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Study of Role of Ultrasonography in Evaluation of Thyroid Nodules

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ABSTRACT

Introduction: Thyroid nodules are a very common clinical finding which can be single or multinodular and benign or malignant. Ultrasonography (USG) followed by USG guided fine needle aspiration cytology (FNAC) is usually done in evaluating any thyroid nodule that is palpable on physical examination. The purpose of this study was to study the role of USG in evaluating thyroid nodules and its correlation with findings of FNAC of thyroid.

Methods: One hundred and twenty five patients with palpable thyroid referred for USG neck were included in the study. Ultrasonography assessments of thyroid with different parameters were done. The findings were later compared with FNAC thyroid.

Results: On FNAC and histological analysis, thyroid malignancy was observed in 14 out of 125 (11.21%) subjects. Malignant nodules on USG demonstrated hypoechoic pattern (sensitivity 82.3%, specificity 97.2% and positive predictive value 82.3%), irregular margins (sensitivity 77.8%, specificity 96.3% and accuracy 77.8%), central vascularity (sensitivity 82.3%, specificity 95.4% and positive predictive value 73.7%) and taller-than-wider shape (sensitivity 82.3%, specificity 96.3% and accuracy 77.8%). Sixteen cases with suspicion of malignant thyroid nodules demonstrated these 2 or more USG features. Sensitivity, specificity and positive predictive value of thyroid nodules for detecting malignancy increased to 87.5%, 98.2% and 87.5% respectively when two or more of these USG features were present.

Conclusions: Thyroid USG demonstrating hypoechoic pattern, irregular margins, central vascularity and taller-than-wider shape had potential of being malignant. Thyroid nodules were found to have more malignant potential when two or more of these USG features were present.

***Key words*:** *Thyroid nodule; Ultrasonography; Thyroid Neoplasms; Sensitivity and Specificity*

INTRODUCTION

Thyroid nodules are a very common clinical finding, with an estimated prevalence on the basis of palpation that ranges from 3% to 7%.[1] Clinical presentation is most common for hypothyroidism, goiters and infrequently for hyperthyroidism.[2] Thyroid nodules are

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more common in women, in those with iodine deficiency, and in those with a history of radiation exposure.

Ultrasonography followed by USG guided FNAC is usually done in evaluating any thyroid nodule that is palpable on physical examination. Several studies have shown efficacy of USG thyroid in predicting malignancy.[3,4]

The purpose of this study was to study different parameters in USG in evaluating thyroid nodules for malignancy, its accuracy in diagnosing malignant nodules and its correlation with FNAC thyroid.

METHODS

This observational, cross-sectional, prospective hospital based study was carried out in the department of Radiodiagnosis and Imaging at Manipal Teaching Hospital, Pokhara, Nepal from January 2017 to June 2018. The study was approved by Institutional Ethical Committee, and informed consent was taken from all subjects. All subjects referred from other departments especially Medicine, Surgery and ENT with clinically palpable thyroid swelling irrespective of their age, sex and clinical features were enrolled for the study. Patients with previously diagnosed thyroid disorders, those who had already undergone surgery or radiotherapy and those who failed to give consent were excluded from the study. Subjects detected with thyroid nodules on USG, further underwent evaluation with fine needle aspiration cytology (FNAC).

All scans were performed on LOGIQ P3 by Wipro GE Ultrasound equipment using a high frequency 5–12 MHz probe. Echogenicity, central vascularity, internal composition, margins, shape of the nodule and dimensions including height and width were assessed. The echogenicity was assessed as hyperechoic, isoechoic, hypoechoic, or anechoic in comparison to normal thyroid parenchyma. Doppler was used for evaluation of central vascularity of thyroid.

Data regarding age, sex, consistency and nodularity of thyroid on palpation, USG findings, various parameters suggesting malignancy and FNAC of thyroid nodules were collected and documented on a structured proforma and entry was done in Statistical Packages for the Social Sciences version 20. All categorical data were expressed in percent and absolute number. All numerical continuous data were expressed in mean ± SD. The data analysis was done using SPSS version 20. All tests were analyzed with a 95% confidence interval and a P value of <0.05 was considered significant.

