ORIGINAL ARTICLE

DIAGNOSTIC ACCURACY OF THYROID ULTRASOUND IN DETECTION OF MALIGNANCY IN THYROID NODULES

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Background: Occurrence of thyroid nodules is a common clinical problem in Pakistan being endemic area for hypothyroidism. This study was carried out to evaluate the diagnostic accuracy of thyroid ultrasound in detection of malignancy in thyroid nodules keeping Fine Needle Aspiration Cytology (FNAC) as a gold standard. **Methods:** A descriptive cross-sectional validation study was conducted at Departments of Radiology and Pathology, Shaikh Khalifa Bin Zayed Al-Nahyan Hospital/ CMH, Muzaffarabad from Dec 2014 to Jun 2015. Patients referred for evaluation of thyroid nodules were included in the study. Ultrasound guided FNAC was performed under direct imaging guidance. The imaging findings and FNAC were compared to access the diagnostic accuracy of ultrasound in predicting malignancy in thyroid nodules. **Results:** A total of 175 patients were studied with age range between 20–70 years. Mean age of the patients was 44.05±14.8 years. Of these, 35.4% were males and 64.6% were females. On FNAC, 27.4% cases were positive and 72.6% cases were negative while on thyroid ultrasound 26.3% cases were positive and 73.7% cases were negative. True positive were 24.0%, false positive 2.3%, false negative 3.4%, and true negative were 70.3%. Thyroid ultrasound showed sensitivity 87.5%, specificity 96.8%, diagnostic accuracy 94.2%, positive predictive value 91.3% and negative predictive value 95.3%. **Conclusion:** High resolution ultrasound is a very useful tool in accessing and selecting thyroid nodules for biopsy with a high diagnostic accuracy.

Keywords: Thyroid, Ultrasound, FNAC, Malignancy, Thyroid nodule, Tumour, Diagnosis

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INTRODUCTION

The incidence of thyroid nodules has increased in the recent years. This has been attributed to increased use of imaging modalities, mainly ultrasound.[1] Malignancies have been found in up to 15% of the nodules that were evaluated with Fine Needle Aspiration Cytology (FNAC).[2,3] In evaluation of thyroid nodules, high-resolution ultrasound is being increasingly used to detect malignancy and guide fine needle aspiration for cytological analysis.[4] In addition, ultrasonography (USG) can evaluate the size and characteristics of non-palpable nodules and it may diagnose lymph node metastasis.[5] According to Lingam *et al*[6], a nodule should have at least one of the following findings to be subjected to FNAC: markedly reduced echogenicity, irregular or micro lobulated margins, presence of micro calcifications, length greater than the width.[6] Other investigators have highlighted the sensitivity of intra-nodular vascularity as being relatively high in predicting neoplastic nodules ranging from 66.7% to 91.7%.[7] According to the Society of Radiologists in Ultrasound, FNAC should be performed on a nodule 1 Cm in diameter or larger with micro calcifications, 1.5 Cm in diameter or larger that is solid or has coarse calcifications, and 2 Cm in diameter or larger that has mixed solid and cystic components or is associated with abnormal cervical lymph nodes.[8,9]

Based on these criteria sensitivity and specificity of ultrasound has been reported at 89.2% and 85.2% respectively.[10] Worldwide, USG is becoming the mainstay for detection and evaluation of thyroid nodules as well as in providing guidance for FNAC.[11,12] Occurrence of thyroid nodules is a common clinical problem in Pakistan being endemic area for hypothyroidism. The careful evaluation of thyroid nodules for malignant potential and targeted approach to avoid unnecessary intervention should prove useful.

There is lack of local scientific data showing the importance of thyroid USG in detecting malignancy in thyroid nodules. The incidence of malignancy has been reported as 28.97% in this endemic area. There was high incidence of papillary carcinoma mainly in middle aged female patients while majority of the thyroid enlargements were benign.[13]

Several studies done in urban centres of Pakistan have shown that USG has overall good sensitivity in detecting thyroid cancer.[13–18] The use of ultrasound in selecting patients for biopsy is a useful screening tool as the availability of USG is almost universal even in our remote areas and may help screen patients in need for referral to higher centre for FNAC or follow up. This study was carried out to evaluate the diagnostic accuracy of thyroid ultrasound in detection of malignancy in thyroid nodules keeping FNAC as a gold standard.

MATERIAL AND METHODS

This descriptive, cross-sectional validation study was conducted at Departments of Radiology and Pathology, Shaikh Khalifa Bin Zayed Al-Nahyan Hospital/CMH, Muzaffarabad from 24 Dec 2014 to 23 Jun 2015

following approval from Institutional Ethical Review Committee. Patients referred to radiology and pathology departments for solitary or multiple thyroid nodules evaluation or FNAC of thyroid nodules, were included in the study. The patient population was from Muzaffarabad and surrounding areas. Referrals from non-residents of the region, already diagnosed cases and patients taking radioactive iodine were excluded from the study. A total of 175 adult (18–70 years) patients with no gender discrimination were included in the study. Patients fulfilling inclusion and exclusion criteria were enrolled by non-probability consecutive sampling method after describing the study protocol and informed verbal consent. Demographic, clinical, and sonographic information of the patients was recorded on a pre-designed proforma.

