

Role of High Resolution Ultrasonography Evaluation of Thyroid Nodules and Pathological Correlation

Research Article

Penaka H¹, Venkatesh M^{1*} and Manjunatha YC²

¹Department of radiodiagnosis, Narayana medical college & hospital, India

²Consultant Radiologist Sree chowdeswari, Multispeciality Hospital, Kolar, Karnataka, India

*Corresponding author: Venkatesh M, Assistant Professor, Department of radiodiagnosis, Narayana medical college & hospital, Nellore-524 002, A.P, India

Copyright: © 2019 Penaka H, et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

Aims and objectives: To identify morphologic patterns on High Resolution Sonography (HRS) those are predictive of benign and malignant nodules and to evaluate the efficacy of histopathology and HRS in differentiating benign and malignant nodules.

Materials and methods: Over a period of 18months, 50 patients referred for USG of the thyroid to R.L. Jalappa Hospital and Research Centre, Tamaka, Kolar, Karnataka who were diagnosed clinically with solitary thyroid nodule. Thyroid sonographic findings relevant to benign or malignant nodules were recorded and these findings were compared with histopathology reports of the thyroidectomy specimen.

Results: Out of 50 cases of solitary thyroid nodules, 35(70%) cases were benign and 15(30%) were malignant. Among benign lesions, adenomas were the most commonest group comprising 45.8%, followed by nodular goiter 22.9%. Among malignant, papillary carcinomas were the most commonest group 86.7%, followed by follicular carcinoma 13.3%. Majority of the patients are in the age group of 31-40 years. Among malignant lesions, papillary carcinoma was the most common and medullary was the least common type. Follicular carcinoma was seen in 2(13.3%) cases among malignant lesions. Out of 50 cases of solitary thyroid nodules evaluated at USG, 33 were diagnosed to be benign, 17 were malignant, after histopathological evaluation, 35 out of 50 cases were found to be benign and 15 were malignant. Ultrasound is a safe, fairly accurate investigation to differentiate benign from malignant etiology with sensitivity of 85.7 % and specificity of 80 %. USG proved to be a more sensitive modality to differentiate benign from malignant lesions.

Conclusion: Thyroid nodules were common in the females of age group 31-45 years. Ultrasound is a safe, fairly accurate investigation to differentiate benign from malignant etiology with sensitivity of 80% and specificity of 85.7%. Ultrasound features of thyroid nodules are useful to distinguish patients with clinically significant thyroid nodules from those within nodule nodules despite the overlap of findings.

Keywords: Solitary thyroid nodule; High resolution sonography; Histopathology; Sensitivity; Specificity

Introduction

Thyroid nodules are a common clinical condition. Increasing with patient age, thyroid nodules are found in up to 20% of adults by palpation and in up to 70% on sonographic studies; the malignancy rate is 7-15% [1].

Non-palpable thyroid nodules may be found in about 50% of patients with a clinically palpable solitary nodule, but they are also incidentally detected by imaging studies performed for various reasons [2].

Sonography is a choice of investigation in evaluation of thyroid nodules. The high resolution of ultrasound has resulted in discovery of large number of thyroid nodules which are obscure clinically. Many ultrasound features have been described to differentiate benign and malignant nature of the lesion [3].

Color and/or power Doppler ultrasound are useful to evaluate vascularity of the thyroid gland and focal masses [4]. Although sonographic guidelines have been established by society of Radiologists in ultrasound, the American thyroid association and European thyroid association, there is no specific ultrasound features

in differentiating benign and malignant lesions [3].

Sonographic features that increase the likelihood that a nodule is malignant include size, interval growth, marked hypoechogenicity, and irregular margins and the presence of Microcalcifications, lymphadenopathy, and local invasion of adjacent structures.

Prediction of malignancy using ultrasound remains difficult. Since there is overlap of sonographic features between benign and malignant thyroid nodules, ultrasound features are usually corroborated with FNAC/Histopathology results in differentiating various thyroid nodules [5].

Fine needle aspiration biopsy is considered the most reliable diagnostic test for evaluation of thyroid nodules and has a low rate of complications, especially when ultrasound guidance is used [4].

Recognition of specific morphologic patterns is an accurate method of identifying benign thyroid nodules that may substantially decrease the number of unnecessary biopsy procedures [3].

The goal in evaluating a thyroid nodule is to determine whether it is benign or malignant so that patients with thyroid cancer can receive a diagnosis and undergo treatment at an earlier stage to reduce possible morbidity and mortality due to the disease, while avoiding unnecessary tests and surgery in patients with benign nodules [6].

The purpose of this study is to evaluate accuracy of sonographic morphologic feature oriented approach in identification of benign and malignant thyroid nodule [3].

