Approach to a case of Solitary thyroid Nodule

Prof. Abhinav Arun Sonkar

(MS, FRCS(Engl), FRCS(Ire), FRCS(glas)FACS, FUICC)

Head of department

General surgery

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Prof Abhinav Arun Sonkar
Email : abhinavarunsonkar@gmail.com

Objectives

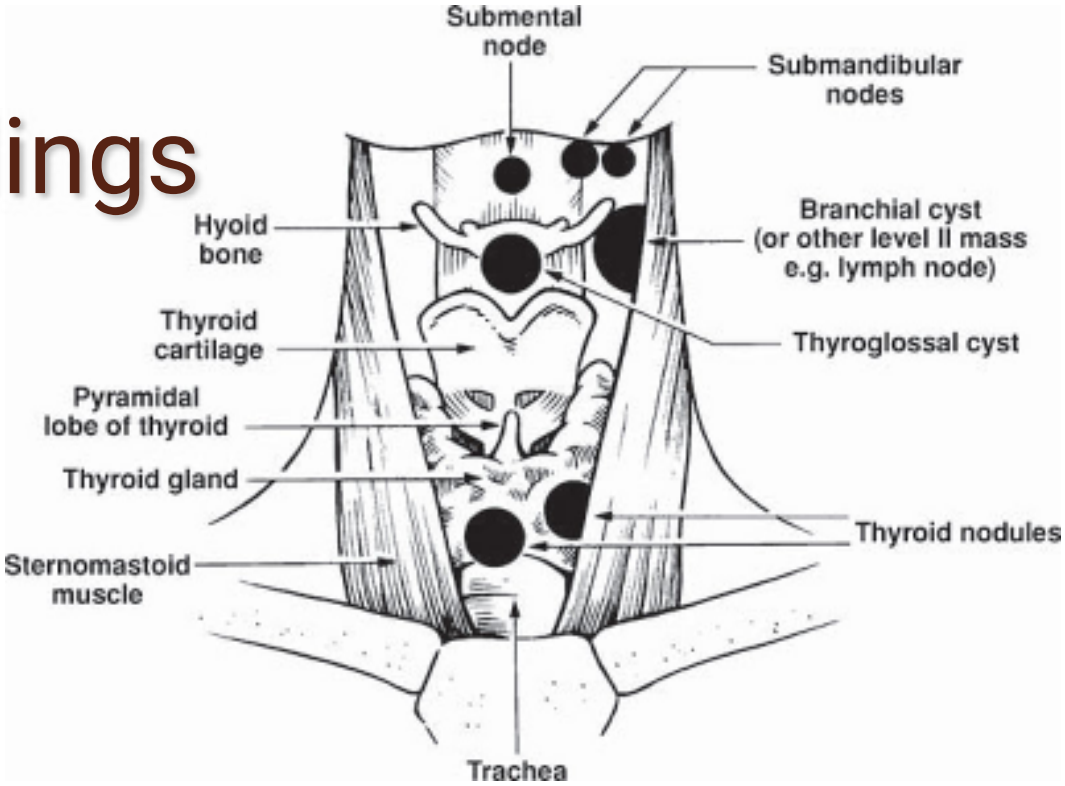
- Definition and Clinical Importance
- Clinical features
- Investigation
    - Thyroid function test
    - Ultrasonography
    - FNAC
    - Ancillary Investigations

