Analysis Of Fine Needle Aspiration Cytology Of Thyroid Lesions

N Kukar, V Malhotra, M Saluja

Citation

Abstract
This is a five year study of 412 cases of thyroid lesions reported by Pathology Department in a tertiary care hospital. These lesions were studied for Cytological features and correlation with Clinical, Radiological, Hormonal & Histopathological features. Neoplastic lesions were classified according to WHO guidelines. The study concluded that thyroid lesions were more common in females with male to females ratio 1:9. Non-neoplastic lesions were more common 70.4% as compared to Neoplastic lesions. Diffuse goitre was the most common Non-neoplastic lesion and follicular neoplasm was the most common Neoplastic lesion. Good correlation was noted in Cytodiagnosis, Clinical status, Radiological findings, Histopathological and Hormonal findings.

INTRODUCTION
Fine needle aspiration (FNA) of thyroid was documented in the Martin and Ellis paper of 1934(1). The use of this technique was established subsequently by Scandinavian workers. FNA is now recognized to be the first line investigation for a solitary thyroid nodule, has a valuable role in the diagnosis of the diffuse non–toxic goitre and can be used to confirm the diagnosis of clinically obvious malignancy, enabling the separation of treatable lymphomas from anaplastic carcinomas. (1)
The purpose of aspiration cytology is to obtain diagnostic material for cytology study from organs that do not shed cells spontaneously. The bone marrow, spleen, liver, breast, thyroid gland and lymph nodes are typical targets for this type of diagnostic procedure.
FNAC thyroid
Thyroid nodules are common clinical findings and have a reported prevalence of 4-7% in general population. Thyroid nodules are common in women. The vast majority of these nodules are non neoplastic lesions. However distinction of these benign lesions from a malignancy cannot be based reliably on the clinical presentation only. Several diagnostic tests have been used for diagnosis of these lesions. Recent studies have demonstrated that among all the diagnostic modalities, FNA is most accurate and simplest screening test for rapid diagnosis of thyroid lesions.
The prevalence of thyroid lesions in India and potential curability of the disease if detected early has underscored the need for quick and reliable diagnostic methods. Today “Fine needle aspiration cytology” of thyroid gland is firmly established as a first line diagnostic test for the evaluation of thyroid lesions and single most effective test for the preoperative diagnosis of thyroid lesions. FNAC carried out by a well-trained cytopathologist is a reliable, cost effective and simple diagnostic procedure for palpable thyroid swellings. This procedure is painless and may obviate the need of subjecting the patients to open biopsy (2).
If aspiration cytology is done with care and the smears are interpreted carefully, the accuracy rates are quite high (3).

CLASSIFICATION OF THYROID LESIONS (4)
Thyroid Lesions are classified into Non-neoplastic and Neoplastic.
Non- Neoplastic
• Acute thyroiditis
• Granulomatous ( de Quervain’s) thyroiditis
• Autoimmune ( lymphocytic and Hashimoto’s thyroiditis)
• Riedel’s thyroiditis
• Dyshormonogenetic goitre
• Multinodular goitre
- Nodular goitre
- Colloid goitre
- Adenomatous goitre
• Diffuse toxic goitre
Thyroid Neoplasms: Classified according to WHO classification.
MATERIAL AND METHODS
The present study is a five years analysis of patients referred to the tertiary care hospital for FNAC of Thyroid lesions. Smears were prepared and stained by Papanicolaou, Giemsa and H & E.

Staining of smears
1. Dry fixed smears were prepared by air drying and then fixing in methanol followed by staining with Giemsa
2. Wet-fixed smears were prepared by immediately fixing in 95% isopropyl alcohol and stained by H & E and Papanicolaou.

OBSERVATIONS
This study was conducted for five years in tertiary care hospital. There were a total 412 patients who underwent fine needle aspiration of thyroid lesions.

TABLE 1
AGE & SEX DISTRIBUTION OF SUBJECTS

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Male (N=44)</th>
<th>Female (N=368)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-20</td>
<td>4</td>
<td>21</td>
</tr>
<tr>
<td>21-30</td>
<td>6</td>
<td>64</td>
</tr>
<tr>
<td>31-40</td>
<td>9</td>
<td>104</td>
</tr>
<tr>
<td>41-50</td>
<td>10</td>
<td>102</td>
</tr>
<tr>
<td>51-60</td>
<td>7</td>
<td>48</td>
</tr>
<tr>
<td>61-70</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>71-80</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>&gt;80</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

In the present study out of the total 412 cases, 368 were females and 44 were males. Thus male to female ratio was 1:8.4. The commonest age group presenting with thyroid lesion was 31-50 years (54.5%).

