Neck

- The thyroid gland

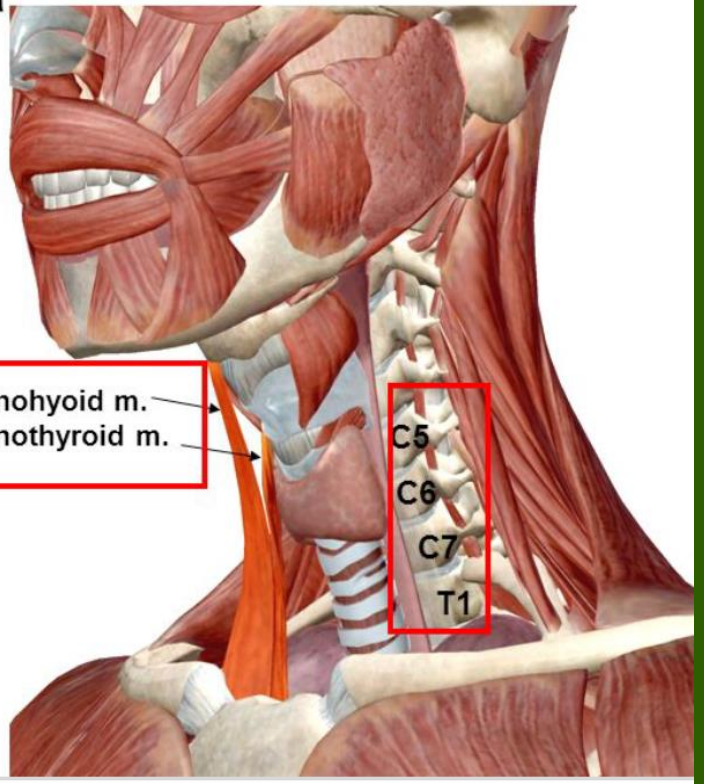
* shape & texture: consist of 2 lobes with interconnecting isthmus . & has homogenous intermediate echogenicity
* size : the isthmus is less than (1 cm) in AP diameter
  each lobe is less than (2 cm) in AP diameter, (3 cm) in width & (4 – 5 cm) in length.
* site : the lobes situated on either side of the larynx & trachea & are joined across the midline by the isthmus

- posteriorly : the larynx & trachea produce acoustic shadow & oesophagus may be seen posterio – laterally usually to the Lt side .
- laterally : the carotid aa. & internal jugular vv.
- anteriorly : the strap muscles , subcutaneous tissue & the skin .
- superiorly : the sublingual salivary gland in the floor of the mouth , laterally are the submandibular glands ,& more laterally & superiorly are the parotid glands against the angle of mandible & all have homogenous texture similar to that of the thyroid. .

Thyroid gland

Thyroid Gland Location

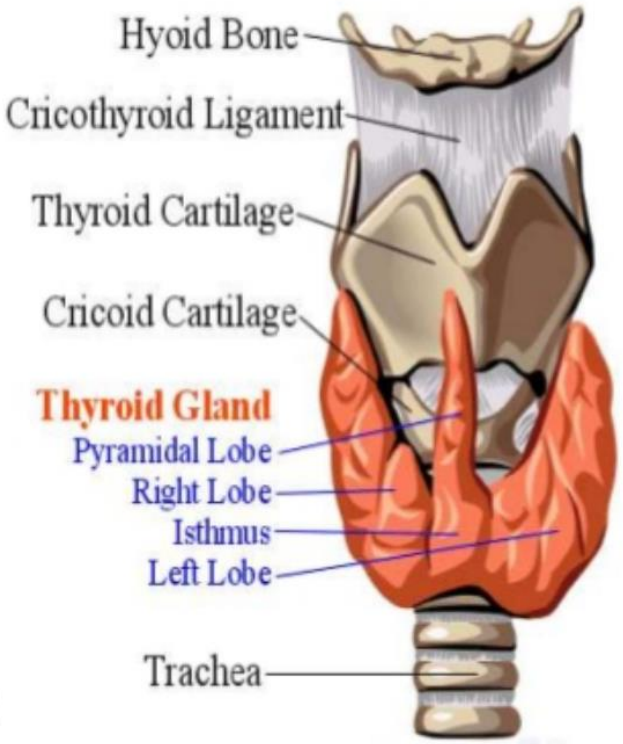
- The thyroid gland lies deep to the sternothyroid and sternohyoid muscles, located anteriorly in the neck at the level of the C5 - T1 vertebra
- Consists of right and left lobes, anterolateral to the larynx and trachea
- A relatively thin isthmus unites the lobes over the trachea, usually anterior to the second and third tracheal rings, the isthmus may be incomplete

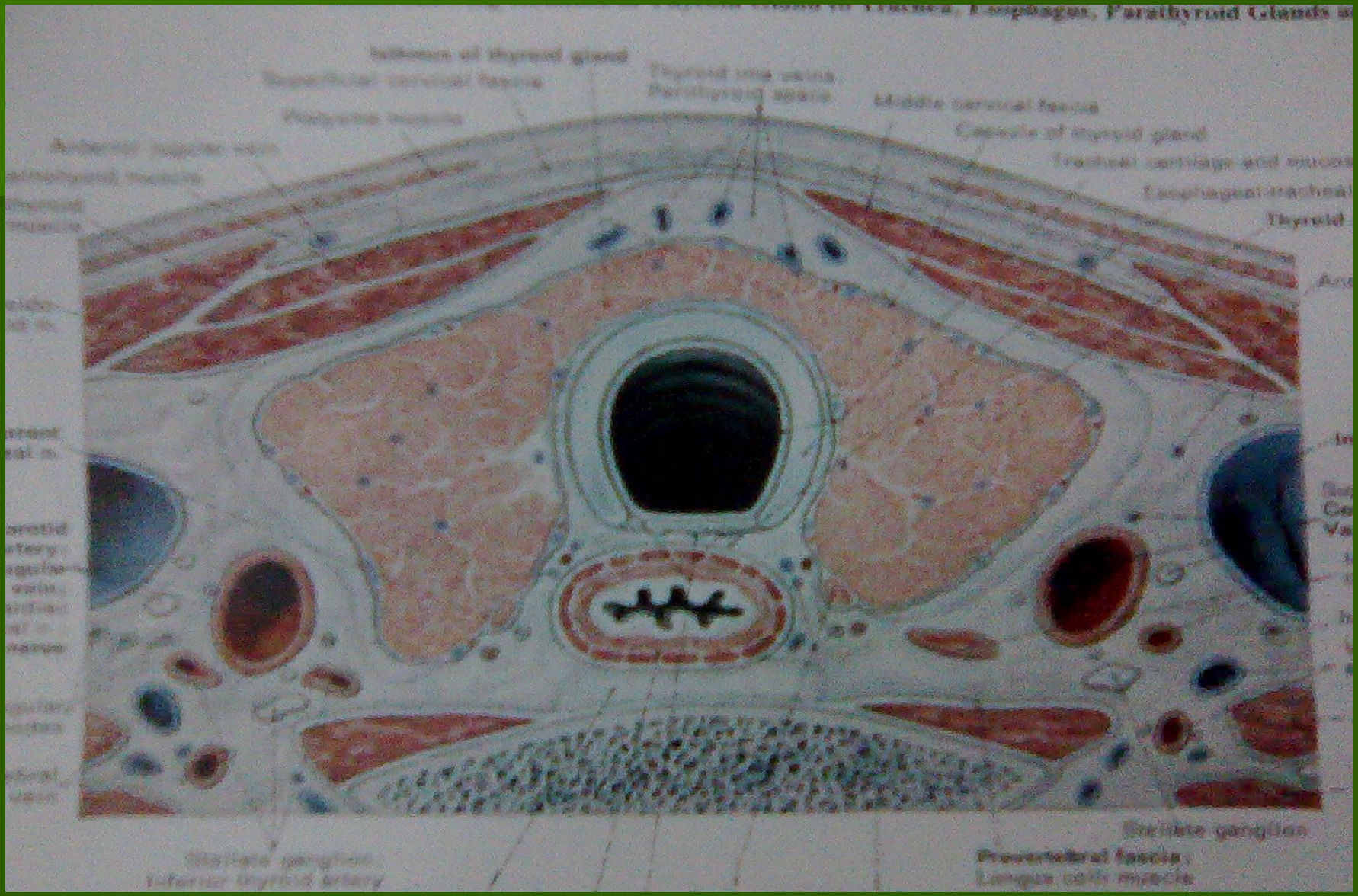


Thyroid gland

Anatomy

- **Location:** lower part of the front and side of the neck opposite to the C5, C6, C7 and T1 vertebrae.
- Each lateral lobe extends upwards to oblique line of thyroid cartilage and below up to the 5th or 6th tracheal ring.
- The isthmus extends across the midline in front of the 2nd ,3rd and 4th tracheal ring.