Current study designed to identify morphologic patterns on High Resolution Sonography (HRS) those are predictive of benign and malignant nodules and to evaluate the efficacy of histopathology and HRS in differentiating benign and malignant nodules.

Materials and Methods

The study was conducted at R.L. Jalappa Hospital and Research Centre, Tamaka, Kolar, Karnataka. We included all patients who were diagnosed clinically with solitary thyroid nodule referred for USG of the thyroid in R.L. Jalappa Hospital and Research Center during a period of 18 months from December 2010 through May 2012.

High resolution ultrasonography of neck performed by using SIEMENS G 40 & SIEMENS G 50 with 5-10 MHz transducers.

Thyroid sonographic findings relevant to benign or malignant nodules were recorded.

The sonographic findings were compared with histopathology reports of the thyroidectomy specimen.

Results

The present study deals with HRS of the thyroid that are diagnosed clinically with solitary thyroid nodule and determination of diagnostic accuracy of HRS with histopathology findings.

Benign lesions of STN were more common (70%) when compared to malignant lesions (30%).

The commonest age group with thyroid pathology is between 31-40 years (54%).

Out of 50 cases, 41(82 %) cases were females and 9(18%) cases were males with male to female ratio of 1:4.5.

Nodules in the right lobe were more frequent and seen in 33(66%) cases as compared to the left lobe seen in 15(30%) cases. Isthmus lesions were seen in 2(4%) cases.

The female group showed occurrence of malignancy almost in all from 3rd to 6th decade with maximum occurrence in 4th decade.

Out of 9 male patients 5 were benign nodules and 4 were malignant nodules. In males malignant lesions were more common in 3rd and 5th decade.

Out of 50 cases, histopathology revealed 35(70%) were benign and 15(30%) were malignant.

The most common lesion was benign follicular adenoma 16 cases among benign lesions and papillary carcinoma 13 cases among malignant lesions.

The commonest performed surgery in our series is hemithyroidectomy, which accounts to 28(56%) cases. Functional neck dissection was done in 3 cases of papillary carcinoma of thyroid where lymph nodes were palpable.

Discussion

The number of males in the present study was 9 (18%) and the females were 41 (82 %) with a male to female ratio of 1:4.5. Sex distribution was similar when compared to Tsegaye et al. [9]. The higher incidence of single nodules in females is more or less constant for all age groups.

The incidence of STN is more common in females than males.

The highest age incidence in the present study as well as other studies was between 21-50 years, the maximum being 31-40 years.

A solitary thyroid nodule presenting after 50 years of age primarily neoplastic. The carcinoma in younger patients is more often of a lower grade than in older patients who tend to have a more aggressive form of malignancy.

Watters et al. (1992) 41 found that four specific morphologic features are predictive of benign thyroid nodules were identified which had 100% specificity for benignity.

- Spongiform configuration
- Cyst with colloid clot
- Giraffe pattern
- Diffuse hyperechogenicity

Watter et al. interpreted an USG report as suggestive of benign, if the nodule was suggesting benign includes purely cystic/cystic with thin septa, isoechoogenicity, hyperechogenicity, well defined margins, peripheral complete thin halo, comet tail artifact, egg shell/coarse calcifications, peripheral vascularity.

USG report as suggestive of malignancy includes Hypoechoogenicity, Poorly defined margins, Taller than wide shape, Incomplete peripheral halo, Microcalcifications, Intranodular vascularity.

High resolution real-time USG is far better than clinical examination in detecting thyroid nodularity.

Walker et al. have shown that the prevalence of multi nodularity in clinically solitary thyroid nodules is between 20% and 40%, and it has been observed that for a thyroid nodule to be detected by palpation, it must be atleast 1 cm in diameter, while USG detects nodules as small as 3 mm in diameter [16].

Conclusion

Solitary thyroid nodule is one of the commonest thyroid disorders. Commonest presenting complaint is swelling in the anterior neck. Solitary thyroid nodules commonly occur between 21-59 yrs age group, the maximum being 31-40 yrs. Benign lesions are more common than malignant lesions. Among benign, adenomas are the most common lesions and among malignant, papillary carcinomas are the most common lesions. Ultrasound features of thyroid nodules are useful to distinguish patients with clinically significant thyroid nodules from those with innocuous nodules despite the overlap of findings. Sonographic findings can be useful when used alongside cytological results, especially in nodules with cytological results that are benign or suspicious for malignancy. Recognition of specific morphologic patterns is an accurate method of identifying benign thyroid nodules that may substantially decrease the number of unnecessary biopsy procedures.

