

# The predictive value of selected ultrasound features in evaluating malignancy in thyroid nodules

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## Abstract:

**Background:** Thyroid ultrasound has been widely used to differentiate benign from malignant nodules; many investigators have tried to point out few ultrasonographic features in order to identify those lesions, which are at a higher risk of malignancy.

**Objectives:** To evaluate the efficacy of selected conventional ultrasound (US) features of thyroid focal lesions useful for predicting malignancy and establishing indications for fine-needle aspiration cytology (FNAC).

**Patients and Methods:** Two hundred and four consecutive patients with thyroid nodules who visited the outpatient clinic of the surgical department of Tikrit University teaching hospital for the period from January 2011 to April 2014, and who underwent surgery for clinical suspicion of malignancy; were examined by US before thyroidectomy. Conventional US evaluated the presence of a halo sign, hypoechogenicity and microcalcifications.

**Results:** On histology, 60 nodules were diagnosed as malignant and 148 as benign nodules. On US, the echographic pattern most predictive for malignancy was microcalcification ( $P = 0.0001$ ; specificity 78.0%; sensitivity 67.6%). The most specific combination on US, absent halo sign/microcalcifications ( $P < 0.005$ ; specificity 92.2%, sensitivity 27.6%).

**Conclusion:** Findings on US become effectively predictive for malignancy only when multiple signs are simultaneously present in a thyroid nodule. Thus the predictive value of these techniques increases at the expense of their sensitivity.

**Key words:** Ultrasound, Thyroid, Nodule, Malignancy, Feature.

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## Introduction

It has been estimated that palpable thyroid nodules are present in 4–7% of the population (1), but when examined by ultrasound (US), as many as 50–70% of subjects with no history of thyroid disease have been found to have incidentally discovered thyroid nodules, many of which are not palpable (2–3). Ultrasound is an ideal imaging modality for assessment of the thyroid gland (2). It is readily available, relatively inexpensive, and does not involve ionizing radiation. The superficial location of the gland readily lends itself to sonographic evaluation using high-resolution transducer (with its excellent spatial and contrast resolution).

The role of ultrasound in benign thyroid disease includes: Ultrasound helps confirm benignity of most thyroid nodules and helps to reassure patients and guide subsequent management. In addition, ultrasound also helps to identify the small number

of malignant nodules for better preoperative counseling of patients and timely management.

US can be used for follow-up of benign thyroid disease and surveillance to detect any associated malignancy and sequelae/ complications.

In addition, ultrasound is easily combined with FNAC which increases its diagnostic accuracy (3). Among several US patterns, hypoechogenicity of the nodule, microcalcifications and absence of halo sign were reported to be useful in predicting thyroid malignancy (2–4). The Society of Radiologists in Ultrasound consensus panel acknowledged that “although there are certain trends in the ultrasound distinction of benign and malignant thyroid nodules, there is also overlap in their appearances. Because of the inconsistent predictive value of ultrasound features, most agree that FNA and cytopathologic evaluation of a thyroid nodule are usually required before a patient undergoes surgical resection for a possible thyroid malignancy” (5-12).

The aim of this study was to assess the ability of conventional thyroid US, to predict malignancy of thyroid nodules.

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**Patients and methods:**

The study included 208 consecutive patients, with nodular goiter, who visited the outpatient clinic of the surgical department of Tikrit University teaching hospital for the period from January 2011 to April 2014, and who underwent surgery for clinical suspicion of malignancy. All the patients were euthyroid, as assessed by the thyroid function tests mini-VIDAS Lab system. US was performed using an apparatus (Philips ClearVue 850), with a 7.5 MHz linear transducer. The features evaluated; the halo sign, microcalcifications and nodule echogenicity relevant to surrounding glandular tissue. The data were analyzed statistically using the statistical package for Microsoft windows system (XLstat software) using Chi square and sensitivity/specificity tests of Galen.