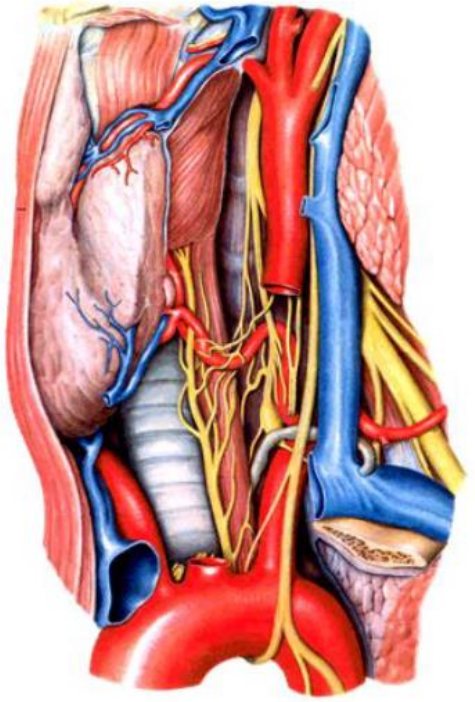




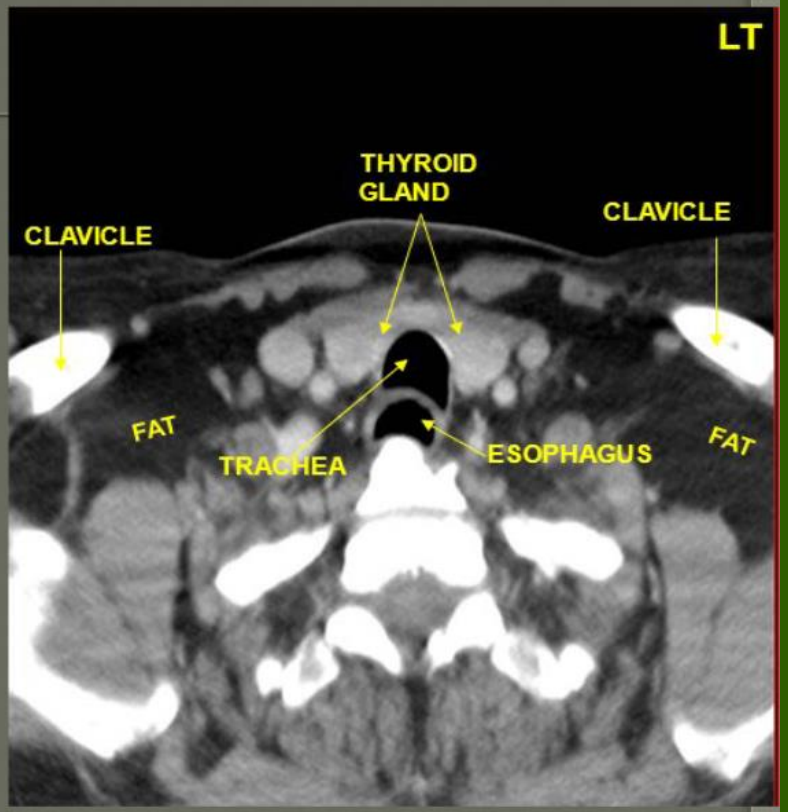
★ Thyroid gland 甲状腺

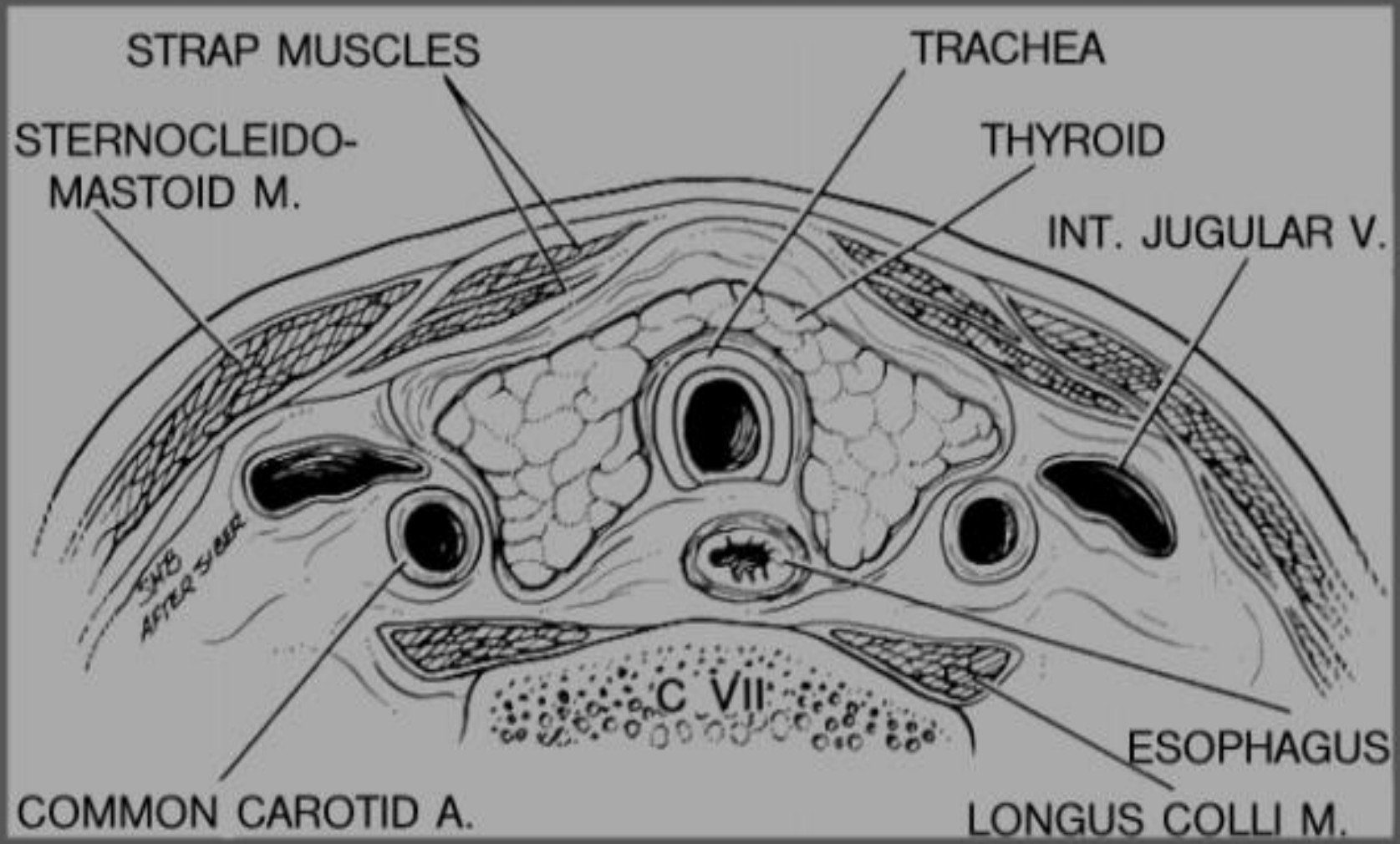
Relations of the thyroid gland

- Anteriorly:
  - Skin
  - superficial fascia
  - investing fascia
  - Infrahyoid muscles and pretracheal fascia
- **Posteromedially:**
  - Larynx and trachea
  - Pharynx and esophagus
  - Recurrent laryngeal nerve
- **Posterolaterally:**
  - Carotid sheath with common carotid a., internal jugular v., and vagus n.
  - Cervical sympathetic trunk

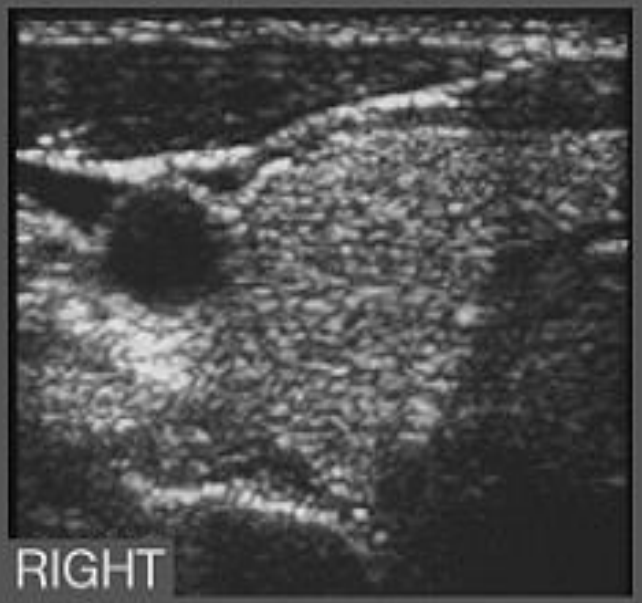


SCAN LEVEL

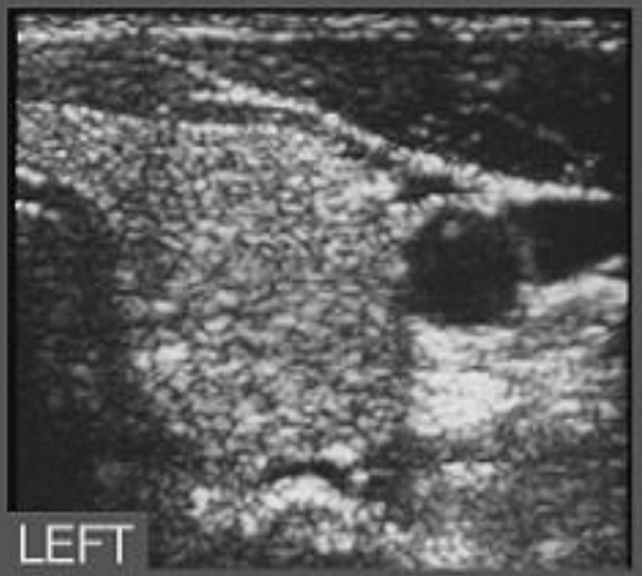

LT
THYROID GLAND
CLAVICLE
CLAVICLE
FAT
TRACHEA
ESOPHAGUS
FAT


STRAP MUSCLES
TRACHEA
STERNOCLEIDO-
MASTOID M.
THYROID
INT. JUGULAR V.
C VII
ESOPHAGUS
COMMON CAROTID A.
LONGUS COLLI M.

