THYROID GLAND

Dr.Yousef Al-Bustanji

Department of Surgery

Faculty of Medicine

Mu'tah university

Embryology

- First of the body's endocrine glands to develop, on approximately the third week (24th day) of gestation.
- Endoderm
- Fourth pharyngeal pouch
- The production of Thyroxin starts at the 20th week of gestation.

Anatomy & Physiology :

- 10-20g .
- The functioning unit is the lobule, which consists of 24-40 follicles .
- Hypothalamus (TRH)>>Pituitary (TSH) >>Thyroid (T3 , T4)
- Negative feedback

Anatomy & Physiology :

- Only free T3 , free T4 are active (protein bound not active)
- T4:T3 serum ratio 20:1
- T3 more active (4X)
- Most T3 (from T4>T3 conversion in periphery) by deiodinasase !
- Thyroglobulin : stores T3 T4 in colloid
- Thyroid binding globulin : transport majority of T3 T4 in blood stream

Blood supply :

- Superior thyroid artery :ECA
- Inferior thyroid artery : thyrocervical trunk
- 3% of the population **a thyroidea ima artery** is found, from the aortic arch or brachiocephalic artery and courses to the inferior portion of the isthmus or inferior thyroid lobes.

- Sup &middle thyroid vein >> IJV
- Inf. Thyroid vein >>Innominate vein

- **Superior laryngeal nerve :**
- Close to Superior thyroid artery .
- MC nerve injured with thyroidectomy >>easy voice fatigability .
- Internal Sensory &external motor branches
- **Recurrent laryngeal nerve :**

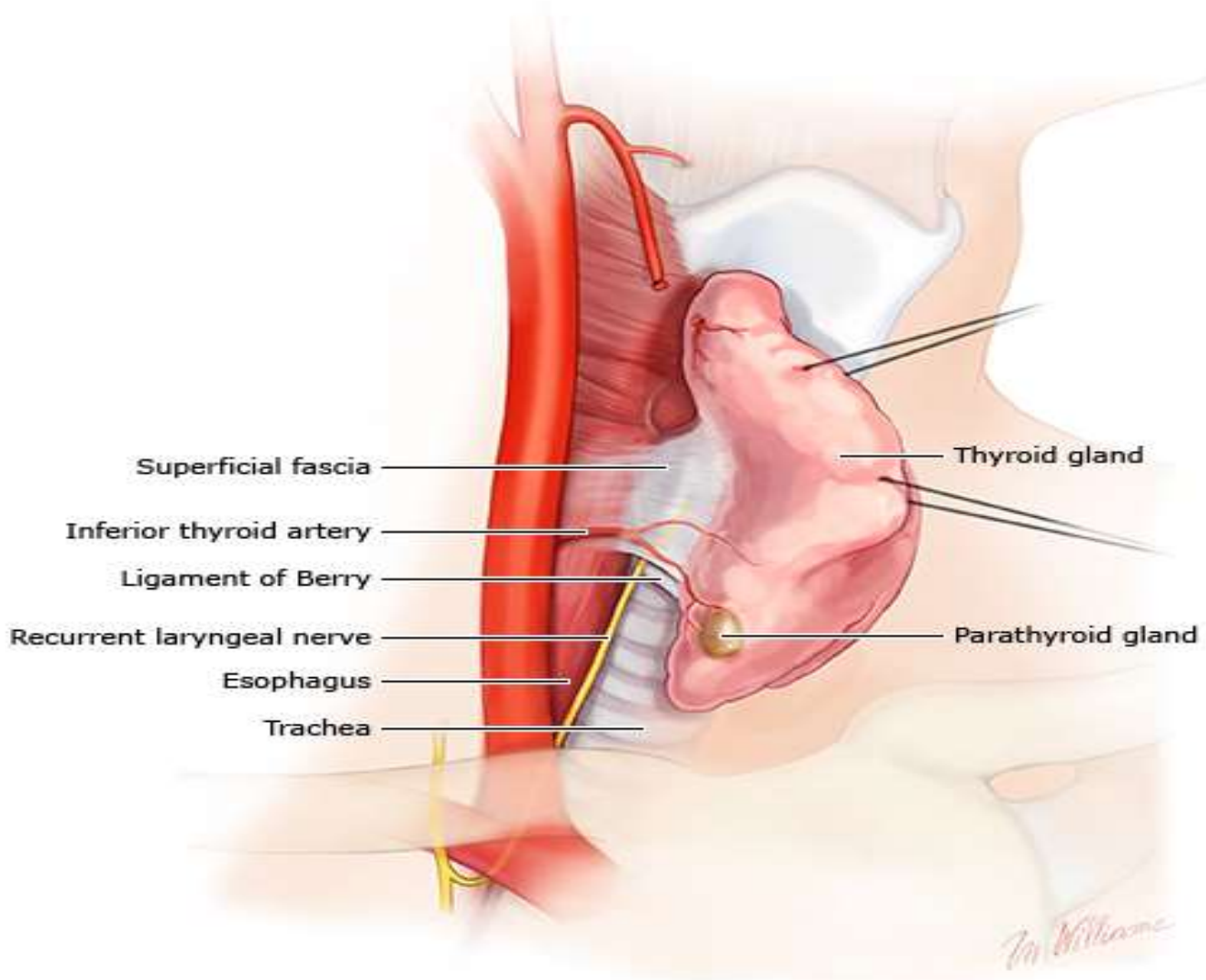
Post & medial to thyroid lobes in the tracheo-esophageal groove

