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TO EVALUATE ROLE OF MORPHOLOGICAL CRITERIA ON USG AND ELASTOGRAPHY IN DIFFERENTIATING BENIGN AND MALIGNANT THYROID LESION

Radiodiagnosis

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ABSTRACT

Introduction: Thyroid nodules are common and are commonly benign. The reported prevalence of nodular thyroid disease depends on the population studied and the methods used to detect nodules. Numerous studies suggest a prevalence of 2-6% with palpation, 19-35% with ultrasound, and 8-65% in autopsy data.

Aims and objectives: To evaluate diagnostic reliability of ultrasound morphological criteria (ACR-TIRADS system) and elastographyin differentiating benign from malignant thyroid nodules in patients using cytopathology or histopathology as gold standard.

Materials and methods: Prospective observational study, Patients visiting LLR (Hallet) Hospital with clinically suspicious thyroid nodule, LLR (Hallet) Hospital, GSVM Medical College, Jan 2019 to Oct 2020.

Result: Showing distribution of composition of nodules in our study subjects Maximum nodules have mixed solid cystic composition . Showing distribution of echogenicity of nodules in our study subjects. Maximum nodules in our study have to hyperechoic echogenicity. Showing distribution of margin of nodules in our study subjects. Maximum nodules in our study have ill defined margin.

Conclusion: In conclusion, no single investigation was found to be 100% sensitive or specific in diagnosing malignancy in nodular goiter but a good clinical, FNAC and USG examinations are complimentary to each other in predicting malignancy and avoid unnecessary or inadequate surgery.

KEYWORDS

ACR-TIRADS, thyroid nodule and malignant thyroid.

INTRODUCTION

Thyroid nodules are common and are commonly benign. The reported prevalence of nodular thyroid disease depends on the population studied and the methods used to detect nodules. Numerous studies suggest a prevalence of 2-6% with palpation, 19-35% with ultrasound, and 8-65% in autopsy data. With widespread use of sensitive imaging in clinical practice, incidental thyroid nodules are being discovered with increasing frequency. Ultrasonography is the most accurate and cost-effective method for evaluating and observing thyroid nodules. Current ultrasonography machines are relatively inexpensive, sensitive, and easy to operate. Most endocrinologists are now using ultrasound examination in the initial evaluation of a patient with known or suspected thyroid nodules.[1]

High resolution ultrasound is the ideal imaging modality for evaluation of thyroid gland due to its superficial location, homogenous echotexture, and relatively profuse normal vasculature and clearly defined surrounding structure anatomical landmarks. Colour and power doppler examination are also facilitated by combination of surety.[2]

Thyroid nodules are clinically important for several reasons. They may cause thyroid dysfunction and rarely compressive symptoms, but they are primarily important because of the need to exclude thyroid cancer. There are wide variations in the reported proportion of malignancy among the clinicallyor radiologically detected thyroid nodules. The average prevalence of malignancy rates across the world in thyroid nodules, as evaluated by invasive procedure ranges from 4.0 to 6.5%.[3]

One of the major challenges in thyroid ultrasound is overlap in appearances between benign and malignant nodules. According to the American Thyroid Association guidelines, no single US feature or combination of features is adequately sensitive or specific to identify all malignant nodules.[4]

Varying combinations of features can strongly influence the likelihood of benignity or malignancy within individual nodules and helps to guide further management. These features help to select the choice of nodules to undergo ultrasound guided fine needle aspiration(FNA) for cytological evaluation.[5]

General features more commonly associated with malignant nodules are: marked hypoechogenicity, calcification (particularly microcalcification), spiculated margins and taller than wide shape. Conversely, relatively benign features are isoechogenicity, predominantly cystic appearance and comet tail artifact.

Thyroid elastography is increasingly being used in the evaluation of thyroid nodules and has been documented to be useful in differentiating benign from malignant thyroid nodules. Elastography works on the principle of detecting decreased elasticity (increased stiffness) of tissue. Malignant tumors, in general, have firmer stroma due to increased presence of collagen and myofibroblasts. Hence decreased elasticity of any tissue in general is treated with a suspicion of malignancy.

