ROLE OF FINE NEEDLE ASPIRATION CYTOLOGY IN SOLITARY THYROID NODULES

Dinesh Kumar Singh¹, Ravindra Kumar Shrivastava², D.G. Paricharak³, Nitu Nigam⁴, Sanjay Kumar Nigam⁵

HOW TO CITE THIS ARTICLE:

Dinesh Kumar Singh, Ravindra Kumar Shrivastava, DG Paricharak, Nitu Nigam, Sanjay Kumar Nigam. "Role of fine needle aspiration cytology in solitary thyroid nodules". Journal of Evolution of Medical and Dental Sciences 2013; Vol2, Issue 36, September 9; Page: 6903-6914.

ABSTRACT: BACKGROUND: In practical and numerical terms, the solitary nodule is the most important target of thyroid FNAC. Since FNAC can provide an unequivocal benign diagnosis in 60% of patients with benign nodules, its potential to reduce the number of unnecessary operations is significant. Of all the thyroid glands that on surgical resection prove to contain solitary nodules, 70-80% are benign adenomas and about 10-30% is malignant growth. Over the past two decades, fine needle aspiration cytology (FNAC) has become an essential step in the evaluation of thyroid nodules, due to its superior diagnostic reliability and cost effectiveness. **AIMS & OBJECTIVES:** The present study aims to explore the role of FNAC in the diagnosis of various thyroid lesions presenting as solitary thyroid nodules (excluding multiple nodular lesion). **MATERIAL & METHODS:** 140 patients of more than or equal to 15 years of age presenting with solitary thyroid nodule were the subjects of the current study. Subjects were referred for fine needle aspiration by the treating clinicians. **OBSERVATIONS:** Male: Female ratio was (18/122) 1:6.8 and age of the patients ranged from 15 years to 62 years. Maximum number of cases was in 3rd and 4th decades. 4 patients were in 7th decade. Cytodiagnostic break up of all 122 cases included colloid goitre 31 cases (25.5%), hyperplastic nodule 3 cases (2.5%), lymphocytic thyroiditis 2 cases (1.6%), Hashimoto's thyroiditis 7 cases (5.7%) and subacute thyroiditis 5 cases (4.0%), from non-neoplastic category. Amongst the neoplastic category, follicular neoplasm (45 cases, 36.9 %) was the most common lesion and remaining included 15 cases of papillary carcinoma (12.3%), 4 cases of Hurthle cell neoplasm (3.3%), 3 cases of medullary carcinoma (2.5%), 2 cases of anaplastic carcinoma (1.6%) and a solitary case of squamous cell carcinoma (0.8%). Colloid was observed in all cases and was abundant in 18 cases (58%) and moderate in 11 cases (35.5%). Dominant cellular pattern observed in all cases and uniform follicular cells were arranged in monolayered sheets (honey comb pattern), nuclear pleomorphism was an uncommon finding, being seen in only 4 cases (13%). Foamy histiocytes or hemosiderin laden histiocytes were a fairly common finding, being observed in 23 cases (74.1%). A cytodiagnosis of follicular neoplasm accounted for 36.9% (45 out of 122) of all diagnosis rendered on adequate aspirates and 64.3% of all diagnosed neoplasms. (45 out of 70 cases), thus reflecting that this entity comprised not only the highest number of cases amongst the neoplastic group but also the most common lesion when both non-neoplastic and neoplastic lesions were considered together. Aspirates from follicular neoplasms were either moderately cellular or highly cellular. Thus good cellularity was the outstanding characteristic feature observed in all cases. Blood in the background was a consistent finding observed in almost all the cases. Scant to moderate colloid was observed in 31 cases (68.8%). The dominant pattern was one of repetitive microfollicles or acini being observed in all 45 cases (100%). Most of the cases also had cellular aggregates with nuclear overlapping. Histopathological correlation was available in 20 cases. 19 cases were consistent with cytodiagnosis although 1 case showed discrepancy. **CONCLUSION:** It was concluded that FNAC of

thyroid is a safe, simple, cost- effective, reliable and accurate investigation for cases of solitary thyroid nodule as firm diagnosis can be made on cytology alone in vast majority of cases, thus obviating the need for unnecessary surgical procedures. Cystic lesions mandate careful clinical correlation.