TRANS

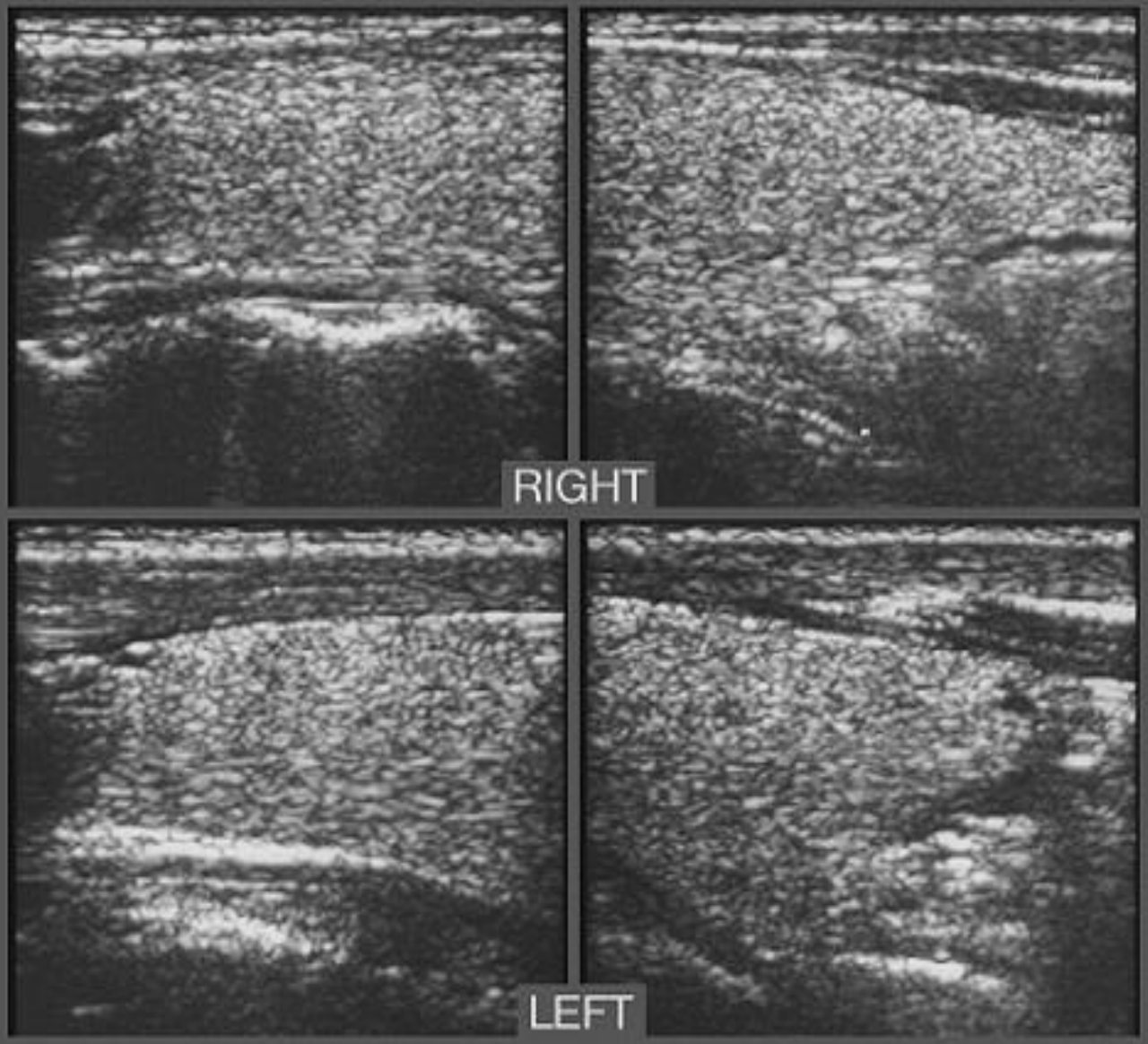


RIGHT



LEFT

LONG



How to do the examination

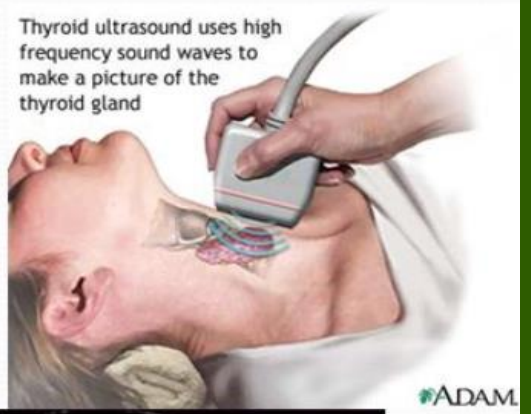
1. The patient lies supine with the neck extended.
2. Transverse scan at the mid cervical region to detect any asymmetry .
3. Transverse scan at the lower cervical region to exclude retrosternal extension .
4. Transverse scan at the upper cervical region to exclude thyroglossal cyst or any other pathology & to demonstrate the salivary gland .
5. Longitudinal scan starting from the midline & moving laterally , to see each lobe separately , the carotid aa & internal jugular vv. & to exclude any pathology or LAP.

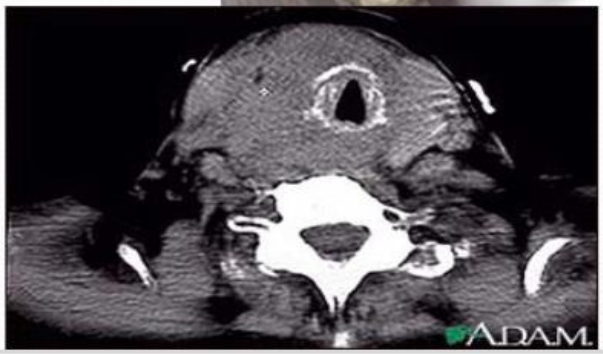
D-Imaging study

1-plan X ray of the neck: to evaluate the trachea, retrosternal extension and cervical spine .

2-Ultrasound: distinguishing solid from cystic masses, information about size and multicentricity, assess cervical lymph nodes and guides for FNAC.

3-CT scan and MRI: assessment of known malignancy, extent of retrosternal and occasionally recurrent Goitres.

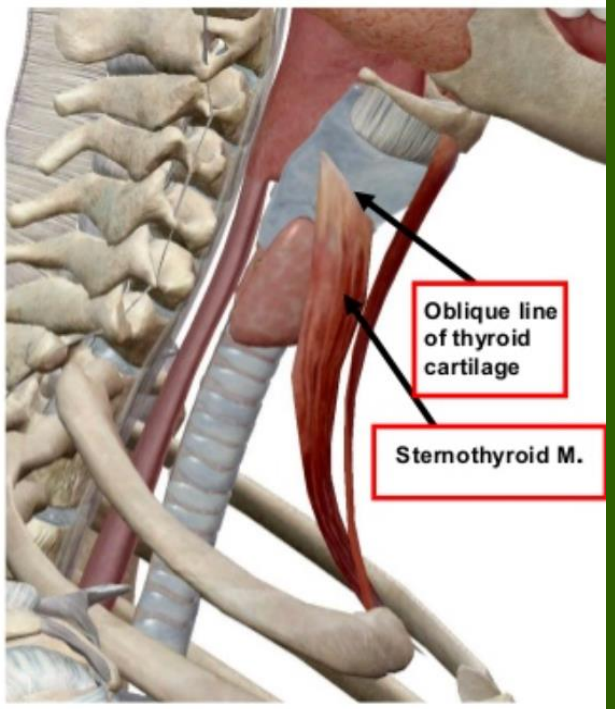




Thyroid gland

Enlarging Thyroid is tend to grow downwards and not upwards

- Upper pole of thyroid gland can not expand above point of attachment of **sternothyroid muscle**
- The srernothyroid muscles are attached onto the **oblique lines of the thyroid cartilage**
- No limitation to the downward expansion of the thyroid gland
- Pathologically enlarged thyroid gland (goitre) extended behind the sternum is termed **retrosternal goitre**



Normal cervical U/S

- Thyroid gland : normal size & texture , no focal lesion.
- Salivary glands : normal size & texture , no focal lesion.
- Normal cervical vessels .
- No cervical mass or LAP.

Parathyroid Gland

The superior parathyroid : lies at the middle of the posterior border of the lobe of the thyroid gland within the capsule of the thyroid gland.

The inferior parathyroid : is variable in position . it may lie

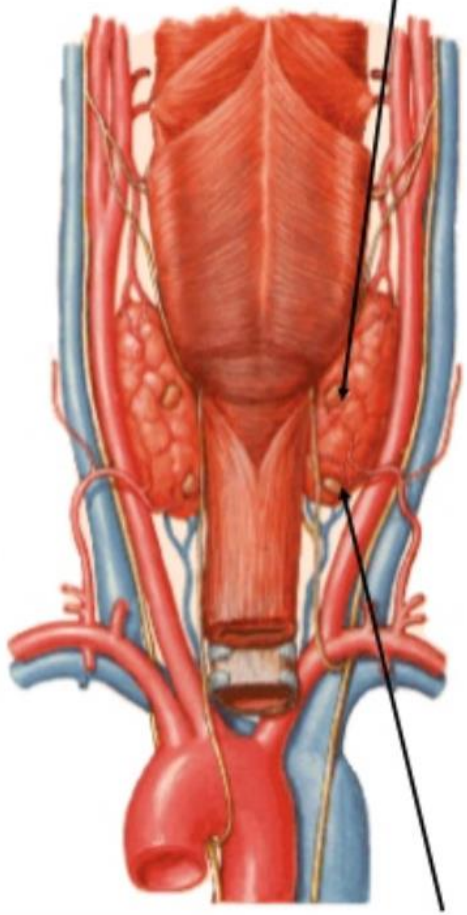
(1) within the thyroid capsule , below the inferior thyroid artery and near the lower pole of the thyroid lobe;

(2) (2) behind and outside the thyroid capsule, immediately above the inferior thyroid artery ; or

(3) (3) within the substance of the lobe near its posterior border

Shape and size : oval or lentiform in shape , measures 6x4x2 mm . each one weighs 50 mg.

