IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 20, Issue 7 Ser.7 (July. 2021), PP 41-45
www.iosrjournals.org

Diagnostic Efficacy of Ultrasound Guided Fine Needle Aspiration Cytology in the Diagnosis of Thyroid Lesions :A retrospective study in a tertiary care unit

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Abstract:
Introduction*: Image guided fine needle aspiration cytology (FNAC) is emerging as an important diagnostic tool in the evaluation of thyroid swellings.* ***Aims and objectives*** *Our aim was to evaluate the efficacy of ultrasound guided fine needle aspiration cytology (USG-FNAC) in diagnosis of thyroid lesions by comparing it with standard fine needle aspiration cytology (S-FNAC)(without ultrasound guidance].****Material and methods****: In all, 314 patient with thyroid lesions who underwent USG guided FNAC as well as FNAC without USG guidance were studied during period of 1 year. Age, sex, cytological features, and histological diagnoses were analyzed. Statistical analyses of all the findings were done to derive conclusions.****Result****: Out of 314 cases 264 were benign and 18 malignant,rest being of intermediate,suspicious and inadequate.Malignant lesions were more frequently associated with hypo echoic appearance, irregular margins and micro calcification on ultrasound than benign lesions.* ***Conclusion****: The final conclusion was that USG-FNAC reduces the inadequacy rate significantly thus increasing the diagnostic accuracy and management of the patients.*

Keywords: *Thyroid lesions, USG Guided FNAC, Standard FNAC*

Date of Submission: 28-06-2021 Date of Acceptance: 12-07-2021

I. Introduction

FNAC has been established as a safe and cost effective first line investigation in distinguishing benign from malignant thyroid lesions, thus reducing the number of unnecessary surgeries.

However, one of the major limitations of FNAC thyroid has been found to be a high inadequacy rate, ranging from 6.4 to 32.4% in various studies. **[1]** Since the introduction of USG-FNAC by Rizatto et al in 1973, several studies have reported that USG-FNAC not only reduces the inadequacy rate but also helps to accurately select the patients for surgery hence avoiding unnecessary diagnostic thyroidectomies. **[2,3,4,5]** It does this by selection of the biopsy site, avoiding cystic areas and coarse calcification. Its role has been found useful in detecting micro carcinomas, cystic carcinomas, cancer associated with benign nodules for example Hashimoto's thyroiditis or coarse calcification. **[6]** However to date, there is very little literature that has compared the efficacy of S-FNAC and USG-FNAC in a large series in India. The present study was performed to compare the efficacy of S-FNAC and USG-FNAC in the diagnosis and management of thyroid diseases in a large series of patients.

II. Material And Methods

This was a retrospective study including 314 patients with thyroid disease. All the cases from January 2019 to December 2019 were subjected to S-FNAC as well as USG guided FNAC randomly. 110 cases underwent S-FNAC while in 204 cases USG-FNAC was done.

Technique of USG-FNAC [7, 8] Procedure was done with patient in supine position with neck extended. Ultrasonography was done with an ultrasound scanner equipped with 12 MHz transducer and findings were noted. Sterile gel was used as a coupling agent and no local anaesthesia was given. Procedure was performed by the Radiologist. Under the guidance of radiologist 23 G needle was introduced directly in the lesion through the skin. The needle was inserted obliquely along a path parallel to the scanning plane, so that tip and shaft of the needle were continuously visualised. When the needle reached the target, the technique of capillary sampling was employed. 4 passes were made, needle withdrawn, material expressed on slides and thin smears were prepared. Half of the slides were immediately fixed in 95% ethyl alcohol for Haematoxylin and Eosin and Papanicolaou stain.Half slides were air-dried for May- Grunwald- Giemsa stain. Standard FNAC was carried out with a similar procedure described above except ultrasound guidance was not used. Following

precautions were strictly followed during the procedure: 1. In case of cystic lesions the aspirated fluid was centrifuged and smears prepared from the sediment. If a residual mass was palpated, it was sampled and slides labelled separately. 2. In case of multinodulargoiter, if more than 2 nodules measuring > 1 cm were present, FNAC was done from the most suspicious nodule. If more than 2 nodules were present and both appeared benign, then larger one was aspirated. All cases were classified into five categories. 1. Benign (Negative): Included simple goiter, colloid goiter with cystic change, adenomatous goiter, Grave's disease, thyroglossal cyst, colloid cyst and thyroiditis. 2. Indeterminate: Follicular neoplasm and Hurtle cell neoplasm in which differentiation between benign and malignancy was not possible**.** 3. Suspicious: Included cases in which FNAC smears showed high cellularity, microacinar pattern, anisonucleosis, nucleomegaly, some but not all features of papillary carcinoma and scant to absent colloid. 4. Malignant (Positive): Included papillary carcinoma, medullary carcinoma and anaplastic carcinoma. 5. Inadequate: Adequacy criteria- Smears should have at least six follicular cell clusters, each cluster having at least ten follicular cells, spread on at least two separate smears.

