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DIAGNOSTIC YIELD OF USG GUIDED FINE NEEDLE ASPIRATION CYTOLOGY IN THYROID SWELLINGS

Radio-Diagnosis

Anurag Shukla* Assistant Professor, Department of Radio diagnosis, Rama Medical College Hospital and Research Centre, Rama City ,Mandhana, Kanpur Nagar, Uttar Pradesh, India Pin-209217. *Corresponding Author

Pragya Pandey Assistant Professor, Department of Pathology, Rama Medical College Hospital and Research Centre, Rama City ,Mandhana, Kanpur Nagar, Uttar Pradesh, India Pin-209217.

Nikhil Saini Post Graduate Trainee, Department of Radio diagnosis, Rama Medical College Hospital and Research Centre, Rama City ,Mandhana, Kanpur Nagar, Uttar Pradesh, India Pin-209217.

Shubham B Sude Post Graduate Trainee, Department of Radio diagnosis, Rama Medical College Hospital and Research Centre, Rama City ,Mandhana, Kanpur Nagar, Uttar Pradesh, India Pin-209217.

ABSTRACT

Introduction: Thyroid nodules need good clinical and radiological evaluation to differentiate between benign and malignant nature. High resolution Ultrasonography is the commonest and usually first ordered radiological investigation for preoperative assessment. Ultrasonography-guided fine-needle aspiration cytology could be an excellent screening tool as it provides real-time visualization of the needle to aspirate from the suspicious site **Materials and Method:** A research cross sectional descriptive study including 100 patients was conducted at Rama Medical College Hospital and Research Centre, Rama City, Mandhana, Kanpur from March 2023 till December 2023. Out patient and In patients Subjects of 18 -80 years meeting the inclusion and exclusion criteria were selected. The study participants underwent preoperative ultrasonography-guided fine-needle aspiration cytological evaluation of thyroid nodule. The histopathological findings were correlated to determine diagnostic values. **Result:** The sensitivity, specificity, and accuracy of ultrasonography-guided fine-needle aspiration cytology of thyroid nodule was 94.32%, 63.96%, and 82.45%, respectively. On stratification according to size, high sensitivity of 100% was observed in evaluating lesions of size<2 cm and >4 cm. There was a good interrater agreement between findings of ultrasonography-guided fine-needle aspiration cytology and histopathology with a kappa coefficient of 0.607. **Conclusion:** Under ultrasonography-guidance fine needle aspiration cytology is an excellent tool for evaluating small, non-palpable nodules and is a reliable procedure to evaluate thyroid lesions with high diagnostic value.

KEYWORDS

Accuracy, Cytology, Fine needle, Thyroid nodule, Ultrasonography

INTRODUCTION

Thyroid nodules are one of the chief symptoms drawing patient's and doctor's attention to investigate as it leads to anxiety in patients. It can be associated with symptoms related to thyroid dysfunction, compression symptoms, and potential malignancy risk, thus requires a prompt and accurate investigation at the earliest [1]. The main concern of a thyroid nodule is its potential to turn into a malignancy. The incidence of malignancy in thyroid nodules is 5-10% [2]. A large nodule or lesion with high suspicion of being malignant after clinical and radiological grounds needs to be handled with surgical treatment. It is one of the common incidental findings worldwide and one of the most common swellings assessed in Ear, Nose, Throat and Head & Neck Surgery Department, hence it is a major clinical dilemma for surgeons. [3]. FNAC is commonly done by palpatory method but this approach has various limitations. An ultrasound-guided fine needle aspiration cytology (UN FNAC) is considered the gold standard to evaluate thyroid malignancy. Ultrasonography-guided fine needle aspiration cytology (USG-FNAC) is the commonly ordered radiological investigation as it is an effective investigation method for analyzing thyroid nodules. Ultrasonography (USG) and fine-needle aspiration cytology (FNAC) are effective preoperative diagnostic tools in analyzing thyroid nodules. Real time images of needle and thyroid lesion on USG [4] guided FNAC offers a direct identification of area for aspiration for cytology [5]. Inadequate sampling and inability to aspirate from non-palpable lesions limits non USG FNAC [6]. There is significant overlapping of USG findings in benign and malignant lesions along with the operator dependency which affect the diagnostic yield and outcome of the procedure. Small solid and cystic suspicious nodules can be discovered and biopsied using a needle that can be directed to the solid area [7]. Thus, an asynergistic combination of USG guidance in FNAC helps counter each other's deficiencies to some extent and increase the diagnostic yield[6]. A more accurate diagnostic method to evaluate thyroid nodules is provided by adding a real-time visualization to guide the needle to aspirate from a suspicious site. The high diagnostic accuracy of USG guided FNAC helps surgeon to adopt a surgical strategy. [8, 9]. There is limited data available on the correlation of findings of USG-guided FNAC with histopathology in thyroid nodule in this part of North Indian belt. Thus, this study aimed to correlate preoperative ultrasonography-guided fine-needle aspiration cytology (BETHESDA SYSTEM) [10] with histopathology in a thyroid nodule.

