Role of Ultrasonography in thyroid swellings

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Abstract
Thyroid swelling is one of the commonest clinical presentations witnessed by a practicing surgeon. Ultrasonography is one of the established tools of assessment; it provides valuable data about morphology and character of the disease. It also helps to detect neoplasia. We performed a descriptive study to see the usefulness of ultrasonography in assessing thyroid swelling and its ability to detect neoplasia.

Keywords: thyroid, ultrasound, thyroid neoplasia

1. Introduction
Thyroid swelling is one of the most common neck swellings seen by a surgeon. Although the classical presentation provides a working diagnosis, clinical diagnosis is limited with only differentiation between solid and cystic lesions and in describing the anatomical associations. The neck also poses a unique challenge to the surgeon as many of the supporting and deep structures are beyond the scope of topographic evaluation. Hence the clinical examination is often inconclusive and some form of diagnosing imaging is necessary to come to a diagnosis.

Radiologic imaging provides an effective solution in differentiating neck masses and intrathyroidal masses. The major limitation of ultrasound (USG) in thyroid imaging is that it cannot determine thyroid function, i.e., if it is hyper or hypoactive. Simultaneous use of blood tests and radioactive isotope uptake test are helpful. These recent practices have revolutionized assessment of thyroid masses.1,2

1.1 Aims and objectives:
1. To evaluate the site, size and consistency of the thyroid swelling.
2. To study the any abnormal features like internal echos, calcifications etc.
3. To assess the use of USG as an effective screening tool to detect thyroid neoplasia.

2. Materials and methods
It is a descriptive study which was conducted in the department of general surgery, ENT and Radio diagnosis at Father Muller Medical College, Mangalore between the periods of may 2011-april 2012. 200 cases of thyroid swellings were taken up by purposive sampling technique.

2.1 Inclusion criteria: Thyroid swellings presenting for first time without previous surgical treatment.
2.1 Exclusion criteria: Neck swellings other than thyroid enlargement. Detailed general and local examinations were done. Apart from routine haematological tests, X Ray soft tissue neck, lateral and anteroposterior view were taken. USG examination was done to note the size, echotexture, consistency (solid/cystic) and calcification. All studies were done using HD 11 Philips Ultrasound unit with 10–12 MHz transducer. The diagnosis was confirmed with fine needle aspiration cytology (FNAC) / histopathology. The collected data was analyzed using chi square test.

3. Results
200 cases of thyroid swellings were enrolled in this study. Out of those 180 (90%) were females and 20(10%) were males, sex ratio being 9:1. Age distribution ranged from 11-76 years. Most of the patients presented with complain of neck swellings (84%), followed by swallowing difficulty, pain, fever. On USG examination nodular thyroid disease was the most common presentation (distribution of cases as mentioned in Table 1).

Table 1: Ultrasound features of thyroid swellings n=50

<table>
<thead>
<tr>
<th>USG FEATURES</th>
<th>Number of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GROSS CHARACTER</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diffuse increase in size</td>
<td>44</td>
<td>22</td>
</tr>
<tr>
<td>Nodular Thyroid Disease</td>
<td>86</td>
<td>46</td>
</tr>
<tr>
<td>Solitary nodule</td>
<td>64</td>
<td>32</td>
</tr>
<tr>
<td><strong>INTRAESIONAL CHANGES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Necrosis/degeneration/cystic</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td>Calcification</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td><strong>ECHOGENICITY OF NODULE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypoechoic</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Hyperechoic</td>
<td>128</td>
<td></td>
</tr>
<tr>
<td>Isoechoic</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td><strong>ECHOGENICTY OF GLAND</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homogenous</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Heterogenous</td>
<td>196</td>
<td></td>
</tr>
</tbody>
</table>
8 cases of thyroid malignancy were missed on USG. Sensitivity of USG to detect thyroid neoplasia in the present study is 66.67% and specificity is 100%. Positive predictive value was being (PPV) 100% and negative predictive value (NPV) being 95.65%.

