Role of High Resolution Ultrasonography With Colour Doppler In Evaluation Of Clinical Thyroid Swelling In Correlation With FNAC In A Tertiary Care Cancer Institute Of Eastern India

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ABSTRACT

Thyroid swellings are commonly encountered in clinical practice which may be diffuse or nodular in nature. For any thyroid lesion the initial investigation includes USG and FNAC. Most commonly ultrasound with colour doppler is the first choice of investigation for evaluation of any thyroid lesion due to its high sensitivity for small nodule detection. Fine needle aspiration cytology (FNAC) is further helpful in arriving at definitive diagnosis of thyroid pathologies. The aim of this study is to assess the role of USG in evaluation of thyroid lesions in correlation with FNAC.

This was a cross sectional study carried out from march 2016 to march 2017 including 155 patients who presented with clinically palpable thyroid swelling and underwent high resolution USG of Neck and FNAC of the swelling. All clinical, imaging and FNAC data were collected in pre designed data collection sheet.

Among 155 patients, 50 presented with diffuse thyroid swelling and 105 with nodular thyroid swelling. Among the 50 cases 21 were diagnosed as thyroiditis on USG out of which 20 came out to be same on FNAC with USG sensitivity of 95.24% in detecting it.

Out of 105 cases who presented with nodular thyroid swelling most commonly diagnosed pathology on USG were papillary carcinoma and multinodular goiter. Among 59 cases that were diagnosed suspicious for malignancy on USG,57 came out to be malignant on FNAC and 2 were benign with USG sensitivity of 91.94% in detecting malignancy in nodular thyroid diseases.

High resolution ultrasonography along with colour Doppler has emerged as an initial imaging modality in evaluation of patients with both diffuse as well as nodular thyroid enlargement with high sensitivity in detecting malignancy. USG guidance for FNAC further helps in suspicious lesion localization. Differentiation between thyroid and extra thyroid lesions, adjacent structural invasion and displacement, cervical lymphadenopathy can also be evaluated by high resolution ultrasonography.
INTRODUCTION:
Thyroid gland is the largest among all endocrine Glands. Due to its superficial location, it allows direct physical examination, excellent sonographic visualisation and evaluation of its normal anatomy as well as pathologic conditions and detection of the lesion through FNAC.
Thyroid swellings are commonly encountered in clinical practice which may be diffuse or nodular in nature. Diffuse thyroid swellings are associated with diseases that affect the entire gland as in thyroiditis, hyperplasia and some diffuse malignancies. Nodular thyroid swellings are associated with disorders that produce clinically palpable nodules and may present as a solitary nodule or multiple nodules. Both benign and malignant lesions present with nodular thyroid swellings. Usually solitary thyroid nodule has high probability of malignancy ranging from 5-35% of all solitary nodule.

For any thyroid lesion the initial investigation includes USG and FNAC. Most commonly ultrasound is the first choice of investigation for evaluation of any thyroid lesion due to its high sensitivity for small nodule detection. The spatial resolution achieved by ultrasound is of the order of 0.7 to 1 mm, which can’t be achieved by any other imaging modality. It is easily accessible, inexpensive, non-invasive and highly sensitive imaging modality for differentiation of cystic from solid lesion. Additional colour doppler is beneficial in characterising the thyroid lesions.
Fine needle aspiration cytology (FNAC) is further helpful in arriving at definitive diagnosis of thyroid pathologies.
The aim of this study is to assess the role of USG in evaluation of thyroid lesions in correlation with FNAC.

MATERIAL & METHODS
This was a cross sectional study carried out in the Dept. Of Radiodiagnosis, S.C.B. Medical college Cuttack and Dept. of oncopathology, AHRCC Cuttack from march 2016 to march 2017. The study included 155 patients who presented with clinically palpable thyroid swelling and underwent HRUS of Neck and FNAC of the swelling.
Patients were placed in supine position with a pillow underneath the shoulders to slightly extend the neck for optimal visualisation of thyroid gland. Ultrasound was performed using 12MHz linear probe of PHILIPS HD 7 ultrasound machine. Thyroid glands were scanned in both transverse and longitudinal planes under grey scale and colour doppler for evaluation of any pathology.
This was followed by FNAC of the clinically palpable thyroid swelling which was done in the cytology OPD of AHRCC Cuttack using 22 gauge needle. Smears were stained with pap and leishman stain and were observed under microscope.

Inclusion criteria
I) Clinically palpable thyroid swelling neck.
II) Age - > 15 years – 80 years.

Exclusion criteria:
I) K/C/O thyroid lesion treated either medically or surgically.
ii) FNAC showing either hemorrhagic smear or inadequate aspirated material.

