DEVELOPMENT & STRUCTURE
OF THYROID GLAND

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DEVELOPMENT OF THYROID

Concept of pharyngeal arch

Lateral lingual swelling
Tuberculum impar
Terminal sulcus
Body of tongue
Copula (hypobranchial eminence)
Epiglottal swelling
Foramen cecum
Laryngeal orifice
Arytenoid swellings
Palatine tonsil
Root of tongue
Epiglottis
DEVELOPMENT OF FOLLICULAR CELLS

- **7th Week**: Solid cord of cells breaks into network of epithelial cells as invaded by vascular mesenchyme
- **10th Week**: Cellular groups formation, Lumen formation
- **11th Week**: Colloid formation
- **20th Week**: Level of TSH ↑, Adult levels by 35th week
DEVELOPMENT OF PARAFOLLICULAR CELLS

- 4th or 5th pharyngeal pouch
- Ultimobranchial body
- Neural crest cells origin
Ultimopharyngeal body / Ultimobranchial body
AGENESIS OF THE THYROID GLAND

- Defective development of thyroid gland ~ Congenital hypothyroidism i.e. Cretinism
- No central cause related to Hypothalamic-Pituitary axis
- Absence of gland or one of its lobes ~ Rare anomaly
- Thyroid Hemiagenesis ~ Left lobe most commonly
- Mutations in the receptors for TSH is involved in some cases
40% population
Usually to the left of midline
Levator glandulae thyroideae
Innervated by branch of external laryngeal nerve
THYROGLOSSAL DUCT CYSTS

- Asymptomatic ~ unless the lesion become infected
- Painless, progressively enlarging swelling
- Appear in childhood, adolescence or young adults
- Treatment: Surgery with removal of hyoid bone
POSSIBLE LOCATIONS OF THYROGLOSSAL CYSTS

Body of tongue
Foramen cecum
ThyroGLOSSal cyst
Epiglottis
Hyoid bone
ThyroGLOSSal cysts
Thyroid cartilage
Cricoid cartilage
Thyroid gland
THYROGLOSSAL SINUS & FISTULA

A
- Thyroglossal duct cyst
- Thyroid gland
- Opening of thyroglossal duct sinus

B
- Foramen cecum of tongue
- Hyoid bone
- Thyroid cartilage
- Lingual thyroglossa duct cyst
- Cervical thyroglossal duct cyst

thyroglossal fistula
ABERRANT/ECTOPIC THYROID GLAND
ACCESSORY THYROID TISSUE

- Nerve to thyrohyoid
- Superior laryngeal nerve, internal branch
- External carotid artery
- Superior laryngeal nerve, external branch
- Superior thyroid artery
- Sternohyoid, reflected superiorly
- Thyrohyoid
- Accessory thyroid gland
- Cricothyroid
- Superior thyroid vein
- Thyroid plexus of veins
- Right lobe of thyroid gland
- Middle thyroid vein
- Internal jugular vein
- Vagus nerve
- Common carotid artery
- Trachea
- Subclavian artery
- Left lobe of thyroid gland
- Inferior thyroid vein
- Brachiocephalic trunk
- Sternohyoid, reflected inferiorly
- Accessory thyroid tissue
- Pyramidal lobe (remnant of thyroglossal duct)
- Incomplete isthmus
- Connective tissue band
GROSS STRUCTURE OF THYROID

- Only endocrine gland to store its secretions
- Location & extent
- Shape
- Length: 5 cm
- Width: 2.5 cm
- Weight: 25-30 g
- True Capsule
- Pretracheal fascia covering
RELATIONS OF THE LOBES

ANTEROLATERALLY

POSTEROLATERALLY

MEDIALLY
WHY SWELLINGS OF THYROID GLAND MOVE WITH SWALLOWING?
ARTERIAL SUPPLY

- Superior thyroid artery (Anterior & posterior branches)
- Inferior thyroid artery
- Stroma richly vascularized
- Vessels lie between true & false capsule
(B) Posterior view

- Internal carotid artery
- External carotid artery
- Common carotid artery
- Right parathyroid glands
- Left parathyroid glands
- Inferior thyroid artery
- Superior thyroid artery
- Thyrocervical trunk
- Recurrent laryngeal nerves
RELATIONSHIP OF NERVES WITH THYROID ARTERIES & THEIR DAMAGE

Superior Thyroid Artery Ligation: Close to gland
Inferior Thyroid Artery Ligation: Lateral to gland
Blood accumulation and serous exudate after the operation ~ Pressure effects & nerve compression

Non-recurrent laryngeal nerve (due to lack of normal subclavian artery) 1% incidence ~ Possible hazard in thyroidectomy
A: Weakness of voice

B: Speech not greatly affected; Hoarseness of voice; temporary aphonia or disturbance of phonation (voice production) and laryngeal spasm