There are two kinds of elastography (strain and shear wave elastography) that are currently used in clinical practice.

The high frequency of benign versus malignant nodules creates a dilemma, how to manage patients with thyroid nodules that most probably are benign. To overcome this dilemma, thyroid nodules in FNAC are classified as benign, malignant, suspicious, and insufficient for diagnosis. By considering this classification, clinicians will be able to decide if the thyroid nodule should be removed by surgery or not. In fact, introduction of FNAC into the field of thyroid diagnostic tests has reduced thyroid surgeries considerably.

To evaluate diagnostic reliability of ultrasound morphological criteria (ACR-TIRADS system) and elastographyin differentiating benign from malignant thyroid nodules in patients using cytopathology or histopathology as gold standard.

MATERIALAND METHODS

STUDY AREA: LLR (Hallet) Hospital, GSVM Medical College.

STUDY POPULATION: Patients visiting LLR (Hallet) Hospital with clinically suspicious thyroid nodule.

SAMPLE SIZE: 100 thyroid nodules.

STUDY DURATION: Jan 2019 to Oct 2020.

STUDY TYPE: Prospective observational study.

INCLUSION CRITERIA:

- Patients who gave consent to FNAC.
- All the patients aged> 18 years undergoing FNAC of thyroid nodules in our intervention radiology department.
- Patients having either clinically palpable/sonologically detected thyroid nodules.
- Both genders.

EXCLUSION CRITERIA:
- Patients who do not give consent to FNAC.
- Patient age <18 years.
- Patients with diffuse thyroid diseases, with non thyroid lesions.

Patients with FNAC contraindication (bleeding diathesis, local skin infections).

RESULTS AND DISCUSSION

Diagnosing the patients having benign or malignant thyroid nodules in early stage is most important in patient care and management. Ultrasound morphological criteria and elastography can be used to determine wheather the thyroid nodule is benign or malignant and is important to avoid unnecessary surgical intervention.

Our study included 70 patients, total 100 thyroid nodules. Age distribution in our study population include 4.3% (3) of patients between 18-20 years age, 10%(7) patients were between 21-30 years, 11.4%(8) patients were between31-40 years, 27.1%(19) patients were between41-50 years,21.4%(15) patients were between 51-60 years,14.3%(10) patients were between 61-70 years,11.4%(8) patients were >70 years. The Mean age of the study group is 49 years.

In our study majority of patients i.e 27.1 % were in 41-50 year age group. The youngest patient with thyroid nodule of our study was 18years and the oldest was 86 years.

The study included 62.9 % females and 37.1% male's shows thyroid nodules are more common in females. Which correlates with almost all previous studies.

The right lobe of thyroid was the most common location for both benign (62%) and malignant (7%) thyroid nodules. On the whole, the malignant thyroid nodules (average 3.0 cm, range=0.8 to 6.0cm) were found to be slightly smaller in size than the benign nodules (average 3.5 cm, range=0.9 to 6.8cm). During previous study done by Mohanty J et al [6], 2019 found that malignant nodules were smaller (average 2.4cm, range=0.9 to 5.6cm) than benign nodules (average 2.6cm, range=0.7 to 5.4cm).

Pathological results showed that out of 100 nodules 11 were malignant and 89 were benign, which corresponds with 11% malignancy rate among all thyroid nodules. Previous study done by Moifo *et al* [7], 2013, showed malignancy rate of 9.5% and 2.4 % respectively, so in our study malignancy rate among studied nodules was higher than these both studies.

In our study most common group was Bethesda II benign nodule (84%) of the total nodules, among them maximum were colloid nodule (70%), Nodular goitre (8%), Benign cystic lesion (5%) and granulomatous (subacute) thyroiditis (1%).