Arterial supply : from the inferior thyroid arteries and the anastomosis between the superior and inferior thyroid arteries.



Mohamed el fiky

Abnormal cervical U/S

- Thyroid

* size & texture :

1. enlarged & homogenous :

- physiological goiter due to increased demand at puberty , pregnancy , …
- iodine deficiency in endemic areas

in both cases there is high TSH level , normal or low T3, T4.

- Graves disease : there is thyroid stimulating immunoglobulin resulting in high T3 , T4 & low TSH.

2. enlarged , heterogeneous , multiple nodules of variable size & texture :

- Multinodular goiter : no symptoms apart from cervical swelling .
- sub acute thyroiditis (De Quervain) : tender swelling , may progress to :
- Hashimotas thyroiditis : tender swelling , may progress to :
- diffuse lymphoma : with cervical LAP

Continued abnormal cervical U/S

* Focal lesion

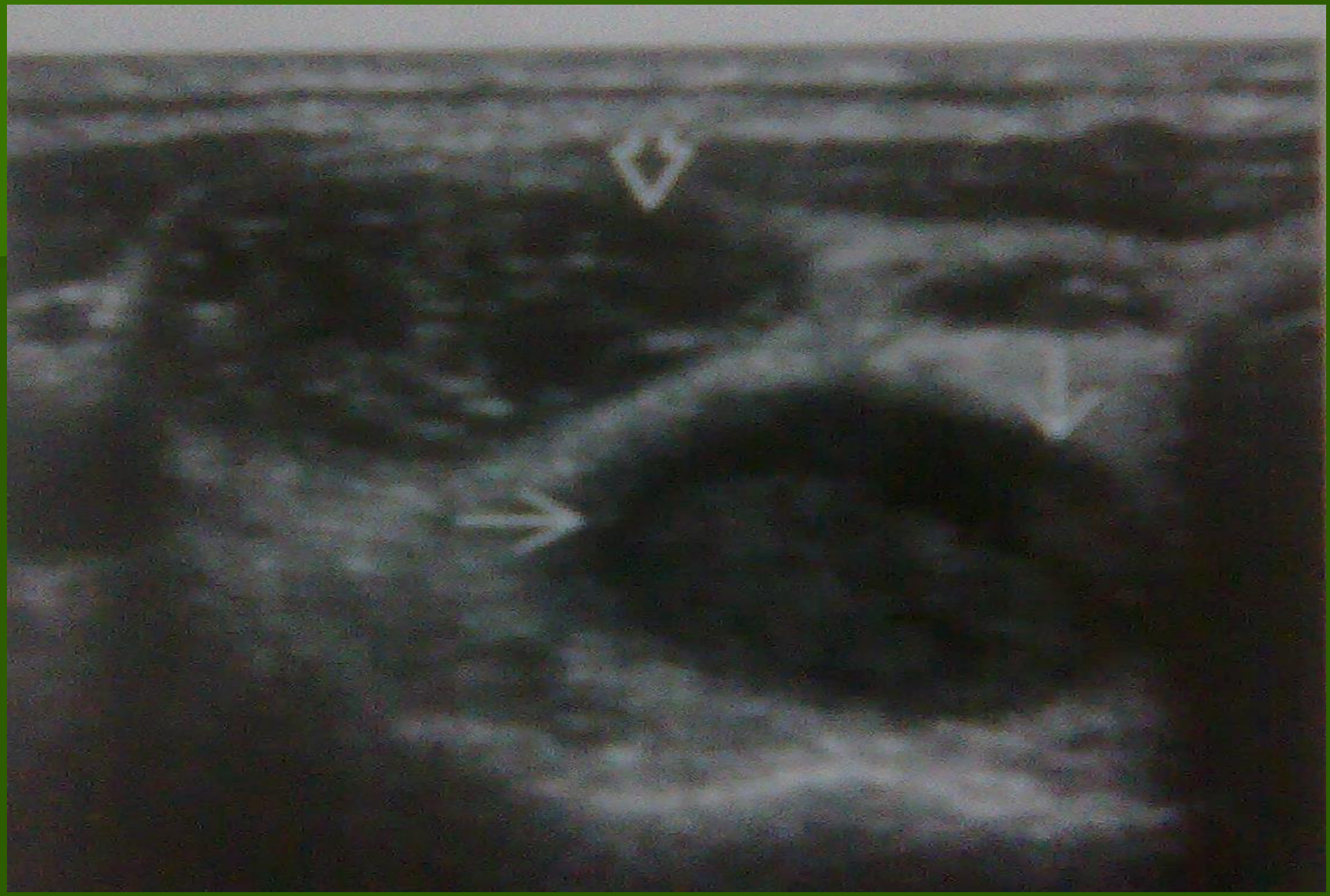
1. cyst :

- true simple cyst is not common

- more commonly are cystic degeneration of benign or malignant nodule, abscess , haematoma & there for it usually has thick irregular wall & internal echos.

2. benign adenoma : well defined heterogeneous with solid & cystic components, calcifications & may have surrounding hypoechoic halo.

3. malignant tumor : papillary , medullary , follicular , anaplastic CA & focal lymphoma. : usually less well defined , other wise can not differentiated from benign nodule unless ther is associated cervical LAP or vascular invasion .



Multinodular goiter

benign thyroid adenoma

Malignant thyroid nodule

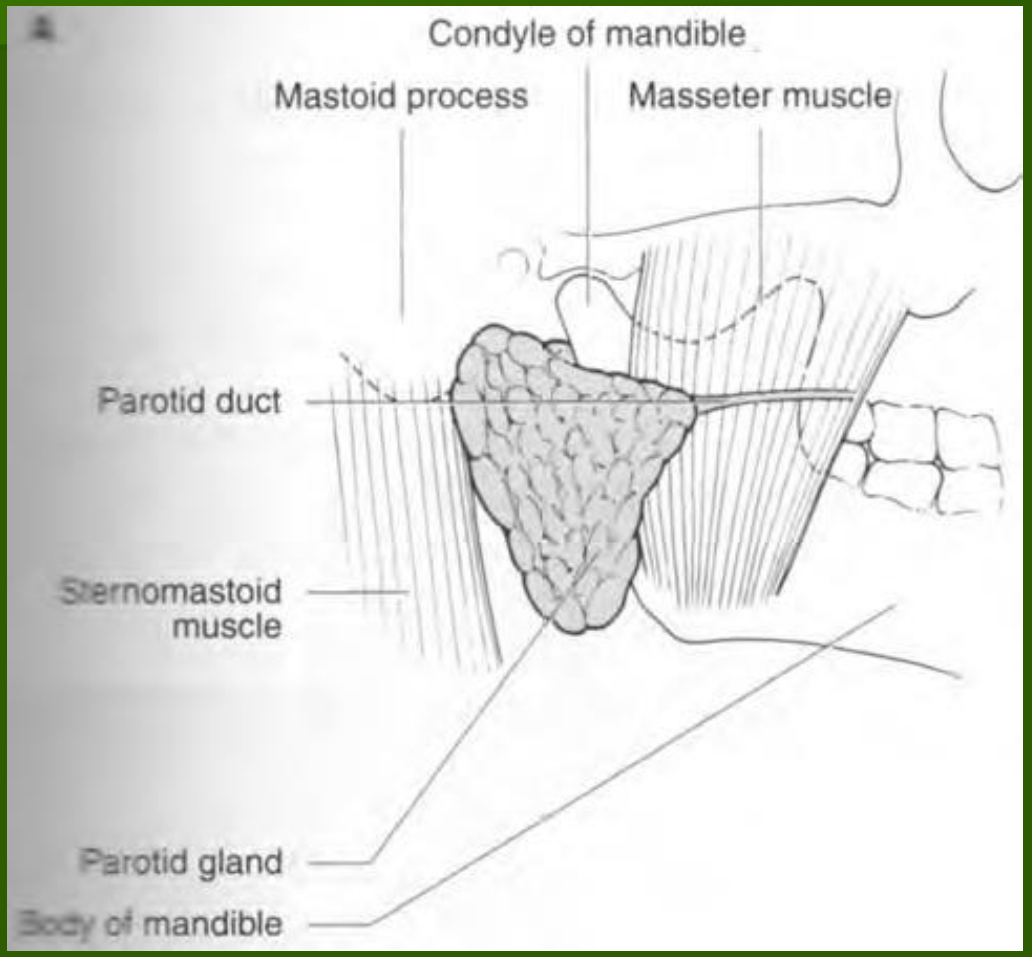
Salivary gland

- These exocrine glands are situated symmetrically around the oral cavity and produce saliva

The parotid gland

- This is the largest of the salivary glands and lies behind the angle of the jaw and in front of the ear. It is moulded against the adjacent bones and muscles. The gland has a smaller deep part and a larger superficial part, both of which are continuous around the posterior aspect of the ramus of the mandible via the isthmus
- The parotid duct **(Stensen's duct)** begins as the confluence
- of two ducts in the superficial part of the gland and
- runs anteriorly deep to the gland. It arches over the masseter
- muscle before turning medially to pierce buccinator
- and drain into the mouth opposite the second upper molar.
- The duct is approximately **5** cm long. Small accessory
- parotid glands are common **(**20**%),** joining the duct along its
- length.