KEYWORDS: FNAC, Solitary Thyroid nodules, Follicular Neoplasm, Colloid Goitre, Histological Correlation.

INTRODUCTION: The thyroid gland is a bilobed organ situated in the anterior neck in front of the upper trachea. The normal thyroid gland in adult weighs 15-30 gm.¹ Normal function of the thyroid gland is to secrete thyroxine (T4) and triiodothyronine (T3). FNAC is highly successful in triaging patients with solitary thyroid nodule into operative and non-operative groups.² It may also be diagnostic for certain thyroid lesions, such as colloid goiter, Hashimoto's thyroiditis, papillary carcinoma, anaplastic carcinoma, large cell lymphoma, and metastatic carcinoma.

In practical and numerical terms, the solitary nodule is the most important target of thyroid FNAC.³ Over the past two decades, fine needle aspiration cytology (FNAC) has become an essential step in the evaluation of thyroid nodules, due to its superior diagnostic reliability and cost effectiveness.^{4, 5}

Since FNAC can provide an unequivocal benign diagnosis in 60% of patients with benign nodules, its potential to reduce the number of unnecessary operations is significant.^{6, 7, 8, 9.} Palpable thyroid nodules occur in 4-7% of the population (10 to 18 million persons) but nodules found incidentally on USG suggest a prevalence of 19-67%.¹⁰

Thyroid carcinoma occurs in roughly 5-10 % of palpable nodules.¹⁰ Thyroid cancers constitute only about 1-2% of all malignant neoplasms in most populations and are three times more common in women than in men.¹¹ The prevalence of thyroid cancer in patients undergoing fine needle aspiration biopsy is estimated to be about 4%. Of all the thyroid glands that on surgical resection prove to contain solitary nodules, 70- 80% are benign adenomas and about 10-30% is malignant growth.¹²

AIMS& OBJECTIVES: The present study aims to explore the role of FNAC in the diagnosis of various thyroid lesions presenting as solitary thyroid nodules (excluding multiple nodular lesion).

OBJECTIVES:

1. To study the distribution of thyroid lesions according to age & sex.
2. To study the adequacy of fine needle aspirates in solitary thyroid nodules.
3. To study the frequency of cystic & solid lesions amongst solitary thyroid nodules.
4. To study the cytological findings & the frequency of various diagnoses rendered.

MATERIAL & METHODS: This study was performed in the Department of Pathology, D.Y. Patil Medical College, Kolhapur during a study period of 2 year from June 2008 –to May 2010. 140 patients of more than or equal to 15 years of age presenting with solitary thyroid nodule were the subjects of the current study. Subjects were referred for fine needle aspiration by the treating clinicians.

ORIGINAL ARTICLE

OBSERVATIONS:

S. NO.	SEX	No. of cases	PERCENTAGE
1	Female	122	87.1
2	Male	18	12.9
	Total	140	100.0

Table -1: Distribution of cases according to sex

S.No.	Age (range)	No. Of cases	Percentage
1	10-19	6	4
2	20-29	49	35
3	30-39	41	29
4	40-49	28	20
5	50-59	12	9
6	>60	4	3
	Total	140	100.0

Table -2: Distributions of cases according to age

Male: Female ratio was (18/122) 1:6.8 and age of the patients ranged from 15 years to 62 years. Maximum number of cases was in 3rd and 4th decades. 4 patients were in 7th decade.

S.No.	Diagnosis	No. Of cases	Percentage
1	Non neoplastic	48	39.3
2	Neoplastic	70	57.3
3	Indeterminate	04	3.4
	Total	122	100.0

Table - 3: Frequency of Non Neoplastic and Neoplastic Diagnosis rendered on Adequate Aspirates

Cases with adequate cellularity were divided into non- neoplastic 48 cases (39.3%), neoplastic 70 cases (57.3%) and indeterminate 4 cases (3.4%). Indeterminate category included cases in which a firm diagnosis could not be rendered despite an adequate aspirate. In one case, clear distinction between non- neoplastic and neoplastic could not be made and in the remaining 3 cases there was some degree of suspicion for neoplasm, but cytological features were not sufficiently conclusive.