III. Results

Age of the patients ranged from 5 to 80 years, with maximum number of cases belonging to fourth decade. Thyroid disease was more common in females i.e., 267 cases (85%).

Table 1 shows the cytologic diagnostic categories in 314 cases.

Table 2 shows the ultrasound findings in the 204 cases.Out of 314 cases 264 were benign and 18 malignant,rest being of intermediate,suspicious and inadequate. On ultrasound, 19 of the lesions were cystic and 185 cases were solid. 18 (8.75%) nodules were hypo echoic and showed micro calcification. Remaining 186 (91.24%) cases showed mixed echogenicity and no micro calcification. Irregular margins were seen in 27 (12.47%) of the cases. 11 cases (5.68%) were given a malignant diagnosis on FNAC.

264 (94.31%) cases were diagnosed as benign on FNAC, Malignant lesions were more frequently associated with hypo echoic appearance, irregular marg.ns and micro calcification on ultrasound than benign lesions. However out of 40 cases with hypo echoic appearance, irregular margins and micro calcification on ultrasound, only 13 cases were confirmed as malignant on FNAC.

Table 3 shows cytological diagnosis of 40 cases suspected as malignancy on ultrasonography.

Table 4 shows Comparison of adequacy and inadequacy rate in S-FNAC and USG-FNAC

Table 5 shows Correlation of cytologic with histopathologic diagnosis in all the cases

Table 6 shows Final diagnosis of cases non-consistent on FNAC

Table 7 shows Sensitivity, specificity and accuracy of S-FNAC and USG-FNAC

Table 1: Cytologic diagnostic categories in 314 cases

S. No.	Cytologic diagnostic categories	Number of cases	Percentage
1	Negative/Benign	264	84
2	Intermediate	10	3.1
3	Suspicious	02	0.6
4	Positive/Malignant	18	5.7
5	Inadequate	20	6.3
	Total		

Table 2: Ultrasonography findings in 204 cases

S .No	Ultrasonography findings	Number of cases	Percentage
1	Echo structure 1. Solid 2 . Cystic	 185 19	 90.6 9.3
2	Echogenicity 1. Hypo echoic 2. Mixed echogenicity	 18 186	 8.8 91.1
3	Calcification 1. Presence 2. Absence	 18 186	 8.8 91.1
4	Margins 1. Regular 2. Irregular	 177 27	 86.7 13.2
	Total		

Table 3: Cytology diagnosis of 18 cases suspected as malignant on ultrasonography

S. No.	Cytology diagnosis	Number of cases	Percentage
I	Benign 1. Colloid goiter 2. Adenomatous goiter 3. Thyroiditis	 5 3 2	 27.7 16.6 11.1
II	Indeterminate Follicular	1	5.5

	neoplasm		
III	Suspicious	1	5.5
IV	Malignant 1. Papillary carcinoma 2. Medullary carcinoma 3. Anaplastic carcinoma	 2 1 2	 11.1 5.5 11.1
V	Inadequate	1	5.5
	Total	18	100

Table 4: Comparison of adequacy and inadequacy rate in S-FNAC and USG-FNAC

S. No.		S-FNAC	USG-FNAC
1	Number of adequate smears	93[84.5%]	200[98%]
2	Number of inadequate smears	17[15.4%]	4 [2%]
	Total	110	204

Chi square test was employed $X^2 > 42$, df=1 and *p*value was less than 0.05 and this was statistically significant.

Table 5: Correlation of cytologic with histopathologic diagnosis in all the cases

S.No	Histopathology	Number of cases (percentage)	S-FNAC		USG-FNAC	
			Consistent	Non Consistent	Consistent	Non Consistent
1	Nodular colloid goiter	69	28	--	41	--
2	Multinodular goiter	3	1	1	1	--
3	Colloid cyst	1	--	--	1	--
4	Thyroglossal duct cyst	4	2	--	2	--
5	Lymphocytic thyroiditis	1	1	--	--	--
6	Hashimoto's thyroiditis	3	--	2	1	--
7	Follicular adenoma	5	--	3	1	--
8	Hurthle cell neoplasm	1	--	--	1	--
9	Follicular carcinoma	5	--	--	3	1
10	Papillary carcinoma	5	2	--	2	--
11	Medullary carcinoma	1	--	--	1	--
	Total	98	37	5	55	1