Parotid gland



The submandibular gland

- This gland lies in the floor of the mouth medial to the angle of the mandible. It is a mixed mucinous and serous gland, hence its tendency to form calculi. It has a lower superficial lobe continuous with a smaller deep lobe above around the posterior border of the mylohyoid muscle.
- The submandibular (Wharton's) duct is about **5** cm
- long and commences as a confluence of several ducts in
- the superficial (lower) lobe. From here it runs superiorly
- through the deep (upper) lobe before running forward in
- the floor of the mouth to open at the side of the frenulum of the tongue.

The sublingual gland

- This small gland lies submucosally just anterior to the deep lobe of the submandibular gland and drains via several ducts (up to 20) directly into the floor of the mouth posterior to the opening of the submandibular gland. Some of its ducts may unite and join the submandibular gland.

Continued abnormal cervical U/S

- Salivary gland

* enlarged & hypoechoic: due to inflammation .

* focal lesion :

1. benign : more common in the parotid .

- Pleomorphic adenoma : well defined , homogenously hypoechoic.

- adenolymphoma (Warthin tumor) : well defined , heterogeneous with solid & cystic components ,may have multiseptated appearance .

- lipoma : well defined , homogenously hyperechoic , may be hypoechoic & have hyperechoic lines .

2. malignant : more common in the smaller glands

usually ill defined , heterogeneous , hypoechoic , associated LAP .

- Cervical vessels :

- displaced or compressed by a mass

- abnormal narrowing or dilatation compared with the other side

- invaded by malignant tumor .

Continued abnormal cervical U/S

- Other masses :

  - thyroglossal cyst : midline cyst above the thyroid isthmus to which it may has a visible connected duct.

  - abscess or haematoma : thick irregular wall , internal debris .

- LAP :

  1. benign : infection , sarcoidosis,….
  2. malignant : leukemia ,lymphoma , metastasis

Criteria	Benign	Malignant
Minimal diameter	< 1 cm	> 2 cm
Maximal / minimal	> 2	< 2
Minimal / maximal	< 55 %	> 55 %
Hilar fat	Present	Absent

Parotid pleomorphic adenoma

Parotid warthin tumor

Submandibularn malignancy

Thyroglossal cyst

breast

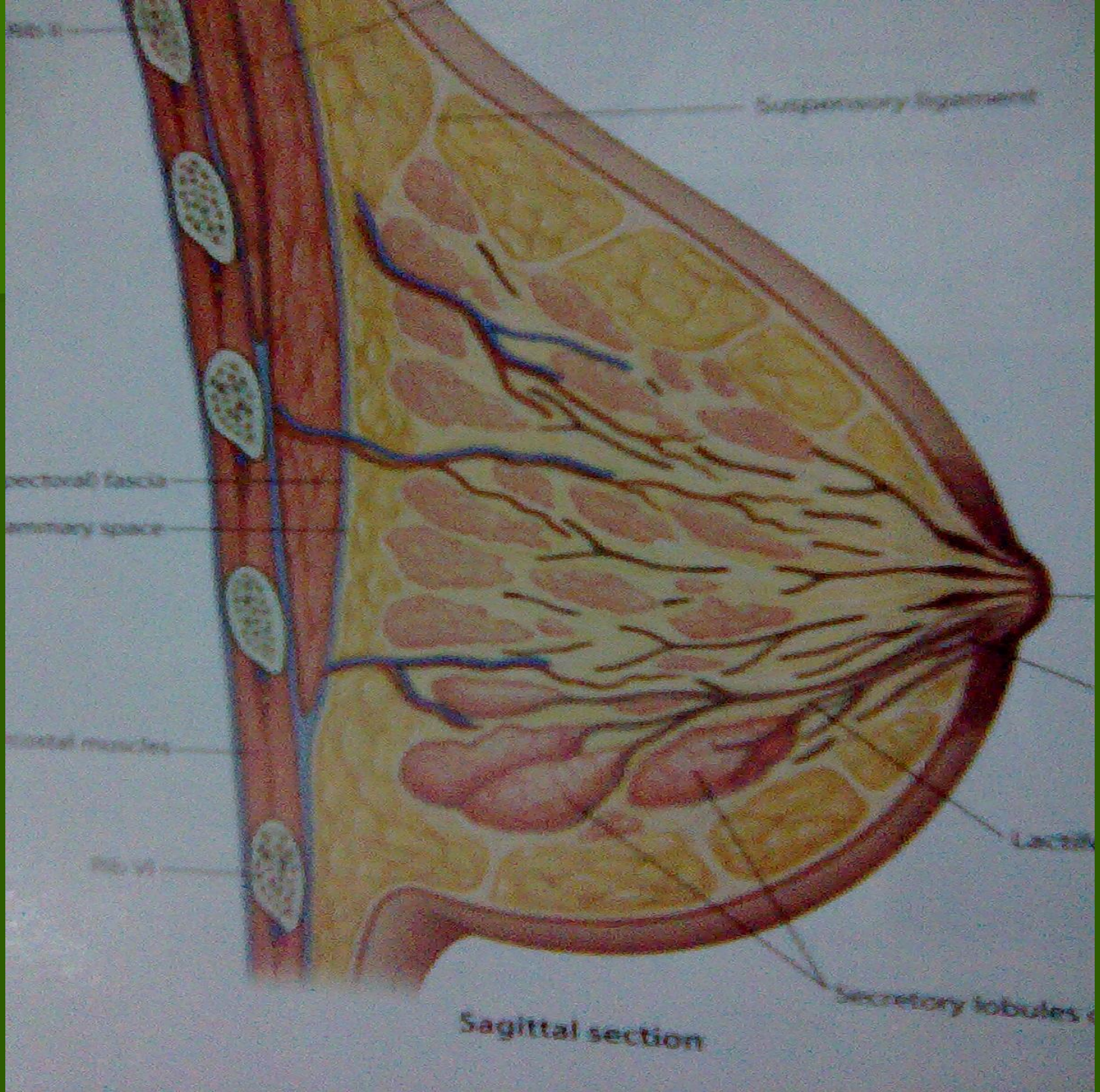
- The superficial chest wall fascia split into anterior (superficial) & posterior (deep) layers investing the breast tissue & form septa (Coopers ligament) to attach it to the fascia of pectoralis muscle posteriorly & to the skin & subcutaneous tissue anteriorly .

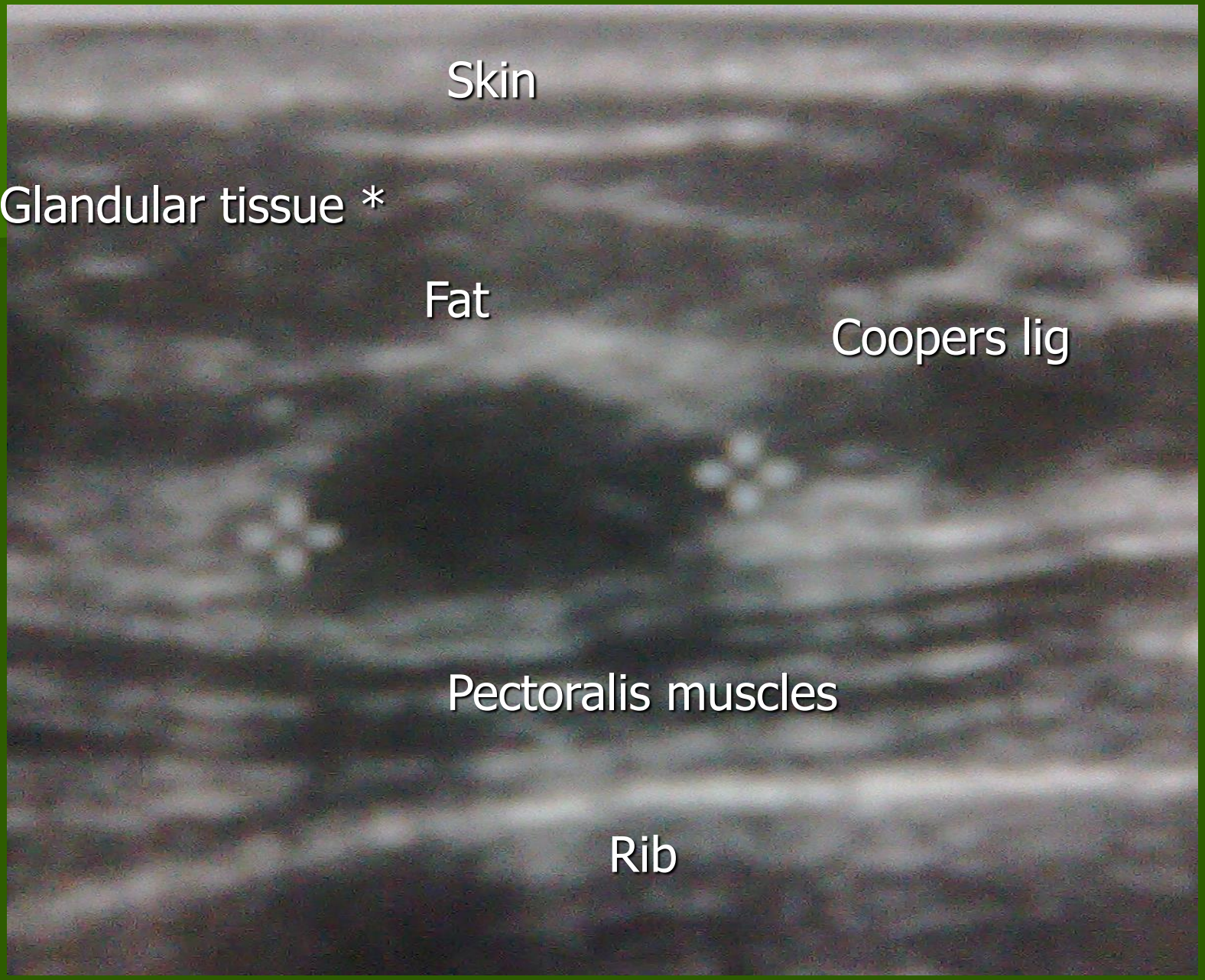
- The breast tissue consist of :
  1. hyperechoic fibrous network
  2. hypoechoic fat lobules
  3. hyperechoic foci of glandular tissue
  4. anechoic tubular lactiferous ducts

- The consistency is dependent on hormonal effect :
  * more hyperechoic glandular tissue after menarche , pregnancy & lactation
  * less glandular tissue & more hypoechoic fat after menopause

How to do the examination

1. The patient lies supine with the arm of the same side elevated above the head.
2. Perform transverse scans in anti radial direction from the periphery of the breast toward the nipple .
3. The patient turned to the opposite side to examine the axillary tail & the axilla .


