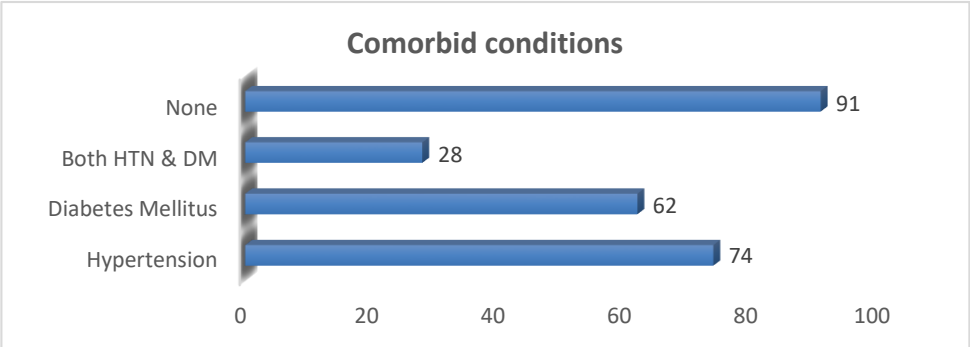

Figure 1: Frequency of comorbid conditions of the study population

Table 2. Prevalence of incidental thyroid nodules detected on CT scan

Presence of ITN	Frequency (n)	Percentage (%)
Present	46	18.0
Absent	209	82.0
Total	255	100.0

Among the 46 patients with ITNs, the most common nodule size was <1 cm in 21 (45.6%), followed by 1–1.5 cm in 14 (30.4%) and >1.5 cm in 11 (24.0%). The right thyroid lobe was the most frequent site (52.1%), followed by the left lobe (39.1%) and isthmus (8.8%) (Table 3).

Table 3. Characteristics of incidental thyroid nodules (n = 46)

Nodule Feature	Frequency (n)	Percentage (%)
Size		
< 1 cm	21	45.6
1–1.5 cm	14	30.4
> 1.5 cm	11	24.0
Location		
Right lobe	24	52.1
Left lobe	18	39.1
Isthmus	4	8.8
Calcification		
Present	12	26.1
Absent	34	73.9
Margins		
Well defined	28	60.9
Irregular/Poorly defined	18	39.1
Associated lymphadenopathy		
Present	7	15.2
Absent	39	84.8

Of the 46 patients with ITNs, 29 (63.0%) underwent further evaluation (ultrasound ± fine-needle aspiration cytology). Out of these, 2 (6.9%) were confirmed malignant on histopathology, while 27 (93.1%) were benign. The remaining 17 patients (37.0%) were lost to follow-up or not evaluated further.

The overall malignancy rate among all ITNs was 2/46 (4.3%). Malignancy was more frequent in nodules >1.5 cm (9.1%) compared to <1 cm (0%), but this difference did not reach statistical significance ($p > 0.05$) (Table 4).

Table 4. Outcomes of incidental thyroid nodules (n = 46)

Outcome	Frequency (n)	Percentage (%)
No follow-up evaluation	17	37.0
Evaluated further (n = 29):		
– Benign	27	93.1
– Malignant	2	6.9
Overall malignancy rate	2/46	4.3

Discussion

The current study evaluated a cohort of 255 patients undergoing CT scans for non-thyroid indications, focusing on the prevalence and characteristics of incidental thyroid nodules (ITNs). The observed prevalence of 18.0% aligns with existing literature, which suggests a similar incidence of incidental findings within diverse clinical populations. For example, Helvacı et al. reported ITN prevalence rates after COVID-19-related chest CT scans, noting a prevalence of approximately 20% (12). Meanwhile, Kohlenberg et al. provided insights on the malignancy rates of incidental thyroid nodules, confirming a similar prevalence in their study (13).

Among the identified ITNs, nodule size proved to be a critical factor. In this study, 45.6% of the nodules were below 1 cm, while larger nodules (greater than 1.5 cm) accounted for 24.0% of the cases. Literature indicates that smaller nodules generally pose a lower risk of malignancy, as highlighted in studies such as those by Jo et al., which found that larger nodules were associated with higher malignancy rates. However, no distinct CT characteristics can reliably differentiate benign from malignant nodules (14). Our observed malignancy rate of 4.3% is lower compared to other findings, such as those by Cai et al., who reported an overall malignancy incidence of 10% to 15% in ITNs, supporting the notion of varying prevalence across studies (15).

