

## ORIGINAL RESEARCH

### **A Prospective Study to Evaluate the Accuracy of Fine Needle Aspiration Cytology (FNAC) and Touch Imprint Cytological Study in Correlation with Histopathological Study of Thyroid Lesions at Tertiary Care Center**

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#### **ABSTRACT**

**Background:** Fine Needle Aspiration Cytology has been established as the investigation of choice in thyroid lesions. Different imaging techniques are now used for preoperative diagnosis of thyroid nodules like radionuclide scanning, high-resolution ultrasonography (USG). The present study aims at diagnosing various thyroid diseases based upon cytomorphological features in FNAC and wherever possible with its histopathological correlation, which is the gold standard.

**Material & Methods:** A prospective study done on 100 specimens from thyroid were received in the Department of pathology, SMS Medical College, Jaipur for histopathological examination from SMS hospital, Jaipur during one year period. Out of these 100 cases imprint cytology was done for 48 cases. A correlative study between Fine Needle Aspiration Cytology and histopathology was done for these 100 cases. Data analysis was done with the help of computer using Epidemiological Information Package (EPI 2002).

**Results:** Our study showed that mean age of patients was 40.2 years and maximum patients were seen in 21 to 30 years of age group. There is a female preponderance with a Female to Male ratio of 13.28:1. Out of these 100 lesions 61 cases were non neoplastic lesions and 39 were neoplastic lesions. Among the 61 non neoplastic lesions 45 cases were reported as nodular goiter, 15 cases as hashimoto thyroiditis and 1 case as Granulomatous thyroiditis. Out of the 39 neoplastic lesions 21 cases were reported as benign neoplastic lesions and 18 as malignant neoplastic lesions. A correlation done between Fine Needle Aspiration cytology with imprint cytology and histopathology showed the following results. 31 Fine Needle Aspiration cytology reports (64.58%) were correlated with histopathological diagnosis.

**Conclusion:** High rate of diagnostic accuracy can be achieved by use of ultrasound guidance with strict adherence to adequacy criteria and meticulous examination of all the smears. Touch Imprint Cytology alone may provide a correct diagnosis in vast majority of cases with minimal expense and without the need of sophisticated cryostat machine thus making it quite suitable when cryostat machines are not available.

**Keywords:** FNAC, Touch Imprint, Thyroid Lesion, Histopathology.

## INTRODUCTION

Thyroid lesions are one of the common conditions encountered in clinical practice. The diseases of thyroid are of great importance because most of them are amenable to medical or surgical treatment.<sup>1</sup> Often it is difficult to make an accurate diagnosis by clinical evaluation alone. Hence Fine Needle Aspiration Cytology (FNAC) study of such lesions along with clinical evaluation is emphasized in order to aid towards accurate diagnosis.

Fine-needle aspiration cytology of the thyroid was described by N. Soderstrom in 1952 and has been generally available since the 1970s.<sup>2</sup> From then on, FNAC enjoyed an increasing popularity in many countries, as the technique proved to be a highly accurate and cost-effective procedure with low morbidity. During the 1960s FNA became a standard procedure in Sweden not only for the thyroid but for all palpable lumps in the body.<sup>3</sup>

With this rapid diagnostic technique, costly days in hospital can be saved. The whole procedure, including fixation and staining is quick and a report can be issued within hours. The immediate diagnosis relieves patient's anxiety and saves time. A definitive treatment can be planned in advance.<sup>4</sup>

FNAC examination has proved to be a simple, accurate, safe and cost-effective method for the preoperative diagnosis of benign and malignant thyroid nodules.<sup>5</sup> Its use has decreased the number of thyroid surgeries performed and increased the ratio of malignant to benign lesions resected. As a result, many thyroid surgeries for benign diseases have been avoided.<sup>6</sup> The clinical value of thyroid FNAC is useful in the diagnosis of inflammatory, infective and neoplastic conditions.<sup>1</sup>