MATERIALS AND METHOD

This was a cross-sectional study conducted at Rama Medical College Hospital and Research Centre, Rama City ,Mandhana, Kanpur from March 2023 till December 2023. Ethical clearance was obtained from the Institutional review committee of Rama Medical College Hospital and Research Centre, Rama City, Mandhana, Kanpur, with the reference number of RCHRC/2023/B26. The study protocol was as per the Declaration of Helsinki, revised in 2013 on human experimentation. We used patients with the following criteria to include in the study.

1. Age Over 18 Years

Patients who underwent USG-guided FNAC and were reported as per The Bethesda Reporting of Thyroid Cytology (TBSRTC) [10] and had final histopathology report available.

Exclusion Criteria Were

1. Hemorrhagic Thyroid Swellings.
2. Patients Who Came For Completion Thyroidectomy.

In all patients, a radiologist performed USG-guided fine needle aspiration of the thyroid nodule. After counselling and valid consent, under aseptic conditions, the needle was oriented either parallel or perpendicular to the USG probe. The subject was then requested not to move or swallow and remain silent. Te operator was preferably positioned at the contra lateral side of the lesion with good ergonomics. A needle was targeted at the lesion; the sample was collected by multiple back and forth movements of needles over 5–10 s. Negative pressure was applied if insufficient sample was received. Before withdrawing the needle, the negative pressure was released. The smear was prepared using the aspirate. The pathologist examined the smear under light microscope, and the results were classified as per TBSRTC.

TBRSTC category II was considered benign and TBSRTC category III-IV was considered malignant. [9]. The TBSRTC category I was excluded from the study because it does not yield any diagnosis. 10% formalin was used to fix the specimen, then stained with with hematoxylin and eosin stains. The raw data were collected on proforma and then entered on Microsoft Excel 2016 through the data validation tool. IBM-SPSS 16 (Statistical Package for Social Sciences) was used to analyze data. The findings of USG-guided FNAC were compared against histopathological findings. The findings were expressed in terms of sensitivity, specificity, positive predictive value, negative predictive value, and accuracy. Further evaluation of diagnostic indices of USG-guided FNAC was done for nodules of different sizes viz. <2cm, 2-4 c and >4 cm. Cohen Kappa interrater agreement was used to test the agreement between findings of USG-FNAC and gold standard histopathological evaluation. The strength of USG-FNAC to diagnose a pathology while analyzing thyroid nodule will be based on the Kappa coefficient value. A p-value ≤ 0.05 was considered to be significant [12]. In each Bethesda category, we calculated the risk of malignancy (ROM) by dividing the number of malignant findings found in HPE by the number of cases in that category.

