Approach to a case of Solitary thyroid Nodule

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Objectives

- Definition and Clinical Importance
- Clinical features
- Investigation
  - Thyroid function test
  - Ultrasonography
  - FNAC
  - Ancillary Investigations
Objectives continued...

- Surgical Procedure
- ...At the end of the lecture student is expected to identify a STN & decide its appropriate management
Mid line Neck swellings

- Thyroglossal duct cyst
- Sublingual dermoid cyst
- dermoid cyst.
- Plunging ranula.
- Thyroid swelling at isthmus.
- Subhyoid bursa.
- Pretrachial, prelaryngeal lymphnodes.
Swelling within Thyroid gland

- **Benign**
  - Collid nodule
  - Follicular adenoma/ Hurthle cell adenoma
  - Graves’/toxic MNG/Toxic adenoma
  - Thyroiditis

- **Malignant**
  - Cancer from Follicular cell origin
    - Papillary Thyroid Cancer
    - Follicular Thyroid Cancer
    - Hurthle cell carcinoma
    - Anaplastic thyroid cancer
  - Cancer from Non Follicular cell origin
    - Medullary Thyroid cancer – Sporadic / MEN syndrome (MEN II)
    - Primary Lymphoma

- **Secondaries** – Kidney, breast, lung, colon, melanoma, Prostate
**Thyroid Nodule**

- A ‘Thyroid Nodule’ is defined as a discrete lesion in thyroid gland which is radiologically distinct from surrounding thyroid parenchyma.
Solitary Thyroid Nodule

- A ‘Solitary Thyroid Nodule’ is a discrete palpable single nodule in thyroid gland in otherwise Impalpable gland.

Dominant nodule

- A discrete nodule with nodularity elsewhere in thyroid gland is “dominant nodule”
Epidemiology

- **Incidence** of palpable thyroid nodules in adults
  - 1% in men, 5% in women
- Ultrasonography has increased the incidence of unselected patients (19% to 67%)

<table>
<thead>
<tr>
<th>Method of detection</th>
<th>Study</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palpation</td>
<td>Tan &amp; Gharib, 1997*</td>
<td>1-5%</td>
</tr>
<tr>
<td>Autopsy</td>
<td>Wang et al, 1997</td>
<td>49.5%</td>
</tr>
<tr>
<td></td>
<td>Mayo clinic study, 1955**</td>
<td>50%</td>
</tr>
<tr>
<td>USG</td>
<td>Mazzaferri, 1993***</td>
<td>19-46%</td>
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## Prevalence on imaging

<table>
<thead>
<tr>
<th>Imaging modality</th>
<th>Detection Rate</th>
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<tbody>
<tr>
<td>USG neck</td>
<td>67 %</td>
</tr>
<tr>
<td>CT / MRI</td>
<td>16 %</td>
</tr>
<tr>
<td>Carotid Duplex scan</td>
<td>9.4 %</td>
</tr>
<tr>
<td>FDG PET</td>
<td>2-3 %</td>
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</table>
Challenge

To identify patients with clinically significant cancers among large number of patients with Solitary Thyroid nodule.
• Every nodule should be considered malignant and effort should be made to rule out malignancy

• Risk of malignancy 15 – 20 % are malignant

• 80% of STN are benign
Characteristics on imaging

- Size more than 1 cm - 67%
- Size more than 4 cm - 38%
- Stage III or IV - 25%
- Positive LN - 30%
Risk of Malignancy

- Risk varies on the modality used and on the imaging characteristics of the nodule.

- Risk / Malignancy rate of:
  - Impalpable thyroid nodules - same as palpable nodules (4-12%). (Diagnosed on Neck US, CT or MRI)

- When diagnosed with FDG PET – risk is 30%. (more aggressive variant of PTC, unfavourable prognostic factors)
Clinical issues

- Possibility of malignancy / diagnostic dilemma?
- Large enough to be symptomatic?
- Patient’s anxiety about the nature of nodule?
- No clear cut protocols till recent past – potential malpractice liability
How to evaluate

- **Triple Test** –
  - History & Examination
  - TFT
  - Investigations – Ultrasound +/- CT, FNA

- **History** - thorough history regarding risk factors.