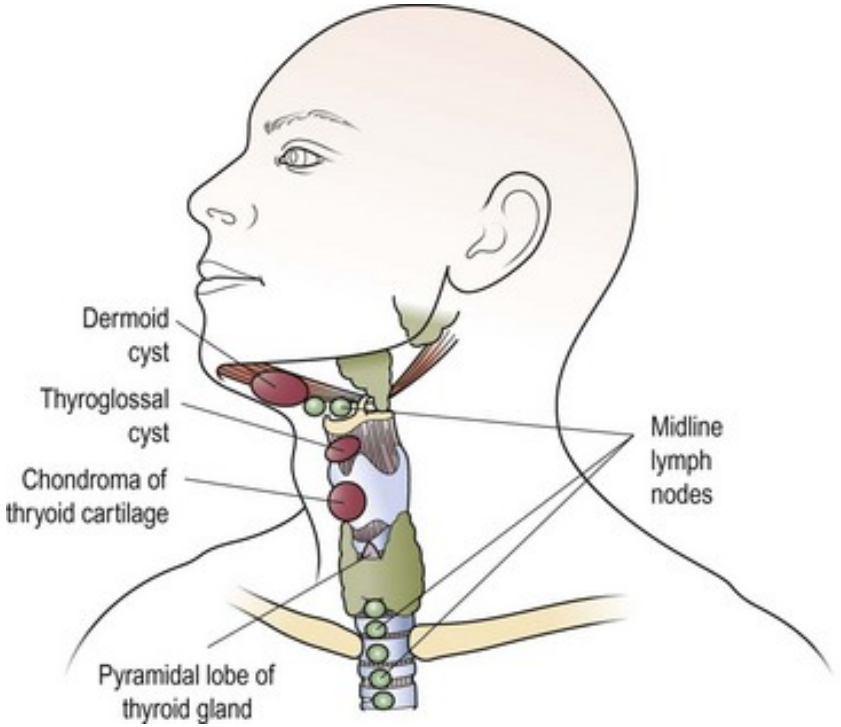
Objectives continued…

- 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.



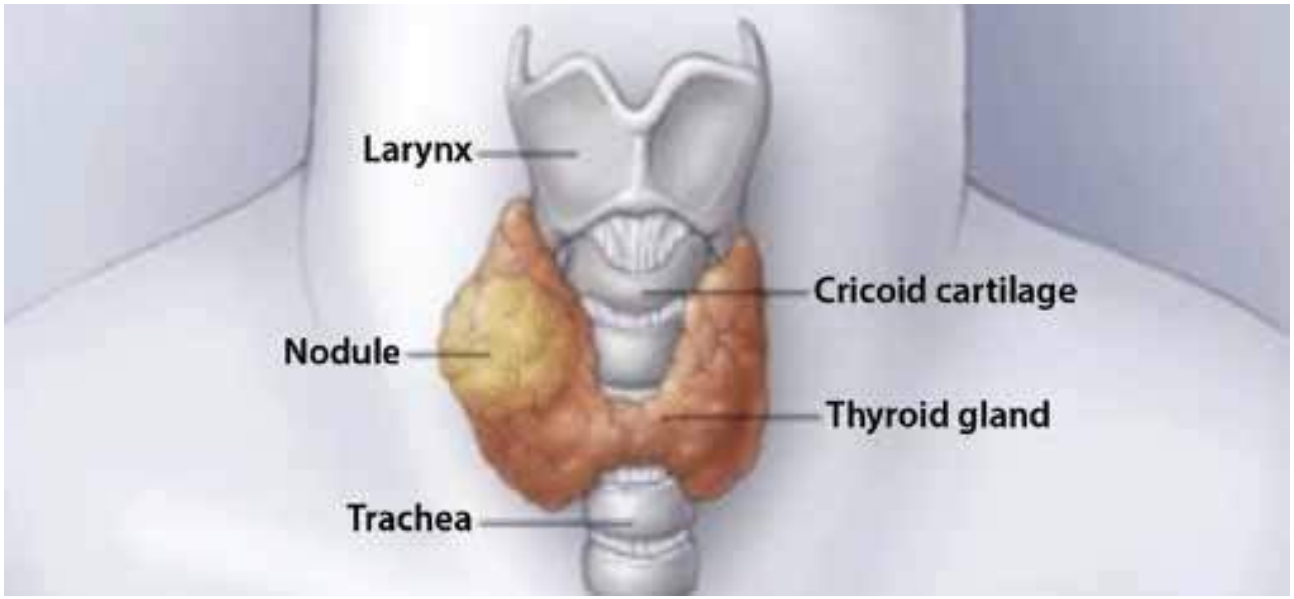


Swelling within Thyroid gland

- 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

Definition

- 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 un selected patients (19% to 67%)

Method of detection	Study	Prevalence
Palpation	Tan & Gharib, 1997*	1-5%
Autopsy	Wang et al, 1997 Mayo clinic study, 1955**	49.5% 50%
USG	**Mazzaferri, 1993*** **	**19-46%**

Prevalence on imaging

Imaging modality	Detection Rate
USG neck	67 %
CT / MRI	16 %
Carotid Duplex scan	9.4 %
FDG PET	2-3 %

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.

