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ROLE OF ULTRASOUND TO DIFFERENTIATE BETWEEN BENIGN AND MALIGNANT THYROID NODULES WITH HISTOPATHOLOGICAL CORRELATION

Radio-Diagnosis

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ABSTRACT

Background: The only endocrine gland that may be directly examined because to its superficial placement and size is the thyroid gland, which is the largest of all endocrine glands. High resolution real-time gray-scale sonography with the thyroid gland's superficial position enables good visibility and assessment of both its pathologic status and normal structure. **Aim:** The goal was to link histopathology results with sonographic criteria to distinguish between benign and malignant thyroid nodules. **Materials and Methods:** From April 2022 to November 2022, based on criteria for inclusion and exclusion, 50 cases with thyroid nodules were included in the study. Each nodule's sonographic features were identified. After that, the outcomes were contrasted with histopathological diagnosis. **Results:** 40 benign and 10 malignant solitary thyroid nodules assessed by ultrasound out of 50 total cases were determined, 43 out of 50 instances were benign and 7 were malignant, according to histopathological analysis. To distinguish between benign and malignant etiologies, ultrasound is a relatively safe and accurate investigation with sensitivity of 85.7 % and specificity of 90.7%. In order to distinguish between benign and malignant lesions, USG has proven to possess greater sensitivity. **Conclusion:** Thyroid nodules were prevalent in women between the ages of 31 and 45. With a sensitivity of 85.7% and a specificity of 90.7%, ultrasound is a relatively safe and accurate test to distinguish between benign and malignant etiologies.

KEYWORDS

Ultrasound, Histopathology, Benign vs Malignant thyroid nodule.

INTRODUCTION:

Worldwide, 3-7% of adults are found to have nodular thyroid disease. They are prevalent in women, with a 5:1 incidence. The key factors influencing prevalence include age, sex, iodine consumption, treatment and environmental exposure. When evaluating thyroid nodules, ultrasound is a viable investigative method. Numerous thyroid nodules with cryptic clinical characteristics have been found by ultra-high resolution of ultrasonography. To distinguish between a benign and malignant tumor, numerous ultrasonography characteristics have been described. Despite the fact that the Society of Radiologists in Ultrasound has developed sonographic guidelines, there are no distinguishing ultrasonography characteristics between benign and malignant tumors, according to the American Thyroid Association and the European Thyroid Association. Size and shape of the nodule [taller than wide], Periodic expansion of nodule, significant hypoechogenicity, irregular borders, an appearance of microcalcifications, enlargement of lymph nodes, and adjacent structures are being invaded locally are ultrasonography characteristics that raise the risk that a nodule is malignant. It's still challenging to predict malignancy with ultrasound, due to the fact that benign and malignant thyroid nodules share some ultrasonography characteristics. When discriminating between thyroid nodules, ultrasonography characteristics are typically supported by histopathology findings. This study's objective is to assess the efficacy of an ultrasonography characteristics to distinguish between benign and malignant thyroid nodules and correlate with histopathological findings. [1,2]

MATERIALS AND METHODS:

Study population:

The study has been carried out after institutional committee acceptance and ethical clearance and data was collected. According to the inclusion and exclusion criteria, 50 cases of thyroid nodules, diagnosed by ultrasound were included in this study and compared with histopathological findings. The study is conducted in department of radio-diagnosis, D. Y. Patil Hospital and Research Institute, Kadamwadi, Kolhapur from march 2022 and December 2022.The study is primarily based on investigations as radiology itself is a tool of investigation. Informed consent has been obtained before any procedure from competent voluntary patient. Consent has been taken after explaining the procedure and receiving their approval to be included in the study.

Inclusion And Exclusion Criteria:

The study covered all of the individuals who had thyroid nodules measured by ultrasonography that were larger than 1.5 cm and regardless of size, any patient with thyroid nodules that are suspect of being malignant were included. The study eliminated those participants who had diffuse thyroid enlargement. [2]

Equipment &technique Of Examination:

The patients are examined by high frequency linear probe ideally at 13 MHz (right) adjusting the focus to point of interest. Every ultrasonography examination was done using LOGIC GE F8 machine. In a supine position with their neck extended, the patient is examined. In order to better expose the neck, a pillow is positioned beneath the shoulders. The 13 MHz linear transducer is utilized because the gland is located superficially. In both longitudinal and transverse planes, the thyroid gland is inspected from upper to lower poles, including the isthmus. Additionally, inspected are the indentation immediately above the clavicle, jugular veins, and bilateral carotid arteries. The ultrasonography characteristics used in the study were based on criteria that had previously been published.