S.No	Diagnosis	No. of cases	Percentage
1	Colloid goitre	31	25.5
2	Hyperplastic nodule	3	2.5
3	Lymphocytic thyroiditis	2	1.6
4	Hashimoto's thyroiditis	7	5.7
5	Subacute thyroiditis	5	4.0

ORIGINAL ARTICLE

6	Indeterminate cases	4	3.3
7	Follicular neoplasm	45	36.9
8	Hurthle cell neoplasm	4	3.3
9	Papillary carcinoma	15	12.3
10	Medullary carcinoma	3	2.5
11	Anaplastic carcinoma	2	1.6
12	Squamous cell carcinoma	1	0.8
	Total	122	100.0

**Table – 4: Frequencies of Various Diagnoses
Rendered on Adequate Aspirates**

Cytodiagnostic break up of all 122 cases included colloid goitre 31 cases (25.5%), hyperplastic nodule 3 cases (2.5%), lymphocytic thyroiditis 2 cases (1.6%), Hashimoto's thyroiditis 7 cases (5.7%) and subacute thyroiditis 5 cases (4.0%), from non-neoplastic category. Amongst the neoplastic category, follicular neoplasm (45 cases, 36.9 %) was the most common lesion and remaining included 15 cases of papillary carcinoma (12.3%), 4 cases of Hurthle cell neoplasm (3.3%), 3 cases of medullary carcinoma (2.5%), 2 cases of anaplastic carcinoma (1.6%) and a solitary case of squamous cell carcinoma (0.8%). 4 cases (3.3%) were indeterminate or suspicious for neoplasm as mentioned before.

INADEQUATE CASES:

In this series 18 cases (13%) were found to be inadequate due to absence of follicular epithelium or very scant epithelium with or without colloid or due to dilution with blood.

Table- 5a: Solitary Thyroid Nodules – Cytomorphological features in Fine Needle Aspirates.

DIAGNOSIS	No. of cases (122)	Cellularity			Colloid				Sheet form			
		+	++	+++	0	+	++	+++	0	+	++	+++
Colloid goiter	31 (25.6%)	12 (38.7%)	16 (51.6%)	3 (9.7%)	0	2 (6.5%)	11 (35.5%)	18 (58%)	0	4 (12.9%)	20 (64.5%)	7 (22.5%)
Hyperplastic nodule	3 (2.6%)	0	2 (66.6%)	1 (33.4%)	0	2 (66.6%)	0	1 (33.4%)	0	2 (66.6%)	1 (33.4%)	0
Indeterminate	4 (3.5%)	0	3 (75%)	1 (25%)	1 (25%)	2 (50%)	1 (25%)	0	1 (25%)	1 (25%)	2 (50%)	0
Neoplasm	70 (57.8%)	0	34 (48.5%)	36 (51.5%)	18 (25.7%)	31 (44.3%)	17 (24.2%)	4 (5.7%)	33 (47%)	16 (22.8%)	14 (20%)	7 (10%)
Thyroiditis	14 (11.5%)	3 (21.4%)	8 (57.2%)	3 (21.4%)	1 (7.1%)	5 (35.8%)	7 (50%)	1 (7.1%)	2 (14.2%)	7 (50%)	5 (35.7%)	0

Table Contd.....

ORIGINAL ARTICLE

S. No.	Diagnosis	No. of cases (122)	Acinar or rosette	Papillae	PVG	INI	Nuclear Groove	MV	Hurthle Cells	Blood		
										-	+	++
1	Colloid goiter	31 (25.6%)	7 (22.5%)	0	17 (54.8%)	0	0	6 (19.3%)	1 (3.2%)	10 (32.2%)	12 (38.7%)	9 (29%)
2.	Hyperplastic nodule	3 (2.6%)	1 (33.3%)	0	0	0	1 (33.3%)	2 (66.6%)	0	0	1 (33.3%)	2 (66.6%)
3.	Indeterminate	4 (3.5%)	4 (100%)	1 (25%)	0	1 (25%)	2 (25%)	3 (75%)	1 (25%)	0	1 (25%)	3 (75%)
4.	Neoplasm	70 (57.8%)	50 (71.5%)	16 (22.8%)	6 (8.6%)	90 (27.1%)	15 (21.4%)	26 (37.1%)	13 (18.5%)	2 (2.8%)	24 (34.2%)	44 (62.8%)
5.	Thyroiditis	14 (11.5%)	0	0	7 (50%)	0	0	3 (21%)	7 (50%)	5 (35.7%)	5 (35.7%)	4 (28.5%)

Table- 5b: Solitary Thyroid Nodules - Cytomorphological features in Fine Needle Aspirates.

