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Original Research Article

Correlation of radiological parameters with cytological finding in the diagnosis of thyroid swelling

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ABSTRACT

Introduction: Thyroid gland diseases are the most common endocrine disease seen in clinical practice after Diabetes mellitus. Ultrasound parameters along with correlation with cytology finding helps in differentiate between benign and malignant thyroid nodule.
Aim: The purpose of this study was to study the sonographic features of various benign and malignant thyroid nodules, and to correlate the sonographic findings with Fine Needle Aspiration Cytology (FNAC) and so as to evaluate the accuracy of ultrasonography in diagnosing benign and malignant nodules.
Materials and Methods: The study was conducted in the Pathology department in collaboration with the Radiology Department on 209 patients who were send for ultrasound for thyroid swelling. These patients were further send for fine needle aspiration to the pathology department.
Result: The majority of cases which turned malignant on cytology report in this study have association with ultrasound features like predominant solid lesion, hyperechoic lesion, irregular margin, AT ratio greater than 1, absent peripheral halo, microcalcification along with increased internal vascularity and solitary nodules.
Conclusion: Ultrasonography of thyroid nodules along with fine needle aspiration cytology serves as a best screening test to detect malignancy in outpatient department. The use of different parameters in ultrasound helps in categorizing the lesion and their management. In this study we have association with ultrasound features like predominant solid lesion, hyperechoic lesion and irregular margin, AT ratio less than 1, absent peripheral halo, microcalcification along with increased internal vascularity and solitary nodules with malignancy on cytology.

1. Introduction

Thyroid gland disease are the most common endocrine disease seen in clinical practice after Diabetes mellitus.[1] The prevalence of thyroid related disease is 3-8 % of the general population contributing around 42 million people in india are suffering from thyroid disease presently in India as per various studies.[2,3] Ultrasonography (USG) gives good knowledge of its internal anatomy and its relation with adjacent organs and details of different pathological features which occurs in benign and malignant lesion of thyroid without using ionizing radiation or iodine-containing contrast medium.[4,5] It tells about internal composition (solid or cystic), presence of nodularity, echogenecity of mass, invasion in nearby structures, antero-transverse diameter, assessment of blood flow pattern in and around lesion, calcification and presence of peripheral halo to differentiate between benign and malignant thyroid nodule.[6,7] Fine-needle aspiration cytology (FNAC) is the first investigation of choice in thyroid swellings. Fnac is simple and quick to perform in the outpatient department has excellent patient compliance, and can be repeated

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in case of doubt.[8] FNAC is the best single test for discriminating malignant thyroid nodules due to its high sensitivity and specificity, Innumerable research have been performed for use in thyroid ultrasonography (USG) parameters to differentiate benign from malignant thyroid nodules.[9–13]

2. Aim of the study

The purpose of this study was to study the sonographic features of various benign and malignant thyroid nodules, and to correlate the sonographic findings with Fine Needle Aspiration Cytology (FNAC) and so as to evaluate the accuracy of ultrasonography in diagnosing benign and malignant nodules.

3. Materials and Methods

The study was conducted in the Pathology department in collaboration with the Radiological Department on 209 patients who were send for ultrasound for thyroid swelling. These patients were further send for fine needle aspiration to the pathology department.

3.1. Inclusion criteria

1. Patients selected for this study were undiagnosed cases with palpable thyroid swelling.
2. Patients selected for this study were undiagnosed cases with clinically non palpable thyroid swelling but detected on ultrasound.

3.2. Exclusion criteria

1. Patients excluded were from previously diagnosed cases of thyroid disease.
2. Patients excluded were follow up for treatment of thyroid disease.

The investigations were performed on cases using a high frequency probe ultrasound machine. The 8 parameters used were

1. Internal Composition (Solid, Predominantly solid, Cystic, Predominantly cystic and Spongiform)
2. Echogenecity (isoechoic, hyperechoic, hypoechoic, heterogeneous)
3. Margins (Well defined or Poorly defined)
4. Antero-posterior and Transverse Ratio (AT Ratio > 1 or < 1)
5. Peripheral halo (Present or Absent)
6. Calcification (Macro-calcification or Micro-calcification)
7. Internal Vascularity (increased or decreased or peripheral)
8. Nodules (Absent or single or multiple)

Fine needle aspiration was done using a 21 gauge spinal needle with suction using 10 ml syringe under all aseptic conditions. The cytology slides were air dried and wet fixed in Absolute Ethanol and air dried were stained with Liesman – Giemsa stain and wet fixed slides were stained with Papanicolaou stain. These slides were examined under microscope and categorize into Benign and Malignant on cytology and were subclassified also.