Suspicious for malignancy Bethesda V was detected in (6%) of the total nodules , these nodules were further evaluated with histopathology and were found to be papillary carcinoma thyroid.

Malignant Bethesda VI was seen in (2%) of the total nodules which on subsequent evaluation by histopathology were found to be papillary carcinoma thyroid.

Bethesda grade III (Follicular Neoplasm) was detected in (3%) of the total nodules which were found papillary thyroid carcinoma on post operative histopathology Bethesda I was noted in total 5%of the total nodules which on subsequent repeat FNAC were proved to be benign Bethesda Group II Study done by Mohanti j et al [6] 2019 showed the most common benign nodule was colloid nodule (68%) and most common malignant nodule was papillary carcinoma (14%). Other pathologic findings included follicular adenoma (4%), inflammatory pseudo nodule (2%), granulomatous thyroiditis (2%), Medullary thyroid carcinoma (4%), follicular carcinoma (2%), follicular variant of papillary carcinoma (2%) and anaplastic carcinoma (2%).

Risk of malignancy for various features were as follows in our study of 100 nodules: Composition-cystic (0%), spongiform (0%), solid-cystic (27.3%) and solid (63.6%); Mohanti J et al [6] (2019) found Solid nodules were the most common composition comprising 66% of all nodules. Mixed solidcystic and spongiform nodules were each 16% and cystic nodules were 2% in numbers.

Echogenicity-anechoic(0%), Iso-hyperechoic (9.1%), hypoechoic (54.5%) and markedly hypoechoic (36.4%) Mohanti J et al [6] 2019 in their study found that Hyperechoic nodules is the most common type (42%), followed by hypoechoic (34%) and isoechoic nodules (18%). Markedly hypoechoic nodules comprised of 4% and anechoic nodules were only 2%.

Shape-wider-than-tall (54.5%) and taller-than-wide (45.5%); Mohanti J et al [6] (2019) Most of the nodules in his study were wider than tall (94%). Only 6% were taller than wide.

Margins-smooth (0%), illdefined (27.3%), lobulated/irregular (54.5%) and extrathyroid extension (9.1%).Most of the nodules in study done by Mohanti J et al [6] 2019 had a smooth margin (64%). 26% showed irredular/lobulated margin. 8% of the nodules had an illdefined margin and only 2% had extra thyroid extension.

Echogenic foci-none or comet tail artfacts (18.2%), macro calcification (9.1 %), rim calcification (36.4%) and punctate calcification (36.4%).Most of the nodules in study done by Mohanti J et al [6]2019 did not have any echogenic foci (60%). 16% of the nodules had punctuate acrogenic foci, 14% had macro calcification, 6% had large comet tail artifacts and 4% had rim calcification.

Nodules having Elasographic score 1,2 showed 9.1% and score 3,4 showed 90.9% malignancy in our study. Elastographyshowed Sensitivity 79.8 %, Specificity100 %, PPV 100.0%, NPV37.9%, Accuracy82.0% for characterization of thyroid nodules. Study done by Rubaltelli L et al [8] 2008 found Specificity, sensitivity and accuracy ,predictive positive value (PPV) and predictive negative value (PNV) 87.5 %, 81.8 % , 86.2 %,94.5 % and 64 % respectively. Asteria C et al [9] 2008 calculated sensitivity, specificity, PPV, NPV and accuracy 94.1%, 81%,55.2% and 98.2% respectively. Merino S et al [10] 2011 found 100% sensitivity and 40.6% specificity.

There are reports to suggest that USE is not suitable for the diagnosis of Follicular Lesion of Undetermined Significance, as four of nine Follicular Lesion of Undetermined Significance in the meta-analysis published by Bojunga et al [11] 2010 were missed on USE. In our study total 3% cases of Follicular Lesion of Undetermined Significance (FLUS) one of them that was incorrectly scored. Highlighting the limitation of USE in this scenario. It is believed that most types of thyroid cancers have consistently increased stiffness and hence reliably picked up by thyroid elastography. The exception to this rule is Follicular Lesion of Undetermined Significance with modified elasticities, explaining the poorer performance of elastography in their detection.