RESULTS

A total of 350 cases with palpable thyroid swelling, irrespective of their clinical features underwent evaluation by USG. A total of 145 cases were detected with thyroid nodules on ultrasonography of neck and were included for the study that further also underwent FNAC evaluation. Twenty patients were excluded from the study due to lack of adequate data. Finally, a total of 125 cases were enrolled in the study. There were 105 females and 20 males. The mean age group was 38 ± 7.3 years (Range of 13 to 72 years). Majority of the cases (60 out of 125) were in the age group of 35-49 years of age followed by 41 cases in age group of 15-34 years of age (Figure 1).

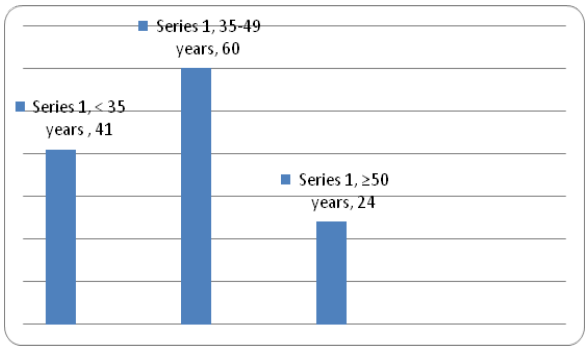

***Figure 1**: Age distribution of subjects with Thyroid nodules.*

FNAC of these nodules revealed malignancy in 14 (11.2%) cases with 9.5% females (10/105) and 20% males (4/20) (Figure 2). Majority of (9/14) of these cases had multiple nodules on USG. Thyroid nodules were more prevalent in females whereas malignancy was observed more among males with thyroid nodules. Bimodal age distribution was noted with malignant thyroid nodules. Five cases were detected below 35 years of age and 6 cases were detected above 50 years of age.

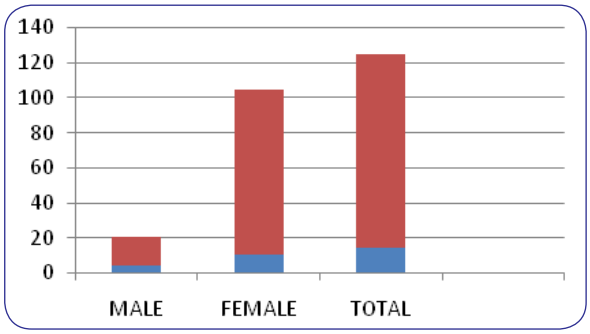

Figure 2: *Sex distribution of subjects with benign and malignant Thyroid nodules.*

On USG, solitary nodule was seen in 32.8% subjects (41/125) and rest had multiple nodules. Nodules were predominantly hyperechoic in 101 subjects followed by hypoechoic in 17, isoechoic in 5 and anechoic in 2 subjects. USG of thyroid revealed hypoechoic nodules, taller than wide pattern, central vascularity and ill-defined margins, in 17, 18, 19 and 18 subjects respectively. Sixteen cases with suspicion of malignant thyroid nodules demonstrated these two or more USG features (Figure 3).

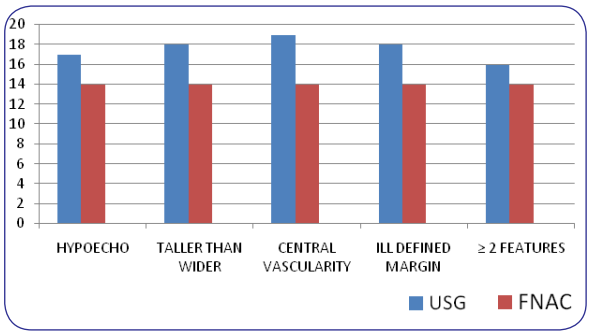

Figure 3: *Various features on USG of thyroid suggesting malignancy vs FNAC results.*

Sensitivity, specificity and positive predictive value (PPV) of various ultrasound features in detecting malignancy are shown in table below (Table 1).