TABLE 2
DISTRIBUTION OF SUBJECTS ACCORDING TO HORMONAL STATUS

<table>
<thead>
<tr>
<th>Hormonal Levels</th>
<th>T3</th>
<th>T4</th>
<th>TSH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%age</td>
<td>%age</td>
<td>%age</td>
</tr>
<tr>
<td>Normal</td>
<td>87%</td>
<td>87%</td>
<td>74%</td>
</tr>
<tr>
<td>Increased</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Decreased</td>
<td>3%</td>
<td>3%</td>
<td>16%</td>
</tr>
</tbody>
</table>

Hormonal status was known in 25% of the total cases. Out of which 87% cases had normal T3, T4 and TSH levels. T3, T4 and TSH were increased in 10% of the cases. T3, T4 was decreased in 3% and TSH was decreased in 16%. The commonest clinical presentation of patients in thyroid lesions in this study was in the form of diffuse swelling (60.4%) followed by solitary nodule (29.6%) and multinodular swelling (10%).

TABLE 3
DIVISION OF NON NEOPLASTIC THYROID LESIONS

50% of non neoplastic lesions were of diffuse goiter. 25.9%, Hashimoto’s Thyroiditis, 11.8% Multinodular goiter, 10.3% colloid nodule, 1% each of dequervain’s thyroiditis and benign cystic lesion.

Figure 1
Diffuse goitre
**Figure 2**
Diffuse goitre

**Figure 3**
Multinodular goitre

**Figure 4**
Multinodular goitre

**Figure 5**
Hashimoto thyroiditis
**Figure 6**  
Hashimoto thyroiditis

![Hashimoto's Thyroiditis](image)

**Figure 8**  
Papillary Carcinoma- Intranuclear Grooves & Inclusions (Giemsa x 1000)

![Papillary Carcinoma](image)

**Figure 9**  
Hurthle Cell Tumour (Giemsa x 100)

![Hurthle Cell Tumour](image)

**TABLE 4**  
DIVISION OF NEOPLASTIC THYROID LESIONS

<table>
<thead>
<tr>
<th>Thyroid Neoplasms</th>
<th>No.</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Follicular neoplasm</td>
<td>70</td>
<td>66.1%</td>
</tr>
<tr>
<td>Colloid adenoma</td>
<td>20</td>
<td>18.9%</td>
</tr>
<tr>
<td>Papillary carcinoma</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Medullary carcinoma</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Anaplastic carcinoma</td>
<td>2</td>
<td>1.9%</td>
</tr>
<tr>
<td>Adenoid cystic carcinoma</td>
<td>1</td>
<td>0.9%</td>
</tr>
<tr>
<td>Hurthle cell neoplasm</td>
<td>1</td>
<td>0.9%</td>
</tr>
<tr>
<td>Total Neoplastic lesion</td>
<td>106</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 4**  
DIVISION OF NEOPLASTIC THYROID LESIONS
Figure 10
Medullary Carcinoma (Giemsa x100)

Figure 11
Adenoid Cystic Carcinoma (H & E x 100)

Figure 12
Anaplastic Carcinoma (Giemsa x 400)

Figure 13
Anaplastic Carcinoma-Bizarre Cells (Giemsa x 400)
Figure 14
Anaplastic Carcinoma (H & E x 400)

TABLE 5
CORRELATION BETWEEN CYTOLOGICAL AND HISTOPATHOLOGICAL DIAGNOSIS

<table>
<thead>
<tr>
<th>Correlating</th>
<th>No.</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>276</td>
<td>95.8%</td>
</tr>
<tr>
<td>Not-correlating</td>
<td>12</td>
<td>4.2%</td>
</tr>
</tbody>
</table>

Cytological diagnosis was correlating with histological diagnosis in 95.8% cases. It was not correlating in 4.2% cases.

TABLE 6
CORRELATION BETWEEN CYTOLOGICAL DIAGNOSIS AND RADIOLOGICAL DIAGNOSIS

<table>
<thead>
<tr>
<th>Concordant</th>
<th>Non-concordant</th>
<th>No.</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>57</td>
<td>86.05%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>13.95%</td>
</tr>
</tbody>
</table>

Radiological status was known in only 43 cases out of 412 cases. Who underwent fine needle aspiration? In 86% of the cases cytological diagnosis was correlating with the radiological diagnosis.