History and examination

- Diagnosis of a Thyroid Nodule should prompt a thorough history and examination.

To identify those factors that increase the risk of thyroid cancer

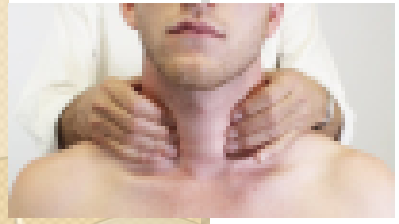
Risk factors on History

- 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.

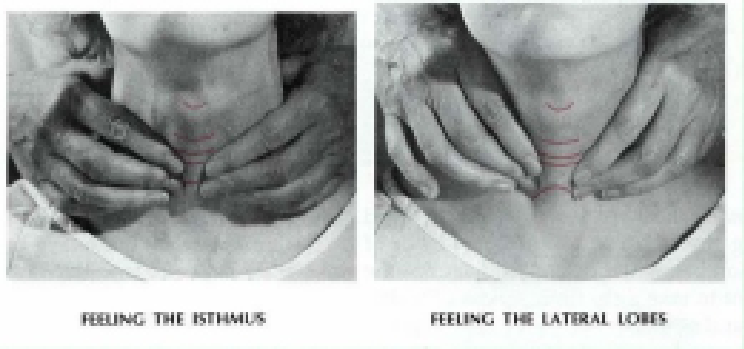
- fixation to skin/surrounding
- firm to hard nodule
- neck nodes
- vocal cord fixation
- features of hyperthyroidism – less malignant chances

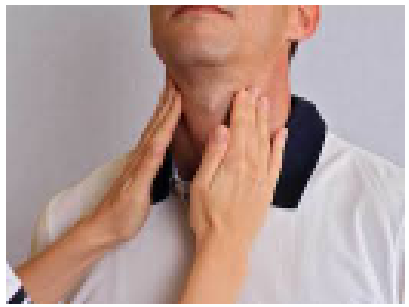


Clinical Examination

- Inspection – *Pizzillo's meth*
  - *Hands behind head, neck extrended*
  - *Especially in obese persons, short neck*
  - Trail sign – tracheal deviation

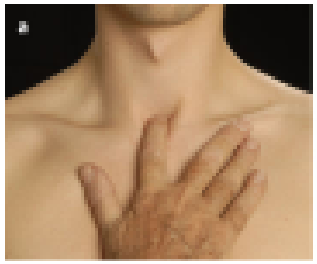
- Palpation – examine fro
  - Behind the patient
    - Characterize the thyroid swelling
    - Look for **Retro-sternal extension**
    - Cervical LN
    - Tracheal shifting / deviation
  - Front of the patient –
    - Lahey's Method – sit in front of patient
    - To look for Tracheal shifting / deviation

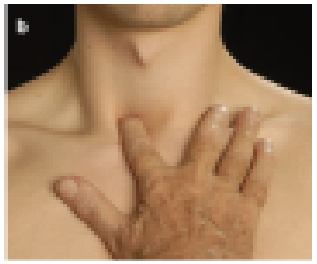




Clinical Examination

- Palaption Contd.
  - For trachea





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

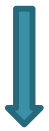
50 % of nodules discovered on ultrasonography escaped detection on clinical examination;

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)

