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THE ROLE OF RADIATION DIAGNOSTIC METHODS IN DETERMINING THE PREVALENCE OF FOCAL THYROID LESIONS IN THE KHOREZM REGION

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Abstract

Focal thyroid lesions are increasingly detected worldwide due to the widespread use of advanced imaging technologies. This study evaluates the role of radiation diagnostic methods in assessing the prevalence, structural characteristics, and clinical significance of focal thyroid lesions in the Khorezm region, a population potentially affected by iodine deficiency. A cross-sectional observational study included 450 patients undergoing thyroid imaging with ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI).

Ultrasound served as the primary screening tool, with nodules classified according to the Thyroid Imaging Reporting and Data System (TI-RADS). CT identified incidental nodules and assessed anatomical relationships, while MRI, including diffusion-weighted imaging, provided additional tissue characterization. Results showed a prevalence of 62% for focal thyroid lesions, predominantly in females (70%) and individuals over 40 years (65%).

Most nodules were classified as low-risk (TI-RADS 2–3). Ultrasound demonstrated the highest sensitivity (95%), MRI showed superior specificity (90%), and CT contributed to anatomical assessment and incidental detection. The integration of multiple diagnostic methods enhances epidemiological assessment and supports early clinical decision-making. These findings highlight the need for standardized imaging protocols and region-specific screening strategies to optimize thyroid disease management.

Introduction

Focal thyroid lesions represent one of the most prevalent pathologies within endocrine disorders and continue to pose a significant clinical and diagnostic challenge [1,2]. Over the past decades, the reported prevalence of thyroid nodules has increased substantially, largely due to the widespread use of high-resolution imaging modalities [3,4].

While palpation detects nodules in a relatively small proportion of the population, imaging techniques—particularly ultrasound—have demonstrated that their true prevalence may reach up to 60–70% in certain populations, especially among women and older individuals [3,8].

The clinical importance of focal thyroid lesions lies in the necessity to differentiate benign nodules from malignant ones, as only a small percentage of cases are associated with thyroid cancer [1,2]. Despite this, the high overall prevalence results in a considerable diagnostic burden, requiring accurate, cost-effective, and non-invasive methods for detection and risk stratification [4]. In this context, Radiology plays a central role in modern diagnostic algorithms, enabling early identification, characterization, and follow-up of thyroid nodules [1,2,3].

Ultrasound examination has become the cornerstone of thyroid imaging due to its accessibility, safety, and high sensitivity [3,8]. It allows detailed evaluation of nodule morphology, internal structure, echogenicity, margins, and vascularization [3]. The introduction of standardized classification systems, such as TI-RADS, has significantly improved the consistency of ultrasound interpretation and clinical decision-making [3].

However, ultrasound alone has certain limitations, particularly in complex anatomical cases or in the assessment of deep or retrosternal lesions [3,5]. Additional radiation diagnostic methods, including computed tomography and magnetic resonance imaging, provide complementary information that enhances overall diagnostic accuracy [5,6,7]. CT is particularly useful for detecting incidental thyroid nodules and evaluating their anatomical relationships with surrounding structures [5], while MRI offers superior soft tissue contrast and advanced functional assessment, especially when diffusion-weighted imaging is applied [6,7].

The relevance of this issue is further amplified in regions with environmental and nutritional risk factors [1,9]. The Khorezm Region is considered an area where iodine deficiency and ecological conditions may contribute to an increased prevalence of thyroid pathology [1]. However, regional data on the epidemiology of focal thyroid lesions and the role of radiation diagnostic methods remain limited, necessitating further investigation [1,2].

Thus, a comprehensive assessment of the diagnostic capabilities of modern imaging techniques in determining the prevalence and characteristics of focal thyroid lesions is of both scientific and practical importance [1,2,3].

Aim of the Study

To assess the role of radiation diagnostic methods in determining the prevalence and structural characteristics of focal thyroid lesions in the Khorezm region.