The sensitivity for prediction of malignancy in our study was highest for solid or almost solid composition (63.6 %) and specificity was highest for punctuate calcification (98.9%). Mohanti J et al [6] 2019 found 100% risk for malignancy in Markedhypoechogenicity and extrathyroid extension with while cystic, spongiform and mixed solid-cystic composition, anechoic echogenicity, ill-defined margins and long comet tail artefacts had 100% PPV for benignity with 0% malignancy risk. Hence in our study there was no single parameter that had high sensitivity and specificity both to be used as a predictor of malignancy and screen patients for FNAC.

Our study showed an increasing risk of malignancy with higher scored characteristic as described in ACR-TIRADS lexicon.

Out of all the suspicious features of malignancy highest risk was found for solid (63.6%); lobulated/irregular (54.5%), wider-than-tall (54.5%) and taller-than-wide (45.5%). Cystic, spongiform and composition, anechoic echogenicity showed 100% PPV for benignity and 0% malignancy risk. Study done by Mohanti J et al [6] 2019 found that out of all the suspicious features of malignancy highest risk was found for Markedhypoechogenicity and extrathyroid extension with 100% risk. Cystic, spongiform and mixed solid-cystic composition, anechoic echogenicity, illdefined margins and long comet tail artefacts had 100% PPV for benignity with 0% malignancy risk.

On categorizing nodules into ACR-TIRADS categories from TIRADS 1 to TIRADS 5, number of nodules in each category was found to be 5%,29%,36%,21%and 9%respectively which on correlating with the FNAC/Histopathology results our study showed an increase in risk of malignancy with increase in ACR-TIRADS categories. Amongst ACR-TIRADS (TR) categories TIRADS 1, TIRADS 2 and TIRADS 3 had 0% risk while TIRADS 4 had 18.2% and TIRADS 5 had 81.8% risk of malignancy with p value of < 0.001.

White Paper of the ACR TI-RADS Committee by Tessler et al [12] 2017 has categorized the risk as <2% for TIRADS 1 and 2, 2-5% for TIRADS 3, 5-20% for TIRADS 4 and >20 for TIRADS 5. Mohanti J et al [6] 2019 found 0% risk in TIRADS 1, TIRADS 2 and TIRADS 3, 30% risk in TIRADS 4 and 56% risk in TIRADS 5. A statistically significant correlation was noted with p-value 0.001.

Table: Showing distribution of composition of nodules in our study subjects, Showing distribution of echogenicity of nodules in our study subjects and Showing distribution of margin of nodules in our study subjects

		%	
Composition	**Cystic or Almost Cystic**	0	88.0%
		1	12.0%
	Spongiform	0	73.0%
		1	27.0%
	Mixed Solid Cystic	0	61.0%
		1	39.0%
	Solid or Almost Solid	0	78.0%
		1	22.0%
Echogenicity	**Anechoic**	0	88.0%
		1	12.0%
	Iso / hyperechoic	0	47.0%
		1	53.0%
	Hypoechoic	0	73.0%
		1	28.0%
	Very hypoechoic	0	93.0%
		1	7.0%
Margin	**Smooth**	0	65.0%
		1	35.0%
	Ill defined	0	49.0%
		1	41.0%
	Lobulated or irregular	0	81.0%
		1	19.0%
	extrathyroidal extension	0	95.0%
		1	5.0%

CONCLUSION

In conclusion, ACR-TIRADS and elastography was found to be a highly specific and accurate classification system for categorizing the thyroid nodules based on ultrasound features, for assessing the risk of malignancy. If the nodules are properly classified on ultrasound, the probability of a particular nodule being malignant can be inferred from the ultrasound-based TIRADS system with a certain level of confidence and appropriate measures for management of the nodule can be initiated, thus avoiding unnecessary FNA procedures.