DISCUSSION
Clinical presentation

The age of presentation of various thyroid lesions ranged from 11 years to 80 years with maximum patients falling in the age group of 31-50 years. The youngest was a child aged 11 years diagnosed as goiter and oldest 83 year old male diagnosed as having a malignant neoplasm. The mean age at presentation was 41.48 years. Dorairagan N et al(5)(1996) observed that majority of the patients with thyroid lesions were in the age group of 30-50 years and a very small number were below 20 years of age. Our study is in concordance with this study.

Thyroid lesions are more prevalent in females than males. In our study 89.3% of cases were females and 10.7% males. Male to female ratio was 1:8.4. Similar findings were reported by Dorairagen N et al (5) (1996) with Male to Female ratio being 1:9. (1) Most common presentation of thyroid lesions noticed by us was diffuse swelling (60.4%) followed by solitary nodule (29.5) and multinodular swelling (10%). Hyang et al (6) (2003) in a study on 1344 cases of thyroid lesions observed a high incidence of diffuse goitre (90%). Second commonest presentation was with nodules (10%).

Cytological categorization of thyroid lesions

Cytological smears in thyroid lesions were divided into benign, malignant, suspicious/indeterminate & unsatisfactory/ nondiagnostic as per criteria given in observations. Benign lesions were more common constituting 70.4% whereas malignant were seen to the extent of 8.5% in this study. Smears were suspicious/indeterminate in 17.2% & unsatisfactory in 3.9%, i.e. composed of blood mainly. Suspicious/indeterminate lesions included follicular neoplasms, hurthle cell neoplasms & smears suggestive of but not diagnostic of malignancy. Gharib et al (7) (1991) examined 10917 cytological smears of thyroid lesions and observed that 64% were of benign lesions, 4% malignant, 11%suspicious and 21%were nondiagnostic. Our findings were in concordance with this study. The variability of various lesions could be due to studies being conducted on different population of various countries and variable influences of geographical, environment, dietary and hereditary factors.

The various non neoplastic lesions seen in the present study were diffuse goiter, multinodular goiter, Hashimoto’s thyroiditis, dequervains thyroiditis, colloid nodule and benign cystic lesion. Diffuse goitre constituted 50% of non neoplastic lesions followed by hashimoto’s thyroiditis (25.9%), multinodular goiter (11.8%), colloid nodule (10.3%), dequervains thyroiditis (1%) & benign cystic lesions (1%).

In an analysis of 1344 cases of thyroid lesions conducted by Hyang Mi KO Et Al (6) (2003) 83.4% cases were non-neoplastic, 1.6% follicular neoplasm, 7.3% malignant, 2.7% indeterminate & 5% unsatisfactory. Out of 83.4%
nonneoplastic lesions maximum cases were of diffuse & multinodular goiter (61%), remaining 22.4% cases were of hashimoto’s & dequervains thyroiditis. which is in concordance with our study. Diffuse goiter is most common in the iodine deficient areas where the prevalence may be as high as 40%. Endemic goitre as well as non endemic goitre showed striking females preponderance

Neoplastic lesions constituted 106 cases out of total 412 cases in our study. Follicular neoplasms were the commonest neoplasms (66.1%) followed by colloid adenoma (18.9%), papillary carcinoma (8.5%), medullar carcinoma (2.8%), anaplastic carcinoma (1.9%), adenoid cystic carcinoma (0.9%), and hurthle cell neoplasms (0.9%). Silverman et al (8) (1986) in their study on neoplastic lesions observed that maximum cases were of follicular neoplasms (81%) followed by hurthle cell neoplasms (9.3%), papillary carcinoma (4.6%), medullar carcinoma (2.3%) and anaplastic carcinoma (2.3%). Studies by various authors showed follicular neoplasm ranged from 66-81%, papillary carcinoma 4.6-25%, medullar carcinoma 2.3-16.2%, anaplastic carcinoma 2.3-24.3% and hurthle cell neoplasm 0-9.3%. Our findings are in concordance with this study.

Thyroid neoplasms like follicular and hurthle cell type are usually reported as neoplasms without further distinguishing them into benign and malignant on the basis of cytology. We have put them under the category of neoplasms.

Follicular neoplasms are the most difficult tumors to categorise into benign or malignant, because of the similarity in the morphology of the cytological smears. In such cases only histological biopsy can confirm the true nature of the neoplasm.

Cytological features
Smears were satisfactory in 96.84% and unsatisfactory in 3.16% cases in the present study.