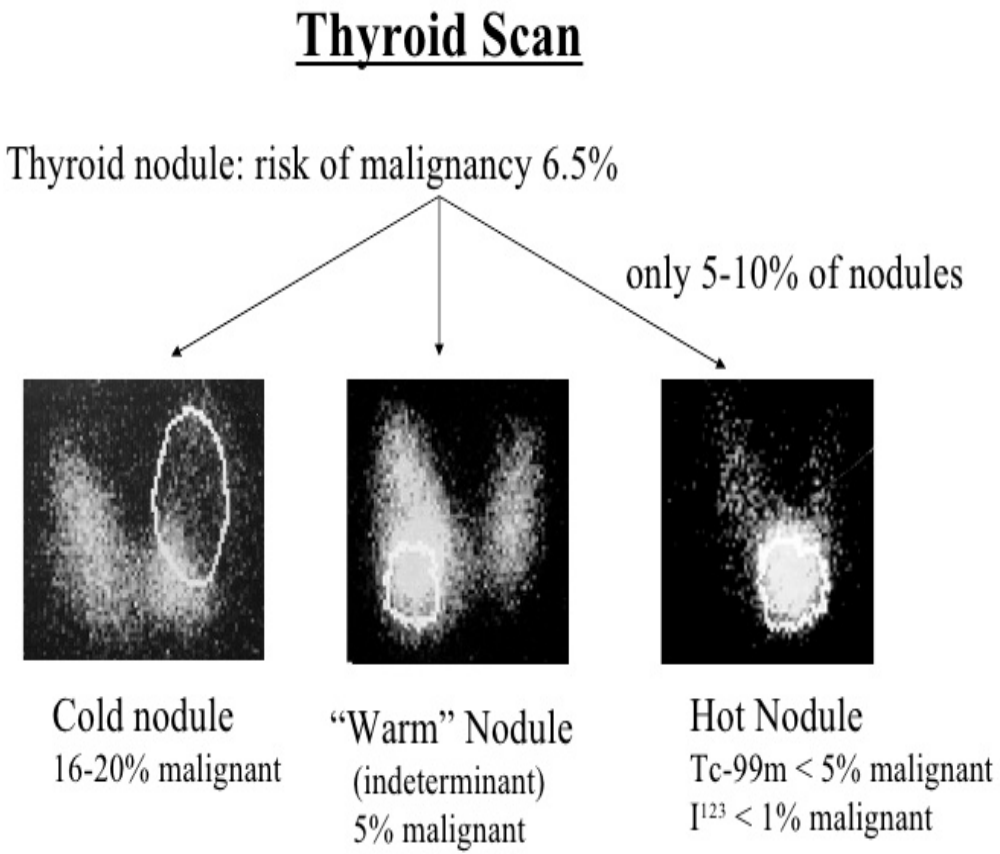
If Hot Nodule confirmed – No FNAC Indicated

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 –
  - Hypoechogenicity
  - Solid composition
  - Irregular magin
  - Fine micro calcification
  - Absence of halo
  - Shape tall more than wide
  - Central rather than peripheral vascularity on Doppler USG.

Size does **NOT** seems to correlate with malignancy.

Table 1
Ultrasonographic features, malignant versus benign incidental thyroid nodules

Ultrasonographic Feature	Malignant (%)	Benign (%)	*P* value
Hypoechoic	87	56	.009
Irregular borders	77	15	.0001
Vascular pattern (central hypervascularity)	74	19	.0001
Microcalcification	29	4	.0001

Data from Papini E, Guglielmi R, Bianchini A, et al. Risk of malignancy in nonpalpable thyroid nodules: predictive value of ultrasound and color-Doppler features. J Clin Endocrinol Metab 2002;87:1941–46.