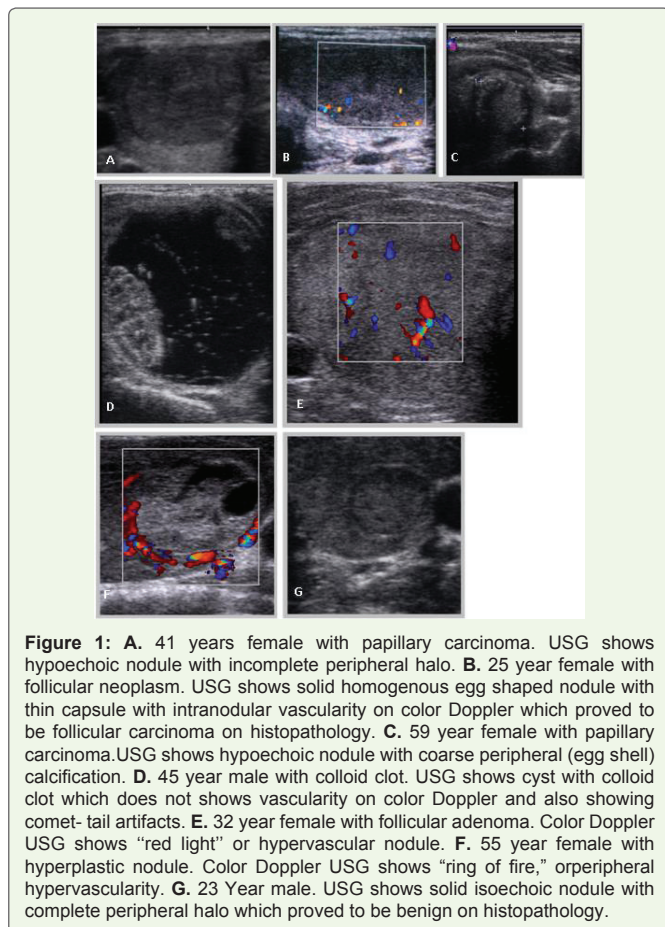


Figure 1: A. 41 years female with papillary carcinoma. USG shows hypoechoic nodule with incomplete peripheral halo. B. 25 year female with follicular neoplasm. USG shows solid homogenous egg shaped nodule with thin capsule with intranodular vascularity on color Doppler which proved to be follicular carcinoma on histopathology. C. 59 year female with papillary carcinoma. USG shows hypoechoic nodule with coarse peripheral (egg shell) calcification. D. 45 year male with colloid cyst. USG shows cyst with colloid clot which does not shows vascularity on color Doppler and also showing comet- tail artifacts. E. 32 year female with follicular adenoma. Color Doppler USG shows "red light" or hypervascular nodule. F. 55 year female with hyperplastic nodule. Color Doppler USG shows "ring of fire," or peripheral hypervascularity. G. 23 Year male. USG shows solid isoechoic nodule with complete peripheral halo which proved to be benign on histopathology.

Table 1: Age incidence of stn lesions

Age (years)	Number of cases (n= 50)	Percentage (%)
21-30	10	20%
31-40	19	38%
41-50	12	24%
51-60	8	16%
61& above	1	2%
Total	50	100%

Table 2: Age and sex ratio of benign and malignant lesions

Age (yrs)	Female		Total	Male		Total
	Benign	Malignant		Benign	Malignant	
21 -30	8	2	10	2	-	2
31 -40	12	3	15	1	3	4
41 -50	5	5	10	1	-	1
51 -60	4	1	5	1	1	2
61&above	1	-	1	-	-	-

Table 3: distribution of lesions on usg.

Category	Lesion	Number of cases
Benign (33)	Cystic	5
	Hyperechoic nodule	21
	Isoechoic nodule	7
Malignant (17)	Hypoechoic nodule	12
	Mixed	5

Table 4: Types of benign lesions.

Benign lesions	Number of cases(35)	Percentage (100%)
Follicular adenoma	16	45.80%
Nodular goiter	8	22.90%
MNG	6	17.10%
Colloid nodule	5	14.20%

Table 5: Types of malignant lesions.

Malignant lesions	Number of cases(15)	Percentage (100%)
Papillary carcinoma	13	86.70%
Follicular carcinoma	2	13.30%
Medullary carcinoma	-	-

Table 6: Types of surgeries performed.

S.NO	Type of surgery	No of cases
1	Hemithyroidectomy	31
2	Near total thyroidectomy	2
3	Total thyroidectomy	17
4	Functional neck dissection	9

Table 7: Benign: comparision of usg with histopathology.

USG	HISTOPATHOLOGY			TOTAL
		+	-	
	+	30	3	
	-	5	12	17
TOTAL		35	15	100

Sensitivity- 85.7%; specificity- 80%; positive predictive value-90.9%; negative predictive value-70.5%.

