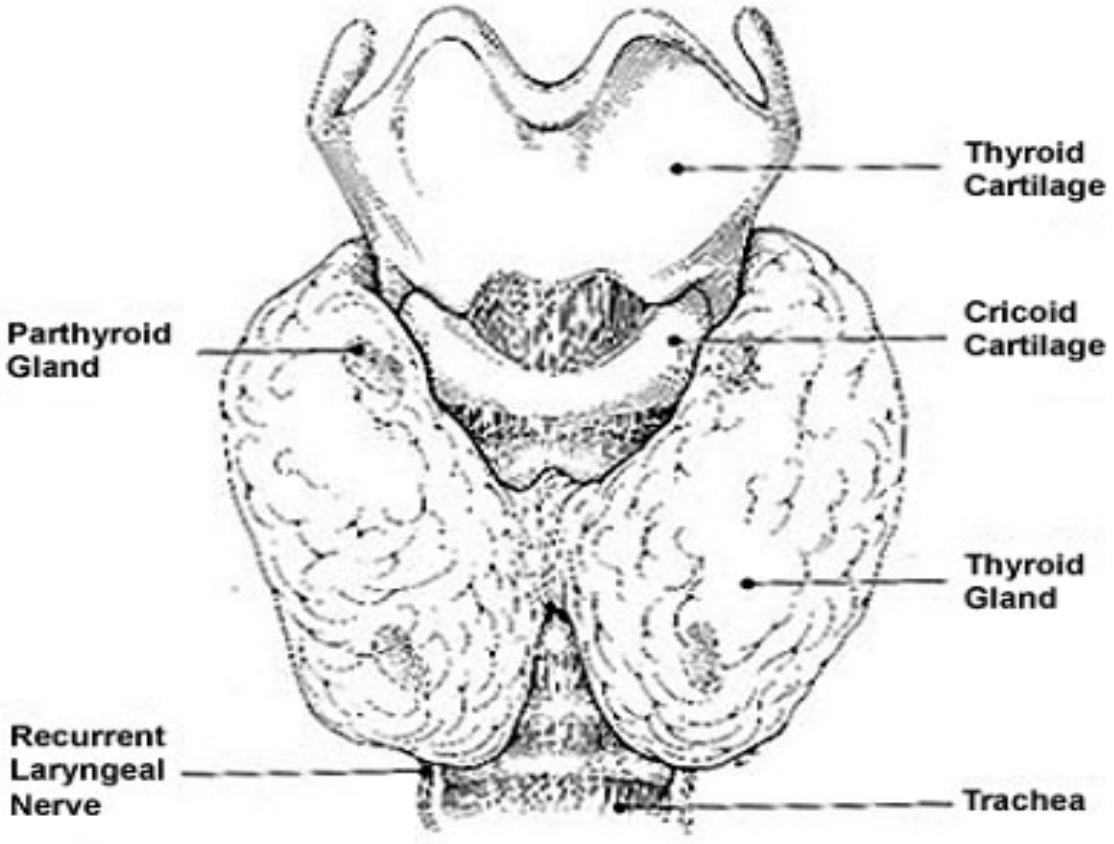
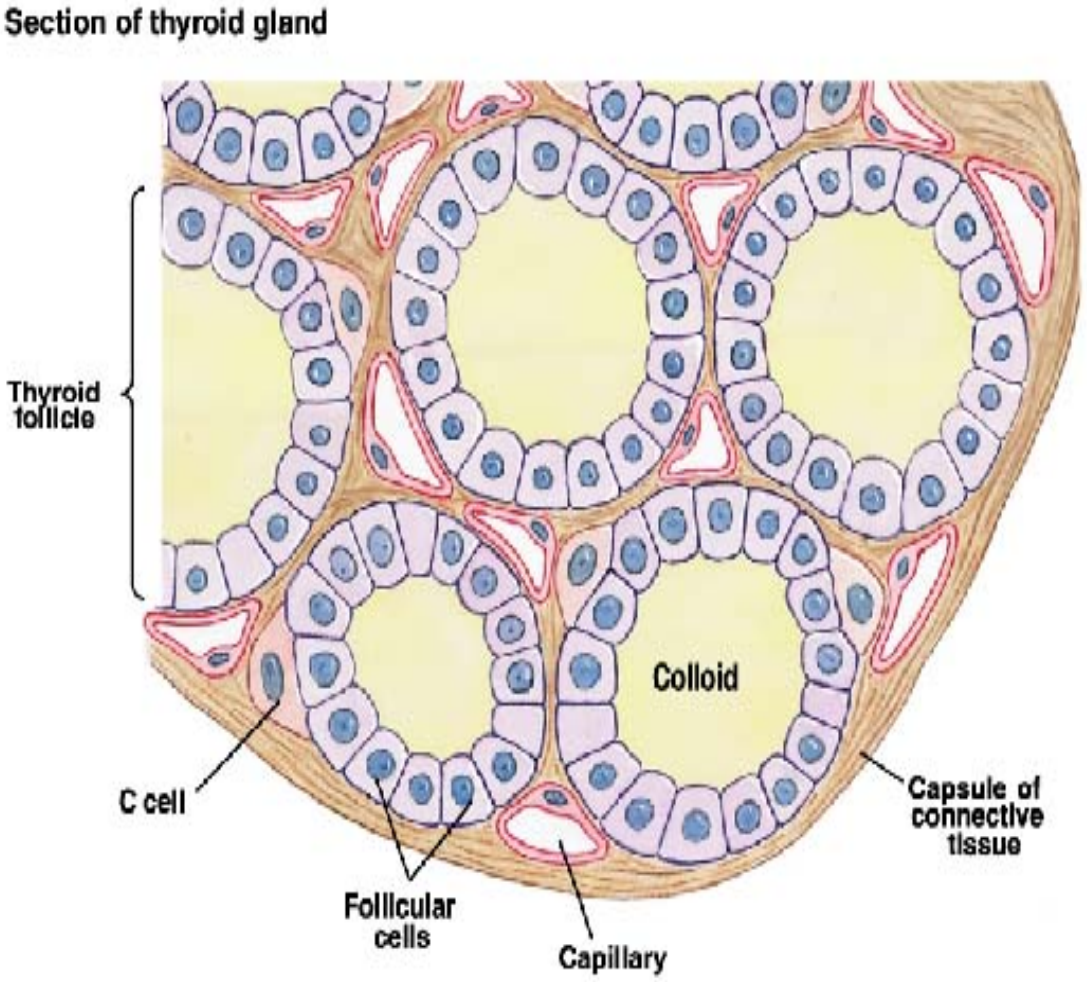
Approach to a thyroid nodule

