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Current Practice and New Insights in Thyroid Ultrasound

SHORT ABSTRACT

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ABSTRACT

Thyroid nodules are common and detected in 2–6% in the adult population by palpation. This prevalence increased to 40–60% with the use of ultrasound. Thyroid cancer is rare, with 1020 new cancers (751 women and 287 male) registered in 2019 in Belgium [1]. Ultrasound imaging represents the cornerstone for the thyroid nodule work-up and has benefited from significant improvements in recent years. We succinctly focus on how to evaluate thyroid nodules using ultrasonography and how to use the European Thyroid Imaging and Reporting Data System (EU-TIRADS score). We will also review the possible added value of complementary ultrasound techniques such as high-resolution colour Doppler ultrasound and elastography. Further, we discuss how to select at-risk nodules to benefit from fine-needle aspiration cytology and finally we briefly review new techniques for the treatment of thyroid nodules and the role of artificial intelligence in thyroid nodule classification.

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CATEGORIZATION OF THYROID NODULES USING EU-TIRADS

Various risk stratification systems exist to categorize the risk of malignancy based on the ultrasound appearance of a thyroid nodule. The EU-TIRADS issued by the European Thyroid association in 2017 was the last to have been published [2]. This system categorizes nodules into five categories ranging from 1 – normal appearances to 5 – malignant on US criteria as illustrated in Table 1 and Figure 1.

COLOUR DOPPLER ULTRASOUND

The use of colour Doppler and power Doppler imaging for characterisation of thyroid nodule vascularity is widely used currently. It is considered a nonspecific feature for malignancy even if the presence of intranodular flow raises more concerns than if there is no flow or just perinodular flow is seen. A new Doppler technique was recently developed that improved microvascular flow imaging (Figure 2). Its diagnostic capacities to better detect malignancy in thyroid nodules has to be demonstrated in large and unselected population [3].

ELASTOGRAPHY IN THYROID NODULES

The primary application of elastography is the differential diagnosis of thyroid cancer. Nevertheless, despite the increasing data coming from the literature, a univocal consensus on its role in the selection of thyroid nodules to biopsy is still lacking [4].

FNA OR CORE BIOPSY?

Nodules are selected for fine-needle aspiration biopsy on the basis of ultrasound features, size, and high-risk clinical history. Cytology results are classified by the Bethesda system into six categories ranging from benign to malignant. Limitations

CATEGORY	US FEATURES	MALIGNANCY RISK, %
EU-TIRADS 1: normal	No nodules	None
EU-TIRADS 2: benign	Pure cyst Entirely spongiform	≅0
EU-TIRADS 3: low risk	Ovoid, smooth isoechoic/hyperechoic No features of high suspicion	2–4
EU-TIRADS 4: intermediate risk	Ovoid, smooth, mildly hypoechoic No features of high suspicion	6–17
EU-TIRADS 5: high risk	At least 1 of the following features of high suspicion: – Irregular shape – Irregular margins – Microcalcifications – Marked hypoechogenicity (and solid)	26–87

Table 1 The EU-TIRADS score according to reference 2.

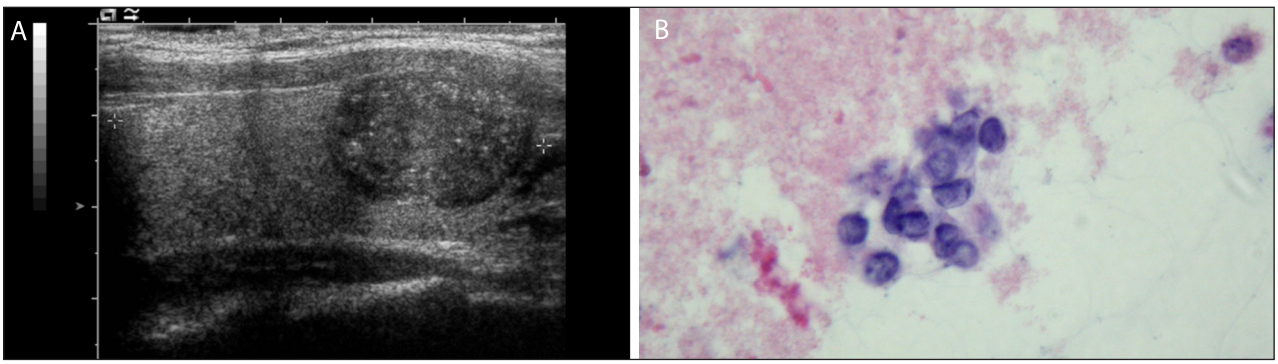

Figure 1 An 18-year-old woman presented at the ultrasound unit for a thyroid nodule discovered incidentally at the school medical examination. No familial risk factor was noted. Blood sample revealed a normal TSH level and no thyroglobulin raise. Ultrasound was performed **(Figure 1A)** and revealed a 1.5 cm thyroid nodule containing many hyperechoci foci suggestive of microcalcifications. The nodule was classified as EU-TIRADS V.