STATISTICALANALYSIS:

Collected data will be presented in the form of tables and figures. Statistical analysis will be done using MS excel and statistical software SPSS (23.0) version. Sensitivity, specificity and predictive values will be calculated based on the appropriate statistical tests.

RESULTS:

Based on five sonographic characteristics, including the nodule's shape pronounced hypoechogenicity, microcalcifications, poorly defined borders, (taller than wide) and internal contents (predominantly solid or cystic), 10 of the 50 thyroid nodules at USG, evaluation were determined to be malignant, and the remaining nodules (40) were determined to be benign.50 nodules were examined cytologically and histopathologically; 43 (86%) were benign and 7 (14%) were malignant.

In present study, 50 patients were between the ages of 21 to 50 years. The age groups 31-40 years (50%) and 41-50 years (24%) have the highest number of cases, with females (78%) outnumbering males (22%). (table 1)

Most malignant nodules are poorly defined, with a form that is taller

than wide. Malignant nodules are the only ones to have microcalcifications. With the exception of a clearly defined peripheral halo, all malignant nodules are deeply hypoechoic. A large majority of malignant nodules have a solid character. However, benign solid nodules comprise the majority.

The majority of benign nodules have a thin, continuous halo around the edges and are highly defined. The nodules with eggshell calcifications on the edges are always benign. Although the majority of benign nodules are cystic, the majority of benign nodules are solid. The benign nodule's shape is oval, with a long axis running along the transverse plane. The majority of the nodules that are hypoechoic, isoechoic, and hyperechoic are benign.

The best indicators of a malignant thyroid nodule are microcalcifications, followed by a taller-than-wide shape, ill-defined edges, pronounced hypoechogenicity, and a lack of a peripheral halo. The USG's primary solid malignant nodule character provides low diagnostic accuracy for malignant thyroid nodules and is not statistically significant.

In 6 out of 7 cases, ultrasound properly identified malignancy, but it misdiagnosed 4 out of 39 benign nodules as malignancy. When used to predict malignancy, ultrasonography was found to have sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of 85.71%, 90.70%, 60%, 97.50%, and 90%, respectively. (table 3)

Table 1 : Age and sex distribution

age in years	male	female	total
21-30	1 (1%)	7 (14%)	8 (16%)
31-40	4 (8%)	21 (42%)	25 (50%)
41-50	3 (6%)	9 (18%)	12 (24%)
51-60	2 (4%)	4 (8%)	6 (12%)
61-70	1 (2%)	0	1(2%)
Total	11 (22%)	39 (78%)	50 (100%)

Table 2 The distribution of ultrasonography features in thyroid nodules, both benign and malignant

USG finding	Benign	malignant	Total
1.Margin			
Well defined	41 (93.1%)	3 (6.8%)	44
Poorly defined	2 (33.33%)	4 (66.66%)	6
2.calcification			
Present	2 (macro) (25%)	6 (microcalcification) (75%)	8
absent	41 (97.6%)	1 (2.38%)	42
3.echogenicity			
hyperechoic	27 (100%)	0	27
hypoechoic	0	7 (100%)	7
isoechoic	16 (100%)	0	16
4.internal contents			
Predominantly solid	40 (85.1%)	7 (14.8%)	47
Predominantly cystic	3 (100%)	0	3
5.shape			
Taller than wider	4 (50%)	4 (50%)	8
Not taller than wider	39 (95.1%)	3 (7.3%)	41

Table 3 Comparison of USG with histopathology

USG	Histopathology		
	Benign	Malignant	total
Benign	4	6	10
Malignant	39	1	40
total	43	7	50

Table 4 The role of USG features in thyroid nodule malignancy prediction

Suspicious us finding	Histopathology		sensitivity	specificity	PPV	NPV	Accuracy
	Malignant (n-7)	benign (n-43)					
Ill-defined margin	6 (85.7%)	3 (6.9%)	85.71%	93.18%	66.67%	97.62%	92.16%
micro calcification	5 (71.4%)	1 (2.3%)	71.43%	97.67%	83.3%	95.45%	94%
hypoechoic	5 (71.4%)	6 (13.9%)	85.71%	88.37%	54.55%	97.44%	88.00%
Solid echotexture	7 (100%)	8 (18.6%)	100%	81.40%	46.67%	100%	84%
Taller than wider	6 (85.7%)	2 (4.6%)s	85.71%	95.35%	75.00%	97.62%	94.00%

DISCUSSION:

A thyroid nodule is described as a discrete thyroid lesion that can be distinguished at USG from the surrounding parenchyma. In present study, 50 patients were between the ages of 21 to 50 years. The age groups 31-40 years (50%) and 41-50 years (24%) have the highest number of cases, with females (78%) outnumbering males (22%).40 benign and 10 malignant solitary thyroid nodules assessed by ultrasound out of 50 total cases were determined, 43 out of 50 instances were benign and 7 were malignant, according to histopathological analysis. ultrasound is a relatively safe and accurate investigation with sensitivity of 85.7 % and specificity of 90.7 %. In order to differentiating benign from malignant lesion, USG has proven to possess greater sensitivity.