Ayman Mismar

Anatomy of the Thyroid Gland



Follicles: the Functional Units of the Thyroid Gland



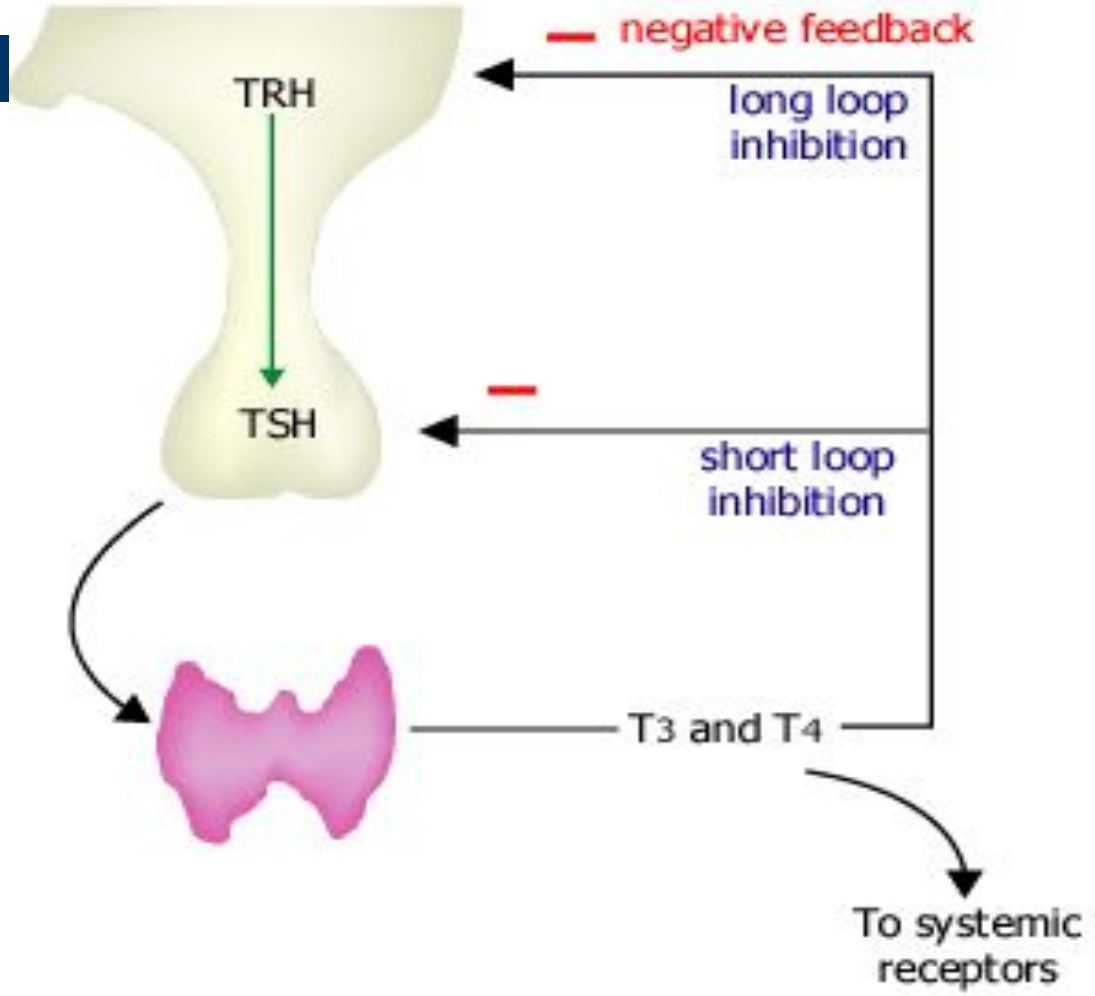
Follicles Are the Sites Where Key Thyroid Elements Function:

