Study of the Role of Ultrasonography to Differentiate between Benign and Malignant Thyroid Nodules and its Correlation with Fine Needle Aspiration Cytology in a Teaching Hospital

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ABSTRACT

Introduction: Thyroid nodule is a common clinical finding. In the past two decades, the widespread use of ultrasonography for evaluation of thyroid and non-thyroid neck diseases has increased the detection rate and prevalence of thyroid nodules. It is widely accepted that Sonography and ultrasound guided FNA Cytology are the modalities of choice for comparison of benign and malignant nodules. Current research aimed to study the role of Ultrasonography to differentiate benign and malignant thyroid nodules in correlation with Fine-Needle Aspiration Cytology in a teaching hospital.

Material and Methods: This was a prospective hospital based study, done over a period of one year. A total of 120 cases were studied. USG examination of thyroid was done for all the patients presenting with anterior neck swellings and/or thyroid nodules followed by FNAC.

Results: The patient age ranged from 10 to 75 years and the male to female ratio was 1:2. On ultrasound neck 120 were reported as benign, 10 (8.57%) were reported as malignant. On cytopathology a total of 115 cases (95.8%) were diagnosed as benign lesions and 05 (4.1%) were reported as malignancy.

Conclusion: Lesions of the thyroid are common in the general population and middle-aged females are more often affected than males. Benign lesions outnumber the malignant lesions. Well defined margins, predominantly solid texture, absence of microcalcification, hyperechoiec and isoechoiec lesions, wider-than-taller lesions and presence of peripheral halo are pointers towards benign pathology. USG findings of thyroid correlate well with the cytopathological diagnosis.

Keywords: USG of Thyroid, FNAC of Thyroid, Calcifications in Thyroid

INTRODUCTION

Thyroid nodule is a common clinical finding and on autopsy examination it is found, in approximately 50% of individuals. Based on clinical examination, its prevalence is about four to seven percent. In the past two decades, the widespread use of ultrasonography for evaluation of thyroid and non-thyroid neck diseases has increased the prevalence of thyroid nodules and the prevalence rate has varied among different studies. Thyroid fine-needle aspiration cytology (FNAC) was introduced in 1950 and became popular over the past 40 years since 1980. Today, it is a well-established technique for preoperative diagnosis of thyroid pathologies. Thyroid lesions cause various signs and symptoms and also have malignant potential. FNAC is considered to be the “gold standard” in the selection of patients for surgery. It is widely accepted that Sonography and ultrasound guided FNA Cytology are the modalities of choice for comparison of benign and malignant nodules. Ultrasound was first used to study the thyroid gland in 1967, primarily to distinguish solid lesions from cystic lesions. Nodular thyroid disease is detected in 3-7% of the adult population worldwide. They are common in females with a ratio of 5:1 and prevalence mainly depends on the age, gender, iodine intake, diet (goitrogens), therapeutic and environmental exposure. The majority of these cases are clinically occult but readily detected by high-resolution ultrasonography (USG). Thyroid sonography was first introduced in 1966-1967. It has been widely practiced since the 1970 and is now one of the most popular radiological methods of diagnosing thyroid disease. Fine needle aspiration cytology (FNAC) is now a well-established, first line, simple and quick screening test as well as the diagnostic tool for surgical and non-surgical goitres. Limitation of FNAC is mainly because of inadequate sampling, inexperience of the pathologist and over-lapping cytological features. Current research aimed to study the role of Ultrasonography to differentiate benign and malignant thyroid nodules in correlation with Fine-Needle Aspiration Cytology in a teaching hospital.
MATERIAL AND METHODS
This was a prospective hospital based study, done in the department of Radiodiagnosis at Mamata Academy of Medical Sciences, Bachupally, Hyderabad, Telangana. No ethical issues were involved. Informed consent was taken from all patients posted for ultrasound (USG) study and FNAC.

The study was done over a period of one year from July 2018 to June 2019. A total of 120 cases were studied. Patients presenting with anterior neck swellings and /or as thyroid nodules were referred from the departments of General Surgery, ENT and General Medicine were referred for ultrasound examination of the neck. All the patients were evaluated by thorough clinical examination. Routine investigations such as haemogram, renal function tests, liver function tests and thyroid function tests advised by the respective departments. Ultrasound of neck was done in our department in all cases using high-frequency linear array Ultrasound transducer.

Equipment: In the present study, gray-scale real-time ultrasound examination was done using 7.5 MHz linear array transducer. Ultrasound machines used were SONOSCAPE S6.

Technique of Examination: The patient was examined in the supine position with an extended neck. A pillow was placed under the shoulders to provide better exposure of the neck. Since the gland is situated superficially, 7.5 MHz linear array transducer was used.