Nuclear features
Nuclear features are diagnostic in papillary carcinoma. This includes intranuclear inclusions and intranuclear grooves. Intranuclear inclusions are readily seen in 10-30% of tumor cells in at least two third of papillary carcinoma. These are round inclusions that have a margin of condensed chromatin and stain similar to the cytoplasm of cells. Nuclear grooves can be appreciated in 88% & 100% cases of papillary carcinoma stained with H&E and pap respectively. In our series intranuclear inclusions were seen in all the cases of papillary carcinoma and one case of medullary carcinoma. Intranuclear grooves were noted in 66.6% cases of papillary carcinoma.

Kini et al (9) (1980) observed intranuclear inclusions in 83% of cases (68 out of 81 satisfactory aspirates of histology proven papillary thyroid carcinoma). Orell et al (10) (1992) reported intranuclear cytoplasmic inclusions in upto 90% of these cases.

Gould et al (11) (1989) observed nuclear grooves in 100% and intranuclear inclusions in 70% cases of papillary carcinoma.

Our findings are in concordance with above study as we found intranuclear inclusions in only one case of non papillary carcinoma i.e medullary carcinoma.

Colloid
In the present study abundant colloid was seen in 100% cases of colloid goiter, multinodular goiter, colloid nodule, benign cystic lesions & colloid adenoma. However scanty colloid was observed in 8% hashimoto’s thyroiditis, 29.8% follicular neoplasms & 22.2% papillary carcinoma. There was no colloid in dequervain’s thyroiditis, medullary carcinoma, anaplastic carcinoma, hurthle cell neoplasm & adenoid cystic carcinoma.

Jayaram G et al (12) (2006) in her study on various thyroid lesions observed colloid was abundant in benign lesions & was scanty or absent in malignant lesions. Similar findings are seen in our study.

Hurthle cell change
Hurthle cell change was noted in 139 cases (33.7%) out of 412 cases. All case of hashimoto’s & dequervain’s thyroiditis showed hurthle cell change. It was also seen in diffuse and multinodular goiter.

Hurthle cell change is not a specific feature of hashimoto’s thyroiditis. It can be seen in other conditions like dequervain’s thyroiditis, diffuse goiter, multinodular goiter and hurthle cell neoplasms.

Histopathological Correlation
Of the 412 patients who underwent FNAC only 290 (70.4%) patients underwent surgery and were subjected to histopathological examination.
Histopathological diagnosis was correlating with the cytological diagnosis in 278 (95.8%) out of 290 patients. Cytohistological discordance was seen in only 4.2%. These were reported as benign, but on histopathological examination malignancy was present. Similarly Khafagi et al (13) (1988) observed 4.1% false negative rate and Gharib et al (7) (1991) reported a 5.2% false negative rate. Observations in these studies are in concordance with our study.

Hormonal status

The patients are grouped into three states based on clinical symptoms: euthyroid, hyperthyroid & hypothyroid. These states reflect the hormonal status of thyroid gland i.e. within normal limits (euthyroid), higher (hyperthyroid) or lower (hypothyroid) than normal.

Hormonal status was known in only 100 (25%) out of 412 cases in the present study. 87% cases were biochemically euthyroid i.e. normal T3 and T4. Only 10% had increased T3, T4 & TSH and these patients were of diffuse goiter, multinodular goiter, hashimoto’s thyroiditis & colloid adenoma. 3% patients had decreased T3, T4 & 16% had decreased TSH level. Decreased levels of T3, T4 & TSH were seen in goiter & hashimoto’s thyroiditis. This is in concordance with the study by Boigen et al (14) (1995) according to which in majority of benign lesions and in almost all malignant thyroid lesions thyroid function tests were normal.

Radiological correlation

USG can determine whether thyroid nodules are solitary and can categorize them into solid, cystic and mixed nodules. Solid nodules have a higher incidence of malignancy (27%) as compared to cystic (7%) and mixed nodules (12%). (12)

Thyroid scintigraphy is used for evaluation of nodular lesions, particularly to determine whether the nodule is hot, warm or cold. The risk of malignancy is greater in cold rather than hot or warm nodule.

Radiological status was known in only 43 out of 412 cases in our study. In 86.05% of the cases cytological diagnosis was correlating with the radiological diagnosis i.e. USG. None of our patient underwent scintigraphy as this is much less commonly used now days because of the more accurate procedure like FNAC.

SUMMARY AND CONCLUSION

This study was conducted in tertiary care hospital. There were a total 412 patients who underwent fine needle aspiration of thyroid lesions. Benign lesions were more common. Cytodiagnosis showed good correlation with Clinical presentation, Radiological findings, Hormonal status and Histopathological diagnosis.

ACKNOWLEDGMENT

Special thanks to Dr. Kanwardeep Kaur Jhajj, Dr. Arunpreet Kaur & my beloved daughter Janvi for their encouragement and support.

References
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