- Thyroglobulin (Tg)
- Tyrosine
- Iodine
- Thyroxine (T_4)
- Triiodotyrosine (T_3)

Thyroid Hormones

- Thyroid pro-hormone is stored as thryoglobulin as an extracellular colloid
- T3 and T4 can cross lipid membranes readily (secretion and uptake)
- T3 and T4 are small, hydrophobic and circulate bound to Thyroxine-binding globulin (TBG)

Hypo – Pit-Thyroid Axis



Approach

- Clinical.
- Biochemical.
- Radiological.
- Histopathological.

Spheres of diagnosis

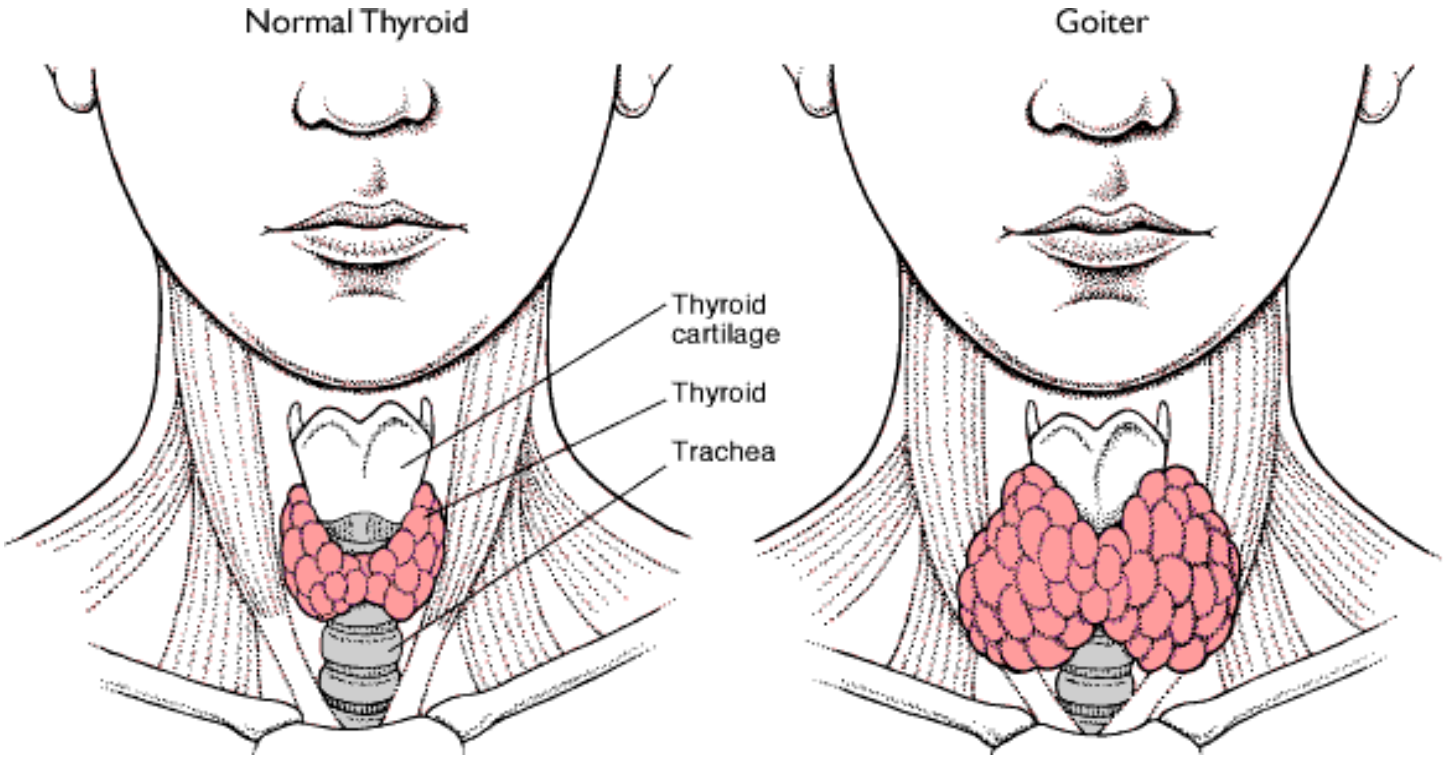
- Anatomical.
- Physiological.
- Pathological

Anatomical

- Diffuse Goitre.