- **Examination** – clinical examination of neck especially to look for vocal cord paralysis, lateral cervical lymphadenopathy, and fixation of the nodule to surrounding tissues.
Diagnosis of a Thyroid Nodule should prompt a thorough history and examination.

To identify those factors that increase the risk of thyroid cancer
Risk factors on History

- Male sex
- Age less than 20 years or greater than 70 years
- Recent onset of hoarseness, dysphonia, dysphagia or dyspnoea
- Past medical history of thyroid cancer
- Previous head and neck irradiation
- Exposure to nuclear fallout e.g. from Chernobyl
- Family history of medullary thyroid carcinoma or multiple endocrine neoplasia type 2 (MEN 2)
- Family history of papillary thyroid carcinoma, familial Polyposis Coli, Cowden’s or Gardner’s Syndrome
Clinical Examination

- We start the examination by palpating the cricoid ring because the isthmus is reliably palpable immediately inferior to this.
  - fixation to skin/surrounding
  - firm to hard nodule
  - neck nodes
  - vocal cord fixation
  - features of hyperthyroidism – less malignant chances
Clinical Examination

**Inspection** – *Pizzillo’s method*
- **Hands behind head, neck extended**
- **Especially in obese persons, short neck**
- **Trail sign** – tracheal deviation

**Palpation** – examine from:
- **Behind the patient**
  - Characterize the thyroid swelling
  - Look for **Retro-sternal extension**
  - Cervical LN
  - Tracheal shifting / deviation
- **Front of the patient** –
  - **Lahey’s Method** – sit in front of patient
  - To look for Tracheal shifting / deviation
Clinical Examination

Palpation Contd.
- For trachea

Percussion
- Over Manubrium sterni, Heads of clavicle
- Usually tympanic
- Dull Note in cases of — Retro-sternal Extension (RSE), Central compartment LN

Auscultation
- Over thyroid superior poles — Bruit + in Graves’ Disease
- To check Tracheal deviation if present — Bronchial sounds
- Upper thorax auscultation in cases of Retro-sternal Extension (RSE)
Clinical examination contd...

A good clinical examination includes

✓ A thorough examination of thyroid
✓ Examination of anterior and posterior cervical triangles, lymphadenopathy
✓ Size and consistency of nodules

multiplicity / diffuse nodularity __ benign
single firm swelling in older men __ malignant
Clinical Examination - How Reliable?

- A nodule - located deep within the gland / the posterior surface is difficult to palpate.
- Even **more difficult** to palpate nodule in patients with short and fat neck.
- Accuracy of thyroid palpation depends on the experience of the examiner.

Christensen et al (1985) - sensitivity of palpation of the thyroid gland in terms of size and nodularity was 38%
Study by Brander and colleagues (1992), - 50% of nodules discovered on ultrasonography escaped detection on clinical examination; Approx. 1/3rd of nodules that had not been detected by palpation were > 2 cm in diameter.

However a prominent but normal thyroid gland in a patient with a thin neck may be perceived as an abnormality of the thyroid gland.
Evaluation - Thyroid function test

- Serum TSH, T3, T4 to be evaluated
- Decreased TSH indicates Hyperthyroidism

  indication for an isotope scan (99m Pertechnetate scan)
  (correlates with lower chances of malignancy in Hot nodule)

If Hot Nodule confirmed – No FNAC Indicated
If Nodule is cold (i.e. Rest gland is Hyper functional) – FNAC is Indicated
99m pertechnetate scan

- Assessment of functional characteristic of gland
  - Hot nodule - 1% malignant
  - Cold nodule - 16-20% malignant

- Done using
  - I-123 (lingual thyroid & substernal goitre)
  - I-131 (thyroid carcinoma metastasis)
• Normal/ High TSH
  • rules out functional nodule ,
  • requires evaluation by USG and FNAC