Suspensory ligament
Sagittal section


Skin
Glandular tissue *
Fat
Coopers lig
Pectoralis muscles
Rib

Normal breast U/S

- Normal texture of glandular , fatty & fibrous tissue , no focal lesion , normal non – dilated subareolar lactiferous ducts , normal overlying skin & subcutaneous tissue .

- No axillary LAP

Abnormal breast U/S

- Edematous breast :

  causes :

  advanced or inflammatory CA

  inflammation , abscess

  part of generalized edema (HF , RF, …)

  features :

  thick skin

  diffusely increased echogenicity

  thick fibrous septa

- fibroadenosis (hormonal mastitis) :

  young patient , bilateral breast pain , tenderness & tenseness especially premenstrual .

  features :

  diffusely increased echogenicity

  thick lace like fibrous septa

  some times small cysts seen

Continued abnormal breast U/S

- Focal lesion :

1. Cyst :

Well defined, smooth outline , thin wall , echofree :

* simple cyst : common above the age of 40 y.
* oil cyst at the site of previous scar .

Ill defined, irregular outline , thick wall , internal echo, solid components :

* galactocele in lactating breast.
* abscess with other features of infection .
* haematoma with history of trauma
* intracystic CA .

Continued abnormal breast U/S

2. Solid nodule :

* benign : fat necrosis, lipoma, fibroadenoma, papilloma, phyloides tumor
* malignant : ductal, medullary, mucinous, papillary, lobular …

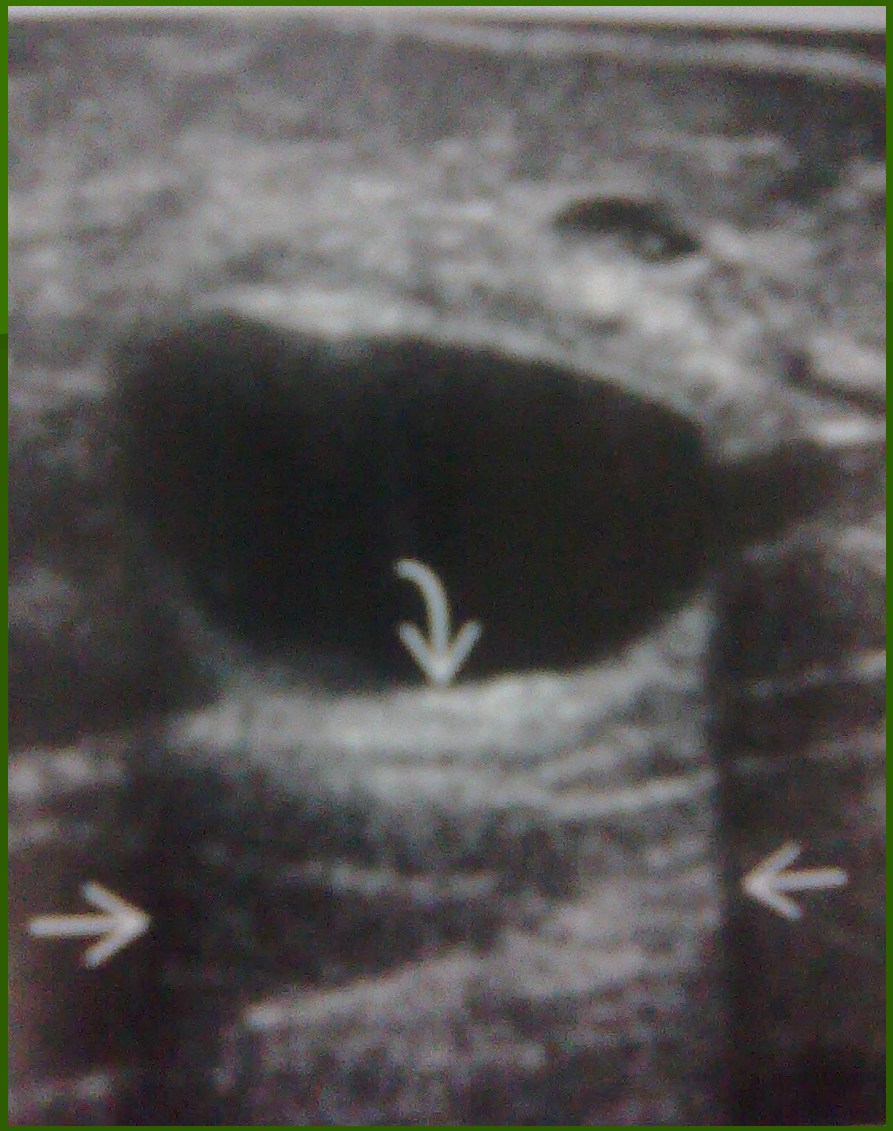
Criteria	Benign	Malignant
Age	< 40 y	> 40 Y
shape	Ovoid , wider than deep	Variable , deeper than wide
Margin	Well defined , smooth outline , 2 - 3 gentle lobulations	Ill defined , irregular outline, speculated
Echotexture	Homogenously hypo, iso, hyperechoic	Heterogeneously hypoechoic
Posterior effect	Minimal attenuation , enhancement	Attenuation , posterior shadowing
calcification	Coarse	Microcalcification
Compressibility	Compressible	Non compressible

Continued abnormal breast U/S

- dilated subareolar lactiferous ducts :
  1. normal : pregnancy & lactation
  2. pathological : due to obstructing ductal CA

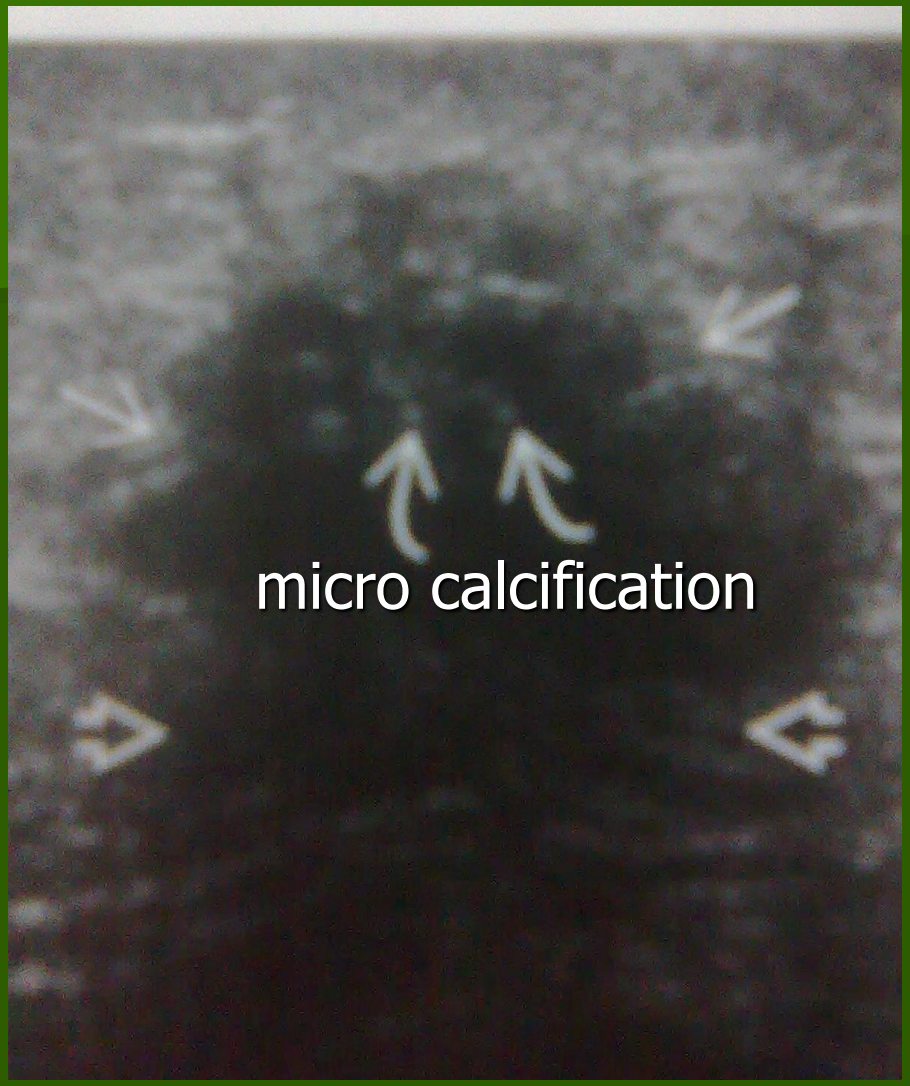
- Enlarged axillary L.N. :
  1. benign : infection , sarcoidosis ….
  2. malignant : leukemia ,lymphoma ,metastasis from breast CA, or rarely other primaries like ovarian CA.