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>USG</th>
<th>FNAC/Histopathology</th>
</tr>
</thead>
<tbody>
<tr>
<td>STN/MNG/Goiter</td>
<td>184</td>
<td>176</td>
</tr>
<tr>
<td>Suspect Thyroid Neoplasia</td>
<td>16</td>
<td>24</td>
</tr>
</tbody>
</table>

Fig 1a: Intrathyroidal multiple nodules along with a discrete nodule seen (white arrow).

Fig 1b: On Doppler, vascularity is well preserved hence minimizing the possibility of malignancy.

Fig 2: Nodular goiter with calcification (comet tail appearance).
4. Discussion

USG imaging has been in use for over 4 decades to assess neck swellings, use of which cannot be overemphasised. USG is non-invasive and non-ionizing tool, it uses sound waves of different frequencies to assess the densities and elasticity of tissues and it utilizes the pulse echo method to produce an image. In assessment of neck B- scans are of primary concern. The head and neck is scanned in horizontal, vertical and oblique directions.

Ultrasound of thyroid provides information regarding echo texture and intranodular character of the gland which help to characterize benign/malignant nodule, detect nodal metastasis, can be used for follow up or screening. It also provides image guidance for FNAC.

The incidence of all thyroid diseases is higher in females than males. Nodular thyroid disease is the most common cause of thyroid enlargement in our series and most of the clinical studies worldwide. Nodularity within thyroid is normal signifying normal maturation. Incidence of thyroid nodule is very high on USG, ranging from 50% to 70%. Thyroid neoplasia accounts for less than 7%.

Diffuse thyroid enlargement can be due to multinodular goiter, thyroiditis or Grave’s disease. Multinodular goiter is the commonest of all. On USG multiple nodules within a diffusely enlarged gland is often seen. Most of the nodules are iso or hyper-echoic in nature (Fig 1a & 1b). These nodules undergo degeneration causing USG features of cystic degeneration, haemorrhage or infection seen as moving internal echoes/ septations.

Isolated or hyper-echoic thyroid nodule showing spongiform appearances are considered benign. Eggshell calcification and comet tail artefact are useful ancillary signs (Fig 2). Punctate calcifications with irregular margins are suggestive of malignancy.

Flow pattern is of help in differentiating benign from a malignant nodule, a complete a vascular nodule is very unlikely to be malignant. Chaotic intranodular vascularity on colour flow imaging, nodal secondaries, cystic necrosis, microcalcifications, pre and paratracheal cervical nodal metastasis are sonological features associated with thyroid malignancy.

In our study, sensitivity to detect thyroid neoplasia on USG was 66.67% as comparable to the range of 60% to 80% in majority of the studies. It was highly specific with PPV of 100% and NPV being 95.65%.

Various studies have been done highlighting the usefulness of ultrasonography imaging, one such study done by Radecki and colleagues compared high resolution ultrasonography and CT scan for thyroid imaging. Both imaging modalities detected and localized the same number of abnormalities and neither one of them was considered to have any specific advantage over the other. However, to study extensions and invasion, CT is better.

Rodrigues et al found the result of ultrasound for detecting neoplastic disease was 65% sensitive and 80% specific, which is comparable to our study where we had 66.67% sensitivity and 100% specificity. This slight discrepancy in almost comparable results may be attributed to the variation amongst radiologists in other studies; we had one radiologist performing all the scans in our study so we didn’t come across this variation.

USG guided FNAC is an advantage in difficult to access lesions with a relatively high accuracy of 74.8% 

In one such case where repeated blind FNAC were inconclusive we got an aspirate positive for papillary carcinoma which was USG guided. It can be used as very valuable adjunct tool in occult cases. Rosario et al in his work has highlighted the use of imaging with radioiodine scans and serum thyroglobulin to detect local early recurrences and how this practice can be beneficial in follow up of patients. We could not assess this aspect of imaging as such patients were not included in our study, however this is a purely diagnostic efficacy study such data can be used for prolonged follow up and assess early recurrence of disease.

5. Conclusion

Ultrasound is one of the most valuable tools available. It can effectively differentiate between different types of thyroid masses and intrathyroidal pathologies. Inflammatory and neoplastic changes can be appreciated well. It can be used as a screening tool to detect thyroid neoplasia. USG guided FNAC provides sensitivity to the test. It acts as effective adjunctive tool to CT and MRI.

References