• Normal TSH – Euthyroid Nodule

• Increased  TSH suggests hypothyroidism ( MC cause - Hasimoto thyroiditis)
Evaluation - Imaging

- Diagnostic ultrasound for thyroid incidentaloma- HRUSG NECK
  - operator-dependent though
  - non-invasive, accessible
  - portability
  - cost-effectiveness
  - lack of ionizing radiation.
  - allows high resolution imaging of the thyroid (7 – 12 MHz).
- Gold standard
  - Features - size, echogenicity, composition, calcification, margin, and halo.
Risk stratification on HRUSG

- Features correlating with malignancy –
  - Hypoechochogenicity
  - Solid composition
  - Irregular margin
  - Fine micro calcification
  - Absence of halo
  - Shape tall more than wide
  - Central rather than peripheral vascularity on Doppler USG.

Size does **NOT** seem to correlate with malignancy.
<table>
<thead>
<tr>
<th>Ultrasonographic Feature</th>
<th>Malignant (%)</th>
<th>Benign (%)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypoechoic</td>
<td>87</td>
<td>56</td>
<td>.009</td>
</tr>
<tr>
<td>Irregular borders</td>
<td>77</td>
<td>15</td>
<td>.0001</td>
</tr>
<tr>
<td>Vascular pattern (central hypervascularity)</td>
<td>74</td>
<td>19</td>
<td>.0001</td>
</tr>
<tr>
<td>Microcalcification</td>
<td>29</td>
<td>4</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Unfortunately, no ‘single’ US sign has sufficient diagnostic value.

Kim et al. (2002) stated combination of four signs, capable of diagnosing 94% of thyroid carcinomas
- microcalcifications,
- a taller-than-wide shape,
- irregular borders and
- marked hypoechogenicity

Brito et al. (2014)
- highest diagnostic odds ratio for malignancy was being ‘taller than wider’
- spongiform appearance, cystic nodules – benign, avoid FNA.
US features of malignancy

- hypoechoic
- Solid/mixed
- microcalcifications
US features of malignancy

Irregular margins

Loss of peripheral halo
Colour doppler - US features

- Peripheral hypervascularity
- Intrinsic hypervascularity
Elastography

- new dynamic ultrasound technique
  - measuring tissue stiffness,
  - Principle - Malignant nodule being more hard than benign.
- has great potential to identify malignant solid thyroid nodule.
- Sensitivity - 97% and
- Positive predictive value of about 100% in STN
- Sensitivity - 97%,
- Specificity of 92% in multiple nodules.
TIRADS (THYROID IMAGING- REPORTING AND DATA SYSTEM)

Quantitative assessment of US features by Horvath et al. 2009
Evaluation – Indication of CT / MRI

- Not required in the routine work up of STN
- Huge STN with mass effects – Tracheal compression and deviation
- Evaluation of local extension in advanced thyroid malignancy
- Assessment of retrosternal extension

- Post operative follow-up for recurrence
Evaluation - FNAC

- **Indication of FNA** (Revised ATA /AACE Guidelines)
  1. **High risk features** on history – (age <20, >70ys; h/o neck irradiation; family h/o MTC/PTC)
  2. **Abnormal cervical nodes** on clinical examination / USG -> FNA of nodes +/- FNA of TI
  3. **Suspicious USG features** (hypoechoic, microcalcification, irregular border, central vascularity, no halo)
  4. **Consistency** of nodule - solid >1cm, solid <1cm with suspicious USG,
     mixed >2 cm, mixed < 1.5 – 2 cm with suspicious USG)
Fine Needle aspiration cytology (FNAC)

- Uses a 23 – 26 gauge needle
- Most cost effective
- Investigation of choice for STN (essential for all nonfunctioning dominant nodule > 1 cm)
- Done without image guidance for palpable nodule and with USG guidance otherwise
# FNAC - Classifications