PVG : PARAVACUOLAR GRANULE.
 INI : INTRANUCLEAR INCLUSION.
 MV : MARGINAL VACUOLE.

COLLOID GOITRE: Colloid was observed in all cases and was abundant in 18 cases (58%) and moderate in 11 cases (35.5%). Scant colloid was an infrequent finding seen in only 2 cases (6.5%). Dominant cellular pattern observed in all cases and uniform follicular cells were arranged in monolayered sheets (honey comb pattern), nuclear pleomorphism was an uncommon finding, being seen in only 4 cases (13%). Acinar pattern or rosettes (microfollicles) were infrequently seen and were present in only 7 cases (22.5%). Foamy histiocytes or hemosiderin laden histiocytes were a fairly common finding, being observed in 23 cases (74.1%) but multinucleate giant cells were seen in only 1 case (3.2%). Other lymphoid cells were also a very infrequent finding, being observed in 4 cases (13%).

HYPERPLASTIC NODULES: 3 cases of hyperplastic nodule were diagnosed. Moderate cellularity was seen in 2 cases (66.6%) and abundant cellularity in 1 case (33.4%). Colloid was observed in all 3 cases, with 2 cases (66.6%) showing scant colloid and one case (33.4%) showed abundant colloid. Cellular arrangement of monolayered sheets was observed in all 3 cases (100%) and acinar pattern or rosettes were present in only 1 case (33.4%). Nuclear pleomorphism was a feature seen in 2 cases (66.6%). 2 cases (66.6%) showed fire flares at the periphery of the follicular cell aggregates.

THYROIDITIS: Category of thyroiditis included 2 cases (1.6%) of chronic lymphocytic thyroiditis, 7 cases (5.7%) of Hashimoto's thyroiditis and 5 cases (4%) of subacute thyroiditis. Six out of seven cases (85.7%) of Hashimoto's thyroiditis were moderately cellular and one case (14.3%) showed marked cellularity. Hurthle cells were frequent in all 7 cases (100%) as were lymphoid infiltrates and intraepithelial lymphocytes. Plasma cells were also seen in all 7 cases (100%). 5 cases of subacute thyroiditis accounted for 4% of all diagnoses. Mild to moderate cellularity was observed in 3 cases (60%) and marked cellularity in remaining 2 cases (40%). Characteristic dirty background mixed with clumps of colloid was observed in all the cases (100%). Aggregates of

ORIGINAL ARTICLE

epithelioid cells and multinucleate giant cells with or without ingested colloid were observed in all 5 cases 100%.

	FN 45(64.3		PC 14(20%		FVPC 1(1.		HCT 4(5.7		MCT 3(4.3		Miscellaneous 3(4.3%)		Total 70(100	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Blood	44	97.7	13	92.8	1	10	4	100	3	100	3	100	68	97.1
Cellularity														
+	0		0	0	0	0	0	0	0	0	0	0	0	0
++	24	53.3	5	35.7	0	0	3	75	1	33.3	1	33.3	34	48.5
+++	21	46.7	9	64.3	1	10	1	25	2	66.7	2	66.7	36	51.5
Colloid														
-	10	22.2	4	28.6	0	0	0	0	1	33.3	3	100	18	25.7
+	20	44.4	7	50.0	0	0	3	75	1	33.3	0	0	31	44.3
++	11	24.4	3	21.4	0	0	1	25	1	33.3	0	0	17	24.3
+++	4	9	0	0	1	10	0	0	0	0	0	0	4	5.7
Chewingum	0	0	3	21.4	0	0	0	0	0	0	0	0	3	4.3
Acinar	45	100	4	28.6	1	10	0	0	1	33.3	0	0	51	72.8
Papillae	2	4.4	14	100	0	0	0	0	0	0	0	0	16	22.8
Monolayered	21	46.7	11	78.6	1	10	4	100	0	0	0	0	37	52.8
Marginal	23	51.1	2	14.3	0	0	1	25	0	0	0	0	26	37.1
Nuclear	7	15.5	12	85.7	0	0	0	0	0	0	0	0	19	27.1
Nuclear	3	6.6	11	78.6	1	10	0	0	0	0	0	0	15	21.4
Hurthle Cell	8	17.8	1	7.1	0	0	4	100	0	0	0	0	13	18.6
Multinucleated Cell	4	8.8	8	57.1	0	0	0	0	2	66.7	2	66.7	17	24.2
Histiocytes	19	42.2	12	85.7	1	10	3	75	0	0	1	33.3	36	51.4
Mitosis	2	4.4	2	14.3	0	0	0	0	0	0	3	100	7	100
Psammoma	0	0	5	35.7	1	10	0	0	0	0	0	0	6	8.5
Nuclear Pleomorphism														
-	4	8.9	0	0	0	0	0	0	0	0	0	0	4	5.8
+	32	71.1	3	21.4	1	10	4	100	0	0	0	0	40	57.1
++	9	20.0	1	7.1	0	0	0	0	3	100	3	100	26	37.1