Table 1: Ultrasound features suggesting thyroid malignancy

USG FEATURES	SENSI-TIVITY	SPECI-FICITY	PPV
Hypoechoic	82.3%	97.2%	82.3%
Taller than wide	82.3%	96.3%	77.8%
Central Vas-cularity	82.3%	95.4%	73.7%
Ill-defined/ irregular margin	77.8%	96.3%	77.8%

Sensitivity, specificity and positive predictive value for detecting malignancy by ultrasound increased to 87.5%, 98.2% and 87.5% respectively when two or more of these features were present.

DISCUSSION

A total of 125 cases with female preponderance (female: male ratio of 5.2:1) was observed in the present study. The observations are almost similar to the female: male ratio of 5.9:1, 5.4:1 and 3.4:1 in the studies by Sharma et al[5], Chen et al[6], and Chakraborty et al[7] respectively.

The mean age group was 38 ± 7.3 years (range of 13 to 72 years). Similar were the findings in the study by Nazir et al[8] with mean age was 38.91 ± 10.85 years (range of 11 to 67 years).

FNAC of these nodules revealed malignancy in 14 (11.2%) cases. Sharma et al[5] in India encountered thyroid malignancy in 10.1% of thyroid nodules, findings almost similar to the present study. The incidence of malignant thyroid nodules was lower (6%) in the study by Nazir et al[8] in Pakistan whereas, study by Chen et al[6], in China suggested a higher incidence of malignancy of 23.5%.

In the present study, 20% males and 9.5% females had malignant nodules suggesting that thyroid nodules though more prevalent in females, malignancy however was observed more among males. Similar were the findings in the study by Chakraborty et al[7] with males having higher malignancy proportion than females (39.1% vs 14.3%).

Sensitivity, specificity and positive predictive value (PPV) of various ultrasound feature (hypoechoic pattern, taller than wide, central vascularity and ill-defined margins) in detecting malignancy are comparable with various studies and tabulated below (Table 2).

Table 2: Comparision of ultrasound features of malignant nodules in various studies

HYPOECHOIC PATTERN	SENSITIVITY	SPECIFICITY	PPV
Current study	82.3%	97.2%	82.3%
Prasad et al[9]	72%	88%	67%
Moon et al[10]	87%	-	-
Papini et al[3]	87%	-	-
TALLER THAN WIDE	SENSITIVITY	SPECIFICITY	PPV
Current study	82.3%	96.3%	77.8%
Prasad et al[9]	84%	83%	62%
Moon et al[10]	40%	-	-
CENTRAL VASCULARITY	SENSITIVITY	SPECIFICITY	PPV
Current study	82.3%	95.4%	73.7%
Prasad et al[9]	64%	84%	57%
Moon et al[10]	48%	-	-
Papini et al[3]	75%	-	-
ILL DEFINED MARGINS	SENSITIVITY	SPECIFICITY	PPV
Current study	77.8%	96.3%	77.8%
Prasad et al[9]	80%	87%	67%
Moon et al[10]	48%	-	-
Papini et al[3]	77%	-	-

The present study was compared with the study made by Frates MC et al[11] which showed highest correlation with hypoechogenicity of the nodule and with central vascularity. It also showed lowest concentration with the taller than wide nodule while irregular margins and central vascularity showed variable correlation.[11]

Majority of cases, i.e. 9 out of 14 malignant nodules had multiple nodules on USG in the current study. Chakraborty et al[7] also reported a higher proportion of malignant cases among subjects with multinodular goiter.

CONCLUSION

Thyroid disorders are a common endocrinological disorder which may present as single or multiple nodules. Ultrasonography of the neck and thyroid is commonly done in evaluating any thyroid nodule which along with FNAC or histological analysis rules out whether it is benign or malignant. This study showed hypoechoic pattern, irregular margins, central vascularity and taller-than-wider shape as good predictors of detecting malignant thyroid nodule. Sensitivity, specificity and positive predictive value increased when 2 or more of these parameters were present.

CONFLICT OF INTEREST
None

SOURCES OF FUNDING
None

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