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

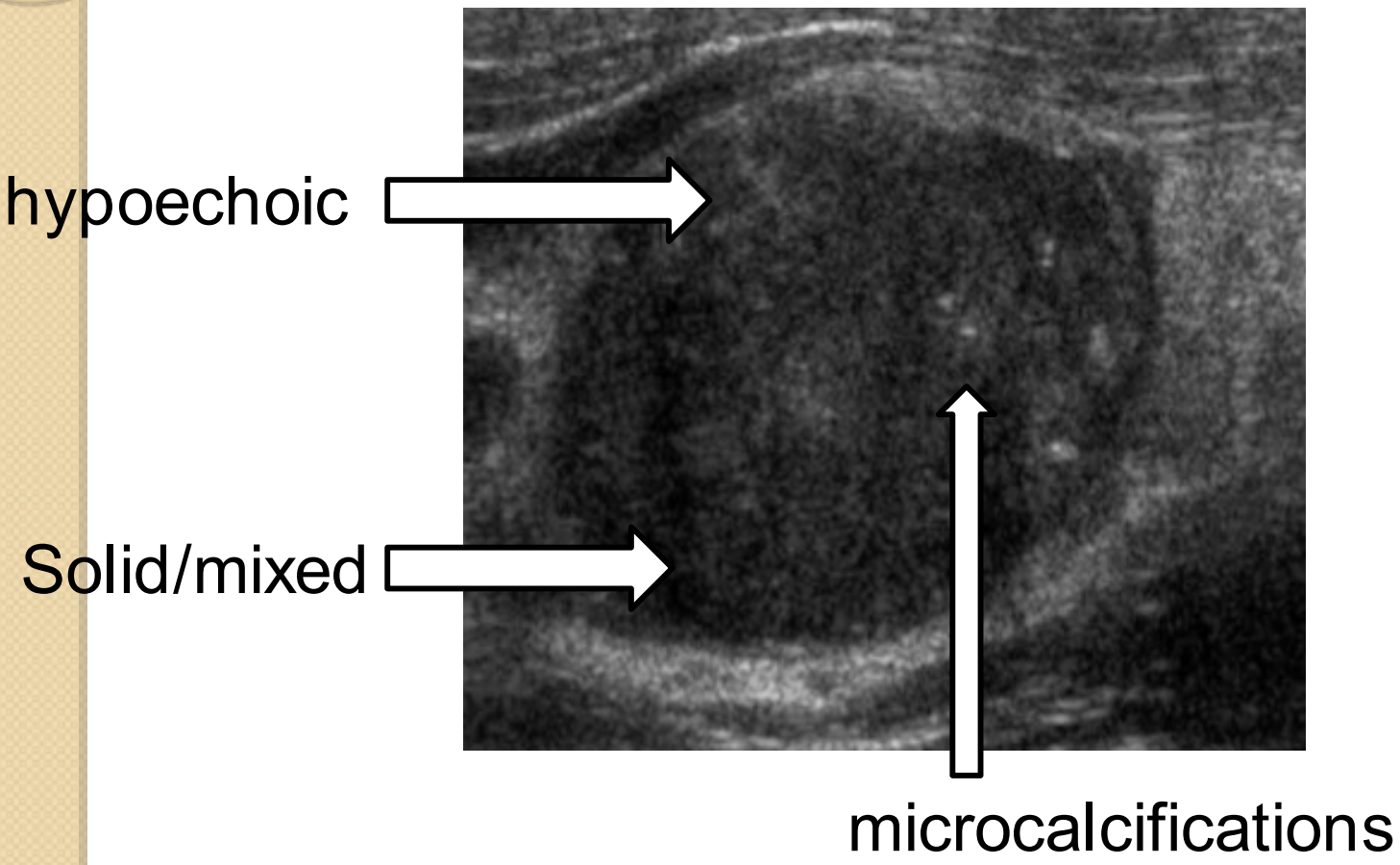
Kim et al. (2002) stated combination of four signs, capable of diagnosing 94% of thyroid carcinomas

- microcalcifications,
- a taller-than-wide shape,
- irregular borders and
- marked hypoechogenicity