Motor function for vocal cord abduction and adduction Except ??

Injury > Asymptomatic …. Hoarseness if (Unilateral)

airway Obstruction … Profound Aspiration (BILATERAL)

Dissection of recurrent laryngeal nerve lateral view



Anatomy of recurrent laryngeal nerve and parathyroid.

UpToDate®

SIGNS AND SYMPTOMS :

- -**MASS EFFECTS** due to goiter (dysphagia, stridor, shortness of breath, and feeling of a lump, voice changes).

- -**HYPER/HYPOTHYROIDISM.**

Goiter :

- Abnormal growth of the thyroid gland.
- Diffuse or nodular.
- Normal, decreased or increased thyroid hormone production.
- If associated with increased production of thyroid hormone is termed **toxic**, if not associated with an increased production is termed non-toxic or simple .
- Most goiters are euthyroid.
- MCC >> Iodine deficiency.

Causes of goiter in adults

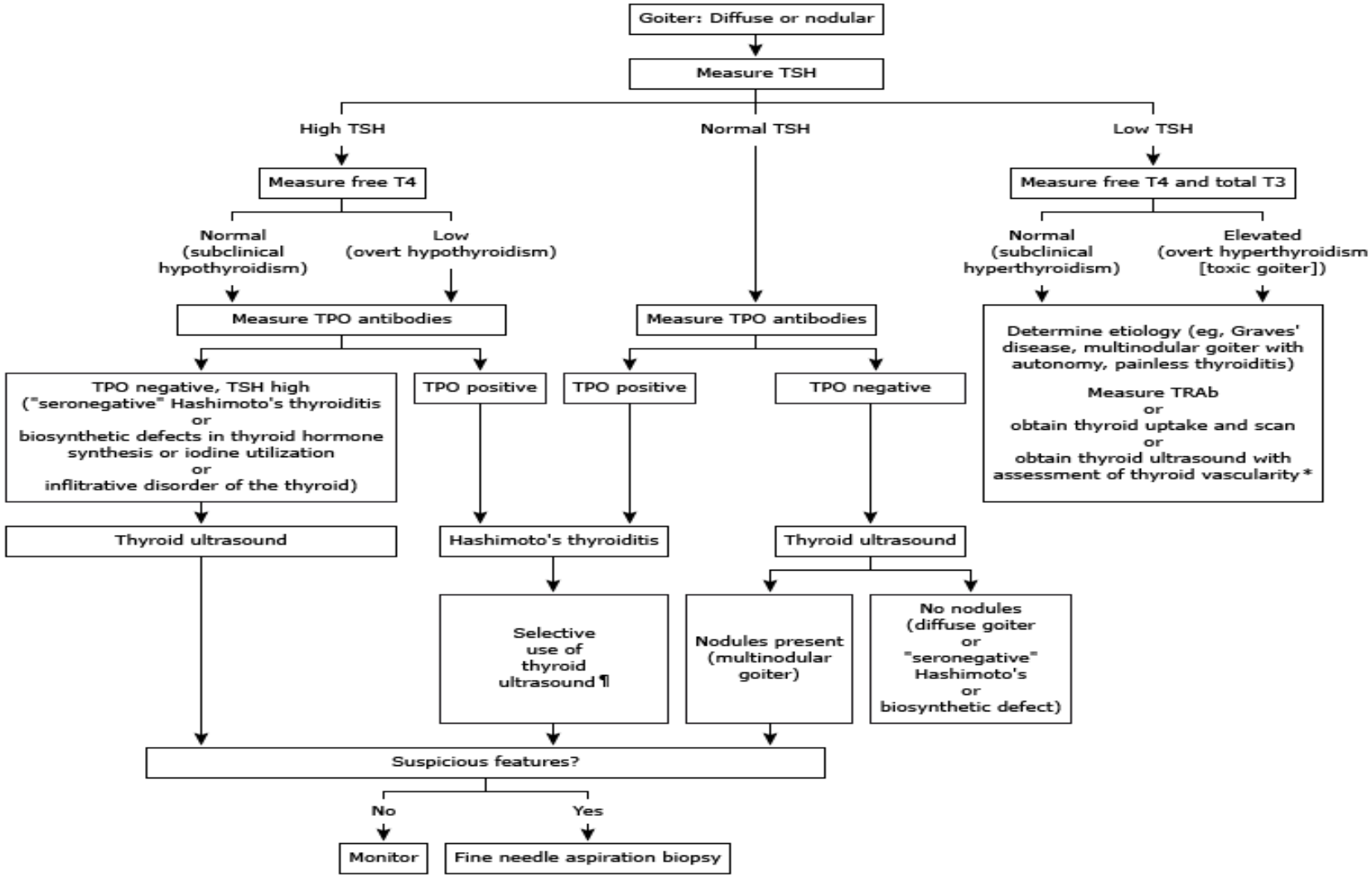
Multinodular goiter
Iodine-deficiency goiter
Autoimmune/thyroiditis
Chronic autoimmune (Hashimoto's) thyroiditis
Painless thyroiditis
Subacute thyroiditis
Postpartum thyroiditis
Infectious thyroiditis
Ingestion of goitrogens
Iodine
Lithium carbonate