Criteria	Benign	Malignant
Minimal diameter	< 1 cm	> 2 cm
Maximal / minimal	> 2	< 2
Minimal / maximal	< 55 %	> 55 %
Hilar fat	Present	Absent



Simple cyst

Fibroadenoma



Breast CA

Dilated subareolar ducts

Normal scrotal anatomy

- Testes :

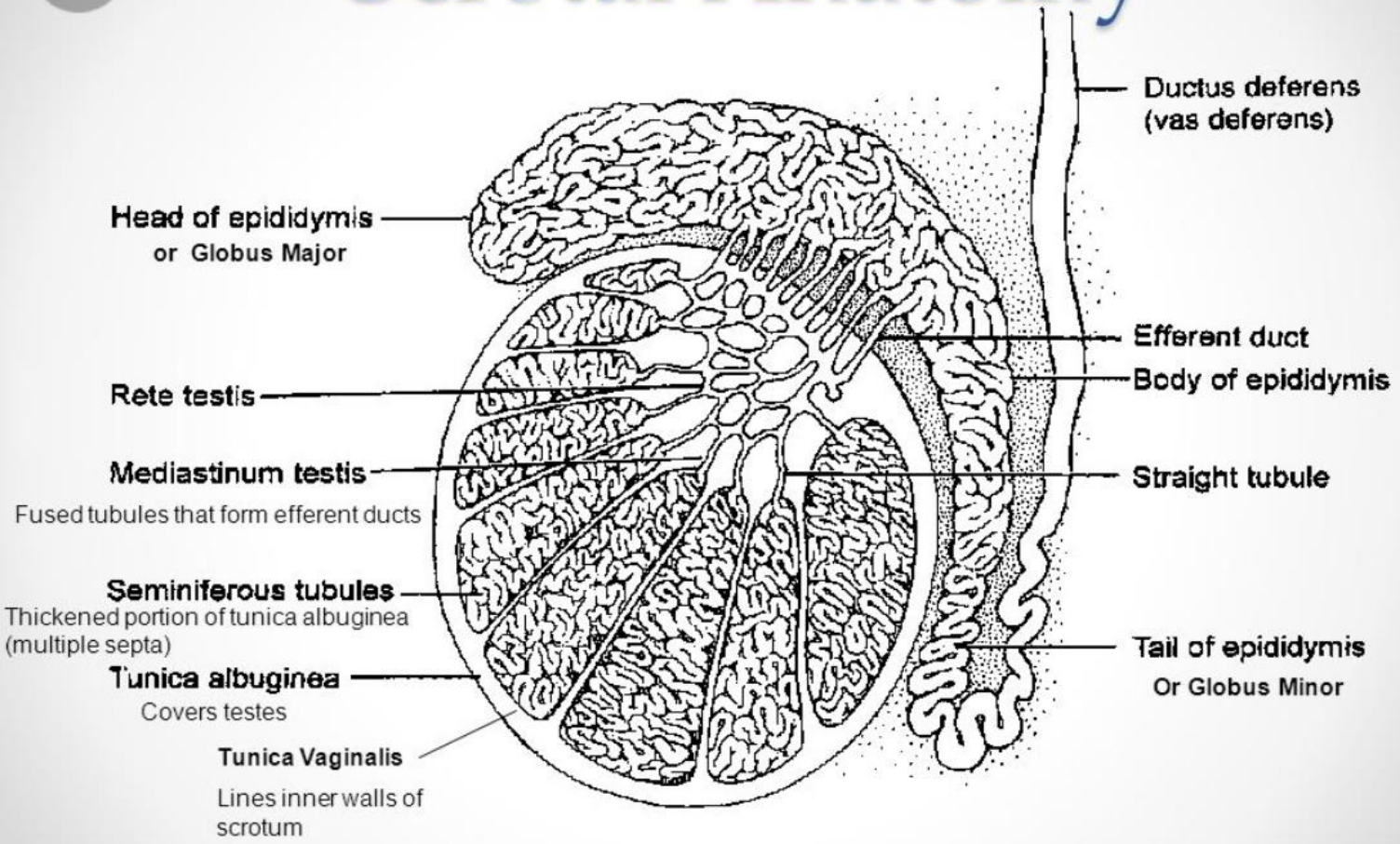
site	within the scrotal
size	3.5X3 cm in longitudinal scan
shape & texture	ovoid , smooth outline , homogenous intermediate echogenicity, the mediastinum may appear as longitudinal echogenic line at the posterior aspect of the testes parallel to epididymis

- Epididymis :

shape	snake like structure consist of head , body & tail
size	head is (5 – 15 mm) , tail is (1 – 3 mm) in diameter
site	head is posterio – lateral to the upper pole of the testes , body & tail taper downward

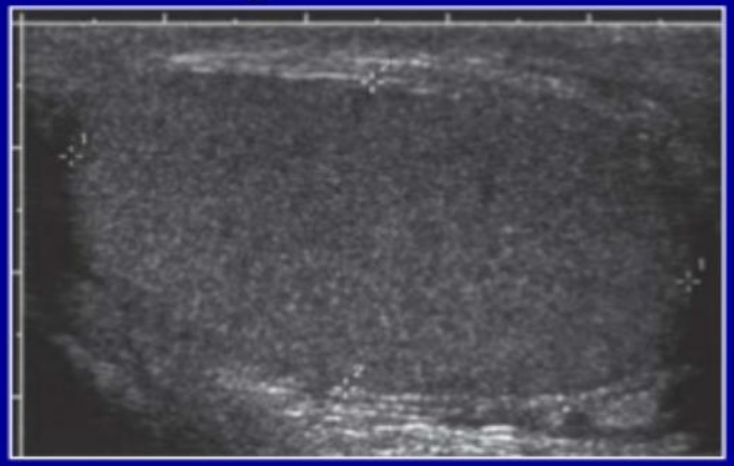
- Veins : may be seen normally & should be no more than 1 – 3 mm
- Fluid : Small amount of may outline normal testes especially in infant
- Skin & subcutaneous tissue : seen as hyperechoic layer 5 – 7 m in thickness

