ORIGINAL ARTICLE

ROLE OF ULTRASOUND IN DIFFERENTIATING BENIGN AND MALIGNANT THYROID NODULES IN COMPARISON WITH EXCISIONAL BIOPSY

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ABSTRACT

Background: Thyroid lesion classification is important for treatment plan. Ultrasound is helpful in diagnosing and differentiating the benign lesions from malignant thyroid nodules. Results of ultrasound will be compared with post excisional biopsy results. The aim of the study is to determine the role of ultrasound in differentiating the benign and malignant thyroid nodules and results was compared with the findings of post excisional biopsy.

Method: This prospective cross sectional cohort study was conducted in the Department of Diagnostic Radiology for three months' time. The study has involved 50 patients from both genders referred to the Department for diagnosing the thyroid nodule lesions. Findings of ultrasound was compared with results of post excisional biopsy.

Results: Total 59 patients were included in the study and mean age of the patients was 43.15 ±10.43. Female patients were 48(81.4%) and male patients were 11(18. 6%). Disease duration mean was 7.58± 2.82 months and nodule size mean was 4.98± 1.72 cm. Ultrasound accurately detected 6 out of 8 malignant cases when compared with post excisional biopsy results and false diagnosis was 2 out of 59 benign cases.3 cases were found true negative. All the calculation made were with confidence interval 95%. Sensitivity of ultrasound results were 92.51%, specificity was 93.96%, positive likelihood ratio was 10.86, negative likelihood ratio was 0.98, positive predictive value was 82.97%, negative predictive value was 87.03%and diagnostic accuracy of gray scale ultrasound was found 91.64%

Conclusion: Ultrasound is reliable and accurate modality to differentiate the benign thyroid nodules from malignant thyroid nodules.

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INTRODUCTION

Thyroid nodules are well defined focal area of changed echogenicity radiologically from the normal parenchyma of thyroid within thyroid gland.[1] Prevalence of thyroid nodule worldwide is about 4-8 % of the total population and accounts 1% mortality among the different types of carcinomas.[2] In Pakistan prevalence of thyroid nodules among population is almost 4%. With improvement in medical imaging technology diagnosis of thyroid nodule has improved and hence the incidence of disease is also increasing.[6]

From cases of thyroid nodule benign incidence are high as compared to malignant nodules which accounts 4-10% of the cases. There are many risk factors like gender, age, family history, exposure to radiation, iodine deficiency and external environmental factors.[3,4] Thyroid nodules are common in women as compared to men from

different epidemiological studies. Thyroid nodules are aggressive and malignancy risk is also high in men despite their less prevalence.[5] Thyroid nodule patients are evaluated in detail by their medical history and imaging findings. Prognosis of thyroid nodule is good after its excision surgically. Therefore, to avoid unnecessary surgical excision accurate diagnosis is important. [7] For screening of thyroid nodules ultrasound is considered first line modality because of its cost effectiveness, noninvasive in nature and widely available option. It helps in identification of number of nodules and size of nodule. Ultrasound is helpful in detection of thyroid nodules and differentiate benign cancer from malignant. Ultrasound findings which are considered suggestive of malignancy are irregular margins, micro calcification, solid nodules, shape of nodule and hypo echogenicity.

Present study will help to diagnose and differentiate thyroid nodule with the help of ultrasound and results will be compared with excisional biopsy performed after suggestive of ultrasound results.

METHODS
The prospective cross-sectional study was conducted in Department of Diagnostic Radiology of Lahore General Hospital from April 2022 to June 2022. Total 59 patients suspected of thyroid nodule from clinical examinations after meeting inclusive and exclusive criteria were included in the study sample size was calculated by formula $N = \underline{Z^2 \text{ x } P(1-P).}$ Ultrasound was performed on every patient by using 7.5 MHz high resolution transducer. All findings were evaluated by senior Radiologist.

Inclusive criteria: Patients with suspected thyroid nodule from clinical reports will be included. Patients of both gender from age group above 15 years were included.

Exclusive Criteria: Patients with diffused thyroid enlargement were excluded from study.