4. Result

In this study it was seen that out of 209 patients 83.73 % of patients are female and 16.26% were male. The mean Age (Years) was 36.67 ± 15.17.

In this study it was seen most patients were in the age group of 40-49 yrs(24%) followed by 20-29 yrs (23%) in the female group while in the male patient most patients are in age group of 20-29 yrs(33%) followed by 40-49 yrs and 50-59 yrs (18%).

Among 209 thyroid cases, 15 cases were reported malignant in Fnac report. Fisher's exact test was used to explore the association between cytological diagnosis and ultrasound parameters.

Among the Ultrasound features regarding composition, predominantly Solid (20.0%) had the largest proportion of Malignant report on cytology while predominantly cystic, cystic, spongiform had the largest proportion of Benign on cytology. Regarding echogenecity, hyperechoic (11.1%) and hypoechoic (7.0%) had strongest association with malignant on cytology report while hypoechoic (93%) on ultrasonography were associated with benign on cytology report.

In respect to margin on ultrasound, irregular margin (20.6%) on USG had the largest proportion of malignant on cytology report while defined Margin (98.6%) of the patients were turned benign on cytology report. Among the ultrasound features regarding AT Ratio, AT Ratio: > 1 had the largest proportion of association with Malignant on cytology and Antero-Transverse Ratio: < 1 had the largest proportion of association with Benign on cytology.

In respect to peripheral halo, absent peripheral halo (8.1%) were associated more with malignancy on cytology and peripheral halo present (97.2%) were more associated with benign on cytology. In view of calcification observed in this study, Microcalcification was strongly associated with malignancy on fnac report and Macrocalcification were strongly associated with benign on cytology report.

Among the internal vascularity features observed in ultrasound, increased internal vascularity (22.8%) were strongly associated more with malignancy on cytology and peripheral vascularity (100%) was associated more with benign on cytology. Among types of nodules, solitary nodules (8.0%) are associated more with malignancy on cytology while multiple nodules (92.5%) are associated more with benign on cytology report.

The majority of cases which turned malignant on cytology report in this study have association with ultrasound features like predominant solid lesion, hyperechoic lesion and irregular margin, AT ratio more than 1, absent peripheral halo, microcalcification along with increased internal vascularity and solitary nodules.

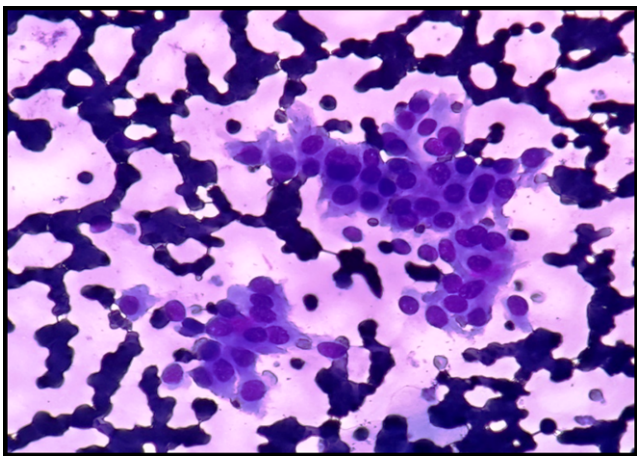

Fig. 1: Showing benign thyroid follicular cells in monolayered sheets in Colloid goiter with background of thin colloid. (MGG Stain 100X).