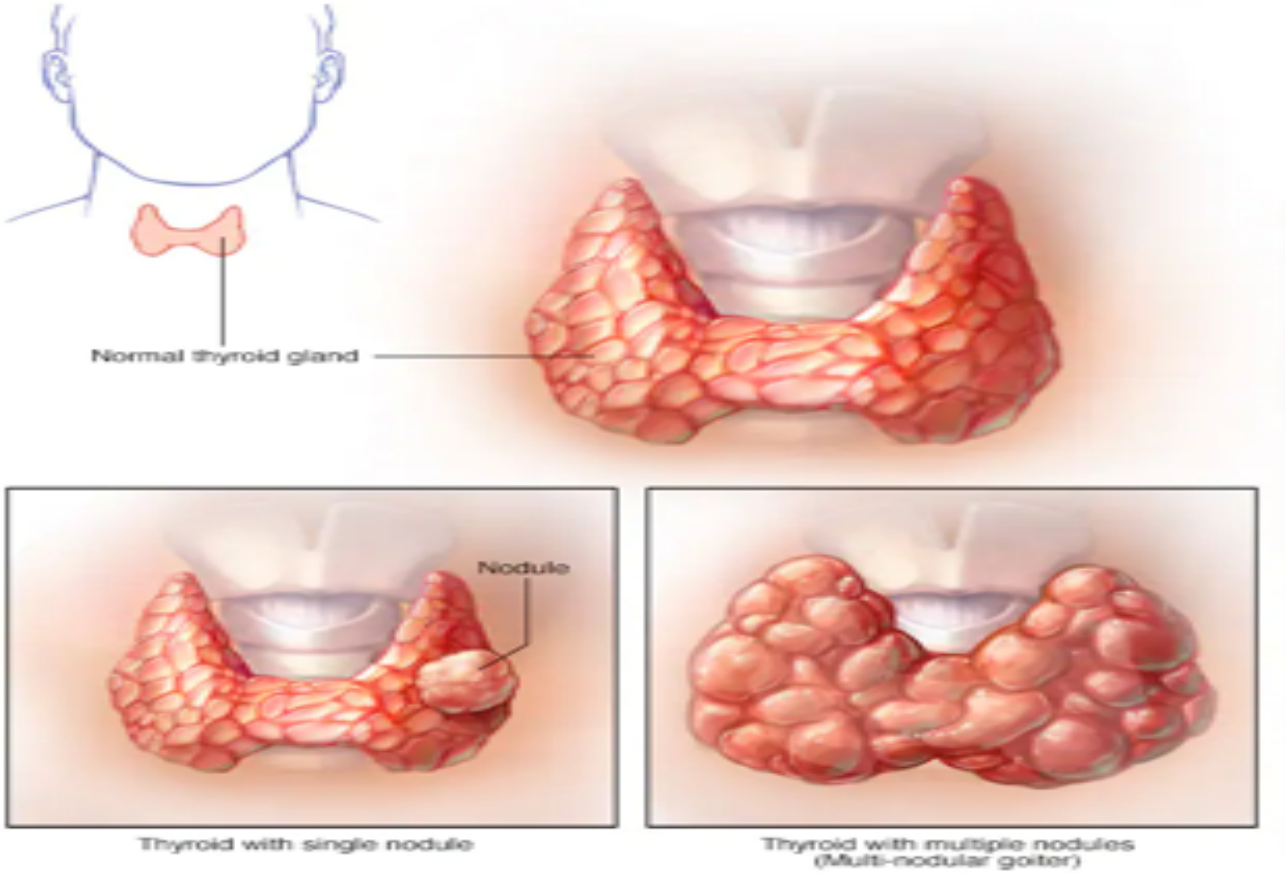
- Nodular Goitre:
  - MNG.
  - Solitary nodule.
  - Dominant nodule.