All clinical, imaging and FNAC data were collected in pre designed data collection sheet.

RESULTS.
Age Distribution:
The Study included patients between the age of 15 and 80 years. Maximum number of patients were in age group of 41-60 years which comprised of 68 cases (43.8%).

Sex Distribution:
In the present study, out of 155 patients 46(29.6%) were male and 109 (70.3%) were female with M:F ratio 1:2.3. Females were more commonly affected by thyroid pathologies than males.

Table 1: Age And Sex Distribution

<table>
<thead>
<tr>
<th>Age group (in years)</th>
<th>No of cases</th>
<th>Percentage</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 15 – 20</td>
<td>10</td>
<td>6.4</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>21 – 40</td>
<td>47</td>
<td>30.3</td>
<td>9</td>
<td>38</td>
</tr>
<tr>
<td>41 – 60</td>
<td>68</td>
<td>43.8</td>
<td>22</td>
<td>46</td>
</tr>
<tr>
<td>61 – 80</td>
<td>30</td>
<td>19.3</td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>155</td>
<td></td>
<td>46</td>
<td>109</td>
</tr>
</tbody>
</table>

![Figure 1: Hypoechoic lesion with calcification and adjacent invasion in right lobe of thyroid](image)
**Presenting Symptoms:**
All the 155 patients presented with neck swelling which on clinical examination appeared to be thyroid swelling. 58 out of 155 patients presented with clinical lymphadenopathy and 45 patients with pressure symptoms as dysphagia, dyspnoea. Only 1% patients (17) presented with hoarseness of voice.

**Table 2: Presenting Symptoms**

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>No of patients</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>clinically thyroid swelling</td>
<td>155</td>
<td>100</td>
</tr>
<tr>
<td>Lymph node enlargement</td>
<td>58</td>
<td>37.4</td>
</tr>
<tr>
<td>Pressure symptom</td>
<td>45</td>
<td>29</td>
</tr>
<tr>
<td>Hoarseness Voice</td>
<td>17</td>
<td>1</td>
</tr>
</tbody>
</table>

Among 155 patients, 50 presented with diffuse thyroid swelling and 105 with nodular thyroid swelling.

**Clinically palpable diffuse thyroid swelling:**

ULTRASOUND: Out of 50 cases presenting with diffuse thyroid swelling, on ultrasound 21 cases showed features of thyroiditis. Diffusely enlarged thyroid gland with heterogeneous echotexture, hypoechoic micronodulation with echogenic septa, normal or altered vascularity were considered as features of thyroiditis. Rest of the cases were diagnosed as multinodular goitre (13 cases), colloid goitre with cystic degeneration and malignancies on ultrasound. 3 out of 50 cases appeared to be normal on ultrasound.

FNAC: Out of 21 cases diagnosed as thyroiditis on ultrasound, 20 were confirmed to be thyroiditis on fine needle aspiration where smears showed clusters of follicular epithelial cells with lymphocytes invading into it causing folliculolysis. Reactive population of lymphoid cells and occasional epitheloid cells were present in background of blood mixed colloid. On retrospective analysis 95.2% cases of thyroiditis were correctly detected by USG with a sensitivity of 95.24%.

11 out of 13 cases diagnosed as multi nodular goitre in USG came out to be same in FNAC showing follicular epithelial cells in clusters, singles over thick and thin colloid background.

**Table 3: USG And FNAC Correlation In Diffuse Thyroid Swellings**

<table>
<thead>
<tr>
<th>Ultrasound diagnosis</th>
<th>No. of cases</th>
<th>FNAC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Benign</td>
</tr>
<tr>
<td>Thyroiditis</td>
<td>21</td>
<td>21 (1-normal)</td>
</tr>
<tr>
<td>Multinodular goitre</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>Colloid goitre with cystic degeneration</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Papillary carcinoma</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Anaplastic carcinoma</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Normal</td>
<td>3</td>
<td>3 (1-thyroiditis)</td>
</tr>
</tbody>
</table>

**Clinically palpable nodular thyroid swelling:**

ULTRASOUND: In the present study 105 cases presented with nodular thyroid swelling. On USG evaluation, 28 cases (26.67%) showed features of multinodular goitre such as multiple iso to hyperechoic nodules with surrounding hypoechoic halo, some showing anechoic areas of colloid degeneration, coarse or peripheral calcification and on doppler study peri-nodular vascularity.
31 cases out of 105 were suspicious of papillary carcinoma on ultrasound showing features like iso to hypoechoic nodules with intra nodular vascularity and microcalcifications having irregular outline. Some cases had cervical lymphadenopathy on USG.

