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COMPARITIVE STUDY OF CONVENTIONAL AND ULTRASOUND-GUIDED FINE NEEDLE ASPIRATION CYTOLOGY OF THYROID IN A TERTIARY CARE CENTER OF NORTH KARNATAKA

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ABSTRACT

Fine needle aspiration cytology (FNAC) is a minimally invasive and cost effective technique. However some of the deep seated lesions may have occult carcinomas which could be missed on conventional FNAC of a multinodular goitre or non–palpable nodules. Ultrasound guidance is helpful in directing the needle to solid portions of the cystic or mixed nodules and reduce the need for repeat FNAs but adds to cost and turn-around time of patient. **Objectives**: The study was conducted to compare the results of conventional FNAC with Ultrasound (USG)-guided FNAC and correlate with histopathology to evaluate the sensitivity, specificity and diagnostic accuracy of both types of FNAC. **Materials and Methods**: The study was conducted on 140 patients who underwent conventional FNAC in the department of Pathology and subsequently USG-guided FNAC in department of Radiology. Smears were prepared from both the FNA and were reported separately by the same pathologist. Statistical Indices used in the present study for both conventional and USG-guided FNAC with histopathology as gold standard are Sensitivity, specificity, and diagnostic accuracy. Comparison of the FNAC results with histopathology showed that there were five false negative results in conventional FNAC and two false negative results in USG-guided FNAC. **Results**: The sensitivity and diagnostic accuracy were 77.8%, 92.9% on USG-guided FNAC and 44.4%, 82.1% on conventional FNAC. In **conclusion**, USG-guided FNAC improved the cytological diagnostic accuracy, sensitivity and reduced the false-negative rates in comparison to conventional FNAC especially in case of multinodular goitre.

Keywords: Conventional FNAC, USG-guided FNAC, Histopathological correlation, Sensitivity, Diagnostic accuracy.

INTRODUCTION

Fine needle aspiration cytology (FNAC) of thyroid is a simple, cost effective method in the management of palpable thyroid lesions[1]. Some cases have more than one lesion co-existing in thyroid which could be missed on conventional FNAC. Multiple revision surgeries are not possible on thyroid due to its location. Ultrasound (USG) simulates the gross appearance of thyroid in the patient. However USG alone cannot be used as gold standard as there are over lapping features between benign and malignant lesions sonographically. An accurate diagnosis is necessary to obtain results with surgery. USG-guided FNAC has advantage of both specialities but add to cost and turn around time to patients.

The study was conducted in Department of Pathology at our institute with the aim of identifying whether USG-guided FNAC is significantly better in identifying the neoplasia than conventional FNAC. With this objective the diagnostic accuracy of USG-guided FNAC and

conventional FNAC were compared with histopathology as the gold standard**.**

MATERIALS AND METHODS

The study was conducted from 1st October 2007 to 31st march 2009, during which 417 thyroid FNAC were done in the department of Pathology. Among them, 140 patients gave the consent for the study and underwent both conventional and USG-guided FNAC. All patients included in the study were referred for FNAC with complaints of thyroid swelling. No age and sex criteria were included in the study.

Conventional FNAC was done in the Department of Pathology. Subsequently USG was done with high frequency probe (5 to 12MHz transducer) in the department of Radiology, at our institution. The number of nodules, size and echogenecity patterns were noted. FNAC was then repeated on the patients under USG-guidance on a representative or suspicious area. In both the methods, FNAC was done under aseptic precautions using 22-gauze needle fitted to 5ml syringe without aspiration with patient in supine or sitting posture with neck extended. The material collected in the bore by capillary action. In some cases aspiration technique was used. The aspirate was then expressed on the clean glass slide and fixed with 95% alcohol and by air dry technique. A minimum of four slides were smeared with the aspirate. The smears were then stained with Hematoxylin and Eosin (H&E), and Wright's stain. The slides prepared from conventional FNAC and USG-guided FNAC were reported separately by the same pathologist. Smears with atleast four clusters of follicular cells were considered adequate for reporting. Among 140 cases, twenty-eight patients underwent surgery and thus histopathological correlation was obtained in them.