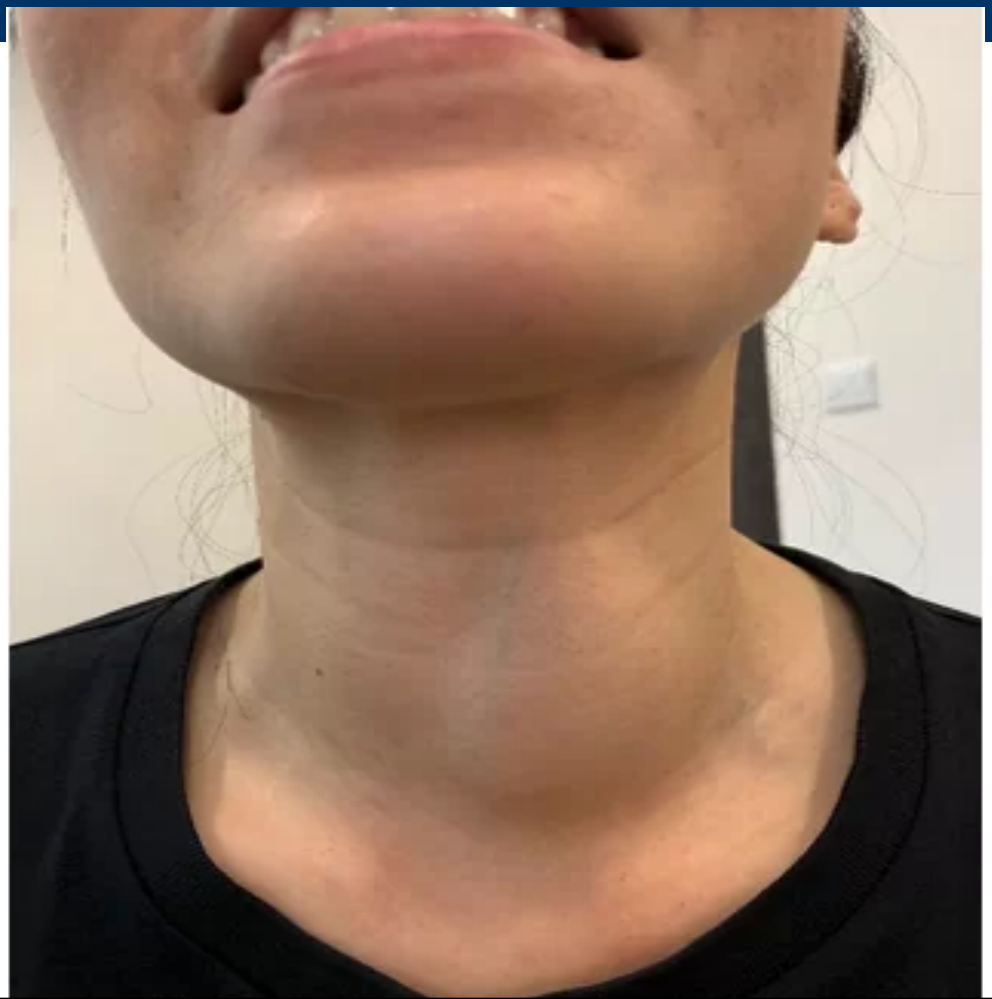
Anatomical Dx
Diffuse Goitre


Normal Thyroid
Goiter
Thyroid cartilage
Thyroid
Trachea

Anatomical Dx
MNG

Anatomical Dx
Solitary Nodule





How to reach Anatomical Dx

- Clinical.
- Ultrasound.
- CT scan, MRI.
- Thyroid scan.

Physical Exam

- Swelling in the anatomical site of thyroid.
- Moves with swallowing
- Dysphagea and Dyspnea suggest retrosternal extension.

- Anatomical dx includes

  retrosternal extension

  extension below sternocledomastoid

- Always Do Ultrasound.

Ultrasound

- One nodule or more
- Cystic or solid
- Presence or abecence of features of malignancy
- Cervical LN enlargement

Features of malignancy in U/S

- Microcalcification.
- Hypoechoeic nodules.
- Increased vascularity.
- Interupted hallo sign

Physiological

- Hypothyroid.
- Euthyroid.
- Thyrotoxic:
  - Hyperthyroidism.
  - Passive thyrotoxicosis.

How to reach physiological Dx

- Clinical
- Lab tests
- Thyroid scan

Symptoms of thyrotoxicosis

- nervousness, tremors, sweating, heat intolerance, palpitations, wt loss despite normal or increased appetite, amenorrhea, weakness.

Hypothyroidism

- Lethargy, hoarseness, hearing loss, thick and dry skin, constipation, cold intolerance, stiff gate, weight gain.

Biocchemical

- T3.
- T4.
- TSH.
- Antithyroid Antibodies: antithyroglobulin, antimicrosomal antibodies.

Thyroid scan

- Can differentiate between passive thyrotoxicosis and Hyperthyroidism.

Pathological

- Degenerative.
- Inflammatory:
  - acute.
  - subacute.
  - chronic.
- Neoplastic:
  - benign.
  - malignant.

Risk factors for malignancy

Age.....Extremes of age
Sex.....Male
Occupation.....Radiologist
family hx.....Positive
Residency..... Mountains
Pain.....Painless
Voice.....Hoarseness
Medical Hx.....Hx of irradiation
Texture.....Hard
Lymph nodes.....Enlargement

Thyroid Noudules

- Neoplastic
- Non neoplastic

Non Neoplastic

- Cyst: degenerative, Hemorrhagic, Hydatid…
  Surgery is indicated after second recurrence.