- At the end of our study, none of the nodules classified under TIRADS 1,2, 3 turned out to be malignant; therefore, it can be safely assumed that FNA may be deferred at least in patients having TIRADS 1,2,3 nodule, which contribute to majority of newly detected cases and thereby avoiding unnecessary surgeries.
- However, USG fairly helps in characterization of thyroid nodules, but cannot be taken as a single tool in assessing malignancy. It aids in deciding which nodule should undergo FNAC. Direction of fine needle aspiration biopsy can be best accomplished with sonography. This preliminary work can be used as a guide to the evolving management protocol of thyroid nodules.
- Ultimately, no single investigation was found to be 100% sensitive or specific in diagnosing malignancy in nodular goiter but a good clinical, FNAC and USG examinations are complimentary to each other in predicting malignancy and avoid unnecessary or inadequate surgery.

REFERENCES

1. Dean DS, GharibH.BestPract Res ClinEndocrinolMetab. 2008 Dec;22(6):901-11. Doi: 10.1016/j.beem.2008.09.019. Review.PMID:19041821
2. De Matos PS, Ferreira AP, Ward LS.Prevalence of papillary microcarcinoma of the thyroid in Brazilian autopsy and surgical series. EndocrPathol. 2006;17:165–73.
3. Kovacs GL, Gonda G, Vadasz G, Ludmany E, Uhrin K, Gorombey Z, et al. Epidemiology of thyroid microcarcinoma found in autopsy series conducted in areas of different iodine intake. Thyroid. 2005;15:152–7
4. D. S. Cooper, G. M. Doherty, B. R. Haugen et al., "Revised American thyroid association management guidelines for patients with thyroid nodules and differentiated thyroid cancer," Thyroid, vol. 19, no. 11, pp. 1167–1214, 2009
5. Kim EK, Park CS, Chung WY, Oh KK, Kim DI, Lee JT, et al.New sonographic criteria for recommending fine-needle aspiration biopsy of nonpalpable solid nodules of the thyroid. AJR Am J Roentgenol. 2002;178:687–691
6. Mohanty J, Sanket, Mishra P. Role of ACR-TIRADS in risk stratification of thyroid nodules. Int J Res Med Sci 2019;7:1039-43
7. Moifo B, Takoeta EO, Tambe J, Blanc F, Fotsin JG. Reliability of thyroid imaging reporting and data system (TIRADS) classification in differentiating benign from malignant thyroid nodules. Open J Radiol. 2013;3:103
8. Rubaltelli L, Corradin S, Dorigo A, Stabilito M, Tregnaghi A, Borsato S, Stramare R.Ultraschall Med. 2009 Apr;30(2):175-9. doi: 10.1055/s-2008-1027442. Epub 2008 May 21.PMID18496776
9. Asteria C, Giovanardi A, Pizzocaro A, Cozzaglio L, Morabito A, Somalvico F, et al. US-elastography in the differential diagnosis of benign and malignant thyroid nodules. Thyroid. 2008;18:523–531
10. Merino S, Arrazola J, Cardenas A, Mendoza M, De Miguel P, Fernandez C, et al. Utility and interobserver agreement of ultrasound elastography in the detection of malignant thyroid nodules in clinical care. AJNR Am J Neuroradiol 2011;32:21422148
11. Bojunga J, Herrmann E, Meyer G, Weber S, Zeuzem S, Friedrich-Rust M. Real-time elastography for the differentiation of benign and malignant thyroid nodules: A meta-analysis. Thyroid. 2010; 20:1145–50.
12. Tessler FN, Middleton WD, Grant EG, Hoang JK, Berland LL, Teefey SA, Cronan JJ, Beland MD, Desser TS, Frates MC, Hammers LW. ACR thyroid imaging, reporting and data system (TI-RADS): white paper of the ACR TI-RADS committee. Journal of the American college of radiology. 2017 May 1;14(5):587-95.