Table 8: Malignant: comparison of usg with histopathology.

USG	HISTOPATHOLOGY			TOTAL
		+	-	
	+	12	5	
-	3	30	33	
TOTAL	15	35	100	

Sensitivity- 80%; specificity- 85.7%; positive predictive value-70.5%; negative predictive value-90.9%.

Table 9: Comparison of sex incidence.

Authors	No. of cases	Male (%)	Female (%)	Ratio
Jose RM et al (2000) [7]	98	16.3	83.6	01:05.1
Afroze et al(2002) [8]	170	28.2	71.7	01:02.5
Tsegaye et al(2003) [9]	780	19.5	80.5	01:04.1
Khadiikar et al(2008) [10]	100	14	86	01:06.1
Present study	50	18	82	01:04.5

Table 10: Comparison of age distribution.

Age	Fenn et al. [11] (1980) (%)	Anantha krishnan et al. [12] (1993)(%)	Nagori et al. [13] (1992)(%)	Present study
21-30	81(23.6)	167(33.1)	25(25)	10(20)
31-40	122(35.6)	150(29.9)	29(29)	19(38)
41-50	74(21.6)	81(16.1)	21(21)	12(24)
51-60	38(11.1)	46(9.1)	8(8)	8(16)
60 & above	09(2.63)	20(4.0)	6(6)	1(2)
Total	342	503	100	50

Table 11: Comparison of usg results.

Series	Sensitivity	Specificity
Watters et al. [14]	74%	83%
Jones et al. [15]	75%	61%
Present study	80%	85.70%

References

- Baier ND, Hahn PF, Gervais DA, Samir A, Halpern EF, et al. (2009) Fine needle aspiration biopsy of thyroid nodules: Experience in a cohort of 944 pts. *AJR Am J Roentgenol* 193: 1175-1179.
- Cappelli C, Castellano M, Pirola I, Cumetti D, Agosti B, et al. (2007) The predictive value of ultrasound findings in the management of thyroid nodules. *QJM* 100: 29-35.
- Bonavita JA, Mayo J, Babby J, Bennett G, Oweity T, et al. (2009) Pattern recognition of benign nodules at Ultrasound of the thyroid: which nodules can be left alone. *AJR Am J Roentgenol* 193: 207-213.
- Ahn SS, Kim EK, Kang DR, Lim SK, Kwak JY, et al. (2010) Biopsy of thyroid nodules: Comparison of three sets of Guidelines. *AJR Am J Roentgenol* 194: 31-37.
- Frates MC, Benson CB, Charboneau JW, Cibas ES, Clark OH, et al. (2005) Management of thyroid nodules detected at US: society of radiologists in ultrasound consensus conference statement. *Radiology* 237: 794-800.
- Alexander EK, Heering JP, Benson CB, Frates MC, Doubilet PM, et al. (2002) Assessment of nondiagnostic ultrasound-guided fine needle aspirations of thyroid nodules. *J Clin Endocrinol Metab* 87: 4924-4927.
- Jose R, Smile SR, Lyengar K (2002) The role of imprint cytology in intraoperative diagnosis of thyroid swelling. *Indian J Pathol Microbiol* 45: 393-396.
- Afroze N, Kayam N, Hasan SH (2002) Role of fine needle aspiration cytology in the diagnosis of palpable thyroid lesions. *Indian J Pathol Microbiol* 45: 241-26.
- Tsegaye B, Ergete W (2003) Histopathologic pattern of thyroid disease. *East Afr Med J* 80: 525-528.
- Khadiikar UN, Maji P (2008) Histopathological study of solitary nodules of thyroid. *Kathmandu Univ Med J (KUMJ)* 6: 486-490.
- Fenn AS (1980) Solitary nodule of thyroid gland. *Ind J Surg* 42: 171-175.
- Ananthkrishnan N, Rao KM, Narasimhan R, Veliath AJ (1993) The single thyroid nodule - A South Indian Profile of 503 patients with special reference to incidence of malignancy. *Ind J Surg* 55: 487-492.
- Nagori LF, Algotar MJ (1992) Solitary thyroid nodule. *Ind J Surg* 54: 75-78.
- Watters DA, Ahuja AT, Evans RM, Chick W, King WW, et al. (1992) Role of ultrasound in the management of thyroid nodules. *Am J Surg* 164: 654-657.
- Jones DD, May KE, Geraci SA (2010) Subclinical thyroid disease. *Am J Med* 123: 502-504.
- Walker J, Findlay D, Amar SS, Small PG, Wastie ML, et al. (1985) A prospective study of thyroid ultrasound scan in the clinically solitary thyroid nodule. *Br J Radiol* 58: 617-619.