The distribution of nodular locations showed that the right thyroid lobe was the most common site (52.1%). In agreement, Rothberger et al. found no significant variations in malignancy rates across different lobe positions, underscoring the importance of follow-up for bilateral nodules (16). This aligns with our results, indicating a need for established guidelines in the management of ITNs, particularly in populations at risk for thyroid pathologies.

In terms of comorbidities within the cohort, hypertension (29.0%) and diabetes mellitus (24.3%) were the most frequently reported, complicating the monitoring of ITNs. Previous studies have shown that these systemic conditions can influence thyroid function and pathology, thus the identification and management of comorbidities should be integrated into evaluation protocols for patients with ITN Bertoni et al. (17). Additionally, the decision to undergo further evaluation, such as ultrasound or fine-needle aspiration cytology, was pursued by 63.0% of patients in our study, which is consistent with findings reported by Abdelrahman et al., highlighting the necessity of systematic follow-ups for benign nodules after initial imaging detection (18).

Notably, the results reveal a consistent trend in which most ITNs remain benign. This observation is supported by analyses from Manta et al. and Chooi et al., reinforcing the idea that active surveillance is often preferable to aggressive intervention for many nodules. (19,20) Our study illustrates how patient characteristics and clinical findings interact, highlighting the need for management strategies tailored to the demographics present in Pakistan, where dietary iodine deficiencies and genetic factors may influence the incidence and outcomes of thyroid nodules (Tel et al., 11).

Overall, these findings can spur further exploration into the nuanced understanding of ITNs within our local context. A targeted approach for managing thyroid nodules could enhance patient care, promote resource efficiency, and contribute to a deeper understanding of thyroid pathology in Pakistan.

Conclusion

Incidental thyroid nodules were detected in 18% of patients, with most being benign. Larger nodules (>1.5 cm) showed a higher, though not statistically significant, malignancy rate. These findings underscore the importance of establishing structured local guidelines and referral pathways to facilitate timely evaluation while minimizing unnecessary interventions.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-24)

Consent for publication
Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

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All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