Histopathological results were correlated with results of conventional FNAC and USG-guided FNAC. Statistical Indices used in the present study for both conventional and USG-guided FNAC with histopathology as gold standard include Sensitivity = TP/ (TP+FN) X100, Specificity = TN/ (TN+FP) X100, PPV= TP/ (TP+FP) X100, NPV= TN/(TN+FN) X100, FPER =FP/total no of cases X 100, FNER = FN/Total no cases X 100, Diagnostic accuracy = TP+TN/TP+TN+FP+FN X100 in order to evaluate their sensitivity, specificity and diagnostic accuracy. (TP = True Positive, FP = False positive, TN = True Negative, FN = False Negative, PPV= Positive predictive value, NPV=Negative predictive value, FPER= false positive error rate, FNER= false negative error rate)

RESULTS

The thyroid aspirations were done on patients with an age range of two to seventy years with mean age of 33.8 yrs. Majority of them were females accounting for 124 cases (88.6%) out of 140. Male were 16 (11.4%). Aspiration was unsatisfactory in three cases (2.2%), on conventional FNAC and in one case (0.7%) on USG-guided FNAC. Non-neoplastic lesions were more common in the present study on both conventional and USG-guided FNAC.

The various lesions found on conventional and USG-guided FNAC were as in table 1. Differences were found in the number of nodular goitre and neoplastic lesions in both FNAC. Nodular goitre was the commonest lesion found on both conventional and USG-guided FNAC. Figure 1 showing clear correlation between cytological findings and USG features of nodular goitre. Out of 140 cases histopathology was available in 28 cases. Histopathology showed 16 cases of nodular goitre, one Hashimoto's thyroiditis, two primary hyperplasia, five papillary carcinomas, three follicular adenomas and one Hurthle cell adenoma. The results of conventional FNAC and USG-guided FNAC were correlated with histopathological diagnosis to know their sensitivity, specificity and diagnostic accuracy as histopathology forms the gold standard.

Nineteen non neoplastic lesions and nine neoplastic lesions were reported on histopathology. In comparison, out of 28 cases, conventional FNAC showed 24 non-neoplastic lesions with 21 cases of nodular goitre, two primary hyperplasia and one Hashimoto's thyroiditis. There were four neoplastic lesions with three papillary carcinoma and one Hurthle cell neoplasm. USG-guided FNAC showed 21 non-neoplastic lesions with 18 cases of nodular goitre, two primary hyperplasia, one Hashimoto's thyroiditis and seven neoplastic lesions with four papillary carcinomas, two follicular neoplasms, and one Hurthle cell neoplasm. Oncomparing the results of conventional and USG-guided FNAC with histopathology, differences were found in five cases as showed in table 2. There were no false positive results in our study. The correlation of conventional FNAC and USG-guided FNAC with histopathology showed four true positives, 19 true negatives and five false negatives on conventional FNAC. USG-guided FNAC showed seven true positives, 19 true negatives and two false negatives. The statistical evaluation with various parameters showed 44.4% sensitivity, 100% specificity, 100% PPV, 79.2% NPV and 82.1% diagnostic accuracy on conventional FNAC and 77.8% sensitivity, 100% specificity, 100% PPV, 90.4% NPV and 92.9% diagnostic accuracy on USG-guided FNAC.

DISCUSSION

It is a well-known fact that FNAC is safe, rapid, inexpensive and reliable in the diagnosis of thyroid nodules[2]. It is possible to classify non-neoplastic and neoplastic lesions with the help of FNAC and subtype them. However, some of the deep seated lesions may have occult carcinomas which could be missed on conventional FNAC of a multinodular goitre or non–palpable nodules. In clinical practice, it is recommended that USG-guidance should be sought after a failed conventional FNA, in small nodules, in non-palpable nodules, in lesions that are located in difficult-to-access locations, in nodules with extensive cystic change, fibrosis or calcification. USG-guidance is also helpful in directing the needle to solid portions of the cystic or mixed nodules and reducing the need for repeat FNAC[3]. The present study was undertaken to compare the results of conventional and USG-guided FNAC with histopathology as gold standard to determine their diagnostic accuracy.

