Thyroid Ultrasound

Thyroid US examination needs:
1. high frequency transducer
2. extended patient’s neck
3. check all the neck area because the swelling could be in areas other than the thyroid such as in case of "thyroglossal cyst" (duct connects between the base of the tongue & the thyroid gland) especially in children.
- Ask the patient to protrude his tongue so it will move in the mid line & appear sonolucent by U.S (thyroid & thyroglossal cyst move with swallowing but protrusion of the tongue causing only movement of thyroglossal cyst).
* N.B: inflammation of the thyroid is "thyroiditis" while inflammation of the tongue is "Glossitis".

* In case of thyroid gland enlargement & falling down (retrosternal) the U.S is not recommended because the thyroid will not seen while the CT chest at the cervico-thoracic junction is more sensitive to differentiate between the tissues this is called tissue characterization.

* If the kidneys are not visualized in supine position before we say ectopic...etc we have to see them from the back because they are superficial from the back but there are a lot of windows in supine so moderate the gate in U.S.

Anatomy of the thyroid gland: it resembles the horse shoe
1. Rt. thyroid lobe
2. Lt. thyroid lobe
3. Isthmus → tissue or connection between the two lobes around the trachea crossing anteriorly, less prone to enlargement & forming nodules & usually not exceed 1cm.
The trachea in US enhances posterior acoustic shadow.

By Doppler US the CCA is seen medially while the IJV is seen laterally, at upper level at the level of angle of mandible the ICA & ECA are seen because of that in patient with short neck its difficult to obtain them so if there is stenosis or atheromatous plaques are seen in the CCA & at the first part of ICA but if the stenosis at upper level it is seen by angiography or MRA.

The normal thyroid is not seen clinically (not palpable) if it’s not enlarged but seen by US, CT & can be measured.

The normal thyroid by US: homogenous texture, isoechoic.

The normal thyroid by CT: hyperdence area due to high iodine content

**Signs of thyroid enlargement**
- Dyspnea
- Dysphagia → this is happen if thyroid more enlarged posteriorly.

*N.B: thyroid enlargement occurs more in female of middle age around 30-45Y old.*

The most common causes of hoarsens of voice:
- Surgical removal (subtotal thyroidectomy) which causes temporal or permanent paralysis for recurrent laryngeal nerves if injured.
- Thyroid cancer that infiltrated nerves.
Enlargement of Thyroid Gland (Goiter)

Thyrotoxic

- nodular
- secondary
- single

→ Due to increase hormones excretion always occurring with:

1. Nervous manifestation such as tremors
2. Circulatory manifestations such as
   - ↑ heart beat (palpitation)
   - ↑ blood pressure → hyper-dynamic circulation → congestive heart failure
4. GIT symptoms:  
   a) Polyphagia.
   b) Loss of weight.
   d) Diarrhea.

Non-thyrotoxic

- nodular
- primary
- multiple

→ normal hormones level - Euthyroid goiter

Thyroid hormones:

- T3-T4 (T=Thyroxin) excreted by the thyroid gland.
- T.S.H (Thyroid Stimulating Hormone) excreted by hypothalamus (master) to order hormone secretion from thyroid gland.
- The test for these hormones usually written in the request.

The steps to evaluate the thyroid gland:

1). the normal size of the thyroid gland, important to check the volume to see if goiter or not:
   - 4cm length cranio-caudal (upper to lower)
   - 2cm width
   - 1cm depth
2). Uniform texture (Homogenous or Heterogeneous)
If heterogeneous may be due to:

- Cyst
- Nodules most common finding, single or multiple in (mm) in Rt. or Lt. lobe usually hypoechoic than thyroid tissue.
- Lesion resembles nodule but cancerous
+ Malignant mass
+ Calcification

3). Shape & position there is ectopic position but rarely happen.
4). Retrosternal extension by CT
5). Check other parts → vessels near the thyroid CCA, IJV but the surrounding carotid sheath & vagus nerve are not seen by U.S.
6). the requested examination are US, analysis, radioisotope scan to see hot or cold nodule & the final diagnosis is the needle biopsy by US (US guided biopsy).
7). the clinical examination for thyroid is done by:
   - Patient sitting while the doctor check from the posterior aspect of the neck, it could be seen by mirror or some one tills him, then check from front with deglutition (Why?) because the thyroid moves during swallowing while the enlarged lymph node is not movable during swallowing.

The thyroid enlargement may be due to:
1) Thyroglossal cyst
2) Neck lymph adenopathy either:
   - secondary inflammatory needs anti biotic drugs or
   - neoplastic:
     a) primary lymphoma (Hodgkin’s - non Hodgkin’s) disease
        The primary lymphoma is lymphatic tumor in its origin
     b) secondary lymphoma due to lymphatic spread of tumor (T N M)
        -do U.S, CT for further assessment / lymphangiography to see the internal structure of lymph nodes.
3) Submandibular gland because it lies beneath the mandible.

*N.B: Thyroid focal lesions are either benign (cyst, nodules) or malignant while the diffuse either infiltration or thyroiditis.

In the case of cyst -what should be done?
1. aspiration of fluid from the cyst ( removal of fluid from a cyst)
2. analysis for this fluid

The exams that need hyperextension of the neck:
+ neck U.S for thyroid, submandibular gland.
+ Plain x-ray for Cervical spine
+ For pediatrics nasopharynx to see adenoids.
U.S can easily differentiate if the lesion is cyst (sonolucent) or solid (hyper or hypoechoic) but the solid has variations on its self such as:
- cystic changes in solid tumors
- degeneration or breaking down they are bad signs unless the solid is inflammatory.

In case of fibroids (benign) in female the echogenic appearance means calcification while the sonolucent appearance means area of degeneration.

Breaking down of tumor is a sign of malignant always & appear sonolucent such as:
- formation of malignancy inside the cyst seen by US
- tumor originated from the cyst wall such as in U.B diverticulum but cyst problems are rarely happen.

The solid mass either:
- homogenous ⇒ most likely benign or
- heterogeneous

Signs of neoplasm changes :( from benign to malignant/malignant to aggressive malignant)
1. breaking down of tumor
2. rapid increase in size.
3. instead of smooth line wall it will be irregular & infiltrated.

Neoplasm in the urinary bladder
- thickening in the wall
- irregular mucosa
- growth originates from the wall (diffuse or focal)