Table 6: Cytomorphological features of Thyroid Neoplasm presenting as Solitary Nodule

FN: Follicular neoplasm, PC: Papillary Carcinoma, FVPC: Follicular variant of papillary Carcinoma, HCT: Hurthle Cell Tumour,

NEOPLASMS: A cytodiagnosis of follicular neoplasm accounted for 36.9% (45 out of 122) of all diagnosis rendered on adequate aspirates and 64.3% of all diagnosed neoplasms. (45 out of 70 cases), thus reflecting that this entity comprised not only the highest number of cases amongst the neoplastic group but also the most common lesion when both non-neoplastic and neoplastic lesions were considered together. Aspirates from follicular neoplasms were either moderately cellular or highly cellular. Thus good cellularity was the outstanding characteristic feature observed in all cases. Blood in the background was a consistent finding observed in almost all the cases. Scant to moderate colloid was observed in 31 cases (68.8%).The dominant pattern was one of repetitive microfollicles

or acini being observed in all 45 cases (100%). Most of the cases also had cellular aggregates with nuclear overlapping.

Papillary carcinoma accounted for 20% of all neoplasms, thus representing the second most common neoplasm in this series. One case out of 70 was identified as follicular variant of papillary carcinoma (FVPC) accounting for 1.4%. Aspirates were highly cellular in 9 cases (64.3%) and moderately cellular in remaining 5 cases (35.7%). Follicular variant of papillary carcinoma (FVPC) also showed hypercellular smears. Papillary fronds were observed in all 14 cases, few with central stromal cores. Monolayered sheets were also a common finding, being observed in 11 cases.

Intranuclear cytoplasmic inclusions were a fairly common finding in 12 cases (85.7%) but not in FVPC. Nuclear grooves were also seen in 11 cases (78.6%) and were also observed in the solitary case of FVPC. Psammoma bodies were identified in 5 cases (35.7%) and also in the solitary case of FVPC.

HURTHLE CELL NEOPLASMS: Hurthle cell neoplasms accounted for 4 cases out of 70. All aspirates showed blood in the background and moderately to highly cellular smears. None of the cases had abundant colloid; cellular patterns observed were monolayered sheets and clusters in all 4 cases (100%). All cases showed Hurthle cells as the predominant cell population. Cells had abundant granular, cytoplasm with distinct cell borders.

MEDULLARY CARCINOMA: 3 cases of medullary carcinoma accounted for 4.3% of all neoplasms in this series. All showed abundant cellularity. Predominant cell pattern was dispersed round (epithelium like) cells with some clustering, although one case showed significant aggregation with marked nuclear overlapping and some dispersal. Spindle cells were also observed in 2 cases, whereas one case showed plasmacytoid cells. Moderate to abundant cytoplasm with ill defined borders was a consistent finding in all 3 cases and cytoplasm was pale and vacuolated in 2 cases and dense in 1 case. Basophilic granules were observed in 2 cases and one case showed suspicious red granularity in the cytoplasm. Amyloid was identified as amorphous pink material in between the cell aggregates and in the background. Multinucleation was observed in 2 cases.