One case of nodular swelling having F/H/O medullary carcinoma on USG evaluation showed multiple iso to hypoechoic nodules with punctate irregular calcific foci along with enlarged cervical lymph nodes and was reported as suspicious for medullary carcinoma. Another 2 cases were K/C/O squamous cell carcinoma of larynx which showed extension of mass from larynx to involve thyroid and presented as nodular thyroid swelling.

Rest of cases were diagnosed as shown in table no.4.

FNAC : On undergoing FNAC, 28 cases that showed F/O MNG on USG, 27 were confirmed to be the same and 1 came out to be malignant. Out of 31 cases that were suspicious of PTC on USG 29 came out to be malignant on FNAC. On FNAC PTC showed branching papillary fragments, nuclear grooving and intranuclear inclusions. Psamomma bodies were seen in few cases with scant chewing gum colloid over hemorrhagic background. The suspected medullary carcinoma case was confirmed to be the same on FNAC where smear showed plasmacytoid, spindloid cells in singles and clusters with stippled nuclear chromatin, amyloid and hemorrhage.

Table -4 : USG And FNAC Correlation In Nodular Thyroid Swellings

<table>
<thead>
<tr>
<th>Ultrasound diagnosis</th>
<th>No. Of cases</th>
<th>FNAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colloid nodule</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Colloid goitre with cystic degeneration</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Multinodular goitre</td>
<td>28</td>
<td>27</td>
</tr>
<tr>
<td>Thyroiditis</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Papillary carcinoma</td>
<td>31</td>
<td>1</td>
</tr>
<tr>
<td>Anaplastic carcinoma</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ultrasound diagnosis</th>
<th>No. Of cases</th>
<th>FNAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medullary carcinoma</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Follicular neoplasm</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Squamous cell carcinoma extending to thyroid</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Table – 5

<table>
<thead>
<tr>
<th>USG diagnosis</th>
<th>No. Of cases</th>
<th>FNAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benign</td>
<td>46</td>
<td>41</td>
</tr>
<tr>
<td>Malignant</td>
<td>59</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>105</td>
<td>43</td>
</tr>
</tbody>
</table>

Figure 4 ill defined hypoechoic nodule showing calcifications in right lobe of thyroid

Figure 5 FNAC showing spindle cell type medullary carcinoma of above case
Thyroid pathologies are among the commonest endocrine disorders worldwide as well as in India. From population studies it has been estimated that approximately 42 million people in India suffer from thyroid pathologies and about 12% of adults have a palpable goitre. Due to its superficial location, it can be easily evaluated by real time high resolution ultrasonography and amenable to FNAC. Prevalence of thyroid disorders is usually more among female than in males due to the presence of estrogen receptors in the thyroid tissue. In the study by Gupta A et al. 2016, M:F ratio was found to be 1:34. Similar female predominance was found by Singh P et al1 (1:4.7) and Sangalli G et al10 (1:4.2). In his study found 78% patients to be females and rest 22% were males. Kilopatric et al found a female to male ratio of 4:1 in non endemic area. In the present study M:F ratio is found to be 1:23 which is comparable to previous studies.

In the present study the most common age group affected is 41-60 years with mean age of 46.47 years. In the study done by Gupta A et al. 2016, among 100 cases most common age range having palpable thyroid nodule was 21-40 years with mean age of about 37.49 years. This difference in age range may be due to the fact that our institute is a tertiary care centre for malignancies and hence is the higher age range of presentation of palpable thyroid swellings. Singh P et al observed 12-80 years as the age range among 108 cases with mean age of 47 years. About presenting symptoms, along with clinically palpable thyroid swelling, other pressure symptoms as dysphagia, dyspnoea are features of thyroid pathologies. These are due to large thyroid swellings causing pressure effect as in multinodular goitre or due to involvement of oesophagus & trachea by malignancies. Hoarseness of voice and cervical lymphadenopathy are associated features usually seen in malignancies. Thyroid pathologies can present with diffuse or nodular thyroid swellings.

Various conditions that present as diffuse thyroid enlargement include thyroiditis, multinodular goitre, Graves disease.

**DISCUSSION:**

 Thyroid pathologies are among the commonest endocrine disorders worldwide as well as in India. From population studies it has been estimated that approximately 42 million people in India suffer from thyroid pathologies and about 12% of adults have a palpable goitre. Due to its superficial location, it can be easily evaluated by real time high resolution ultrasonography and amenable to FNAC. Prevalence of thyroid disorders is usually more among female than in males due to the presence of estrogen receptors in the thyroid tissue. In the study by Gupta A et al. 2016, M:F ratio was found to be 1:34. Similar female predominance was found by Singh P et al (1:4.7) and Sangalli G et al (1:4.2). In his study found 78% patients to be females and rest 22% were males. Kilopatric et al found a female to male ratio of 4:1 in non endemic area. In the present study M:F ratio is found to be 1:23 which is comparable to previous studies.