Table 6: Final diagnosis of cases non-consistent on FNAC

S. No	**S-FNAC diagnosis**	**Histopathologic diagnosis**	**Number of Cases**
1	Colloid goiter with cystic change	Papillary carcinoma	1
2	Adenomatous goiter	Follicular carcinoma	1
3	Follicular Neoplasm	Multinodulargoiter	1
4	Colloid cyst	Hashimoto's thyroiditis	2
	US Guided FNAC diagnosis		
5	Adenomatous goiter	Follicular carcinoma	1

Table 7: Sensitivity, specificity and accuracy of S-FNAC and USG-FNAC

	Sensitivity	Specificity	Accuracy
S-FNAC	50%	97.36%	92.85%
USG-FNAC	87.50%	100%	98.21%

IV. Discussion

FNAC has been established as a first line of investigation in the diagnosis of thyroid disease. Thyroid nodules are seen in 70% of the normal individuals as detected by ultrasonography. **[9]** Most of the thyroid nodules are benign, malignancy being prevalent in only 3- 5% of these cases. **[10,11]** FNAC allows careful selection of patients for surgery reducing the diagnostic thyroidectomies. However, the two major pitfalls of S-FNAC are inadequate aspirates seen in 6.4 to 32.4% cases and indeterminate results, especially in differentiating adenomatous nodules of multinodulargoiter from follicular neoplasms.

Since its introduction by Miskin et al in 1973, ultrasound has been used extensively to characterize thyroid nodules with an attempt to distinguish benign from malignant nodules. **[12]**

Papini Enrico used ultrasound and USG-FNAC to evaluate 494 consequent patients with non-palpable thyroid nodules. They found that hypo echoic lesions with irregular margins and micro calcification were independent risk factors for predicting malignancy **[13]**

USG-FNAC is useful in cases of cystic lesions wherein sampling can be done from solid portion of partially cystic masses, yielding highly cellular aspirates by avoiding dilution with cystic fluid. Hashimoto's thyroiditis can sometimes present as cystic nodule, this possibility should be kept in mind lest an erroneous diagnosis of malignancy can be made. **[14]** Two of our cases of Hashimoto's thyroiditis presented as cystic nodule which were wrongly interpreted as colloid cyst at S-FNAC. In such cases, USG-FNAC allows precise sampling from any solid area. Cystic change in a papillary carcinoma is a majorcause of false negative report.

In our series there was one case of papillary carcinoma with cystic change which was missed at S-FNAC as smears showed only cyst macrophages. 50% of papillary carcinoma demonstrates cystic change. Areas of calcification and fibrosis can be traversed and needle positioned in solid portion under ultrasound guidance. About 5% of multinodular goiter harbor malignancy. In these cases sampling can be done from all nodules, especially highly suspicious nodules which are hypo echoic and show micro calcification. **[15]**

Another major pitfall of FNAC is the follicular and hurthle cell neoplasm-indeterminate category. Smears with microfollicular pattern are a grey zone area and most of the erroneous diagnoses are related to distinguishing benign and malignant follicular neoplasm. Difficulties in distinguishing follicular carcinoma from adenoma and at times adenomatous goitre are well documented in literature and are unavoidable in clinical practice. **[16,17]**

Studies suggest that aspiration from multiple sites, USG-FNAC and adhering to strict criteria may improve diagnostic accuracy in this setting. However criteria of capsular and vascular invasion are needed for satisfactory diagnosis in histopathology. **[18]**

In suspicious category about 25% are found to be malignant at surgery. In these cases USG-FNAC allows positioning of the needle in most suspicious area. **[19].**

Takashima et al reported that sensitivity, specificity, accuracy and negative predictive value of USG-FNAC for malignancy were not significantly different from that of S-FNAC. However the initial failure rate for S-FNAC was significantly higher than for USG- FNAC. **[15]**

As per Hatada et al, sensitivity, specificity and accuracy was higher for USG-FNAC as compared to S-FNAC, especially in patient with tumour < 2 cm. **[7]** It is well documented that greater number of thyroid cancer can be detected by USG-FNAC as compared to S-FNAC. USG- FNAC is a powerful technique in detecting micro carcinomas, cystic carcinomas, cancer associated with benign nodule for example Hashimoto's thyroiditis or coarse calcification. **[6]**

Limitations of the study: Two separate groups were taken and compared.Comparison of FNAC from the same case with and without US guidance would have given us better results.

V. Conclusion

The final conclusion was that USG-FNAC reduces the inadequacy rate significantly thus increasing the diagnostic accuracy and management of the patients.

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Agamya Saxena, et. al. "Diagnostic Efficacy of Ultrasound Guided Fine Needle Aspiration Cytology in the Diagnosis of Thyroid Lesions :A retrospective study in a tertiary care unit." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 20(07), 2021, pp. 41-45.