To characterize the nodules as malignant we selected solid or predominantly solid nodule with greater than 50% solid component that showed hypo echoic echo texture described as being lower than the surrounding normal thyroid tissue or being lower than the strap muscles where normal gland was replaced by multiple nodules, irregular or micro lobular margins, taller than wider shape and the presence or absence of micro calcification. The same were accessed irrespective of number, however in multiple nodules without above features the largest was biopsied.

Ultrasound guided FNAC was performed with patient lying supine having extended neck position and single pass per nodule was made with the help of 23 gauge needle and 5 or 10 cc syringe. Philips USG HD3 and Logic 200 (3.5/7.5 mHz probes) machine was used to characterize the thyroid nodule and to provide guidance for aspiration. Confirmation of placement of the needle in the targeted nodule was done by Ultrasound. The sample was taken from solid portion of the nodule; aspirate was spread on glass slides. Wet and dry fixed smears were made for cytology and the results were compared. The data was analyzed for estimation of sensitivity and specificity using SPSS-10.

RESULTS

A total of 175 patients, during the study period of six months, 18–70 years of age were included in the study. Mean age of the patients was 44.05±14.8 years. Out of 175 patients, 62 (35.4%) were males and 113 (64.6%) were females. Forty-seven (26.9%) patients were having thyroid nodule <1 Cm, and 128 (73.1%) patients were having thyroid nodule >1 Cm in size. On FNAC, 48 cases were positive and 127 cases were negative, and on thyroid ultrasound 46 cases were positive and 129 cases were negative. True positive were 42, false positive 4, false negative 6, and true negative were 123 (Table-1). Thyroid ultrasound showed sensitivity 87.5%, specificity 96.8%, diagnostic accuracy 94.2%, positive predictive value 91.3% and negative predictive value 95.6%.

Table-1: Comparison of thyroid ultrasound and FNAC (n=175)

Thyroid Ultrasound	FNAC		Total
	Positive	Negative	
Positive	42 (TP)	4 (FP)	46 (26.3%)
Negative	6 (FN)	123 (TN)	129 (73.7%)
Total	48 (27%)	127 (72.6%)	175

TP= True positive, FP= False positive, TN= True negative

DISCUSSION

Many benign and malignant thyroid conditions commonly present in the form of thyroid nodules.[19,20] In Pakistan, thyroid disease is a concerning health issue mainly because of dietary iodine deficiency. According to the estimates given by UNICEF, 70% of our total population is at risk of developing thyroid diseases because of deficiency of iodine.[21,22] Moreover, there is a higher incidence of differentiated thyroid malignancy, mainly papillary cancer, in the geographical location of our study.[13] Thyroid cancer is responsible for 1.2% cases of all malignant tumours in Pakistan.[22] With this background, the need for a useful screening tool for early detection of thyroid cancer becomes significant. Several studies have been done demonstrating the usefulness of USG in detecting thyroid malignancy. Several guidelines have been proposed using ultrasound as a screening tool. These have used various sonographically detectable morphological parameters like echogenicity of the nodule, its margins, the presence or absence of micro calcifications, size, taller than wider shape, solid content, central vascularity, extra thyroid extension, calcification and abnormal neck lymph nodes.[23] Because of its simplicity we mainly applied Kim *et al*[24] criteria in our study with assessment of nodal status which was negative in all cases. Using this approach yielded a higher diagnostic accuracy than reported in their original study, probably because of the higher incidence of papillary carcinoma in our setting.[13]

Our results support the usefulness of this simplified method as reported by Frates *et al*[5]. The missed cases on ultrasound in our study warrant a thorough follow up of all cases labelled as negative using these criteria and a 3 to 6 months and 12 month follow up was suggested to look for any increase in size or alteration in sonographic appearance and reassessment of the nodal status of the neck region. Our results follow already reported diagnostic accuracy further consolidating the usefulness of USG being an essential part of FNAC of thyroid nodules.[25,26]

Ultrasound being readily available, cheap, safe without radiation hazards and the ease with which it can access and aid fine needle aspiration cytology of thyroid nodules is conveniently the most commonly employed modality compared to CT, MRI, or an isotope scan. Our study like others reaffirms this point and the pivotal role it has played in the evaluation of patients with thyroid diseases.[14,27–31]

CONCLUSION

The results highlight the usefulness of USG as diagnostic tool for screening patients with thyroid nodules for suspected malignancy and selecting thyroid nodules for biopsy with a reasonably high diagnostic accuracy.

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