Foodstuffs (cassava, millet)
Thyroid infiltrative disease
Riedel's thyroiditis
Amyloid goiter
Histiocytosis
Cystinosis
Sarcoidosis
Toxic goiter
Graves' disease
Autonomously functioning thyroid adenoma
Thyroid cysts
Thyroglossal duct cysts
Thyroid adenomas
Thyroid carcinoma
Papillary carcinoma
Follicular carcinoma
Medullary carcinoma

UpToDate®

Approach :

- History & Physical examination
- **TSH**
- Free T3 , Free T4
- Thyroid Antibodies
- Thyroid US
- Thyroid Isotope Studies : Hot , cold , diffuse .
- FNA

Evaluation of goiter in adults without obstructive symptoms



TSH: thyroid-stimulating hormone; T4: thyroxine; T3: triiodothyronine; TPO: thyroid peroxidase; TRAb: TSH-receptor antibodies.

* Non-autonomous focal areas of possible nodularity on thyroid scan (or exam) should be evaluated with ultrasound.

¶ We do not routinely obtain a thyroid ultrasound in patients with Hashimoto's thyroiditis. Ultrasound should be reserved for such patients with larger goiters, thyroid asymmetry, or a concern for thyroid nodularity.

UpToDate®

Indications for surgery :

- Obstructive symptoms
- Cosmetic reasons.
- Suspected Malignancy.