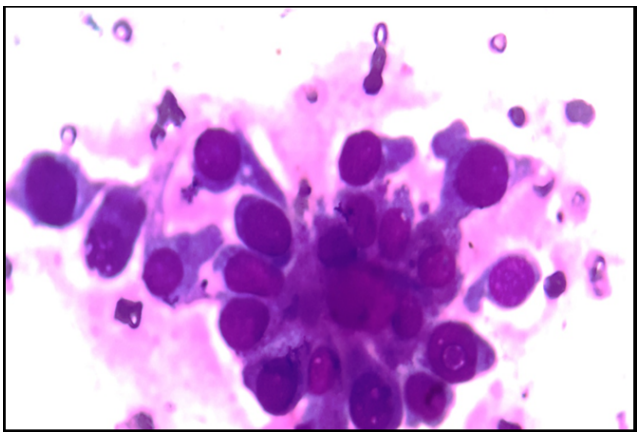

Fig. 2: Thyroid follicular cells showing open fine chromatin and intranuclear inclusion (MGG Stain 400X).

5. Discussion

The present study was focused on correlation of ultrasound features with cytological diagnosis has shown similarity of parameters with the other studies. Most of the cases of thyroid nodules were in age group of 20-29 in males and 40-49 in females.

Thus in this study we have seen that a predominantly solid nodule, hyperechogenecity, irregular margin, AT Ratio > 1 and microcalcification and increased internal vascularity

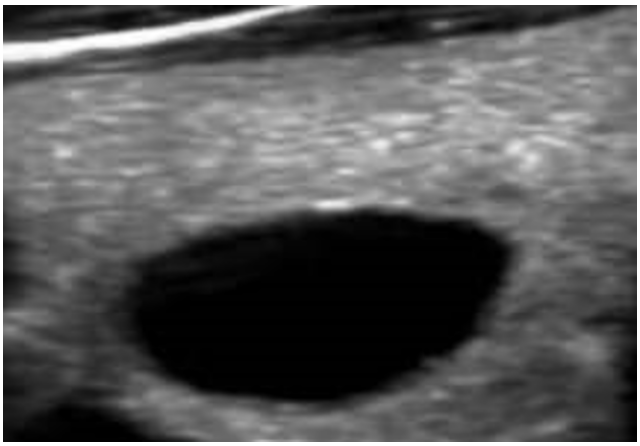

Fig. 3: USG showing a well marginated solitary unechoic cystic colloid nodule

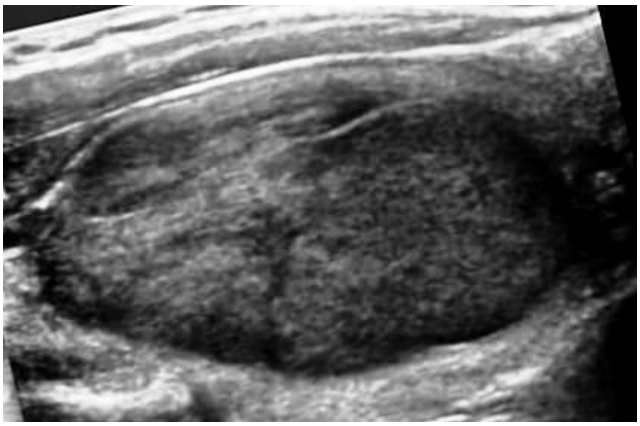

Fig. 4: USG showing a well defined homogeneous solitary thyroid nodule

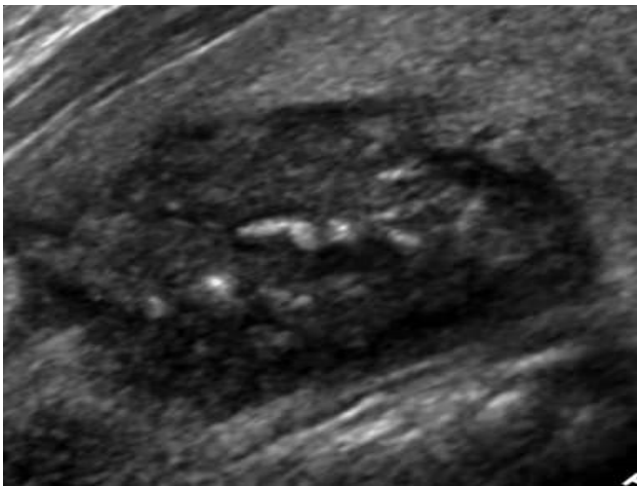

Fig. 5: USG showing Solitary inhomogeneous, hypoechoic mass lesion, irregular in outline and showing multiple punctate echogenecity representing microcalcifications (psammoma bodies)

Table 1: Gender distribution

	Number	Perentage
Female	175	83.73%
Male	34	16.26%
Total number of Cases	209	100%

Table 2: Age and Gender wise Distribution of Cases.