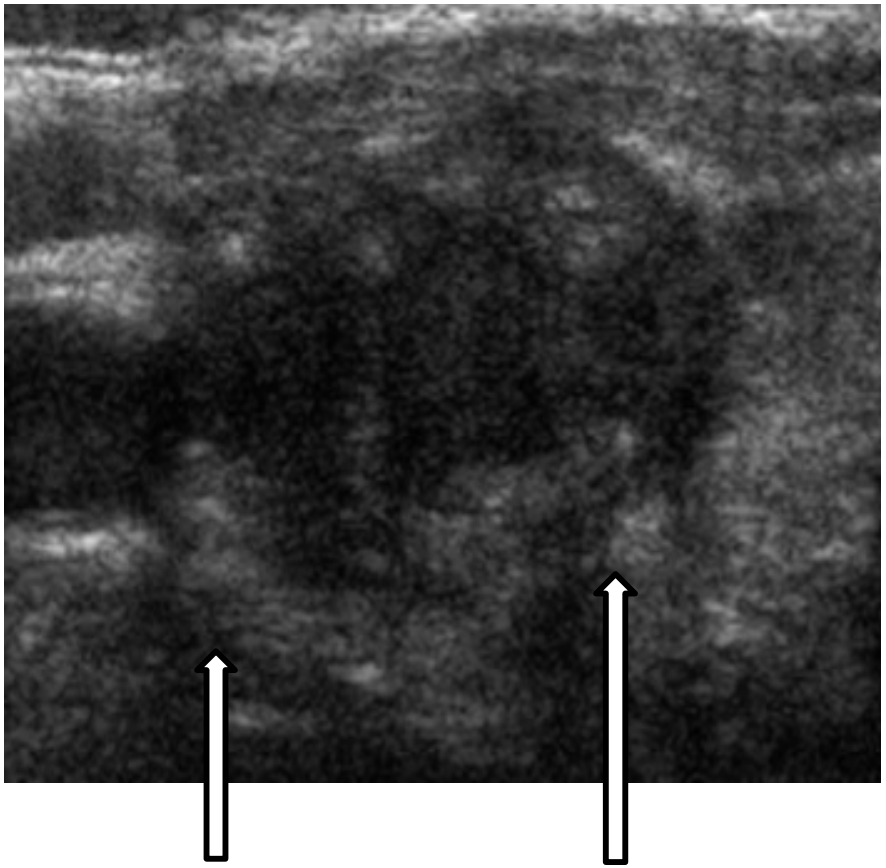
Brito et al. (2014)

- highest diagnostic odds ratio for malignancy was being ‘taller than wider’
- spongiform appearance, cystic nodules – benign , avoid FNA.