The nodule's form has been investigated as a potential indicator of malignancy. In the current investigation, the majority of the malignant nodules had a form that was taller than wide. The results of this study show that the nodule's form, which is taller than wide has sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of 85.71%, 95.35%, 75%, 97.62%, and 94%, respectively, in predicting malignancy. These results demonstrate the low positive predictive value of the nodule's form. However, it is a trustworthy feature for excluding malignancy in a thyroid nodule on USG due to its high specificity, negative predictive value, and accuracy. (table 4) [3,4] When a nodule has significantly less echotexture than the nearby neck strap muscles, it is said to be severely hypoechoic. In the current study, hyperechoic nodules predominate, hypoechoic nodules and isoechoic nodules follow. There are only a few nodules, only identified in malignant thyroid nodules (5 out of 7), were discovered to be noticeably hypoechoic. This suggests that a thyroid nodule's severe hypoechogenicity is a reliable indicator of malignancy on an ultrasound. The current investigation demonstrates that marked hypoechogenicity accurately predicts thyroid nodule malignancy with sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of 85.71%, 88.37%, 54.55, 97.44%, and 88%, respectively. (table 4) [3,4]

The results of the current investigation demonstrated that, although they were not always present, microcalcifications were only present in malignant thyroid nodules (not seen in 2 out of 7 cases). When compared to other sonographic features on USG, microcalcifications were reported to have the best diagnostic accuracy (94%), specificity (97.67%), and negative predictive value (95.45%). This makes it a solid defining characteristics of benign and malignant thyroid nodules on USG. (table 4) [4]

A thyroid nodule is deemed to have a poorly defined margin if more than 50% of its perimeter is not well defined. Malignant lesions frequently have uneven or poorly defined spiculated borders. This study indicated that poorly defined margins for diagnosing malignant nodules had sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of 85.71%, 93.18%, 66.67%, 97.62%, and 92.16%, respectively. (table 4)

In the present investigation, the likelihood of a nodule being malignant can only be roughly predicted by its shape, when contrasted with additional ultrasonography feature such microcalcifications, poorly defined borders, and strong hypoechogenicity. But because of its high negative predictive value, it is a useful sonographic characteristic for excluding malignancy.

Comparing the USG results to the thyroid nodule's pathology findings allowed researchers to assess how well the USG detects malignancy in thyroid nodules. High diagnostic accuracy was established for the USG characteristics of poorly defined margins, significant hypoechogenicity, and taller-than wide shape for diagnosing malignant thyroid nodules. The results of the current investigation demonstrated that combining sonographic features that indicate

malignancy was more accurate than using only one sonographic feature. [5]

In this study, the majority (43 out of 50; 86%) of the nodules were determined to be benign; Adenomatous nodule/colloid nodule/hyperplastic nodule was the most prevalent kind, followed by follicular adenoma. The majority of benign nodules in the current study are clearly defined (93.1%), are growing along tissue planes, meaning that they are broader than tall (95.1%). In benign nodules, calcifications are typically absent or, if present, are macrocalcifications (25% of benign nodules have peripheral eggshell calcification). Most benign nodules are typically solid (85.1%) and have varying echogenicity. However, all cystic lesions or lesions that are primarily cystic are benign. The majority of isoechoic and hyperechoic nodules are benign. (table 2) [5,6]

In conclusion, benign nodules frequently have well-defined edges and a shape that is broader than tall, which are reliable indicators of the nodule's benign nature. Despite the fact that benign nodules do not exhibit calcification, the existence of macrocalcifications or peripheral eggshell calcifications supports the benign nature of the nodules. In benign nodules, microcalcifications nearly never happen. Hyper echogenicity is only observed in benign nodules, despite the fact that their echogenicity can vary. [7]

US characteristics include pronounced hypoechogenicity, ill-defined margins, microcalcifications, and a form that is taller than wide were discovered to be effective predictors of malignancy. The best accuracy for predicting malignancy has been shown to be in microcalcifications. out of all indicators discussed above. ultrasound is a relatively safe and accurate test to distinguish between benign and malignant etiologies. [8,9]

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