RESULTS

We recruited 100 patients in the study. The patients included in the study ranged from 18 to 80 years, with a mean age of 42.387 ±11.42 years. There was notable female preponderance (86.1%) among subjects presenting with a suspicious thyroid nodule. The age group distribution shows most of the patients were in 30 to 60 years (Fig. 1). Most of the thyroid nodules in our study had a maximal diameter of 2–4 cm (n=41). Most nodules belonged to Bethesda category VI (n=23), followed by Bethesda category II (n=18). Cross-tabulation of guided FNAC findings with histopathological findings of different thyroid swellings was done and diagnostic indices were calculated (Table 1). Overall sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy were 94.32%, 63.96%, 76.19%, 94.11%, and 82.45%, respectively. When stratified according to sizes, we observed the highest sensitivity in the lesion of less than 2 cm and over 4 cm. Likewise, specificity was lowest for less than 2 cm and highest for lesion size greater than 4cm (Table 2).The inter-rater agreement concluded as a good agreement for the overall study and was an almost perfect agreement for >4 cm thyroid nodule (Table 3). In our study, we calculated the risk of malignancy (ROM) in each category (Table 4).

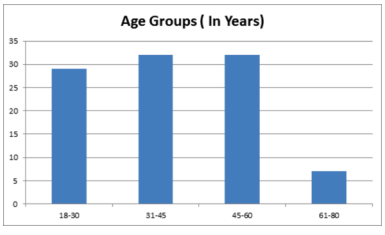

Fig 1: Age Distribution

Table 1: Cross-tabulation Of Guided FNAC Findings With Histopathological Findings Of Different Thyroid Swellings (n=100)

USG-guided FNAC findings	Histopathology findings		
	Malignant (P)	Benign (N)	Total
Malignant (P)	54(TP)	17(FP)	71
Benign (N)	2(FN)	27(TN)	29
Total	56	44	100

P positive, N negative, TP true positive, TN true negative, FP false positive, FN false negative

Table 2: Diagnostic Indices Of USG-FNAC In Different Thyroid Swellings According To Their Size

Size (cm)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
<2	100	25	78.57	100	80
2-4	82.96	66.88	50	82.3	67.35
>4	100	100	100	100	100

Table 3: Cohen Kappa's Coefficient For Inter-rater Agreement Between USG-guided FNAC Findings And Histopathological Findings According To Different Sizes Of Nodules.

Size	Kappa's coefficient	p-value	Interpretation
Overall	0.607	0.000	Good Agreement
2 cm	0.328	0.086	Fair Agreement
2-4cm	0.588	0.000	Moderate
>4 cm	1	0.14	Almost Perfect Agreement

Table 4: Risk Of Malignancy In Each Category Found In Our Study

Bethesda classification	Histopathological findings		
	Malignant	Benign	Risk of malignancy (%)
II	2	27	5.9
III	2	2	50
IV	5	5	50
V	17	5	76
VI	30	5	85