Thyroid nodule

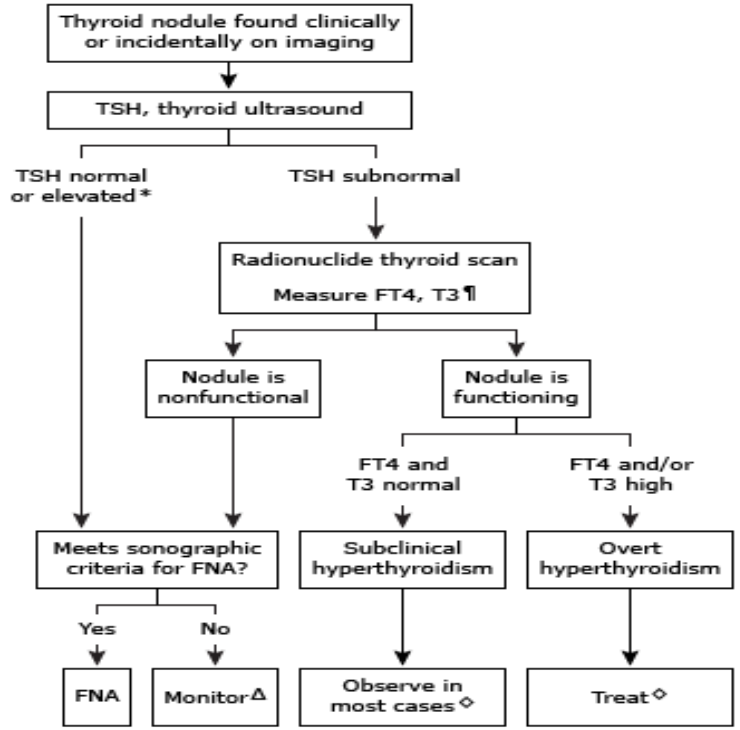
- lump in the thyroid gland , More common in females
- Mostly detected by routine physical exam or radiological procedure.
- Nodules can be found in about 5% of the general population.
- Thyroid cancer accounts for 4 to 6.5% of all thyroid nodules.
- Most of them represent a variety of benign diagnoses, including colloid nodules, degenerative cysts, hyperplasia, thyroiditis, or benign neoplasms.

Causes of thyroid nodules

Benign	Malignant
Multinodular (sporadic) goiter ("colloid adenoma")	Papillary carcinoma
Hashimoto's (chronic lymphocytic) thyroiditis	Follicular carcinoma
Cysts (colloid, simple, or hemorrhagic)	Minimally or widely invasive
Follicular adenomas	Oxyphilic (Hürthle cell) type
Macrofollicular adenomas	Noninvasive follicular thyroid neoplasm with papillary-like nuclear features
Microfollicular or cellular adenomas	Medullary carcinoma
Hürthle cell (oxyphil cell) adenomas	Anaplastic carcinoma
Macro- or microfollicular patterns	Primary thyroid lymphoma
	Metastatic carcinoma (breast, renal cell, others)

UpToDate®

Initial evaluation of a patient with a thyroid nodule



This algorithm is intended to be used in conjunction with additional UpToDate content on thyroid nodules.

TSH: thyroid-stimulating hormone; FT4: free thyroxine; T3: triiodothyronine; FNA: fine-needle aspiration.

* Patients with TSH above the normal range require an evaluation for hypothyroidism. Refer to UpToDate content on hypothyroidism.

¶ Patients with TSH below the normal range require an evaluation for hyperthyroidism. Refer to UpToDate content on hyperthyroidism.

△ Thyroid nodules that do not meet sonographic criteria for FNA should be monitored with periodic ultrasonography. The frequency of evaluation (ranging from 6 to 24 months) depends upon the sonographic features of the nodules.

◇ Selected cases of subclinical hyperthyroidism warrant treatment. Refer to UpToDate content on subclinical hyperthyroidism and toxic adenoma.

Sonographic patterns, estimated risk of malignancy, and FNA guidance for thyroid nodules

Sonographic pattern	Ultrasound features	Estimated risk of malignancy	Consider biopsy (FNA size cutoff, largest dimension)
High suspicion	Solid hypoechoic nodule or solid hypoechoic component of a partially cystic nodule WITH one or more of the following features: Irregular margins (infiltrative, microlobulated), microcalcifications, taller than wide shape, rim calcifications with small extrusive soft tissue component, evidence of extrathyroidal extension	>70 to 90%^	Recommend FNA at ≥1 cm
Intermediate suspicion	Hypoechoic solid nodule with smooth margins WITHOUT microcalcifications, extrathyroidal extension, or taller than wide shape	10 to 20%	Recommend FNA at ≥1 cm
Low suspicion	Isoechoic or hyperechoic solid nodule, or partially cystic nodule with eccentric solid areas, WITHOUT microcalcification, irregular margin or extrathyroidal extension, or taller than wide shape	5 to 10%	Recommend FNA at ≥1.5 cm
Very low suspicion	Spongiform or partially cystic nodules WITHOUT any of the sonographic features described in low, intermediate, or high suspicion patterns	<3%	Consider FNA at ≥2 cm Observation without FNA is also a reasonable option
Benign	Purely cystic nodules (no solid component)	<1%	No biopsy¶

NOTE: Ultrasound-guided FNA is recommended for cervical lymph nodes that are sonographically suspicious for thyroid cancer.