**Results:**

From a total of 208 patients there were 140 females (mean age  $40.1 \pm 15$  years, range 17–72 years) and 68 males (mean age  $46.8 \pm 13.9$  years, range 15–68 years), Histological examination demonstrated malignancy in (29%) 60 nodules; while 148 nodules were benign. The size of malignant nodules was  $3.2 \pm 6.7$ ml (range 0.4–22); the size of benign nodules was  $10.5 \pm 12.4$  ml (range 0.3–58). The single US pattern that was most predictive of malignancy (Table 1) was microcalcification ( $P < 0.0001$ ; specificity 78.0%, sensitivity 67.6%). Absent halo sign/ microcalcifications was the most specific double combination (Table 2) of US patterns ( $P < 0.005$ ; specificity 92.2%, sensitivity 27.6%), no gain in specificity was obtained; when all the three patterns were considered together.

**Table (1): ultrasonographic features and histology in thyroid nodules.**

Sonographic pattern	Malignant	Benign	Significance	Specificity %	Sensitivity %	Positive predictive value %	Negative predictive value %
Microcalcifications	40/60	34/148	$P < 0:0001$	78	67.6	55	86
Absent halo sign	26/60	36/148	$P < 0:05$	76.6	55	56.6	77.7
Hypoechoogenicity	40/60	76/148	$P < 0:15$	49.6	67.6	35.4	79.2

**Table (2): Combined ultrasonographic features and histology in thyroid nodules.**

Sonographic features	Malignant	Benign	Significance	Specificity %	Sensitivity %	Positive predictive value %	Negative predictive value %
Absent halo sign + hypoechoogenicity	36/60	26/148	$P < 0:0001$	83.4	67	59	84.5
Absent halo sign + microcalcifications	16/60	10/148	$P < 0:005$	92.2	27.6	62.5	76.8
Hypoechoogenicity + microcalcifications	18/60	30/148	$P < 0:28$	80.7	31	27.4	74.7

**Discussion:**

The vast majority of these thyroid nodules are benign hyperplastic nodules; 2–6% of the population have multinodular thyroid with a clinically palpable mass. Compared with the very high prevalence of nodular thyroid disease, thyroid cancer is not common (13). Patients with multinodular thyroid are frequently asymptomatic, but may present with an anterior neck lump or swelling. Occasionally, patients present acutely with compressive symptoms or with a rapidly enlarging neck mass, most commonly caused by hemorrhage into an underlying hyperplastic thyroid nodule. Thyroid ultrasound has been widely used to differentiate benign from malignant nodules and to guide fine needle aspiration cytology (FNAC) (13-14). However, the accuracy and predictive values of sonographic

criteria are variable and no single ultrasound feature has both high sensitivity and positive predictive value for prediction of benignity or malignancy. In agreement with other authors, in this study we had found that intranodular microcalcification is the most predictive feature of malignancy on US (15-17); it

was found in 67.6% of malignant and in 21.9% of benign. The sensitivity (67.6%) and specificity (78.0%) was higher than in other studies (18). The absence of halo sign had lower sensitivity (55.0%) and specificity (76.6%) than intranodular microcalcifications, in agreement with other authors' observations (18–22). A hypochoic feature was found in 67.6% of malignant nodules and in 52.3% of benign nodules. Hypoechoogenicity, absence of halo sign and microcalcifications

have already been reported as markers suggestive of malignancy in thyroid nodules in previous reports (21, 23–28). In this study we found that the most predictive combination on US was absence of halo sign plus microcalcifications. This combination had a high specificity (92.2%), but a low sensitivity (27.6%); while the predictive value of other combinations was lower. In conclusion, only when multiple signs are simultaneously detected in a thyroid nodule; findings on US become highly predictive for malignancy. However, the predictive value of these features increases at the expense of their sensitivity.

Authors Contribution:

Dr. Waleed Qahtan Rajab: Researcher and supervisor

Dr. Ahmed Salim Khazaal: Researcher, operator and data collection

Dr. Mohammed Mahmood Habash: Researcher, operator and data collection

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