<table>
<thead>
<tr>
<th>Bethesda</th>
<th>Royal College of Pathologists in UK</th>
<th>Italian</th>
<th>Australian</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Nondiagnostic or unsatisfactory: Low cellularity or obscuring factors or cyst fluid only</td>
<td>Thyroid 1: Nondiagnostic for cytological diagnosis Thyroid 1c: Cystic lesion</td>
<td>TIR** 1: Nondiagnostic TIR 1c: Nondiagnostic cystic</td>
<td>1: Nondiagnostic</td>
<td>1: Inadequate</td>
</tr>
<tr>
<td>II. Benign: Consistent with a benign follicular nodule, lymphocytic (Hashimoto) thyroiditis, or granulomatous (subacute) thyroiditis</td>
<td>Thyroid 2: Nonneoplastic Thyroid 2c: Nonneoplastic, cystic lesion</td>
<td>TIR 2: Nonmalignant</td>
<td>2: Benign</td>
<td>2: Normal or benign</td>
</tr>
<tr>
<td>III. Atypia of undetermined significance or follicular lesion of undetermined significance</td>
<td>Thyroid 3a: Neoplasm possible-atypia/ nondiagnostic</td>
<td>TIR 3A: LRIL</td>
<td>3: Indeterminate or follicular lesion of undetermined significance</td>
<td>3: Indeterminate B others</td>
</tr>
<tr>
<td>IV. Follicular neoplasm or suspicious for a follicular neoplasm</td>
<td>Thyroid 3f: Neoplasm possible, suggesting follicular neoplasm</td>
<td>TIR 3B: HRIL</td>
<td>4: Suggestive of a follicular neoplasm</td>
<td>3: Indeterminate A follicular neoplasms 1 favour benign, 2 borderline A-3 favour malignant</td>
</tr>
<tr>
<td>V. Suspicious for malignancy</td>
<td>Thyroid 4: Suspicious of malignancy</td>
<td>TIR 4: Suspicious of malignancy</td>
<td>5: Suspicious of malignancy</td>
<td>4: Malignancy suspected</td>
</tr>
<tr>
<td>VI. Malignant</td>
<td>Thyroid 5: Malignant</td>
<td>TIR 5: Malignant</td>
<td>6: Malignant</td>
<td>5: Malignancy</td>
</tr>
</tbody>
</table>

**TIR for Tiroide (Thyroid in Italian). LRIL: Low-risk indeterminate lesion, HRIL: High-risk indeterminate lesion**
# Bethesda Classification for thyroid cytopathology

<table>
<thead>
<tr>
<th>Diagnostic category</th>
<th>Risk of malignancy</th>
<th>Usual Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Non diagnostic or Unsatisfactory</td>
<td>1- 4 %</td>
</tr>
<tr>
<td>II</td>
<td>Benign</td>
<td>0 – 3 %</td>
</tr>
<tr>
<td>III</td>
<td>Atypia of Undetermined significance (AUS) or Follicular Lesion of Undetermined significance (FLUS)</td>
<td>5 – 15 %</td>
</tr>
<tr>
<td>IV</td>
<td>Follicular Neoplasm or suspicious of Follicular Neoplasm</td>
<td>15 – 30 %</td>
</tr>
<tr>
<td>V</td>
<td>Suspicious of Malignancy</td>
<td>6- - 75 %</td>
</tr>
<tr>
<td>VI</td>
<td>Malignant</td>
<td>97 - 99 %</td>
</tr>
</tbody>
</table>
Ultrasound guided FNA

- recommended for
  - Nonpalpable – like in obese people, short neck, scarred neck.
  - Posteriorly located,
  - Previous indeterminate nodule on FNAC

- Results in a lower rate of nondiagnostic cytology and sampling error
When to evaluate – nodules < 1 cm

- nodules less than 1 cm may be evaluated if:
  - Suspicious characteristics on ultrasound;
  - Suspicious lymphadenopathy based on ultrasound or clinical examination
  - Family history of PTC,
  - History of radiation exposure,
  - Prior personal history of thyroid cancer
  - Lesions positive on FDG-PET
धन्यवाद
Thank you
Merci beaucoup
Mahalo
Grazie
Gracias