Scrotal Anatomy



Normal adult testis

Longitudinal view



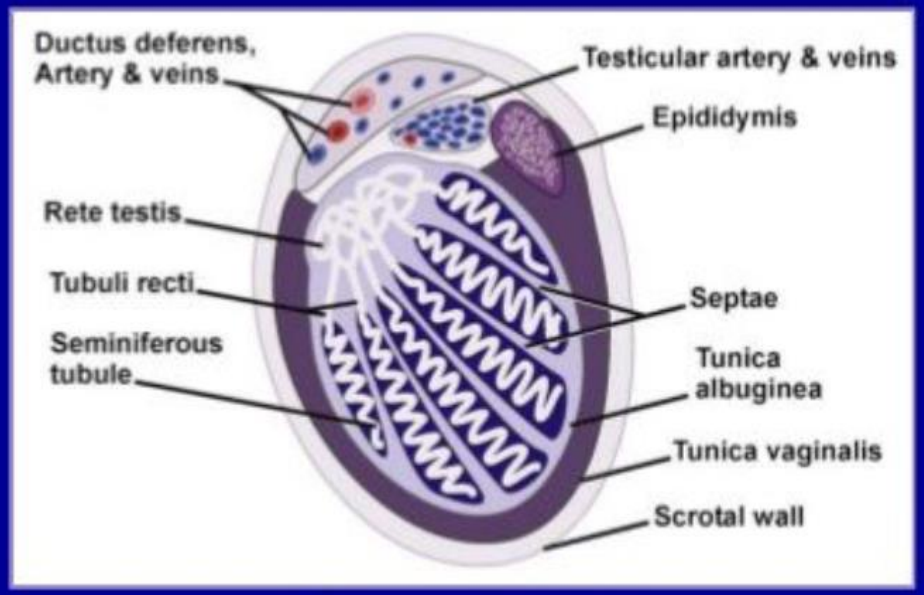
Transverse view

Length: 4 – 5 cm

Width: 2 – 4 cm

Antero-posterior: 3 cm

Diagrammatic representation of testis in cross-section

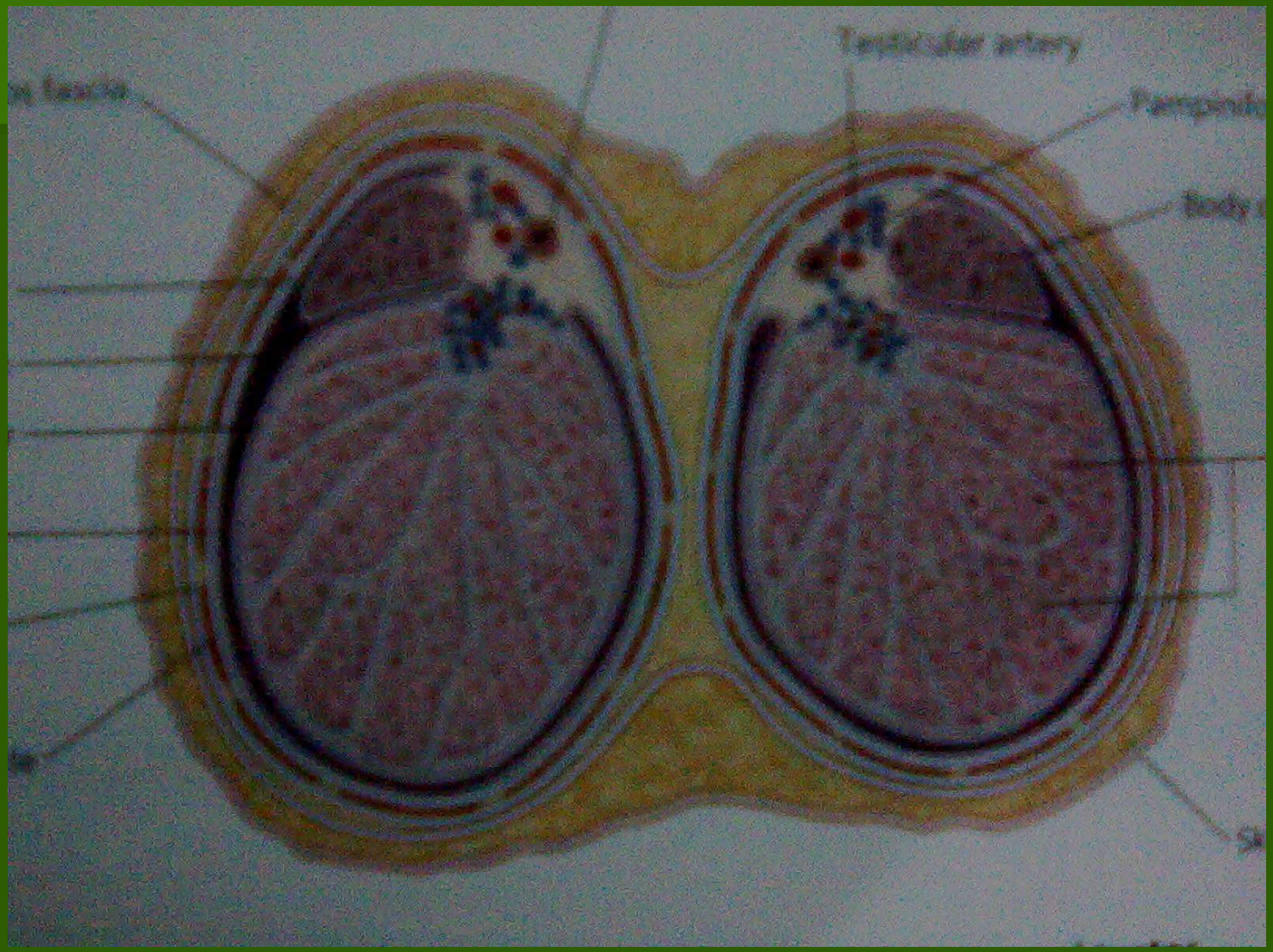


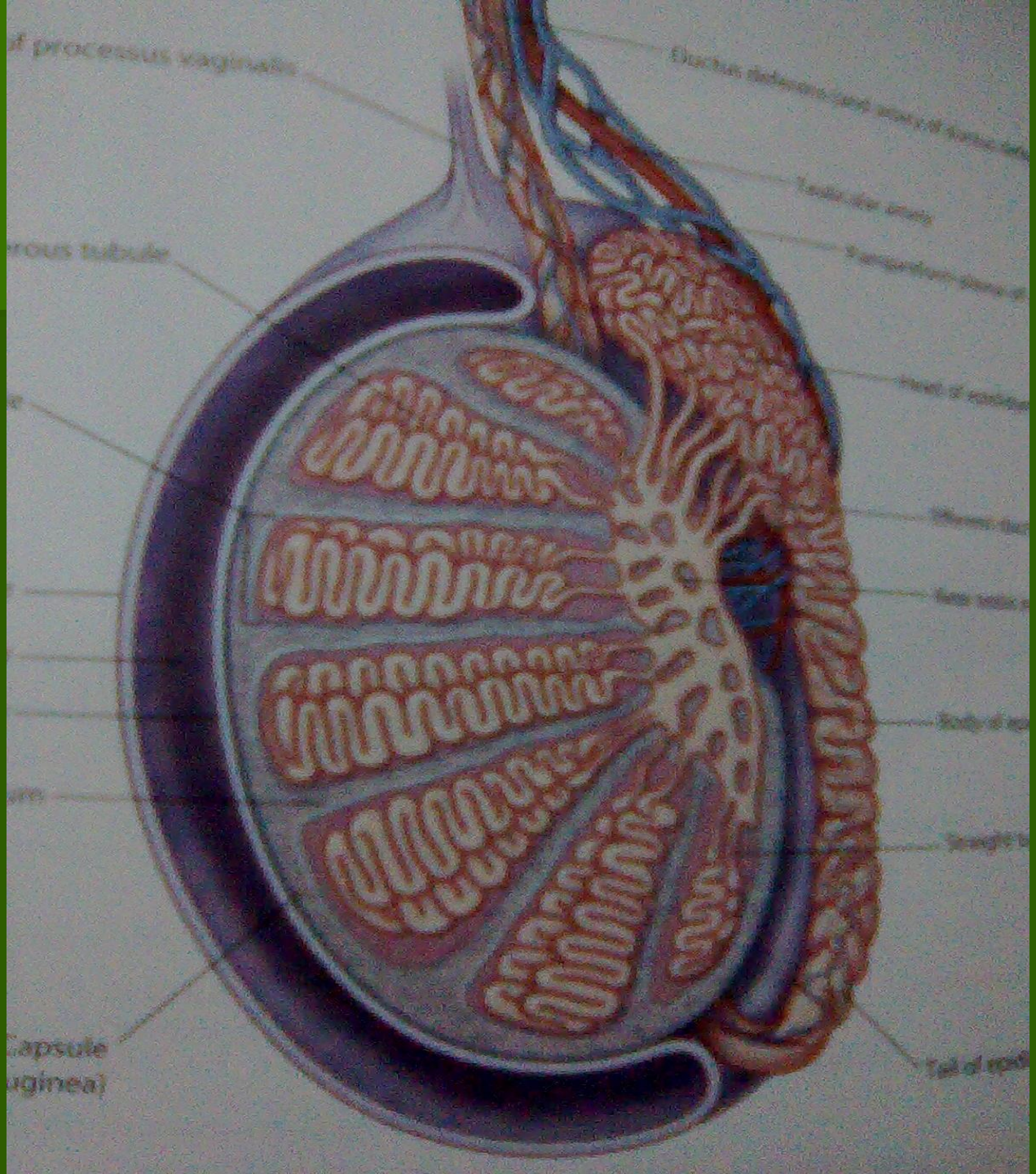
250 – 400 lobules

Each lobule contains 1 – 3 seminiferous tubules

Sspermatocyte – Sertoli cell – Leydig cell (testesterone)

Dogra et al. Ultrasound Clin 2006 ; 1 : 55 – 66.





How to do the examination

1. The patient lies supine .
2. Transverse scan performed to detect any asymmetry .
3. Longitudinal scan performed for each side .
4. Transverse & longitudinal scans performed for the inguinal area to detect undescended testes , LAP, hernia ….

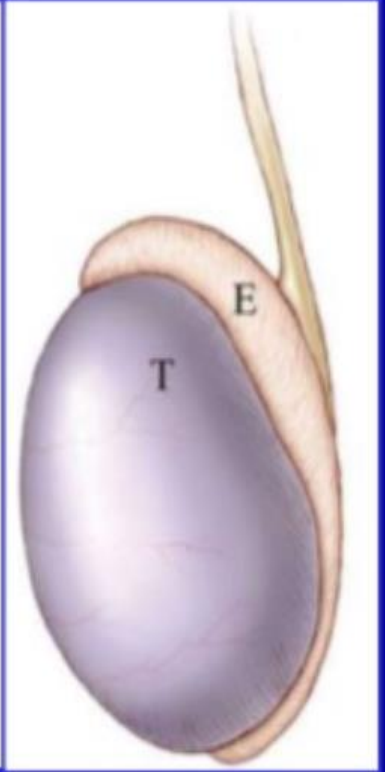
Normal scrotal U/S

- Testes & epididymis : normal site , size & texture, no focal lesion seen .
- No varicocele
- No hydrocele
- Normal overlying skin & subcutaneous tissue

Anatomy of epididymis

6 cm in length – Best evaluated in longitudinal view

- **Head** — Superior pole of testes
  5 – 12 mm — Usually isoechoic to testis
- **Body** — Posterolateral aspect of testis
  2 – 4 mm — Usually hypoechoic to testis
- **Tail** — Inferior pole of testes
  5 – 12 mm — Usually hypoechoic to testes
  Curves to form ductus deferens



Abnormal scrotal U/S

- Testes & epididymis

* site : undescended testes
* size & texture :

1. swollen , focally or diffusely hypoechoic , heterogeneous : due to :
   infection , infarction , trauma , malignancy

2. small echo poor : as end stage of:
   infection , infarction , trauma , undescended testes

* Focal lesion :

1. cyst : well defined , smooth outline , echofree
   common finding in any age but especially in elderly

2. complex : ill defined, irregular outline, heterogeneous, cystic & solid components:
   infection (abscess) , infarction , trauma (haematoma)

3. solid :
   seminoma & lymphoma : well defined , homogenously hypoechoic
   non seminoma germ cell tumor : ill defined , heterogeneous with calcifications & cystic degeneration

continued abnormal scrotal U/S

- Varicocele :
  95 % is Lt sided
  echofree worm like structures > 2 mm in diameter
  enlarged further by sitting , standing & Valsalva maneuver

- Hydrocele : infection , infarction , trauma , malignancy, no cause

- Skin edema :infection , infarction , trauma , malignancy

summary

- Painful scrotal swelling is due to :
  infection
  infarction
  trauma
  malignancy
  in all cases there is :
  skin edema
  hydrocele
  swollen testes & epididymis, focally or diffusely hypoechoic, heterogeneous
  differentiation is depending on clinical features & lab

- Painless scrotal swelling is due to :
  innocent hydrocele
  varicocele
  innocent cyst

Testicular malignancy

Simple cyst

Epididymo orchitis

Hydrocele

Varicocele