According to the European guidelines, a fine-needle aspiration (FNA) cytology under ultrasound guidance was therefore performed and revealed abnormal cells consistent with a thyroid carcinoma (Bethesda 6) **(Figure 1B)**.

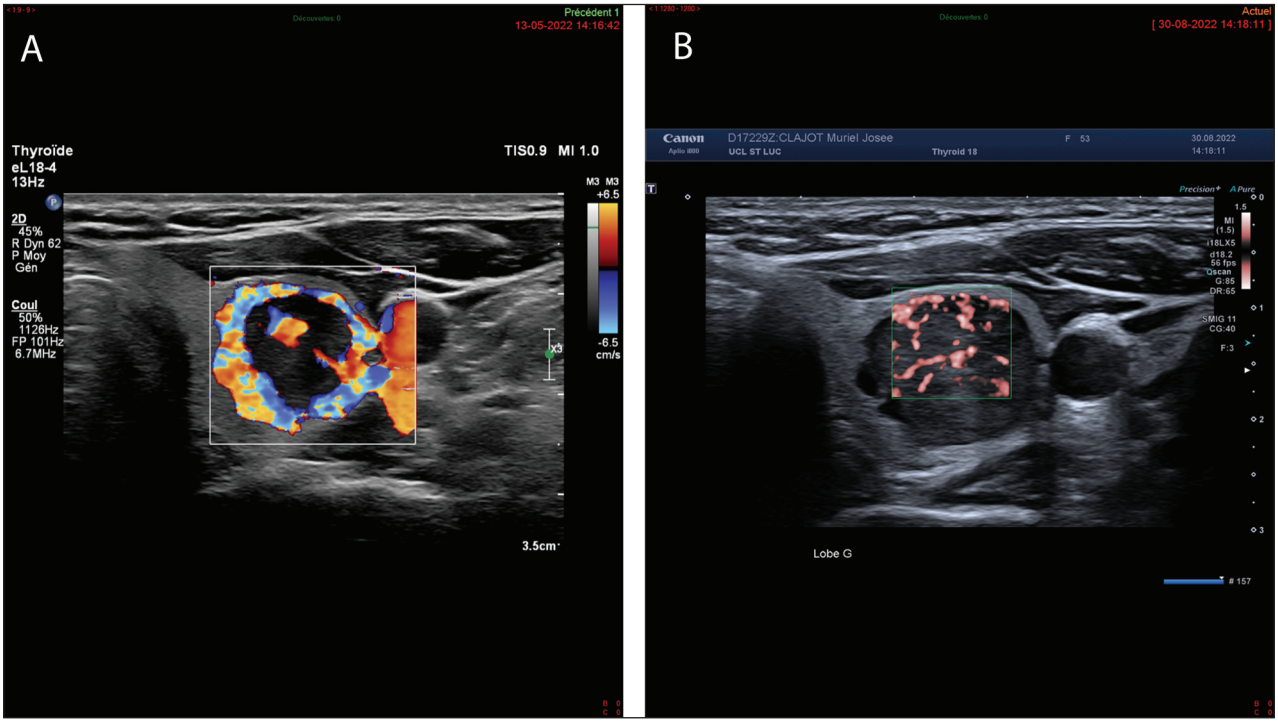

Figure 2 Comparison between vascularity obtained by colour Doppler imaging **(Figure 2A)** and a new technique depicting the microvascular flow imaging **(Figure 2B)**.

of FNA include a substantial rate of inconclusive results or indeterminate interpretations (2–30%). When cytology is indeterminate, molecular testing can further risk-stratify patients for observation or surgery. Core-needle biopsy (CNB) has been suggested as a complementary or even alternate method to FNA with a greater diagnostic accuracy compared to repeated FNA but sill with some limitations regarding differentiation between follicullar neoplasms and hyperplastic nodules [5].

ULTRASOUND-GUIDED ABLATION PROCEDURES FOR THYROID NODULES

There is an increasing interest to use ultrasound-guided thermal ablation procedures to treat both benign and malignant thyroid nodules. Thermal ablation techniques are differentiated based on the method used to develop this temperature differential and include radiofrequency ablation (RFA), laser ablation, microwave ablation and high-intensity focused ultrasound. For benign thyroid nodules, RFA appears the most effective US-guided ablation technique for treating solid, mixed, and spongiform nonfunctioning thyroid nodules. RFA is a developing application in primary thyroid cancer with some efficacy in the setting of recurrent and residual thyroid malignancy. Standardization of practices and reporting has emerged as an important component of multidisciplinary application of these technologies [6].

ARTIFICIAL INTELLIGENCE (AI) AND THYROID NODULES

There is evidence that AI increases diagnostic accuracy and significantly limits inter-observer variability by using standardized mathematical algorithms. It could also be of aid in practice settings with limited sub-specialty expertise, offering a second opinion by means of radiomics and computer-assisted diagnosis. However, the real effectiveness of AI systems remains controversial, taking into consideration the largest and most scientifically valid studies [7].

COMPETING INTERESTS

The author has no competing interests to declare.

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