ANAPLASTIC CARCINOMA: 2 cases of anaplastic carcinoma were diagnosed. Good cellularity and complete absence of colloid were observed in both of them. Most of the cells were dispersed with some clustering in one of the cases whereas another case showed moderate clustering along with dispersal. Marked cellular pleomorphism and large bizarre and multinucleated cells were common in both the cases. Cells were round to oval with abundant pale vacuolated and large, irregular, eccentric nuclei with coarse chromatin and prominent nucleoli. Both the cases also showed necrosis in the background, fair number of mitotic figures and inflammatory cells.

METASTATIC SQUAMOUS CELL CARCINOMA: This diagnosis accounted for only one cases out of 70 cases diagnosed as various neoplasms. Clinical features as well as cytological features were considered together to reach the final diagnosis of metastatic squamous cell carcinoma. Patient was a 62 year old male with complaints of hoarseness of voice and lateral cervical swellings (hard, > 3 cm) of 1 year duration and solitary neck swelling. Aspirates from midline swelling showed good cellularity in necrotic background. Cells were lying singly as well as in sheets. Cells were round,

ORIGINAL ARTICLE

polygonal to spindle in shape with features of malignancy i.e. high N/C ratio, pleomorphism, hyperchromatic nucleus, coarse chromatin and prominent nucleoli. Most of the cells had moderate to abundant cytoplasm with fair number of cells showing glassy blue hue surrounding the nucleus, evidence of keratinization. Some aggregates of normal thyroid follicular epithelium were also present. Aspirates from lateral cervical swellings also showed similar features.

Sl. No.	Cytological Diagnosis	No. Of Cases	No. of cases with available histology	Consistent with cytodiagnosis	Discrepant with cytodiagnosis
1	Colloid Goitre	31	4	4	-
2	Solid/Cystic nodule (inadequate)	18	2	1	1 (follicular adenoma with cyst)
3	Hyperplastic nodule	3	-	-	-
4	Lymphocytic thyroiditis	2	-	-	-
5	Hashimoto's Thyroiditis	7	-	-	-
6	Subacute thyroiditis	5	-	-	-
7	Indeterminate cases	4	-	-	-
8	Follicular Neoplasm	45	8	8	-
9	Hurthle cell Neoplasm	4	-	-	-
10	Papillary Carcinoma	14	3	3	-
11	Follicular variant of papillary carcinoma	1	1	1	-
12	Medullary Carcinoma	3	2	2	-
13	Anaplastic Carcinoma	2	-	-	-
14	Squamous cell carcinoma	1	-	-	-
	Total	140	20	19	1

Table- 7: Cytohistologic Correlation

Histological correlation was available in 20 cases. 19 cases were consistent with cytodiagnosis although 1 case showed discrepancy.

DISCUSSION: In our study female/ male ratio is 6.7:1 as compared with studies⁸ (6.35:1), (2.03:1)⁹ & (2.21:1)¹³. In our study the percentage of solid lesion was obtained in 87.14% which was higher to those quoted by Silverberg¹⁴ (70%). In our study maximum number of cases was in 3rd & 4th decades. One study quoted maximum no of cases in 4th & 5th decade.¹³

In our study the percentage of non- neoplastic lesion was (39.3%) which was lower than those quoted by other authors^{9, 15} and percentage of neoplastic lesion was (57.3%) which was higher than those quoted by same authors (7.52%) (13%).

In 122 cases (87%) adequate aspirate was obtained and these cases were diagnosed as colloid goiter 31 cases (25.5%), hyperplastic nodule 3 cases (2.5%), lymphocytic thyroiditis 2 cases (1.6%), Hashimoto's thyroiditis 7 cases (5.7%) and subacute thyroiditis 5 cases (4%). 4 (3.3%) cases were cytologically indeterminate in which firm diagnosis could not be rendered. Remaining

cases were various neoplastic lesions that included follicular neoplasm 45 cases (36.9%), Hurthle cell neoplasm 4 cases (3.3%), papillary carcinoma 15 cases (12.3%), medullary carcinoma 3 cases (2.5%), anaplastic carcinoma 2 cases (1.6%) and a solitary case of squamous cell carcinoma (0.8%).(Table 4,5)

Colloid goiter accounted for 2nd most common diagnosis in this study (25.5%) preceded only by follicular neoplasm (36.9%). However, Hsu Chih ⁵⁰ (1987) mentioned that nodular goiter was the most common lesion encountered in their study (49.5%) of thyroid nodules. The reason for this discrepancy is not entirely clear.