Age group	Female		Male		Grand Total
<20	23	13%	2	6%	12%
20-29	41	23%	11	33%	25%
30-39	36	21%	3	9%	19%
40-49	42	24%	6	18%	23%
50-59	17	10%	6	18%	11%
60-69	16	9%	4	12%	10%
70-79	00	0%	1	3%	0%
Total	175	100%	34	100%	100%

Table 3: Distribution of the Cases in Terms of Different Ultrasound features.

USG Features	Benign	Malignant	Total
Composition			
Predominantly Solid	24	6	30
Solid	82	08	90
Predominantly Cystic	38	0	38
Cystic	49	0	49
Spongiform	02	0	02
Echogenecity			
Isoechoic	14	01	15
Hyperechoic	25	02	27
Hypoechoic	132	10	142
Heterogenous	24	01	25
Margins			
Defiened	145	01	146
Poorly defiened	40	13	63
At ratio			
AT Ratio <1	166	09	175
AT Ratio >1	29	05	34
Peripheral HALO			
Present	35	01	36
Absent	160	13	173
Calcification			
Macrocalcification	41	01	42
Microcalcification	08	04	12
Absent	146	09	155
Internal vascularity			
Increased	44	13	57
Decreased	140	01	141
Pheripheral	11	00	11
Nodules			
Absent	14	00	14
Solitary	82	06	88
Multiple	101	06	107

Table 4: Distribution of the cases in terms of cytological features

Cytological Features	Frequency	Percentage
Colloid Goiter	123	58.9%
Hyperplastic Nodule	22	10.5%
Lymphocytic Thyroiditis	15	7.2%
Hashimoto's Thyroiditis	12	5.7%
Papillary Thyroid Carcinoma	9	4.3%
Thyroglossal Cyst	5	2.4%
Adenomatoid Nodule	4	1.9%
Benign Cystic Lesion	3	1.4%
Follicular Neoplasm	3	1.4%
Aberrant Thyroid	2	1.0%
Adenomatoid Goiter	2	1.0%
De Quervian's Thyroiditis	2	1.0%
Thyroid Adenoma	2	1.0%
Anaplastic Carcinoma	1	0.5%
Chronic Lymphocytic Thyroiditis	1	0.5%
Follicular Thyroid Carcinoma	1	0.5%
Giant Cell Thyroiditis	1	0.5%
Medullary Thyroid Carcinoma	1	0.5%

Table 5: Sensitivity and Specificity and Positive and Negative Predictive value along with Accuracy of different USG Parameters

Parameters	Sensitivity	Specificity	PPV	NPV	Diagnostic Accuracy
Predominant Solid	100.0%	45.9%	12.5%	100.0%	49.8%
Hypoechoic/Hyperechoic	86.7%	19.6%	7.7%	95.0%	24.4%
Irregular Margin	86.7	74.2%	20.6%	98.6%	75.1%
Antero-Transverse Ratio > 1	40.0%	85.6%	17.6%	94.9%	82.3%
Absent Peripheral Halo	93.3%	18.0%	8.1%	97.2%	23.4%
Microcalcification	26.7%	95.9%	33.3%	94.4%	90.9%
Internal vascularity	11.0%	94.3%	0.0%	92.4%	87.6%
Solitary Nodules	53.3%	49.0%	7.5%	93.1%	49.3%

have more diagnostic accuracy to detect malignancy on cytology.

In our study among USG parameters like internal composition we have noticed predominant solid lesion has more association with malignancy, having sensitivity of 100% and specificity of 45% with accuracy of 49.8%. Sharma et al[14] had reported a solid lesion has high sensitivity (100%) in predicting malignancy but accuracy is low (49.2%). Frates et al[15] also reported that solid composition has highest sensitivity (of 69.0% to 75.4%) in predicting malignancy; however the chance of being malignant of solid nodule predictive value is low (15.6% - 27%) Kwak et al[16] also reported solid echotexture has more association with malignancy.