- Solid : Part of Multinodular Goiter.

Neoplastic

- Benign: Follicular adenoma
- Malignant: Wide spectrum of behaviour

Papillary Ca

- Most common, Best prognosis
- 10 year survival around 85 %
- At younger age group.
- Spreads by lymphatics.
- Can be multifocal.
- Can be familial.
- Usually sensitive to RAI

Follicular Ca

- 10 y survival around 60 %.
- Associated with iodine deficiency.
- Usually monofocal.
- Haematogenous spread.
- Diagnosed by capsular and vascular infiltration.
- Sensitive to RAI.

Medullary Ca

- From Parafollicular cells.
- 10 year survival 25-30%
- Can be Familial or Sporadic.
- Can be part of MEN 2.
- Does not uptake RAI.

Anaplastic

- Around 1 %
- Very aggressive tumor.
- The worst prognosis
- Survival is usually less than 6 months

Fibrolymphovasclar tumors

- Haemangioma, Lymphoma, Fibroma,…..
- Secondary Metastases.

How to reach a pathological Dx

- Fine Needle Aspiration.
- Surgery for definitive biopsy.

U/S guided FNA

- Prefered if
  - > 50 % cystic leision.
  - located posteriorly.

- Nodule < 1cm

No FNA.

Bethesda score

Diagnostic category	Description	Risk of malignancy (%)
I	Non-diagnostic/unsatisfactory	1–4
II	Benign	0–3
III	Atypia or follicular lesion of undetermined significance	5–15
IV	Follicular neoplasm or suspicious for follicular neoplasm	15–30
V	Suspicious for malignancy	60–75
VI	Malignant	97–99

Source: Cibas ES, Ali SZ. The 2017 Bethesda system for reporting thyroid cytopathology. J Am Soc Cytopathol. 2017;6:217–222. https://doi.org/10.1016/j.jasc.2017.09.002

Serum Thyroglobulin

- Increases in most thyroid pathologies.
- Not specific as a diagnostic tool.
- For follow up only.

Serum Calcitonin

- Contraversy about its importance as a diagnostic tool.
- if >100 pg/ml can suggest medullary Ca.

Treatment

- Goals:

  1-to remove the primary tumour and its local extension.

  2-to minimize treatment related morbidity.

  3-to permit accurate staging.

  4-fascilitate postop. Radioactive Iodine ttt.

  5-fascilitate long term postop. Surveilance

  6-minimize disease reccurence and mets.

Thyroidectomy – Types

- **Hemi-thyroidectomy**: Removal of half of thyroid gland (Lobe + Isthmus+ Pyramidal)
- **Lobectomy**: Removal of either right of left lobe of thyroid gland