Hyperplastic nodule accounted for 3 cases. Cases showed moderate (66.6%) to abundant (33.4%) cellularity and scant colloid in (66.6%) 2 cases. Nuclear pleomorphism and fire flares were observed in 2 cases (66.6%). Other studies also observed similar findings^{3, 16, 17}. Hashimoto's thyroiditis was diagnosed in 7 cases. It may seem somewhat strange that a diffuse disorder like Hashimoto's thyroiditis presented as a solitary nodule.

Follicular neoplasm was the most common diagnosis in the current series accounting for 36.9% cases of all diagnosis rendered on adequate aspirates as well as the most common neoplasm encountered. These cases were easily diagnosed due to the presence of good cellularity, hemorrhagic background, scant colloid and repetitive pattern of acinar or micro follicle formations in most of the cases. All these findings were also described by some authors^{3,17}. Papillary carcinoma accounted for 20% of all neoplasms thus representing second most common neoplasm in the current series. Diagnosing papillary carcinoma on aspirate smears from thyroid nodule was not difficult due to the presence of good cellularity with typical nuclear features and papillary structures in almost all the cases. Papillary fronds were also common findings and intra nuclear inclusions with nuclear grooves are described by authors.^{3, 14, 17, 18}

Smears from medullary carcinoma were fairly cellular showing spindle, round or plasmacytoid cells.^{3, 14} However red granularity in cytoplasm and nuclear inclusions described by them was an extremely uncommon finding in current series. Smears from anaplastic carcinoma were extremely cellular and showed marked nuclear pleomorphism, bi/multinucleation, large bizarre cells in necrotic and hemorrhagic background. Other authors also described similar findings in their studies.^{3,14}

CONCLUSION: Colloid goiter was the most common lesion amongst all non – neoplastic diagnoses. Hyperplastic nodules showed cellular smears, moderate colloid and monolayered sheets in addition to few rosettes or microfollicles. All cases of thyroiditis showed typical findings in most of the cases. Follicular neoplasms were most common lesions encountered in current series. Diagnosis was based on cytologic findings like scanty colloid, background haemorrhage, good cellularity and repetitive microfollicle formations. Papillary carcinoma was second most common neoplasm in current series and diagnosis was based on identification of characteristic nuclear features and abundant cellularity with prominent papillary structures. Medullary carcinoma was characterised by good cellularity with prominent dispersal and spindle cell, round (epithelial) and plasmacytoid cells. Anaplastic carcinoma showed excessively cellular smears with marked nuclear pleomorphism and frequent mitoses. Metastatic squamous cell carcinoma showed good cellularity, necrotic background and malignant looking cells with evidence of intracellular keratinisation. Histological correlation was

available in 20 cases and only 1 case was found to be discrepant. This case was inadequate for interpretation on cytology due to absence of follicular epithelial cells.

Thus it was concluded that FNAC of thyroid is a safe, simple, cost-effective, reliable and accurate investigation for cases of solitary thyroid nodule as firm diagnosis can be made on cytology alone in vast majority of cases, thus obviating the need for unnecessary surgical procedures. Cystic lesions mandate careful clinical correlation.

REFERENCES:

1. McNicol AM, Lewis PD. The endocrine system. Systemic pathology Churchill Livingstone, Edinburgh, 1996; 132-155.
2. Lngegowda JB, Muddegowda PH, Rajesh KN, Ramkumar KR. Application of pattern analysis in fine needle aspiration of solitary nodule of thyroid. J 2010 Jan; 27(1):1-7. doi: 10.4103/0970-9371.66688
3. Orell SR et al. Manual and Atlas of fine needle aspiration cytology. 4th Edn. Churchill Livingstone, an imprint of Elsevier, 2005: 125-164.
4. KantasuebSarunya, Sukpan Kornkanok. The study of thyroid lesions and the correlation between histopathological and cytological findings at Maharaj Nakorn Mai Hospital between 2003 & 2007. Chiang Mai Med J 2010; 49: 105-110.
5. BalochNaseem M, Ali Shazia. Contribution of fine needle aspiration cytology (FNAC) in the diagnosis of malignant thyroid nodules. Pakistan J. Of Surgery 2008; 24 :19-21
6. Gharib H, Goellner JR. Fine needle aspiration biopsy of the thyroid: an appraisal. Ann Intern Med. 1993; 118: 282-289.
7. Moosa Ali Foad. Up to what extent FNAC is accurate in detecting malignancy in solitary thyroid nodule. Medical Channel 2010; 16: 280-283.
8. Guhamallick M, Sengupta S. Cytodiagnosis of thyroid lesions – usefulness and pitfalls. A study of 288 cases. J of cytology 2008; 25:6-9.
9. Handa Uma, GargSukant. Role of fine needle aspiration cytology in diagnosis & management of thyroid lesions. J of cytology 2008; 25: 13-17.
10. Mazzaferri EL. Thyroid cancer in thyroid nodules : finding a needle in the haystack, Am. J. Med. 1992; 93: 359-62
11. Castro MR, Gharib H. Thyroid nodule and cancer: when to wait and watch when to refer. Postgrad Med 2000; 107 (1): 113-24.
12. Willems JS, Lowhagen T. The role of fine needle aspiration in the management of thyroid disease. Clinics in Endocrinology and Metabolism, 1981; 10: 267-273.
13. Moosa Ali Foad. Up to what extent FNAC is accurate in detecting malignancy in solitary thyroid nodule. Medical Channel 2010; 16: 280-283.
14. SilverbergSG, De Lellis RA, and Frable WJ. Principles and practice of surgical pathology and cytopathology: Churchill Livingstone, 1997; 2665-2708.
15. Nongrem HB. Fine needle aspiration cytology of thyroid nodule (s).A Nazareth hospital experience. 2008.
16. Jayaram G, Singh B, Marwaha RK. Grave's disease. Appearance in cytologic smears from fine needle aspirates of the thyroid gland. ActaCytol 1989; 36-40.

17. Das DK et al. Solitary nodular goiter. Review of Cytomorphologic features in 411 cases. Actacytol 1999; 43: 563-574.
18. Sharma B et al. Cytodiagnosis of papillary thyroid carcinoma study of 37 cases at RIMS Hospital, Imphal. Indian J. patholMicrobiol 2007; 50(2): 408-410.

Fig-1: Colloid Goitre: Monolayer Sheets of Follicular Cells (Honey comb) pattern) with abundant colloid (H&E 10X10)

Fig. 2: Follicular Neoplasm: Marked Cellularity & Rosettes or Microfollicular Pattern (H&E, 10X10)

Fig.3: Papillary Carcinoma: Intranuclear Inclusions (H&E, 10X40)

Fig-4: Hashimoto's Thyroiditis: Hurthle Cell and Lymphocytes (H&E 10X40)

AUTHORS:

1. Dinesh Kumar Singh
2. Ravindra Kumar Shrivastava
3. D.G. Paricharak
4. Nitu Nigam
5. Sanjay Kumar Nigam

PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Pathology, Major S.D. Singh Medical College & Hospital, Bewar Road, Fateh Garh - Farrukhabad, U.P.
2. Assistant Professor, Department of Pathology, Major S.D. Singh Medical College & Hospital, Bewar Road, Fateh Garh - Farrukhabad, U.P.
3. Associate Professor, Department of Pathology, D.Y. Patil Medical College, Kolhapur.

4. Assistant Professor, Department of Microbiology, CSJM University, Kanpur.
5. Professor, Department of Pathology, Rama Medical College Hospital & Research Centre, Mandhana, Kanpur, U.P.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Dinesh Kumar Singh,
Department of Pathology,
P-10, Campus
Major S.D. Singh Medical College & Hospital,
Bewar Road, Fateh Garh - Farrukhabad,
U.P. - 209601.
Email- sknigam@yahoo.com

Date of Submission: 31/08/2013.

Date of Peer Review: 02/09/2013.

Date of Acceptance: 02/09/2013.

Date of Publishing: 04/09/2013