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About presenting symptoms, along with clinically palpable thyroid swelling, other pressure symptoms as dysphagia, dyspnoea are features of thyroid pathologies. These are due to large thyroid swellings causing pressure effect as in multinodular goitre or due to involvement of oesophagus & trachea by malignancies. Hoarseness of voice and cervical lymphadenopathy are associated features usually seen in malignancies. Thyroid pathologies can present with diffuse or nodular thyroid swellings.

Various conditions that present as diffuse thyroid enlargement include thyroiditis (hashimoto’s, subacute), multinodular goitre and Graves disease. USG features of the above conditions are similar except that they differ in their biochemical and clinical profile, hence USG finding should be correlated with clinical presentation & biochemical status of the patient. Sometimes malignancies involving larger part of thyroid gland can present as diffuse swelling. In our study thyroiditis was found to be most common cause of diffuse thyroid swelling with USG having sensitivity of 95.24% and specificity of 96.55% in detecting the same in correlation with FNAC.

Nodular swellings are the most common type of thyroid enlargement. Incidence of thyroid nodules is very high on USG ranging from 50% to 70% which may be a part of benign or malignant process. Regardless of overlapping ultrasound features, some characteristics help in differentiating malignant from benign nodules. Nodule is considered to be benign when features such as iso to hypoechogenicity (sometimes spongiform appearance), perinodular hypoechoic halo, coarse curvilinear calcifications and perinodular vascularity are present.

Features predictive of malignancy in nodules gland include presence of hypechoegenicity, microcalcifications (<2 mm), irregular margin, solid composition, absent halo sign, local invasion and intranodular vascularity on doppler. Micro calcifications are most commonly found in papillary and medullary carcinoma of thyroid and in their metastasis.

In present study sensitivity of USG in detecting malignant nodule is 91.94% with a specificity of 95.35%. Similar sensitivity (90%) and specificity (98.8%) was found by Gupta A et al in their study. In the studies by Jones AJ et al, sensitivity was 75% and specificity was 61%, Cai XJ et al sensitivity was 80.5% and specificity was 97.8%. Aesha Singh et al found 83.33% sensitivity and 87.50% specificity in Indian population.

Table 5 shows that 57 out of 59 cases were correctly correlated as malignant on FNAC (true positive). The number of cases that were indicated as benign on USG but came out to be malignant was 5 (false negative). On USG 46 cases were indicated to be benign out of which 41 correctly correlated on FNAC (true negative). Only 2 out of 59 cases that were diagnosed as malignant came out to be benign on FNAC (false positive). From above data sensitivity and specificity of USG as a diagnostic modality for detecting malignancy in nodular thyroid swellings were 91.94% and 95.35% respectively.
Studies | Sensitivity | Specificity
--- | --- | ---
Present | 91.94 % | 95.35 %
Gupta A et al | 90 % | 38.8 %
Jones AJ et al | 75 % | 61 %
Cai XJ et al | 80.5 % | 97.8 %
Aeshita singh et al | 83 .3 % | 87.50 %
Dhanadia A et al | 83.3 % | 72. 7%

CONCLUSION:
High resolution ultrasonography along with colour Doppler has emerged as an initial imaging modality in evaluation of patients with both diffuse as well as nodular thyroid enlargement. In combination with FNAC unnecessary surgery can be avoided as in cases of thyroiditis.

With few diagnostic pitfalls like difficulty in differentiating benign & malignant cystic degeneration in a nodule, confusing diffuse infiltrative malignancy for autoimmune thyroid disease and subjective variation (operator dependency), ultrasound is a valuable tool for characterisation of thyroid lesions. USG guidance for FNAC further helps in suspicious lesion localisation.

Differentiation between thyroid and extra thyroid lesions, adjacent structural invasion and displacement, cervical lymphadenopathy can also be evaluated by high resolution ultrasonography. Hence high resolution USG is a valuable tool for initial screening of patients with any clinical thyroid swelling along with FNAC.

BIBLIOGRAPHY:
12. Singh Aeshita, Parihar pratapsingh H. Role of High Resolution USG and Color Doppler in Assessment of Thyroid Swelling in Correlation with USG guided FNAC. IJARS.2016;5:40-44

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