FNA: fine-needle aspiration.
^ The estimate is derived from high-volume centers; the overall risk of malignancy may be lower given the interobserver variability in sonography.
¶ Aspiration of the cyst may be considered for symptomatic or cosmetic drainage.

Bethesda system diagnostic categories for reporting thyroid cytopathology

Bethesda class	Diagnostic category	Cancer risk
I	Nondiagnostic (unsatisfactory)	5 to 10%
II	Benign	0 to 3%
III	Atypia of undetermined significance (AUS) or follicular lesion of undetermined significance (FLUS)	10 to 30%
IV	Follicular neoplasm (or suspicious for follicular neoplasm)	25 to 40%
V	Suspicious for malignancy	50 to 75%
VI	Malignant	97 to 99%

Data from: Cibas ES, Ali SZ. The 2017 Bethesda system for reporting thyroid cytopathology. Thyroid 2017; 27: 1341.

Thyroid cancer :

- Most primary thyroid malignancies are derived from **follicular epithelial cells.**
- >>**differentiated** thyroid cancer (papillary, follicular) .
- >>>**undifferentiated** thyroid cancer (anaplastic).

- **Parafollicular C cells** >> medullary thyroid carcinoma.
- **2ndry or metastases** (most commonly from renal cell carcinoma).

- The single most important etiological factor in differentiated thyroid carcinoma, particularly papillary, is irradiation .

Thyroid Cancer

Wide spectrum of biological behaveour

If treated appropriately there is high survival rate

Types :Papillary

Follicular

Anaplastic

Medullary

Lymphoma

Rare secondary

Papillary Carcinoma

- 80-85% of all thyroid cancers.
- The average age at diagnosis is rather young; 30 to 40 years.
- Women and children
- Most tumor following neck XRT.
- The prognosis is excellent, with a 10-year survival rate above 95%.

Papillary Carcinoma

- About 50% found to have psammoma bodies, which are round calcifications.
- Spreads via the lymphatics, and positive cervical lymph nodes do not affect the prognosis, prognosis depends on local invasion
- Most common site for distant metastasis is the lung , late and rare .
- Thyroglobulin is a tumor marker .

Follicular thyroid cancer

- Second most common type, about 10% of thyroid cancers.
- Women and older adults (50-60)
- Low iodine diet
- Blood borne metastasis is more common than it is for papillary thyroid cancer. (vascular invasion)
- Most commonly spread to the bone with lytic lesions.

Follicular thyroid cancer :

- It is more aggressive than papillary cancer and has a higher mortality rate, but overall still excellent compared to most cancers
- 5-year survival rate -70%, depends on stage
- **Cannot be diagnosed by FNAC.**

Hürthle cell thyroid cancer

- Was considered a variant of follicular thyroid cancer but recent studies indicate that it is a *distinct tumor type*
- Similar clinical presentation as follicular, but unlike follicular carcinoma it commonly spreads to lymph nodes, has poor radioactive iodine uptake and a worse prognosis.
- Only 5% of thyroid cancers

Medullary Thyroid carcinoma :

- 5% of thyroid cancers.
- The male to female =1:1.5.
- lymphatics and hematogenously, commonly to liver, lung and bone.
- The prognosis depends on whether or not lymph nodes are involved.
- The 10-year survival rate without lymph node involvement is about 80%, while it is only 45% with lymph node involvement.
- High levels of **serum calcitonin** and **CEA** .
- Pathology :**amyloid stroma.**
- 10-20% :familial or as part of MEN type 2A ,2B.

Anaplastic thyroid carcinoma

- Most aggressive
- Elderly patients
- Long standing goiters .
- 2% of thyroid cancers.
- The prognosis is dismal; disease specific mortality approaches 100%.
- Almost all patients die within six months.
- Distant spread is apparent at time of diagnosis, most commonly found in the lungs.
- Surgery , chemotherapy , radiotherapy.