Both these are done in solitary goitre

- **Total thyroidectomy**: Removal of whole thyroid gland

This is done in cases of malignancy

Thyroidectomy types

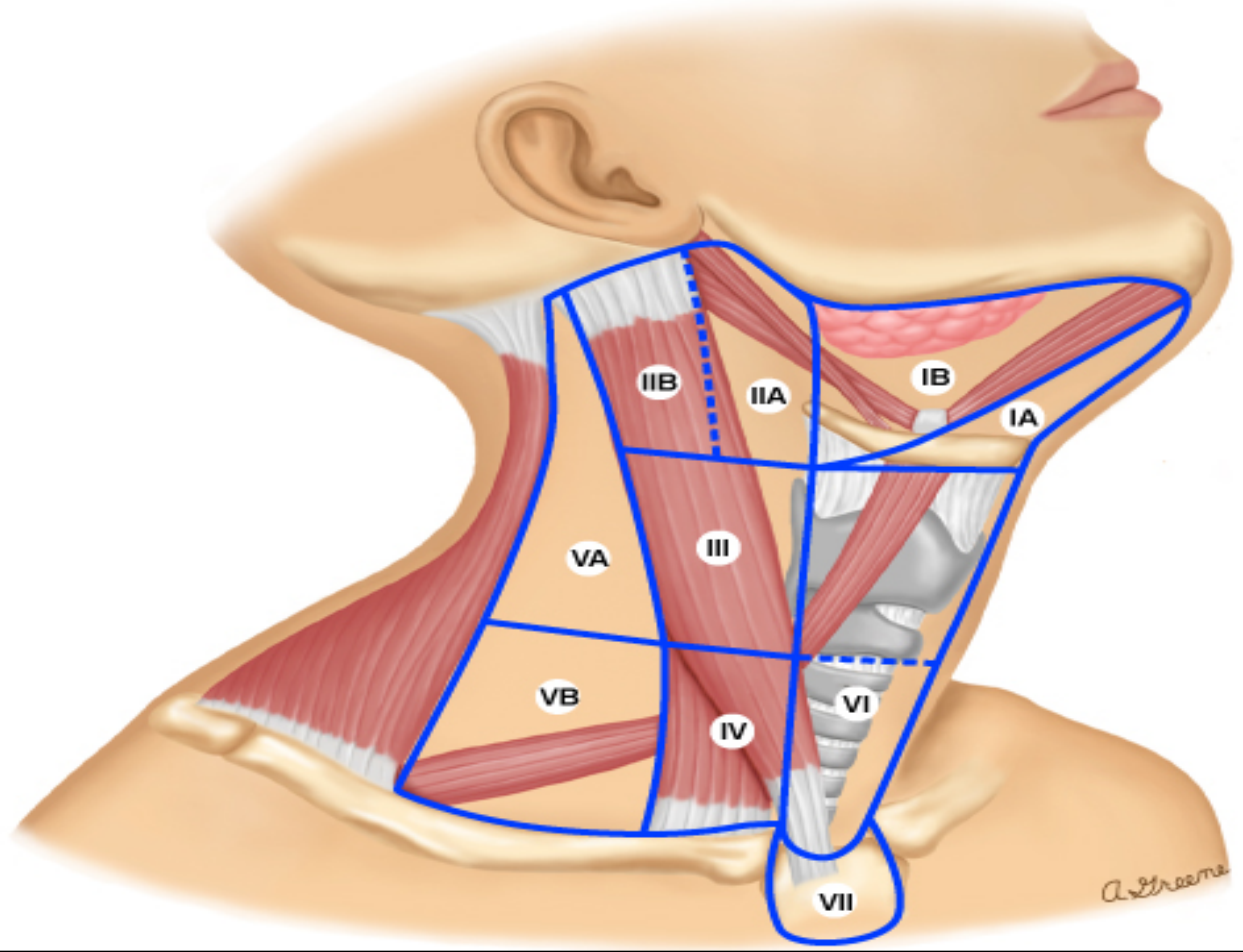
- **Subtotal thyroidectomy**: Removal of a little less than total; done in Graves` disease
- **Near-total thyroidectomy**: Almost same as total, but a little thyroid tissue around one parathyroid gland is preserved
- **Isthmusectomy**: Dividing the isthmus

Neck Dissection

- Removal of fat and lymph nodes en-bloc.
- Lateral Vs central neck dissection.

Lateral neck dissection

- Lymph nodes around internal jugular vein.
- Only therapeutic.


IIB
IIA
IB
IA
III
VA
VB
IV
VI
VII

Lateral Neck Dissection

Levels II,III,IV and V

Done only with biopsy proven metastases after clinical or sonographic suspicion

Central LN Dissection

- CLN are most common site of recurrence.
- Routine CLN dissection is indicated in medullary Ca., no consensus in papillary Ca.

Complications of thyroidectomy

- Intraoperative
  - Bleeding
    - Damage to arteries/veins of neck
- Postoperative presentation
  - Injury to recurrent laryngeal nerve
    - Unilateral: hoarseness
    - Bilateral: respiratory distress
  - Bleeding
    - Expanding hematoma – causes compression, shortness of breath
  - Hypocalcemia
    - Removal or injury to parathyroid glands or their blood supply
  - Scar

If patient develops expanding neck hematoma postoperatively, treatment involves immediate opening of sutures to evacuate clot and return to OR to explore and stop bleed

Prognosis

Table 1.
Prognostic factors in thyroid cancer: AMES (age, distant metastases, extent, size)

Low risk	High risk	Survival by AMES risk groups (20 years)
Younger patients (men = 40, women = 50) with no metastases	All patients with distant metastases	Low risk = 99%
Older patients (intrathyroid papillary, minor capsular invasion for follicular lesions)	Extra-thyroid papillary, major capsular invasion follicular	High risk = 61%
Primary cancers <5.0 cm	Primary cancers = 5.0 cm in older patients (men > 40, women > 50	
No distant metastases		

Based on Lahey Clinic data.

Table 2.
Prognostic factors in thyroid cancer: AGES (age, grade, extent, size)

Prognostic score = 0.05 × age	Survival by AGES score (20 years)
+1 (if grade 2)	<3.99 = 99%
+3 (if grade 3 or 4)	4–4.99 = 80%
+1 (if extra-thyroid)	5–5.99 = 67%
+3 (if distant spread)	>6.00 = 13%
+0.2 × tumor size (cm maximum diameter)	

Based on Mayo Clinic data.

Table 3.
Prognostic factors in thyroid cancer: MACIS (metastasis, age, completeness of resection, invasion, and size)

Score = 3.1 (if age <40 years) or 0.08 × age [if age = 40 years])	Survival by MACIS score (20 years)
+0.3 × tumor size (cm maximum diameter)	<6 = 99%
+1 (if incompletely resected)	6–6.99 = 89%
+1 (if locally invasive)	7–7.99 = 56%
+3 (if distant spread)	>8.00 = 24%

Based on Mayo Clinic data.