The entire thyroid gland from upper to the lower pole and the isthmus was examined in the longitudinal and transverse planes. Bilateral carotid arteries, jugular veins, and supraclavicular fossa were also examined. These cases were subjected to FNAC for confirmation of ultrasound findings and establishment of diagnosis. FNAC thyroid was done in all 120 cases under aseptic precautions. FNAC was performed with 23G needle, smears were fixed with isopropyl alcohol and stained with Hematoxylin and Eosin stains (H&E). USG and cytology results were correlated and analyzed.

Inclusion Criteria:
1. Age group from 10 years to 75 years
2. Both genders
3. All the patients with thyroid nodule detected on ultrasound
4. All patients with thyroid nodules suspicious of malignancy, irrespective of its size.

Exclusion Criteria:
1. Age group less than 10 years
2. All patients with diffuse thyroid enlargement were excluded

RESULTS
In the present study a total of 120 patients were included. On ultrasound neck of the 120 thyroid cases examined, 120 were reported as benign, 10 (8.57%) were reported as malignant. On cytopathology a total of 115 cases (95.8%) were diagnosed as benign lesions and 05 (4.1%) were reported as malignancy. In the present study, age group distribution included from

### Table-1: Age-wise distribution of the cases

| Age (in years) | No. of cases | Percent (%) |
|---------------|--------------|-------------|
| 10-14         | 05           | 4.1%        |
| 15-29         | 20           | 16.6%       |
| 30-44         | 83           | 69.1%       |
| 45-59         | 10           | 8.3%        |
| 60-74         | 02           | 1.6%        |
| Total         | 120          | 100%        |

### Table-2: Gender-wise distribution of the cases

| Gender | No. of cases | Percent (%) |
|--------|--------------|-------------|
| Females | 80           | 66.6%       |
| Males   | 40           | 33.3%       |
| Total   | 120          | 100%        |

### Table-3: Ultrasound findings of the cases

| USG findings | Benign | Malignant |
|--------------|--------|-----------|
| Margins      |        |           |
| Well defined | 100    | 4         |
| Poorly defined | 10    | 8         |
| Internal composition |        |           |
| Solid        | 100    | 12        |
| Cystic       | 6      | 16        |
| Honey comb   | 6      | 0         |
| Calcification |        |           |
| Present      | 20     | 8         |
| Absent       | 110    | 4         |
| Echogenicity |        |           |
| Hyperchoeic | 46     | 0         |
| Hypochoeic  | 52     | 4         |
| Isoechoic    | 18     | 0         |
| Shape        |        |           |
| Taller than wider | 8     | 6         |
| Non taller than wider | 120  | 6         |
| Peripheral halo |      |           |
| Present      | 110    | 2         |
| Absent       | 10     | 10        |

### Table-4: Cytopathology - FNAC diagnosis of the cases

| Microscopy diagnosis | No. of cases | Percent (%) |
|----------------------|--------------|-------------|
| Nodular goitre       | 59           | 49.1%       |
| Colloid goitre       | 12           | 10%         |
| Colloid nodule       | 15           | 12.5%       |
| Follicular neoplasmin | 11     | 9.1%        |
| Hashimoto’s thyroiditis | 17     | 14.1%       |
| Acute suppurative thyroiditis | 01 | 0.8%        |
| Suggestive of malignancy | 05    | 4.1%        |
| Total                | 120          | 100%        |

### Table-5: Comparison between USG findings and FNAC

|        | USG | FNAC |
|--------|-----|------|
| Benign | 110 | 115  |
| Malignant | 10  | 05   |
| Total  | 120 | 120  |
Ultrasonography was able to in their study of 138 thyroid nodules found studied and Sharma et al also in their study observed absence of well-defined peripheral halo. All malignant nodules were profoundly hypoechoic with the absence of well-defined peripheral halo. All malignant nodules were predominantly solid (table-3).

In the present study, on cytology a total of 115 cases (95.8%) were diagnosed as benign lesions and 05 (4.1%) were reported as malignancy (table-4,5).

**DISCUSSION**

**Sample size:** In the present study a total of 120 patients were included. On ultrasound neck, out of the 120 thyroid cases examined, 110 were reported as benign and 10 (8.57%) were reported as malignant. Sharma et al17 in their study of 138 thyroid nodules found 124 to be benign and 14 to be malignant. Kim et al18 studied 201 sponge-like nodules, and found 196 were benign (14 confirmed by surgery, 182 confirmed by repeated cytology) and five were malignant nodules, as confirmed by surgery.