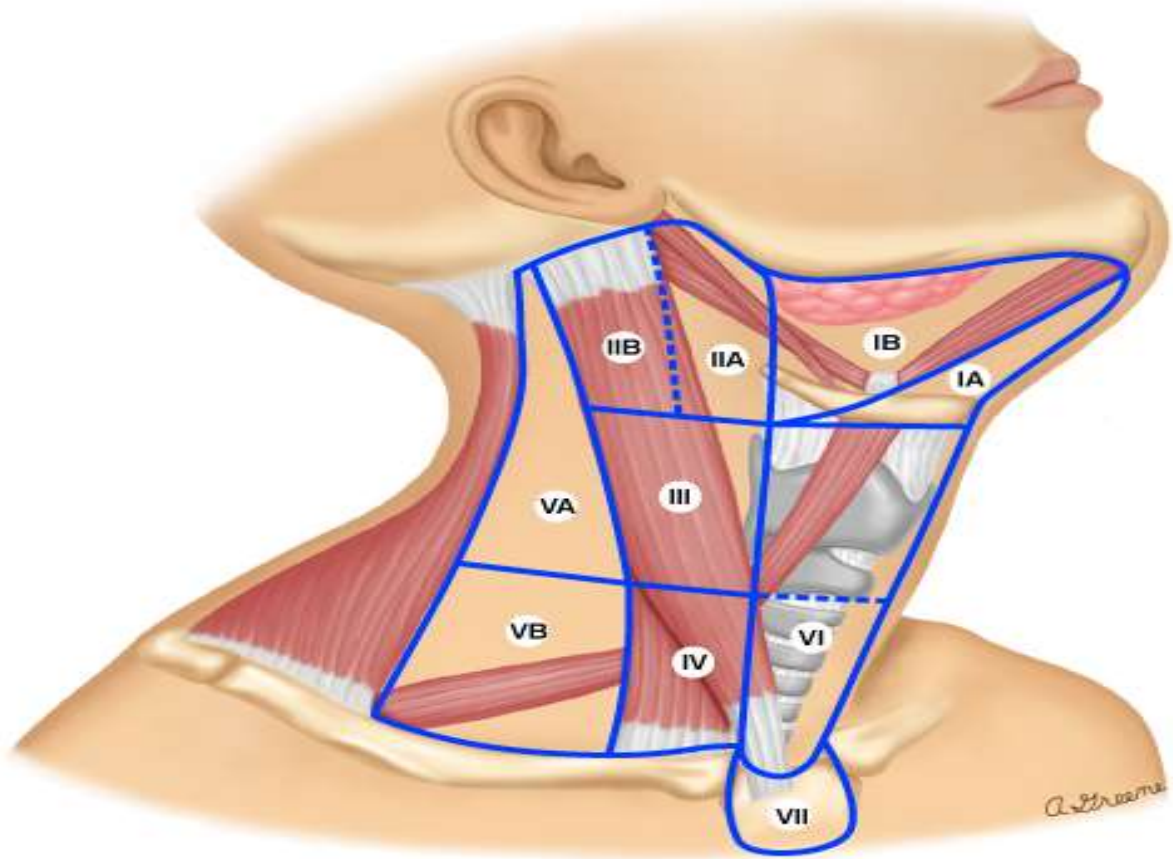
Treatment of differentiated thyroid carcinoma

Surgery :lobectomy or total Thyroidectomy: +- lymph node dissection in the central/lateral neck compartment.

Treatment objectives:

- Eradicate the primary
- Reduce the incidence of metastasis
- Facilitate treatment of metastasis
- Minimal morbidity

Lymph node levels of the neck



Level I, submental (IA) and submandibular (IB); level II, upper internal jugular nodes; level III, middle jugular nodes; level IV, low jugular nodes; level V, posterior triangle nodes; level VI, central compartment; level VII, superior mediastinal nodes.

Adapted from: American Joint Committee on Cancer (AJCC), Chicago, Illinois. The original source for this material is the AJCC Cancer Staging Manual, Seventh Edition (2010) published by Springer New York, Inc.

Complications of thyroid surgery:

- • Hematoma
- • Hypocalcaemia
- • Recurrent laryngeal nerve injury: 1%

Post operative treatment

- **Thyroxin T4**
  - **Replacement**
  - **Suppress TSH**
- **Thyroglobuline**
  - **Sensitive indicator for residual or recurrent tumor**
- **Radioactive Iodine**
  - **Detect metastatic disease**
  - **Ablation**