DISCUSSION

The prevalence of thyroid nodule is 4–7% in patients in the Ear Nose Throat–Outpatient Department, [2]. It has malignant potential of about 5% so it is serious concern for the clinicians. The literature has shown that ultrasonography guided needle to aspiration cytology from the lesion site shows promising diagnostic ability. Studies showed that it reduces inadequacies, and impalpable lesions are also easily aspirated [7-9, 13, 14]. Female predilection in our study is noted which is consistent with existing literature on demographical distribution. [8, 9]. According to TBSRTC, most lesions belonged to TBSRTC category VI as they are the most likely candidates for the surgery, which is a prerequisite for the final histopathology report. Koo et al. also reported the higher prevalence of malignancy, notably TBSRTC VI. The referred cases reviewed by the hospital's pathologist were included in the study [15]. 3% prevalence of TBSTRC III " included in the grey zone category this could be because of imaging advantage while performing FNAC, as shown in the study by Kumari et al. [9]. The low number in our study could be because it including only operated patients. Our study showed a different percentage of ROM than the implied ROM for TBSRTC categories. Smaller size can produce variations in our study. Categories III and IV showed an increased percentage of ROM in our study than the implied ROM percentage of the TBSRTC system. Thus it is totally justified, including TBSRTC categories III and IV in the malignancy category. Kumari et al. reported similar ROM in categories III and IV. Our TBSRTC category VI showed a less risk of malignancy percentage. Since TBSRTC is a relatively adapted system for reporting thyroid pathology, institutional experience in using TBSRTC plays a role in proper diagnosis. So there are some overlapping features between benign and malignant lesions, such as pseudo inclusions and nuclear grooves, might have misguided the cytopathologist in reporting the case. The ROM in TBSRTC VI in the study by Kumari et al. was 100% [10]. The high sensitivity and high NPV of USG-FNAC of a thyroid nodule of our study are broadly in line with previous literature studies, and reporting of cytology report may or may not be based on TBSRTC [8, 15–17]. Similar to our study, the sensitivity was above 90% and better than specificity, mainly when cytological reporting was as per TBSRTC [10, 17, 18]. So , USG-FNAC finding as per TBSRTC could be an excellent tool for screening thyroid lesions as negative findings in USG-FNAC are more likely to be negative and rule out the disease. The study's findings differed from the study by Said et al. [19] because the study has not reported cytological findings according to TBSRTC. The specificity, PPV, and accuracy of our study were not satisfactorily high. Most of the false-positive findings were seen in small lesions. An explanation could be because all the lesions might have been aspirated that no pathology remained behind. Similarly, liberal diagnoses made by cytopathologist for lesions with overlapping features could have an increased number of false positives. USG-FNAC presents itself with the limitation of inability to distinguish between follicular adenoma and Hashimoto adenoma with their malignant counterpart, leading to high false positives in the current study. Also, including TBSRTC categories III and IV as malignant lesions could have accounted for high false positives. Contrary to findings by existing studies, sensitivity did not increase or decrease with size [16, 19–21]. This study showed that USG-guided FNAC has high sensitivity in less than 2 cm or greater than 4 cm. In minor lesion, USG help in locating the nodule and thus accurate sampling. In a more significant lesion, it can accurately sample the part of the lesion with the suspicious feature, increasing the sensitivity. Specificity, however, increased with size, which is similar to the study by Kim et al. but at odds with Aydogan et al. where specificity decreased with size [20, 21]. Zhong et al. proffered that size did not influence specificity with the highest specificity reported at size 1–2 cm [21]. Size did not affect accuracy in

our study and is consistent with previous studies. Also, our study validated claims by Aydogan et al. that ROM decreased with size, but it may be because of selection bias as we included only suspicious small lesions in the study [16, 20–22]. When the Cohen Kappa inter-rather agreement was applied, the Kappa coefficient increased with size > 4cm, having an almost perfect agreement. However, lesion< 2 cm has the fair agreement hence for small thyroid lesions USG –FNAC can be advocated if not for diagnostic but for screening as our study revealed of a smaller sample size and not having a comparison group .The data were collected at a tertiary care referral centre , thus carrying a risk of a sampling bias .

CONCLUSION

The USG-guided fine-needle aspiration cytology (USG-FNAC) procedure is considered highly effective in assessing thyroid lesions, offering significant diagnostic value. According to the TBSRTC guidelines, USG-FNAC demonstrates excellent sensitivity, making it a valuable tool for preoperative screening of thyroid nodules. However, the specificity provided by USG-FNAC, as per TBSRTC standards, is deemed inadequate for making definitive diagnoses. Therefore, while we do not endorse it as a sole diagnostic method, we advocate for broader utilization of USG-FNAC in the evaluation of thyroid nodules.

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Availability of Data and Materials

The datasets generated during our study are available from the corresponding author upon request from the journal.

Declarations

Ethics Approval And Consent To Participate

We have obtained the necessary ethical committee approval with reference number RCHRC/2023/B26 from the Institutional Review Committee of Rama Medical College Hospital and Research Centre, Rama City ,Mandhana, Kanpur for the study and it is included in the manuscript.

Consent to Participate

Informed written consent was obtained from patients/ next of kin to participate in the study.

Consent For Publication

Informed written consent was obtained from patients/ next of kin to participate in the study.

Competing Interests

The authors declare that they have no competing interests.

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