**Age distribution:** In the present study, majority were among 30 to 45 years ie, 50% (83/120) and the next common age group was among 15-30 years ie, 16.6% (20/120) cases. In a study by Bairi et al23 the youngest patient was 16 years of age and oldest 70 years. The maximum number of cases was seen in the age group of 31-40 years (41%) and 41-50 years (25.7%).

**Gender distribution:** In the present study, majority of the patients were females, 66.6% (80/120) compared to males 33.3 (40/120). Sharma et al17 also in their study observed a definite female preponderance with 118 females and 20 males with range of females and males being 18 to 67 years and 26 to 72 years respectively. Bairi et al19 also reported a definite female preponderance with 81.4% females and 18.5% males. Chinta et al20 also observed thyroid lesions to be more common in women. In their study of 100 cases, 89 were women and 11 were men. In the study by Banstola et al21 female patients outnumbered male patients by a ratio of 9: 1. Our findings compare well with the above studies.

**Ultrasonography findings:** In the present study, all the malignant nodules were profoundly hypoechoic with the absence of well-defined peripheral halo. All the malignant nodules were predominantly solid. This correlates well with the observations of Bairi et al19 and Sharma et al17 studies. In the study by Sharma et al17 Ultrasonography was able to correctly identify 10 out of 14 malignancies, and 118 out of 124 benign nodules. Ten nodules were described as suspicious for malignancy on USG; final pathologic diagnosis was malignancy in 2 cases, benign follicular nodule in 7 cases and focal thyroiditis in 1 case.

Chinta et al28 studied 100 lesions with high resolution USG (HRUSG) and observed 70 lesions (65 benign, 5 malignant) as well defined lesions which were then diagnosed on FNAC. 30 lesions (20 malignant, 10 benign) were ill defined on HRUSG. If ill-defined borders of the lesion were considered as an independent factor indicative of malignancy, then HRUSG could detect a malignant lesion with sensitivity, specificity, positive and negative predictive value of 80%, 87%, 67% and 93% respectively.

**Califications:** In our study, microcalcifications were seen in 20 cases in benign and in 8 cases in malignant nodules. Sharma et al17 reported the calcifications as either microcalcification or macrocalcification. Microcalcifications were seen exclusively in papillary carcinomas occurring in 8/9 cases. Macrocalcifications were seen in 5/14 malignancies and in 28/124 benign nodules. Kim et al18 observed calcifications in only 11 nodules; microcalcifications were found in five nodules, macrocalcifications in one nodule, both microcalcifications and macrocalcifications in one nodule, and rim calcification in four nodules. Bairi et al19 have proposed that microcalcifications have the highest accuracy in diagnosing malignant thyroid nodules followed by taller-than-wide shape, ill-defined margins, marked hypoechogeticity, and absent peripheral halo.

**Benign:** In the present study most of the benign lesions were well-defined with thin peripheral halo on USG. Bairi et al19 also observed that most of their benign nodules were well defined with thin peripheral continuous halo. Kim et al19 observed that of the 196 benign nodules, 97 were grade I, 44 were grade II, and 55 were grade III. Common US findings in the benign sponge-like nodules were ovoid to round shape (n=194), smooth margins (n=130), isoechogenicity (n=178), and the presence of colloid microcrystals (n=161).

**Cytology:** In the present study, on cytology a total of 115 cases (95.8%) were diagnosed as benign lesions and 05 (4.1%) were reported as malignancy. Bairi et al19 too after cytological/histopathological evaluation, found that 6 (8.57%) of the 70 nodules were malignant and 59 (91.43%) were benign. 5 nodules, which were given as follicular neoplasms on FNAC, were diagnosed as follicular adenomas at histopathology. All the malignant nodules on FNAC were found to be papillary carcinomas. Banstola et al21 in their study found that on cytological study, 70% cases were diagnosed as benign, 28% as malignant and 2% as inadequate for evaluation. Chinta et al20 observed that out of 100 lesions, 68 (64 were benign and 4 were malignant) were hyper echoic, 27 (9 were benign and 18 were malignant) were hypoechoic and 3 were
isoechoic and 2 were anechoic.

**CONCLUSION**

Lesions of the thyroid are common in the general population and middle-aged females are more often affected than males. Benign lesions outnumber the malignant lesions. Well defined margins, predominantly solid texture, absence of microcalcification, hyperechoic and isoechoic lesions, wider-than-taller lesions and presence of peripheral halo are pointers towards benign pathology. USG findings of thyroid correlate well with the cytopathological diagnosis.