Different imaging techniques are now used for preoperative diagnosis of thyroid nodules like radionuclide scanning, high-resolution ultrasonography (USG). However, FNAC is still regarded as the single most accurate and cost-effective procedure particularly if ultrasound is used as a guide for better sample collection, especially for cystic lesions.<sup>7</sup>

During the last decade, confidence in FNAC as a reliable test has grown considerably and it has emerged as a most direct accurate diagnostic procedure in the management of nodular thyroid disease, gaining worldwide acceptance.<sup>4</sup> FNAC requires careful aspiration technique and interpretation of the cytological findings. Most practitioners rely on FNAC alone, especially for the first attempt at diagnosis.<sup>8</sup>

A uniform reporting system for thyroid FNA will facilitate effective communication among cytopathologists, endocrinologists, surgeons, radiologists, and other health care providers. Also it will facilitate cytologic-histologic correlation for thyroid diseases, facilitate research into the epidemiology, molecular biology, pathology and diagnosis of thyroid diseases, particularly neoplasia and allow easy and reliable sharing of data from different laboratories for national and international collaborative studies.<sup>9</sup>

Touch Imprint cytology was also done immediately after receiving the operated specimens. Then the results were noted, and Histopathological correlation was done for all these cases.

False positive and false negative results were compared with other large series of studies. Limitations of Fine needle aspiration cytology (FNAC) and Touch Imprint cytology in diagnosing thyroid lesions were noted.

The present study aims at diagnosing various thyroid diseases based upon cytomorphological features in FNAC and wherever possible with its histopathological correlation, which is the gold standard.

## MATERIALS & METHODS

A prospective study done on 100 specimens from thyroid were received in the Department of pathology, SMS Medical College, Jaipur for histopathological examination from SMS

hospital, Jaipur during one year period. Out of these 100 cases imprint cytology was done for 48 cases.

The detailed clinical history of these 100 patients including the duration of swelling, pain, fever, loss of weight, loss of appetite and cough with expectoration etc. were obtained and tabulated in the proforma.

Fine Needle Aspiration Cytology was done for 100 thyroid cases. The aspiration syringes used were 10-20 ml and the needle size between 22-23 gauges. The cytological materials obtained were fixed in ninety five (95%) ethyl alcohol then stained with haematoxylin and eosin.

Touch Imprint cytology was done for 48 cases on freshly cut surface of the specimen by gently pressing the glass slide. Then the slides were immediately wet fixed in ninety five percent ethyl alcohol for five to six seconds. Then the smears were stained with haematoxylin and eosin.

The specimens of lobectomy, hemi thyroidectomy, near total thyroidectomy and total thyroidectomy with modified neck dissection were received for histopathological examination.

The specimens were fixed in 10% formalin for 24 – 48 hours. Then detailed gross examination including weight, measurement, shape, colour and consistency were noted. They were cut into parallel and longitudinal slices including the capsular invading areas. The additional features such as hemorrhage, cystic degeneration, calcification, necrosis and distance from the line of resection were noted.

The tissue slices were processed in various grades of alcohol and xylol and subsequently embedded in paraffin wax. Paraffin sections of 4 µm thickness were subjected to haematoxylin and eosin staining. A correlative study between Fine Needle Aspiration Cytology and histopathology was done for these 100 cases.

## STATISTICAL TOOLS

Data analysis was done with the help of computer using Epidemiological Information Package (EPI 2002).

## RESULTS

Our study showed that mean age of patients was 40.2 years and maximum patients were seen in 21 to 30 years of age group. Non neoplastic and neoplastic (benign and malignant) lesions were found to be more prevalent in the age group of 21-30 years. Among total 100 cases, 93 patients were female (93%) and 7 patients were male (7%). There is a female preponderance with a Female to Male ratio of 13.28:1 (table 1).