Regarding echogenecity in our study we have hyperechoic followed by hypoechoic both are associated with malignancy having sensitivity of 86 % and specificity of 19.6% with accuracy of 24.4%. Moon et al[17] reported that a hypoechoic nodule had a sensitivity of 87.2%, specificity of 58.5% and an accuracy of 70.7% in predicting malignancy while Sharma et al[14] had reported a sensitivity of 85.7%, specificity of 67.5% and an accuracy of 69.5% in predicting malignancy. Few studies however showed result inconsistent with the literature, hypoechogenity and the presence of hypoechoic rim did not affect the risk of malignancy.

In respect to margin in our study, Irregular margin were associated more with malignancy having sensitivity of 86.7% and specificity of 74.7% with accuracy of 75.2%.Sharma et al[14] showed poorly defined margins have sensitivity of 78.5%, specificity of 82.2% and a diagnostic accuracy of 81.8%. Hoang et al[18] reported sensitivity of ill-defined margins ranges from 53%–89%. Therefore, unless frank invasion beyond the capsule (if more than 50% of its border is not clearly demarcated) is demonstrated, the US appearance of the nodule margins alone is an unreliable basis for determining malignancy.

Malignant nodules often assume a taller-than-wider shape, i.e, antero-posterior diameter > transverse diameter on a Ultrasound. We reported sensitivity of 40 % and specificity of 85.6 % with accuracy of 82.3 % for AT ratio > 1 in detecting malignancy. Cappelli et al[19] showed sensitivity of 99 % and specificity of 57 % in detecting malignancy. Kim et al[20] found that a solid thyroid nodule

AT ratio > 1 has 93% specificity for malignancy. Sharma et al[14] showed specificity of 87% and the highest diagnostic accuracy of 87.5% for diagnosing a malignant nodule.

An incomplete or complete absence of peripheral halo is often associated with a malignant nodule. Our study demonstrated that the absent peripheral halo sign had a sensitivity of 93.3% and specificity of 18.0 % with accuracy of 23.4% indicating that it is only a low predictor malignancy. Sharma et al[14] showed sensitivity of 64.2% and an accuracy of 54.3% in their study and while Rago et al[21] showed absent peripheral halo had sensitivity of 66.6% and specificity of 77%.

In other studies microcalcification served as best predictor of malignancy. Pallaniappan et al[22] reported that microcalcification had 100% specificity for malignancy, which is similar to our study. Hoang et al[23] stated that microcalcification are one of the most specific features of thyroid malignancy, with a specificity of 85.8%–95% and a positive predictive value of 41.8%–94.2% We got sensitivity of 26.7% and specificity of 95.9% with accuracy of 90.9% which is similar to other studies.

Chan et al[23] reported that study had some intrinsic blood flow is seen in malignancy, and they concluded that completely avascular nodule is very unlikely to be malignant. Sharma et al[14] stated increased internal vascularity seen in malignant nodules with a sensitivity of 85.7% and an accuracy of 66.6%. Our study also showed 11.0% sensitivity and specificity of 94.3% with accuracy of 87.3%.

In view of nodularity, our study showed sensitivity of 53.3% and specificity of 49.0% with accuracy of 49.3% with solid nodules. Ugurlu et al[24] study having a single nodule or two nodules increased the chance of malignancy which showed consistency with our study. But Taneri et al[25] reported that multiple nodules in thyroid glands were associated with malignancy.

6. Conclusion

Ultrasonography of thyroid nodules along with fine needle aspiration cytology serves as a best screening test to detect malignancy in outpatient department. The use of different parameters in ultrasound helps in categorizing the lesion and their management. In this study we have association with ultrasound features like predominant solid lesion, hyperechoic lesion and irregular margin, AT ratio more than 1, absent peripheral halo, microcalcification along with increased internal vascularity and solitary nodules with malignancy on cytology.

7. Conflict of Interest

The authors declare that there is no conflict of interest.

8. Source of Funding

None.

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