US features of malignancy

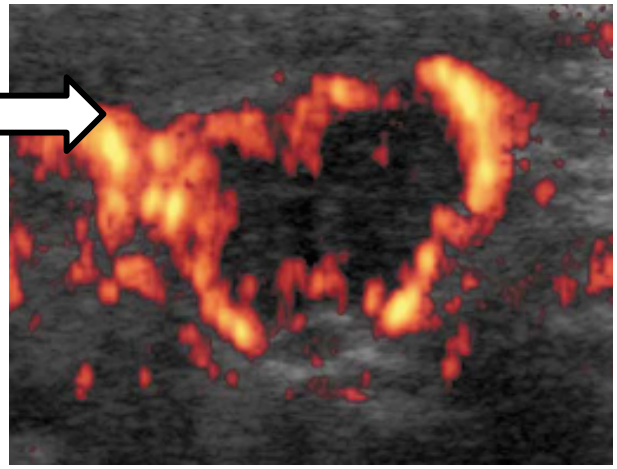


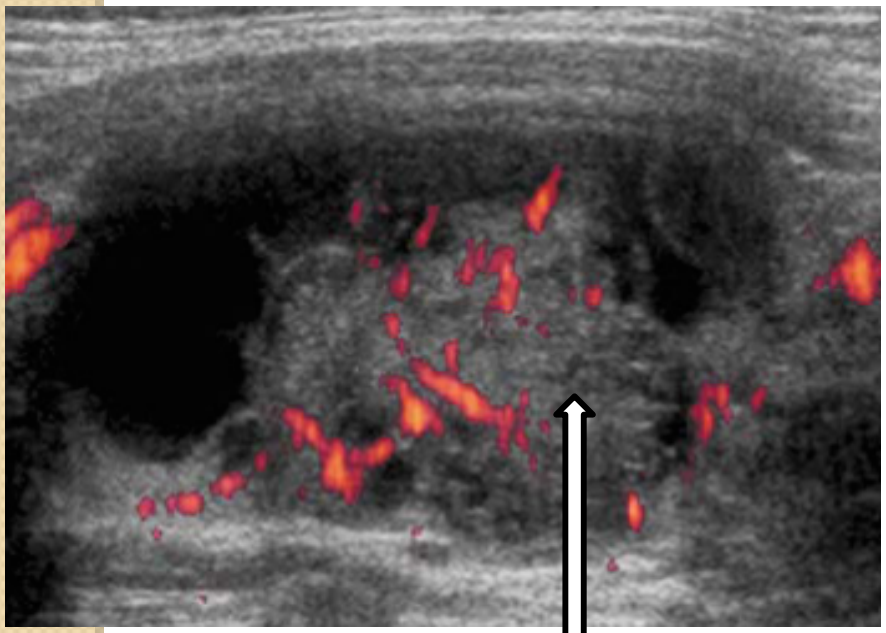
US features of malignancy



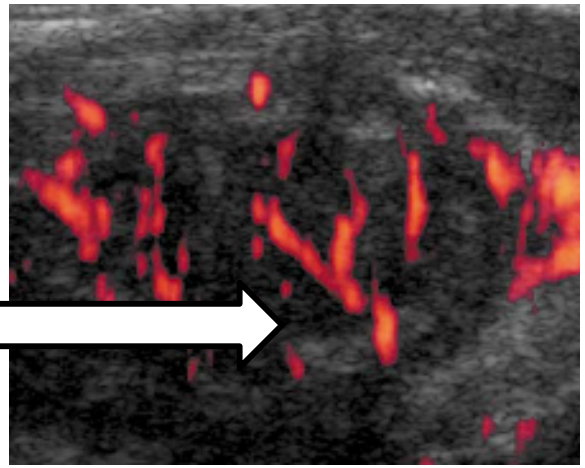
Colour doppler - US features

Peripheral hypervascularity

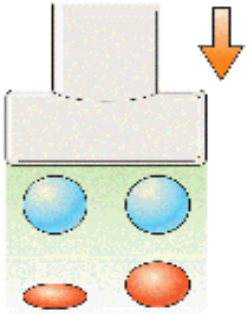


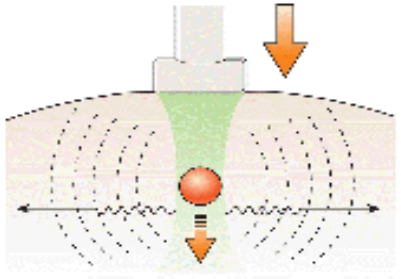


Intrinsic hypervascularity



Elastography





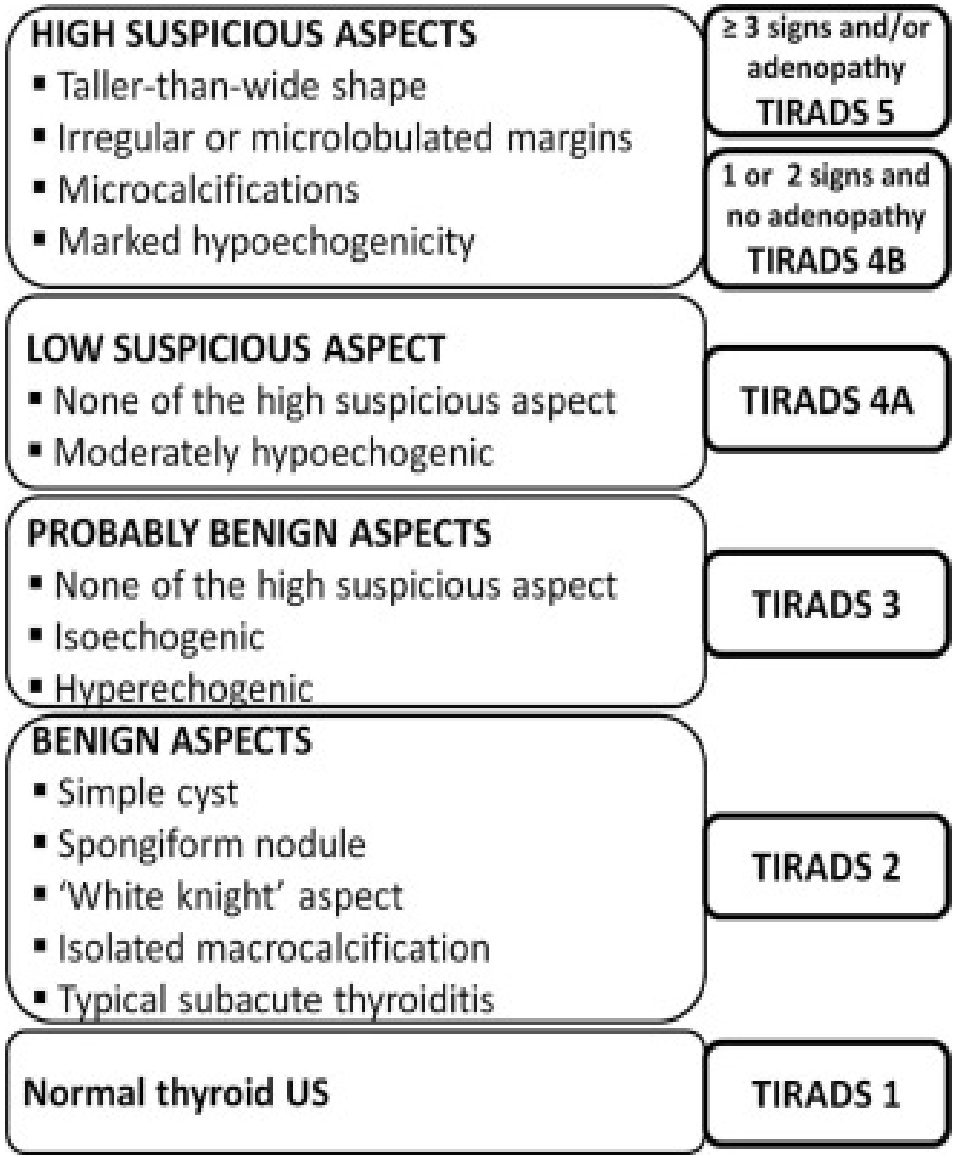
- new dynamic ultrasound technique
  - measuring tissue stiffness,
  - Principle - Malignant nodule being more hard than benign.
- has great potential to identify malignant solid thyroid nodule.
- Sensitivity - 97% and
- Positive predictive value of about 100% in STN

- Sensitivity - 97%,
- Specificity of 92% in multiple nodules.

TIRADS (THYROID IMAGING- REPORTING AND DATA SYSTEM)

Quantitative assessment of US feature

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 > 1cm)
- Done without image guidance for palpable nodule and with USG guidance other wise

FNAC - Classifications

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

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

Bethesda Classification for thyroid cytopathology

	Diagnostic category	Risk of malignancy	Usual Management
1	Non diagnostic or Unsatisfactory	1- 4 %	Repeat FNA with USG Guidance
II	Benign	0 – 3 %	Follow up
III	Atypia of Undetermined significance (AUS) or Follicular Lesion of Undetermined significance (FLUS)	5 – 15 %	Repeat FNA
IV	Follicular Neoplasm or suspicious of Follicular Neoplasm	15 – 30 %	Lobectomy
V	Suspicious of Malignancy	6- - 75 %	Total Thyroidectomy
VI	Malignant	97 - 99 %	Total Thyroidectomy

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 beaucop

Grazie

Mahalo

Gracias