C: Impaired breathing, speech lost

D: Greater degree of paralysis of abductors

E: Dyspnea & stridor; Needs cricothyroidotomy or tracheostomy
LYMPHATIC DRAINAGE

- Deep cervical nodes:
  - Prelaryngeal
  - Pretracheal
  - Paratracheal
  - Thoracic duct

Legend:
- Superior deep cervical
- Inferior deep cervical
- Submental
- Submandibular
- Prelaryngeal
- Paratracheal
- Pretracheal
NERVE SUPPLY

SUPERIOR CERVICAL SYMPATHETIC GANGLIA

MIDDLE CERVICAL SYMPATHETIC GANGLIA

INFERIOR CERVICAL SYMPATHETIC GANGLIA

- Periarteriolar nervous plexus: Vasomotor not secretomotor
- Hypothalamic control of secretion
FUNCTIONS & REGULATION OF SYNTHESIS OF THYROID HORMONES

1. A stimulus (e.g., low body temperature) causes the hypothalamus to secrete thyrotropin-releasing hormone (TRH), which acts on the anterior pituitary.

2. Thyrotropic cells in the anterior pituitary release thyroid-stimulating hormone (TSH).

3. TSH stimulates follicular cells of the thyroid gland to release thyroid hormone (TH).

4. TH stimulates target cells to increase metabolic activities, resulting in an increase in basal body temperature.

5. Increased body temperature is detected by the hypothalamus, and secretion of TRH by the hypothalamus is inhibited. TH also blocks TRH receptors on the thyrotropic cells, inhibiting synthesis and release of TSH. Both effects indirectly dampen TH production in the thyroid.
Hypothalamus → TRH → Anterior pituitary → TSH → Thyroid → Insufficient $T_4$ and $T_3$ produced → No iodine → No inhibition → Thyroid grows to form goiter
ENLARGEMENT OF THYROID GLAND

PHYSIOLOGICAL (e.g., during menstruation & pregnancy)

PATHOLOGICAL e.g., GOITER (HYPOTHYROIDISM/HYPERTHYROIDISM)
HYPOTHYROIDISM

- Congenital Hypothyroidism/Cretinism
- Iodine Deficiency Goiter/Endemic Thyroid
- Autoimmune/Hashimoto’s Thyroiditis
- Adult Hypothyroidism/Myxedema
HYPERTHYROIDISM/TOXIC GOITER/GRAVES’ DISEASE

- Exophthalmic goiter
- Autoantibodies

**Treatment options:**
- Surgery
- Radiotherapy
- Radioactive iodine ingestion
EXTENT & MECHANICAL EFFECTS OF GOITER

- Attachment of sternothyroid muscle
- Limits upward extension
- No limit to downward expansion behind sternum
- Enlarges anteriorly, posteriorly, inferiorly, or laterally
- Retrosternal or substernal more common
- Compression of trachea ~ Dyspnea
- Severe venous compression
SURGICAL APPROACH OF THYROID GLAND

1. Transverse incision in a low skin crease on the front of neck
2. Vertical division of investing fascia
3. Retraction/division of sternohyoid & sternothyroid muscles
4. Division of pretracheal fascia to expose gland proper
TOTAL THYROIDECTOMY
NEAR TOTAL & SUBTOTAL THYROIDECTOMY

- Total Thyroidectomy
- Subtotal Thyroidectomy
- Thyroid Lobectomy

- Parathyroid Glands
- FOR
- FOR
- FOR

- Carcinoma
- Graves' disease (diffuse toxic goiter)
- Nodule in gland (adenoma, etc.)
SURFACE ANATOMY OF THYROID GLAND

- Extent of gland: C5-T1 Vertebrae
- Isthmus: 2\textsuperscript{nd}, 3\textsuperscript{rd} & 4\textsuperscript{th} tracheal rings
MICROSTRUCTURE OF THE THYROID GLAND

PARENCHYMA

STROMA

FOLLICULAR/PRINCIPAL CELLS

PARAFOLLICULAR/C CELLS

3D VIEW OF THYROID FOLLICLES
PARENCHYMA & STROMA

Thyroid Gland
H&E

lobule

follicles

interlobular connective tissue

colloid in follicular lumen

follicular cells
FOLLICULAR CELLS

PRINCIPAL/CHIEF CELLS

Slide 42 Thyroid gland

Follicular epithelial cells

Loose connective tissue

colloid

F

F

F

C

C

C

F

F

F

C

C
PARAFOLLICULAR CELLS
C CELLS/ CALCITONIN CELLS

Slide 42 Thyroid gland

Parafollicular cell (C cell)

C - cells
**HYPOACTIVE & HYPERACTIVE VS. EUTHYROID STAGE**

- **Hypoactive stage**: Simple squamous epithelium lined follicle filled with colloid
- **Hyperactive stage**: Simple columnar epithelium lined follicle with ↓ in colloid
- **Euthyroid stage**: Simple cuboidal epithelium + colloid

*The height of the follicular cells is directly proportional to the glandular activity.*
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THANK YOU