Benign FNA

- Risk of false neg. Up to 5%.

  papable >U/S guided(0.6%).

- Repeat examination or U/S 6-18 m interval
- Growth>20%,or more than 2mm in two dimensions→repeat FNA preferably U/S guided.

Medical Treatment

- No data to suggest that TSH suppression will cause a change in thyroid nodule size in Iodine sufficient area.

- Not recomended.

Children

- Should be evaluated as adults.

Pregnancy

- Thyroid scan should be delayed till delivery.
- If operation is to be done 12-24wks GA.
- After that →should be postponed till delivery.
- (studies:delay less than one year will not affect the eventual prognosis)

Completion Thyroidectomy

- To allow resection of multicentric disease.
- Allow radioactive Iodine diagnostic scan and treatment.
- Studies:same surgical risk as one stage surgery.
- (small tumours<1cm,intrathyroid,node neg.,low risk group) can be managed without completion.

Postoperative Radioactive Iodine Ablation

- Prepared with L-thyroxin withdrawal for 4 wks,or replace it with T3 for 2-4 wks then withdraw it for 2 wks.
- TSH > 30, to increase avidity.
- The minimal activity should be used 30-100 mci.
- Higher dose 100-200, in residual disease or aggressive pathology(tall cell,columnar,insular)

- Recombinant human thyrotropin(rhTSH) can be used in patients who cannot tolerate stopping thyroxin.
- Needs stopping thyroxin for one day only.

- Approved in Europe but still not in USA.

Whole body scan

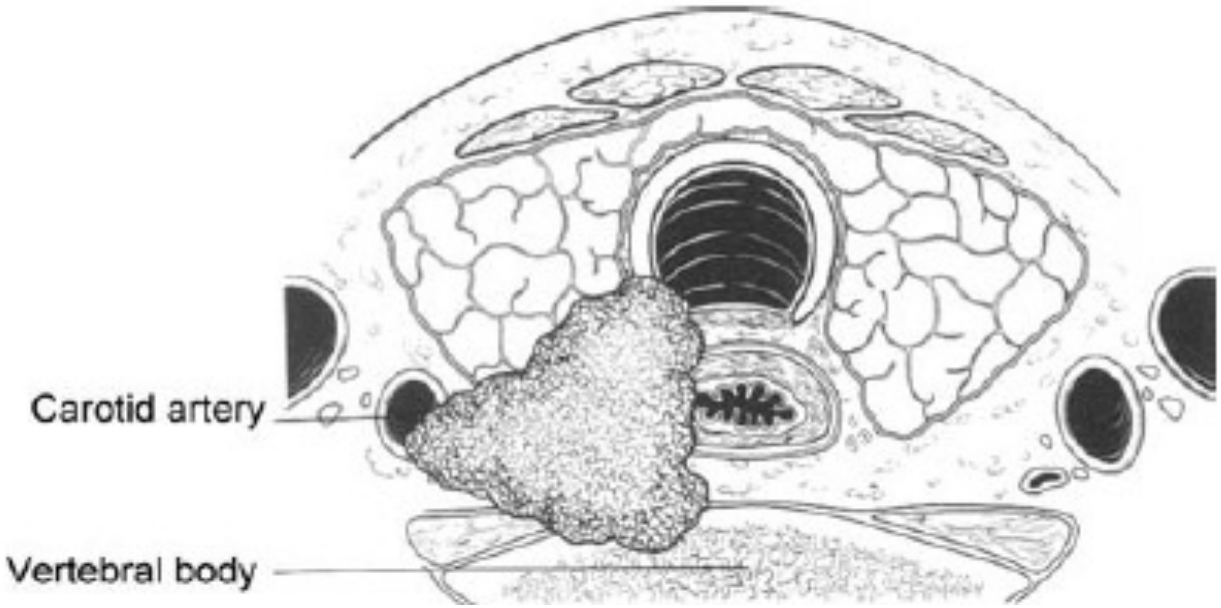
- Usually done one week after ablation therapy.
- 10-26% metastatic foci.

External Beam Radiotherapy

- Indications

  - age > 45 and extrathyroid extension and high likelyhood of microscopic residual tumour.

  -gross residual and further surgery or radioactive iodine treatment is ineffective.


Carotid artery
Vertebral body

Chemotherapy

- NO role for chemotherapy in differentiated thyroid Ca.
- Some studies:Adriamycin can act as a radiation sensitizer for external beam radiotherapy.

TSH Suppression Therapy

- Differntiated thyroid Ca have TSH receptors on cellular membrane.
- High risk patients < 0.1 mu/l
- Low risk patients 0.1 - 0.5 mu/l

Follow Up

- Every 6-12 months.
- Physical examination and cervical U/S
- Thyroglobulin and calcitonin.
- In borderline Tgn →stimulation by withdrawing thyroxin or rhTSH.
- If positive→ whole body scan