The inadequacy rate of 2.2% was seen in conventional FNAC and 0.7% in USG-guided FNAC. The inadequacy rate was not statistically significant in our study in comparison to other studies[4,5]. Majority of the cases were females with 124 cases. Among them 113 cases (80.7%) had non neoplastic lesions and eleven (7.9%) had neoplastic lesions. Both neoplastic and non neoplastic lesions were more commonly seen in females comparable with other studies[6,7]. There were five false negative cases on conventional FNAC and two on USG-guided FNAC. The false negative error rates of 17.9% on conventional FNAC and 7.1% on USG-guided FNAC were comparable with several other studies[8,9]. The cytological criteria for diagnosis of the lesions are well defined but there can be overlapping cytological features, making the diagnosis of the lesions and further more distinction between the neoplastic and non-neoplastic lesions difficult. USG show various patterns due to echogenic variations in the lesions. These patterns include cyst with avascular colloidplug, blocks ofhyperechogenicity separated by bands of hypoechogenicity,uniform hyperechogenicity, intense hypervascularity, hypoechogenicity, isoechogenicity with or without halo, or nodules with intense peripheralvascularity.The absence of features like calcification, halo, hypoechogenecity, isoechogenecity and increased peripheral vascularity favors benignity. These patterns are sensitive in predicting the neoplastic lesions with varying specificity[10]. However in cases with overlapping cytological features these USG patterns help in differentiating and providing more

accurate cytological diagnosis of some of the lesions. There were two false negative results on conventional FNAC due to overlapping cytological features particularly between nodular goitre and follicular neoplasm as seen in other studies[11]. Figure 2 shows a case with features of both nodular goitre and follicular neoplasm cytologically and USG showing features of follicular adenoma supporting the diagnosis of follicular neoplasm. Histopathology confirmed a diagnosis of follicular adenoma in this case. Cellular microfollicular patterns are seen in hyperplastic microfollicular nodule of a multinodular goitre, Hashimoto's thyroiditis, microfollicular adenomas and a well differentiated follicular carcinoma and are the most challenging ones in diagnosing cytologically[12]. In our study features of nodular goitre was seen on conventional FNAC in a patient in whom USG examination showed a single hypoechoic area in left lobe of thyroid. Aspiration from this area under USG-guidance showed features of papillary carcinoma as in figure 3. Histopathological diagnosis of micropapillary carcinoma was made in this case. The results obtained in our study showed that the sensitivity and the diagnostic accuracy of USG-guided FNAC was more than the conventional FNAC and was comparable with other study[13].

In conclusion, thyroid is an organ where multiple revision surgeries are not possible and it is also difficult to obtain the patient's consent for the same. The cytological criteria for identification of a lesion are well defined. But some cases show overlapping cytological features of different lesions. USG-guided FNAC as an added advantage of a multi-modality approach and aids in providing a more accurate diagnosis of the lesion or the lesions in thyroid. In our study USG-guided FNACreduced the false-negative rates in the diagnosis of the neoplastic lesions, in comparison to conventional FNAC and improved the sensitivity and diagnostic accuracy especially in cases of multinodular goitre and thereby reducing the turnaround time in the accurate management of the patient.

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Table 1: Table showing various lesions obtained on both conventional and USG-Guided FNAC

Lesions	Conventional FNAC	USG-Guided FNAC
Nodular Goitre	91 (65%)	88 (62.9%)
Hashimoto's thyroiditis	27 (19.3%)	29 (20.7%)
Primary Hyperplasia	5 (3.7%)	5 (3.7%)
Dyshormonogenic goitre	2 (1.4%)	2 (1.4%)
Acute thyroiditis	1 (0.7%)	1 (0.7%)
Follicular neoplasm	3 (2.1%)	5 (3.6%)
Papillary carcinoma	6 (4.3%)	7 (5.0%)
Anaplastic carcinoma	1 (0.7%)	1 (0.7%)
Hurthle cell carcinoma	1 (0.7%)	1 (0.7%)
Inadequate sample-no opinion	3 (2.1%)	1 (0.7%)

Table 2: Table showing cases with a false negative results on conventional and USG-guided FNAC

No of cases	Diagnosis on Conventional FNAC	Diagnosis on US-Guided FNAC	Histopathology Diagnosis
2	Nodular goitre	Follicular neoplasm	Follicular adenoma
1	Nodular goitre	Micropapillary Carcinoma	Micropapillary Carcinoma
1	Nodular goitre	Nodular goitre	Follicular adenoma
1	Nodular goitre	Nodular goitre	Micropapillary Carcinoma