Examination Protocol: Patients were examined under supine position with neck extended. For better neck exposure pillow was placed under the shoulder. 7.5 MHz linear array transducer was used as the gland is superficially situated. Thorough evaluation of thyroid gland is performed from lower to upper pole and transverse and longitudinal examination of isthmus was performed. Examination of jugular veins, bilateral carotid arteries and supraclavicular fossa was performed.

RESULTS
Age group of patients were from 16 years to 70 plus years and the mean age of the patients was 43.15 ±10.43. Female patients were 39(78%) and male patients were 11(22%). Disease duration mean was 7.58± 2.82 months and nodule size mean was 4.98± 1.72 cm. Thyroid nodule was common among the age group of 30-50 years in female as compared to men. Total 59 nodules were evaluated under ultrasound and 8(13.5%) nodules were found to be malignant. Features suggestive of malignancy were hypo echogenicity, nodule shape, irregular margins, micro calcification, irregular or absent thickened discontinuous peripheral halo and rest of thyroid nodules 51(86.4%) were found benign. After post excisional biopsy 6(10.12%) of the 59 nodules were found malignant. Ultrasound diagnosis was compared with post excisional biopsy results and sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy was calculated. P value calculated 0.001 which was found significant.

Table 1:

Indicators	Value
Sensitivity	92.51%
Specificity	93.96%
Positive Likelihood ratio	10.86
Negative Likelihood ratio	0.98
Positive Predictive value	82.97%
Negative Predictive Value	87.03%
Diagnostic accuracy	91.64%

Shape of the malignant nodules were taller than wide and were ill defined. Among malignant nodules exclusive micro calcification was observed. Hypo echogenicity was observed in all malignant nodules and well-defined peripheral halo was absent. Solid mass lesions were observed among malignant nodules.

While among benign thyroid nodules well defined and thin continuous peripheral halo was observed. Egg shell calcification was observed in benign thyroid nodule cases. Cystic lesions were observed in benign cases and shape of the nodule in benign cases were oval on transverse plane with long axis. The nodules were isoechoic and hyper echoic in benign cases.

Ultrasound accurately detected 6 out of 8 malignant cases when compared with post excisional biopsy results and false diagnosis was 2 out of 59 benign cases.3 cases were found true negative. All the calculation made were with confidence interval 95%. Sensitivity of ultrasound results were 92.51%, specificity was 93.96%, positive likelihood ratio was 10.86, negative likelihood ratio was 0.98, positive predictive value was 82.97%, negative predictive value was 87.03%and diagnostic accuracy of gray scale ultrasound was found 91.64%

DISCUSSION
Ultrasound is helpful in detection of thyroid nodule as a discrete lesion which is differentiated from normal

parenchyma in thyroid gland. From the study it was also observed that the maximum lesions found in the age group of 30-50 years among female. Female patients were 48(81.4%) and male patients were 11(18.6%). Malignant lesions were less in number (13.5%) as compared to the benign thyroid lesions (87. 5%). When compared the results of our study with other research studies similar findings were observed like a study conducted by Popli et al the malignant lesions percentage was 18.33 % which is slightly higher than our study.

In thyroid nodule shape of the nodule is considered marker of malignancy. Malignant nodule shape in the study was found taller instead of wide. From the study hypoechoic nodules were observed in most cases of malignancy. Most of the nodules in the study were hyperechoic, isoechoic and hypoechoic. Hypo echogenicity marker is good predictor of malignancy in ultrasound among cases of thyroid nodule.

Micro calcifications are bright echoes of multiple punctate in ultrasound findings which are <2 mm in size and can be without or with acousting shadow. Micro calcification was exclusively observed in malignant thyroid nodules and are considered good predictor of malignancy under ultrasound. If margin of thyroid glands is not clearly defining, they are considered speculated irregular margins and if more than 50 % margins are poorly defined, they are irregular and mostly observed in malignant cases. From present study ultrasound malignant nodule cases showed irregular thick discontinuous peripheral halo or absence of halo. This feature is also good predictor of malignancy on ultrasound. Ultrasound efficacy was confirmed in differentiating benign and malignant lesions from comparison with post excisional biopsy results and from comparison 2 out of 7 cases were found false positive which describe the good diagnostic accuracy of ultrasound and the combinations of ultrasound features which were present all or in combination in malignant cases included irregular margin, micro calcifications, hypo echogenicity and taller instead of wide shape of nodule.