**Table 1: Demographic profile of patients**

Demographic profile	No. of patients (N=100)	Percentage
<b>Age group (yrs)</b>		
<b>Up to 20 yrs</b>	3	3%
<b>21-30 yrs</b>	30	30%
<b>31-40 yrs</b>	21	21%
<b>41-50 yrs</b>	23	23%
<b>&gt;50 yrs</b>	23	23%
<b>Mean±SD</b>	40.2±13.56 yrs	
<b>Gender</b>		
<b>Male</b>	7	7%
<b>Female</b>	93	93%

The histopathological diagnosis was offered for 100 cases of thyroid lesions which had preoperative cytological diagnosis. Out of these 100 lesions 61 cases were non neoplastic lesions and 39 were neoplastic lesions. Among the 61 non neoplastic lesions 45 cases were reported as nodular goiter, 15 cases as hashimoto thyroiditis and 1 case as Granulomatous thyroiditis. Out of the 39 neoplastic lesions 21 cases were reported as benign neoplastic lesions and 18 as malignant neoplastic lesions (table 2).

**Table 2: HPE diagnosis of thyroid lesions**

HPE diagnosis		No. of patients (N=100)	Percentage
Non-neoplastic lesions (N=61)	Nodular goiter	45	73.77%
	Hashimoto's thyroiditis	15	25.60%
	Granulomatous thyroiditis	1	1.63%)
Benign neoplastic lesions (N=21)	Follicular adenoma	21	100%
Malignant neoplastic lesions (N=18)	Papillary carcinoma	15	83.33%
	Medullary carcinoma	2	11.11%
	Anaplastic carcinoma	1	5.55%

The cytological diagnosis was offered for 100 cases which had postsurgical follow up. Out of these 100 FNAC studies, 69 cases were reported as nodular goiter, 10 cases as papillary carcinoma, 8 cases as hashimoto thyroiditis, 4 cases as lymphocytic thyroiditis, 7 cases as follicular neoplasm, one case as Granulomatous thyroiditis and another one case as anaplastic carcinoma (table 3).

**Table 3: Cytological distribution (FNAC) of thyroid lesions**

FNAC diagnosis	No. of patients (N=100)	Percentage
Nodular goiter	69	69%
Hashimoto's thyroiditis	8	8%
Granulomatous thyroiditis	1	1%
Follicular adenoma	7	7%
Papillary carcinoma	10	10%
Lymphocytic thyroiditis	4	4%
Anaplastic carcinoma	1	1%

Out of these 48 thyroid imprint cytology studies 25 cases were reported as nodular goiter, 7 cases as papillary carcinoma, 6 cases as Hashimoto thyroiditis, 1 case as lymphocytic thyroiditis, 7 cases as follicular neoplasm, one case as Granulomatous thyroiditis and another case as Anaplastic carcinoma (table 4).

**Table 4: Imprint cytology Diagnosis of thyroid lesions**

Imprint cytology Diagnosis	No. of patients (N=48)	Percentage
Nodular goiter	25	52.08%
Hashimoto's thyroiditis	6	12.5%
Granulomatous thyroiditis	1	2.08%
Follicular neoplasm	7	14.58%
Papillary carcinoma	7	14.58%
Lymphocytic thyroiditis	1	2.08%
Anaplastic carcinoma	1	2.08%

Among 100 cases, 58 Fine Needle Aspiration cytology reports (58%) were well correlated with histopathological diagnosis. The remaining 42 Fine Needle Aspiration cytology reports (42%) were not correlated with histopathological diagnosis and tabulated in table -5. Among

them 38 cases were reported as Nodular goiter, 5 cases as Hashimoto thyroiditis, 3 cases as Follicular neoplasm and 10 cases as papillary carcinoma (table 5).