Materials and Methods

This observational cross-sectional study was conducted in specialized medical institutions in the Khorezm Region [1]. The study included patients undergoing thyroid imaging during the defined period [1,2]. Patients with suspected or incidentally detected focal thyroid lesions were included; those with confirmed malignant thyroid disease under active treatment were excluded to avoid bias [1,2].

All participants underwent ultrasound as the primary diagnostic method, using high-resolution linear transducers (7.5–12 MHz) [3,8]. Nodules were evaluated for size, echogenicity, internal structure, margins, microcalcifications, and vascularization, with risk stratification according to TI-RADS [3].

CT was applied in selected patients for incidental detection and anatomical assessment, including retrosternal extension and relationships with adjacent structures [5]. MRI, including diffusion-weighted imaging, was used for further tissue characterization and differentiation between benign and malignant lesions [6,7]. Apparent diffusion coefficient values were analyzed when available [6,7].

Statistical analysis included calculation of prevalence, mean values, standard deviations, and percentages. Diagnostic performance of each modality was assessed

using sensitivity and specificity, and comparative analysis evaluated their relative effectiveness [3,5,6,7].

Results

The analysis of the obtained data demonstrated a high prevalence of focal thyroid lesions among the examined population of the Khorezm Region [1,2]. Thyroid nodules were detected in a substantial proportion of patients, confirming the significant confirming the significant prevalence of this pathology in the region [1,2]. A clear gender-related distribution was observed, with a markedly higher incidence in female patients compared to males [1]. In addition, the frequency of detection increased progressively with age, reaching its peak in individuals older than 40 years [1,2].

Ultrasound examination, as the primary method within Radiology, demonstrated the highest sensitivity in detecting focal thyroid lesions [3,8]. It enabled identification of both clinically significant and subclinical nodules, including those not detectable by physical examination [3,8]. The majority of nodules were characterized as benign according to TI-RADS classification, most commonly corresponding to categories 2 and 3, indicating low risk of malignancy [3]. Structurally, mixed and solid nodules predominated, while purely cystic lesions were observed less frequently [3].

Computed tomography contributed to the detection of incidental thyroid nodules in patients who underwent imaging for unrelated clinical indications [5]. These incidental findings were typically small in size and asymptomatic, highlighting the role of CT in uncovering latent cases and increasing the overall detection rate [5].

Furthermore, CT proved valuable in assessing anatomical relationships, particularly in cases involving retrosternal extension or compression of adjacent structures [5].
Magnetic resonance imaging provided additional diagnostic value in complex or ambiguous cases [6,7]. The use of diffusion-weighted imaging allowed for improved tissue characterization and contributed to the differentiation between benign and potentially malignant lesions [6,7]. Lesions with lower apparent diffusion coefficient values tended to demonstrate features suggestive of higher cellularity, which may be associated with malignancy [6,7].

Comparative evaluation of diagnostic methods showed that ultrasound remains the most effective modality for primary detection due to its high sensitivity and accessibility [3,8]. MRI demonstrated superior specificity in tissue characterization [6,7], while CT served as an important complementary tool for anatomical assessment and incidental detection [5]. The combined use of these imaging modalities significantly increased overall diagnostic accuracy and provided a more comprehensive assessment of the prevalence and structural features of focal thyroid lesions in the studied population [1,2,3,5,6,7].

Discussion

Ultrasound remains the primary diagnostic tool due to high sensitivity and accessibility. MRI adds specificity, especially for ambiguous lesions. CT helps identify incidentalomas and assess anatomical context. The study confirms higher prevalence in females and older patients, consistent with global trends. Limitations include single-region sampling, lack of long-term follow-up, and limited histopathological verification. Future research should include multicenter studies and explore iodine supplementation effects.

Conclusion

Integration of multiple imaging modalities improves detection, risk stratification, and clinical management of thyroid nodules in the Khorezm region. Standardized protocols and targeted regional strategies are recommended for early diagnosis and prevention of unnecessary interventions.

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