Present study has described that suggesting malignancy is based upon multiple features instead of single feature which enhances diagnostic accuracy of ultrasound results and hence can help to avoid unnecessary surgical procedures.

Ultrasound accurately detected 6 out of 8 malignant cases when compared with post excisional biopsy results and false diagnosis was 2 out of 59 benign cases.3 cases were found true negative. All the calculation made were with confidence interval 95%. Sensitivity of ultrasound results were 92.51%, specificity was 93.96%, positive likelihood ratio was 10.86, negative likelihood ratio was 0.98, positive predictive value was 82.97%, negative

predictive value was 87.03%and diagnostic accuracy of gray scale ultrasound was found 91.64%

From present study 51 thyroid nodules were found benign which accounts colloid nodule, adenomatous nodule, hyperplastic nodule and follicular adenoma. The features of benign nodules observed in ultrasound were well defined thin peripheral halo, regular margin, wider in shape and calcifications were almost absent. Macro calcification was observed in few benign cases and micro calcification was not observed in benign cases. Echogenicity may vary but in most benign cases hyper echogenicity was observed.

A study conducted by Avinash B et al,2016 has described in their study involving 70 patients stating that hypo echogenicity, nodule shape, irregular margins, micro calcification, irregular or absent thickened discontinuous peripheral halo are the common indicators of malignancy as compared to the benign thyroid nodules.

A study conducted by Nawaz S et al, 2018 has described that Ultrasound is helpful in differentiating benign and malignant thyroid nodules involving 175 patients having higher ratio of female to male where FNAC was the gold standard. From their study findings specificity 96.8 % sensitivity 87.5%, PPV 91.3%, NPV 95.3% and diagnostic accuracy was 94.2%.

A study conducted by Zahir ST et al,2016 has concluded that ultrasound can help to identify benign and malignant nodules among suspected patients. The study involved 135 patients (female 86.7%, male 13. 3%). Nodule size has a relationship with type of nodule. Specificity, sensitivity, PPV, NPV and diagnostic accuracy was 93.8%,93.2%,81.12%,98.0% and 93.33%.

Barbosa T et al,2019 in their study has described ultrasound as a helpful tool for diagnosing malignant and thyroid nodule using TI-RADS and ATA Classification score of US. Risk of malignancy increases when thyroid nodules Bethesda III is classified. Sensitivity of the study was 95.3% and NPV was 94.1%. Study involved 140 patients and surgical findings were gold standard.

Muthu S et al, 2019 in their study involving 54 patients have found that 30 % of the patients have Adenomatous colloid goiters and 18.5 % have Nodular goiter and common malignant nodule type was papillary carcinoma observed under the ultrasound and was compared with histopathology results of FNAC.

CONCLUSION
From the study it was observed that thyroid nodules are most common in female as compared to male and ultrasound is helpful in diagnosing and differentiating malignant and benign thyroid nodules. Features suggestive of malignancy were poorly defined irregular margin, micro calcification, taller shape instead of wide,

hypo echogenicity and absent or thick discontinuous peripheral halo. Results of ultrasound were compared with post excisional biopsy findings. From comparison it was found ultrasound is good diagnostic option for suggesting malignancy.

ETHICAL APPROVAL

Ethical approval of synopsis was granted by the Ethical Review Committee of PGMI/AMC/LGH vide reference No. 00/177/22 dated 24 August 2022.

CONFLICT OF INTEREST

Authors declare no conflict of interest. FUNDING SOURCE: None

AUTHOR'S CONTRIBUTIONS

BK: Data collection, analysis, interpretation and conclusion
SA Supervision of data collection and analysis
NI: Supervision of data collection and analysis
SF: Data collection
All Authors: Approval of the final version of the manuscript to be published

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