**Table 5: Correlation between FNAC and Histopathology of thyroid lesions**

FNAC diagnosis	No. of patients (N=100)	HPE diagnosis						
		MNG	HAS thyroiditis	Folli adenoma	PAP CA	Medi CA	ANA CA	Gran. thyroiditis
Nodular goiter	69	38	8	17	4	2	0	0
Papillary carcinoma	10	0	0	0	10	0	0	0
Hashimoto's thyroiditis	8	2	5	0	1	0	0	0
Lymphocytic thyroiditis	4	1	2	1	0	0	0	0
Follicular adenoma	7	4	0	3	0	0	0	0
Anaplastic carcinoma	1	0	0	0	0	0	1	0
Granulomatous thyroiditis	4	0	0	0	0	0	0	1

A correlation done between Fine Needle Aspiration cytology with imprint cytology and histopathology showed the following results. 31 Fine Needle Aspiration cytology reports (64.58%) were correlated with histopathological diagnosis (table 6).

**Table 6: Correlation between FNAC, imprint cytological and Histopathology of thyroid lesions**

FNAC diagnosis	No. of patients (N=48)	HPE diagnosis					
		MNG	HAS thyroiditis	Folli adenoma	PAP CA	ANA CA	Gran. thyroiditis
Nodular goiter	25	16	2	4	3	0	0
Papillary carcinoma	7	0	0	0	7	0	0
Hashimoto's thyroiditis	6	1	3	2	0	0	0
Lymphocytic thyroiditis	1	0	0	0	0	0	0
Follicular adenoma	7	4	0	3	0	0	0
Granulomatous thyroiditis	1	0	0	0	0	0	1
Anaplastic carcinoma	1	0	0	0	0	1	0

## DISCUSSION

Fine Needle Aspiration Cytology of thyroid has become the most common and well established preoperative diagnostic procedure used in the management of patients with thyroid lesions. It is relatively cost-effective procedure that provided diagnosis rapidly.

We received 100 gross specimens for histopathological examination following initial cytological evaluation by fine needle aspiration cytology. In present study non neoplastic lesions accounts for 61 cases and neoplastic lesions accounts for 39 cases. The ratio between non neoplastic and neoplastic thyroid lesions in this study is 1.56:1, which was correlate with Hurtado – Lopez LM<sup>10</sup> (1.60:1).

In the present study, the incidence of malignant neoplastic thyroid lesions accounts for 18% which well correlates with studies conducted by various research workers such as Kaur et al<sup>11</sup> (18%) and GG Swamy et al<sup>12</sup> (18.33%).

The mean age of patients was 40.2 years in our study which correlates with the literature of various authors such as Martin et al<sup>13</sup> (39.5 years) and Wasser MH et al<sup>14</sup> (44 years).

In 2008 Handa u et al<sup>15</sup> reported that Fine Needle Aspiration Cytology (FNAC) is routinely used preoperatively for the assessment of thyroid lesions, and it cuts down the number of patients subjected to thyroidectomy for benign diseases of the thyroid. Intraoperative cytological diagnosis is required for the optimal extent of surgery and to know either the lesion is malignant or not. Both Touch Imprint Cytology (TIC) and Frozen Section (FS) serve this purpose well. Both provide accurate results within minutes.

In the present study among the non-neoplastic lesions Nodular goiter was the most common lesion. In this study 69 cases of Nodular goiter on Fine Needle Aspiration Cytology were well correlated with 45 cases in histopathology. Among the other non-neoplastic lesions 8 cases of Hashimoto thyroiditis, 1 case of Granulomatous Thyroiditis were well correlated with histopathology. 4cases of Lymphocytic thyroiditis on Fine Needle Aspiration Cytology showed varied diagnosis in histopathology.

The cytological picture of Nodular goiter can overlap with follicular neoplasm at times. Smears from microfollicular area in nodular goiter may show picture similar to neoplasm.<sup>16</sup> Fine Needle Aspiration Cytology from hyperplastic nodule will show marked cellularity of the smear which may mimic follicular neoplasm. Since this is a focal phenomenon, samples from other different areas should be taken to avoid misdiagnosis.