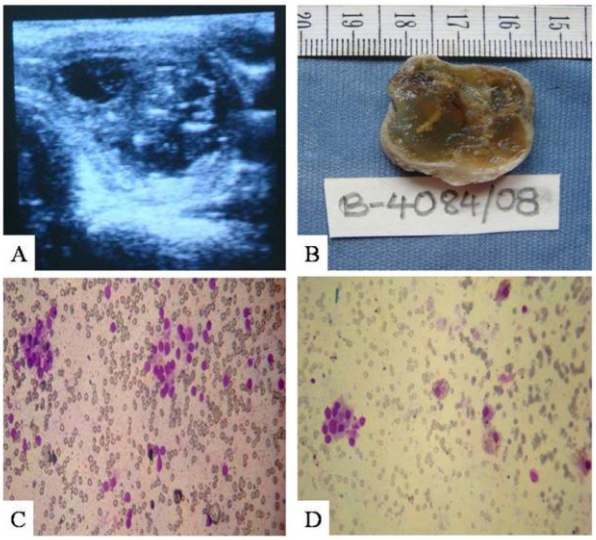

Fig 1: [A]: Mixed echoic lesion with specks of calcification in thyroid. [B]: Gross showing colloid filled nodules with specks of calcification on the septa. [C& D]: FNAC from different area showing clusters of follicular cells with cyst macrophages. Wright's stain 10x.

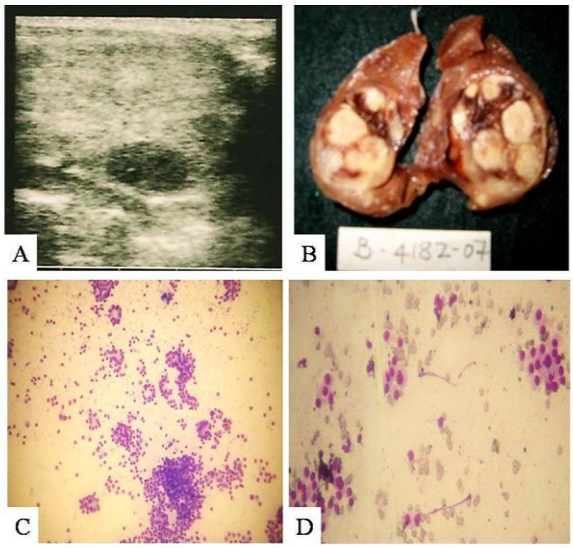

Fig 2: [A]: Single well circumscribed hypoechoic lesion. [B]: Gross of corresponding area showed well circumscribed grey white area. [C]: FNAC showed microfollicles. Wright's stain 10x [D]: Anisocytosis with honeycomb pattern. Wright's stain 10x.

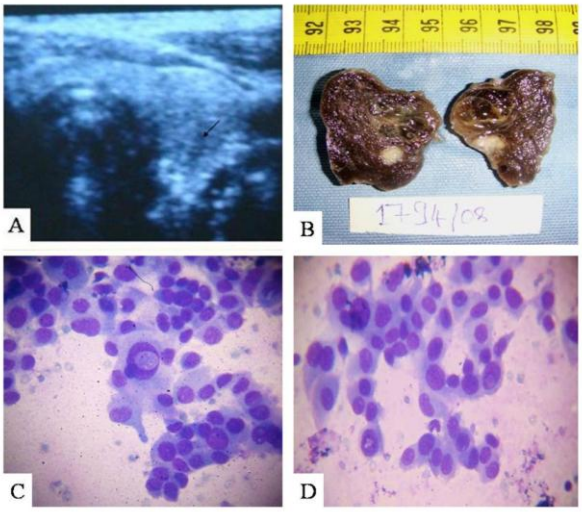

Fig 3: [A]: Arrow showing 0.5 cm hypoechoic area in left lobe of thyroid [B]: Gross of corresponding area showed gray-white areas. [C,D]: US-Guided FNAC from hypoechoic area showed features of papillary carcinoma with INC†. Wright's stain 40x. † Intra nuclear inclusion