References

1. Kamakshi K., Krishnamurthy A., Karthik V., Vinodkumar P., Kumar R., & Lakshmipathy K.. Positron emission tomography–computed tomography-associated incidental neoplasms of the thyroid gland. World Journal of Nuclear Medicine 2020;19(01):36-40. https://doi.org/10.4103/wjnm.wjnm_33_19
2. TURGUT L., KARAKÖSE M., Kocabaş M., Can M., Çordan İ., Kulaksızoğlu M.et al.. The evaluation of the malignancy rate of incidental thyroid nodules detected by FDG PET/CT. Turkish Journal of Endocrinology and Metabolism, 2021; 25(2): 142-150. https://doi.org/10.25179/tjem.2020-80668
3. Abdelrahman A., Ekladious M., & Nagi M. Incidental thyroid nodules on the COVID-19 positive CT chest. The Egyptian Journal of Hospital Medicine 2022;87(1):1017-1023. https://doi.org/10.21608/ejhm.2022.220737
4. Rothberger G., Cohen M., Sahay P., Szczepanczyk P., & Islam S.. Method of detection of thyroid nodules: correlation with frequency of fine-needle aspiration and malignancy rate. Head & Neck 2019;42(2):210-216. https://doi.org/10.1002/hed.25984
5. Erdoğan M., Korkmaz H., Torus B., Avcı M., Boylubay Ş., Çiriş M.et al.. The role of metabolic volumetric parameters in predicting malignancy in incidental thyroid nodules detected in ¹⁸ F-FDG PET/CT scans. Molecular Imaging and Radionuclide Therapy 2021;30(2):86-92. https://doi.org/10.4274/mirt.galenos.2021.75983
6. Owens C., Fitzhugh A., Harrington K., Paleri V., Sharma B., Shur J.et al.. Incidentally detected 18F-FDG PET-CT-avid thyroid nodules in patients with advanced malignancy: long-term oncological outcomes from a single-centre retrospective cohort. Nuclear Medicine Communications 2023;44(9):810-815. https://doi.org/10.1097/mnm.0000000000001720
7. Helvacı B., Özdemir D., Turan K., Keskin Ç., İmga N., Dirikoç A.et al.. Incidental thyroid nodules on COVID-19-related thoracic tomography scans: a giant cohort. Hormones 2023;23(2):227-233. https://doi.org/10.1007/s42000-023-00516-9
8. Wadsley J., Balasubramanian S., Madani G., Munday J., Roques T., Rowe C.et al.. Consensus statement on the management of incidentally discovered FDG avid thyroid nodules in patients being investigated for other cancers. Clinical Endocrinology 2023;101(5):557-561. https://doi.org/10.1111/cen.14905
9. Ozcan K., Pinar K., Yüksel B., & Bozdogan A.. The modified TI-RADS classification and scoring method for thyroid nodules can be effective for evaluating thyroid incidentalomas on FDG PET-CT imaging. Open Journal of Thyroid Research 2019;2(1):005-008. https://doi.org/10.17352/ojtr.000008
10. Xu Y., Tang Y., Zhang Q., Zhao Z., Zhao C., Fan P.et al.. Automatic detection of thyroid nodules with a real-time artificial intelligence system in a real clinical scenario and the associated influencing factors. Clinical Hemorheology and Microcirculation 2024;87(4):437-450. https://doi.org/10.3233/ch-242099
11. Tel B., Kahveci G., Bilgin S., Kurtkulağı Ö., & Kösekli M. Platelet to lymphocyte ratio in differentiation of benign and malignant thyroid nodules. Experimental Biomedical Research 2021;4(2):148-153. https://doi.org/10.30714/j-ebr.2021267978
12. Helvacı B., Özdemir D., Turan K., Keskin Ç., İmga N., Dirikoç A.et al.. Incidental thyroid nodules on COVID-19-related thoracic tomography scans: a giant cohort. Hormones 2023;23(2):227-233. https://doi.org/10.1007/s42000-023-00516-
13. Kohlenberg J., Panda A., Johnson G., & Castro M. Radiologic and clinicopathologic characteristics of thyroid nodules with focal 68Ga DOTATATE PET activity. Nuclear Medicine Communications 2021;42(5):510-516. https://doi.org/10.1097/mnm.0000000000001356

14. Jo J., Kim J., Ryu J., & Lee H. Incidental thyroid nodule on chest computed tomography: application of computed tomography texture analysis in prediction of ultrasound classification. Journal of Computer Assisted Tomography 2022;46(3):480-486. https://doi.org/10.1097/rct.0000000000001286
15. Sajisevi M., Caulley L., Eskander A., Du Y., Auh E., Karabachev A.et al.. Evaluating the rising incidence of thyroid cancer and thyroid nodule detection modes. Jama Otolaryngology–head & Neck Surgery 2022;148(9):811. https://doi.org/10.1001/jamaoto.2022.1743
16. Rothberger G., Cohen M., Sahay P., Szczepanczyk P., & Islam S.. Method of detection of thyroid nodules: correlation with frequency of fine-needle aspiration and malignancy rate. Head & Neck 2019;42(2):210-216. https://doi.org/10.1002/hed.25984
17. Bertoni D., Schlegel L., Gillmore K., Brill-Edwards M., Armache M., & Cottrill E. Significance of incidental thyroid findings in a large community-based lung cancer screening cohort. The Laryngoscope 2024;135(2):964-968. https://doi.org/10.1002/lary.31789
18. Abdelrahman A., Ekladious M., & Nagi M. Incidental thyroid nodules on the COVID-19 positive CT chest. The Egyptian Journal of Hospital Medicine 2022;87(1):1017-1023. https://doi.org/10.21608/ejhm.2022.220737
19. Lin D., Arevalo Y., & Lin C. Incidental thyroid nodules found during acute stroke angiography: prevalence, outcomes, and suggested management guidelines. Journal of Diagnostic Medical Sonography 2021;37(5):451-456. https://doi.org/10.1177/87564793211018459
20. Chooi J., Ravindiran A., & Balasubramanian S.. The influence of incidental detection of thyroid nodule on thyroid cancer risk and prognosis—a systematic review. Clinical Endocrinology 2021;96(2):246-254. https://doi.org/10.1111/cen.14575