Cystic lesions of thyroid constitute a particular problem in Fine Needle Aspiration cytology. Cystic change and hemorrhage can occur not only in non-neoplastic lesions but also in neoplastic lesions like follicular neoplasm and papillary carcinoma. If only cystic fluid containing macrophages but no epithelial cells are obtained neoplasm with cystic change cannot be ruled out.<sup>17</sup> In such cases fine needle aspiration biopsy should be done. Recurrent cysts greater than 3-4 cm is identified for surgery with ultrasound guidance.<sup>18</sup> To identify the neoplastic lesion with cystic change fine needle aspiration biopsy is advised along with ultrasound guidance to minimize the false negative diagnosis.

Cystic Papillary Carcinomas often contain abundant colloid. This can cause diagnostic problem especially if smears are poor in cells. In Nodular goiter groups of large cells with irregular nuclei of uncertain origin are frequently seen. They may be regenerating epithelial cells consistent with repair or may be histiocytes. These aggregates of histiocytes can mimic cells of papillary carcinomas in some cases due to similar nuclear features.<sup>19</sup> So, we can reduce false negative results by a close look at the nuclear features to make a correct diagnosis. According to Handa U et al marked cellularity or increased cellularity of the of the smear is another difficulty in thyroid fine needle aspiration cytology giving false negative diagnosis of carcinoma.<sup>15</sup>

Hurthle cell changes are commonly seen in Nodular goiter.<sup>18</sup> Prominent Hurthle cell change may be seen in some cases of Nodular goiter but lymphoplasmacytic infiltrate will be sparse or absent. In young patients and children "florid lymphocytic" type of thyroiditis with scant epithelial cells are commonly seen.<sup>20</sup> The smears are dominated by a mixed population of lymphoid cells showing centroblasts, immunoblasts and dendritic reticulum cells. Follicular to Lymphoid cell ratios are often as high as 1:10. The epithelial cells are so inconspicuous, and smears resemble reactive lymphoid hyperplasia mimicking lymphocytic thyroiditis.

GG Swamy et al<sup>12</sup> in his institutional experience the diagnostic accuracy rate were improved from 88% to more than 98% after the induction of ultrasound in addition to Fine Needle Aspiration Cytology.

Intraoperative pathologist consultation is required by surgeons for immediate important decisions regarding the nature of the lesion and to decide the optimal extent of surgery required. Both Touch Imprint Cytology (TIC) and Frozen Section (FS) serve this purpose well. Both provide accurate results within minutes while the patient is under anesthesia.

Operating Surgeon then modifies his surgical decision based on the intraoperative consultation with Pathologist. Touch Imprint Cytology provides better and crisp cellular details and even some tissue architecture. In the present study diagnostic accuracy rate, specificity by Imprint cytology is high with low sensitivity when compared to other studies. It showed good positive predictive value (PPV) and negative predictive value (NPV). Results of Frozen section by various authors shows high diagnostic accuracy rate but sensitivity was relatively lower. It pointed out very high specificity and positive predictive value (100% in the present study), although negative predictive value (95.5% in the present study) was less. Therefore, in this study, Touch imprint cytology (TIC) was found to be as good as frozen section in sensitivity and diagnostic accuracy.

Imprint cytology is a simple, rapid and sensitive technique for the diagnosis of thyroid lesions. In present study, we feel sufficiently high accuracy rate can be achieved by imprint study and this can be a useful guide in making decisions regarding the optimal extent of surgery required. Touch Imprint Cytology alone may provide a correct diagnosis in vast majority of cases with minimal expense and without the need of sophisticated cryostat machine, thus making it quite suitable for many hospitals where cryostat machines are not available.<sup>21</sup> Touch imprint cytology has further advantage of being inexpensive, simple and quicker than frozen section.

## CONCLUSION

Fine Needle Aspiration cytology is a cost effective, simple, rapid, almost noninvasive and an efficient method in differentiating benign and malignant lesions there by unnecessary surgical procedures can be reduced. High rate of diagnostic accuracy can be achieved by use of ultrasound guidance with strict adherence to adequacy criteria and meticulous examination of all the smears. Touch Imprint Cytology alone may provide a correct diagnosis in vast majority of cases with minimal expense and without the need of sophisticated cryostat machine thus making it quite suitable when cryostat machines are not available.

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