**REFERENCES**

1. Harach HR, Franssila KO, Wasenius VM. Occult papillary carcinoma of the thyroid. A "normal" finding in Finland. A systematic autopsy study. Cancer. 1985;56(3):531-538.
2. Singer PA, Cooper DS, Daniels GH, Ladenson PW, Greenspan FS, Levy EG, et al. Treatment guidelines for patients with thyroid nodules and well-differentiated thyroid cancer. American Thyroid Association. Arch Intern Med. 1996;156(19):2165-2172.
3. Lyshchik A, Moses R, Barnes SL, Higashi T, Asato R, Miga MI, et al. Quantitative analysis of tumor vascularization in benign and malignant solid thyroid nodules. J Ultrasound Med. 2007;26(6):837-846.
4. Ezzat S, Sarti DA, Cain DR, Braunstein GD. Thyroid incidentalomas. Prevalence by palpation and ultrasonography. Arch Intern Med. 1994;154(16):1838-1840.
5. Tan GH, Gharib H. Thyroid incidentalomas: management approaches to nonpalpable nodules discovered incidentally on thyroid imaging. Ann Intern Med. 1997;126(3):226-231.
6. Ugurlu S, Caglar E, Yesim TE, Tanrikulu E, Can G, Kadioğlu P. Evaluation of thyroid nodules in Turkish population. Intern Med. 2008;47(4):205-209.
7. Tabaqchali MA, Hanson JM, Johnson SJ, Wadchra V, Lennard TW, Proud G. Thyroid aspiration cytology in Newcastle: A six year cytology/ histology correlation study. Ann R Coll Surg Engl 2000;82(1):149-55.
8. Cooper DS, Doherty GM, Haugen BR, Kloos RT, Lee SL. American Thyroid Association (ATA) Guidelines Taskforce on Thyroid Nodules and Differentiated Thyroid Cancer. Revised American Thyroid Association management guidelines for patients with thyroid nodules and differentiated thyroid cancer. Thyroid 2009;19(4):1167-214.
9. Polyzos SA, Kita M, Avramidis A. Thyroid nodules - stepwise diagnosis and management. Hormones (Athens). 2007;6(4):101-9
10. Frates MC, Benson CB, Charboneau JW, Cibas ES, Clark OH, Coleman BG, et al. Management of thyroid nodules detected at US; Society of Radiologists in Ultrasound consensus conference statement. Radiology 2005;237(3):794-800.
11. Marqusee E, Benson CB, Frates MC, Doublet PM, Larsen PR, Cibas ES, et al. Usefulness of ultrasonography in the management of nodular thyroid disease. Ann Intern Med. 2000;133(9):696-700.
12. Fujimoto Y, Oka A, Omoto R, Hirose M. Ultrasound scanning of the thyroid gland as a new diagnostic approach. Ultrasound. 1967;5(1):177-80
13. Solbiati L, Charboneau JW, Osti V, James EM, Hay ID. The thyroid gland. In: Wilson SR, Charboneau JW, Rumack CM, editors. Diagnostic Ultrasound. 3rd ed. Missouri: Mosby, Elsevier Inc.; 2005. p. 735-70.
14. Yeung MJ, Serpell JW. Management of the solitary thyroid nodule. Oncologist 2008;13(3):105-12.
15. Bruno A., Policeni Wendy, R.K Smoker, Deborah L. Reed. Anatomy and Embryology of the thyroid and parathyroid glands. Semin ultrasound CT MRI, 2012; 33(2): 104-114.
16. Khafagi F, Wright G, Castles H, Perry-Keene D, Mortimer R. Screening for thyroid malignancy: the role of fine needle aspiration biopsy. Med J Aust 1988; 149(4): 302-303, 306-307.
17. Sharma G, Keshava GH, Hanchinal V. Ultrasonographic Evaluation of Thyroid Nodules with Pathologic Correlation. International Journal of Anatomy, Radiology and Surgery 2017;6(2): RO53-RO57.
18. Kim JY, Jung SL, Kim MK, Kim TJ, Byun JY. Differentiation of benign and malignant thyroid nodules based on the proportion of sponge-like areas on ultrasonography: imaging-pathologic correlation. Ultrasonography 2015;34(4): 304-311.
19. Bairi A, Ahmed N, Sreedevi T, Swapna Ch, Madhavi Latha R, Jagdeesh Babu. Role of Ultrasonography to Differentiate Benign and Malignant Thyroid Nodules in Correlation with Fine-needle Aspiration Cytology. Int J Sci Stud 2016;4(5):81-87.
20. Chinta VP. Evaluation of correlation between ultrasonography and FNAC of thyroid nodules. IAIM 2016;3(2):92-97.
21. Banstola L. Correlation of ultrasonography guided fine needle aspiration cytology of thyroid nodules with histopathology. Journal of Pathology of Nepal 2018;(1):1271- 275.

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