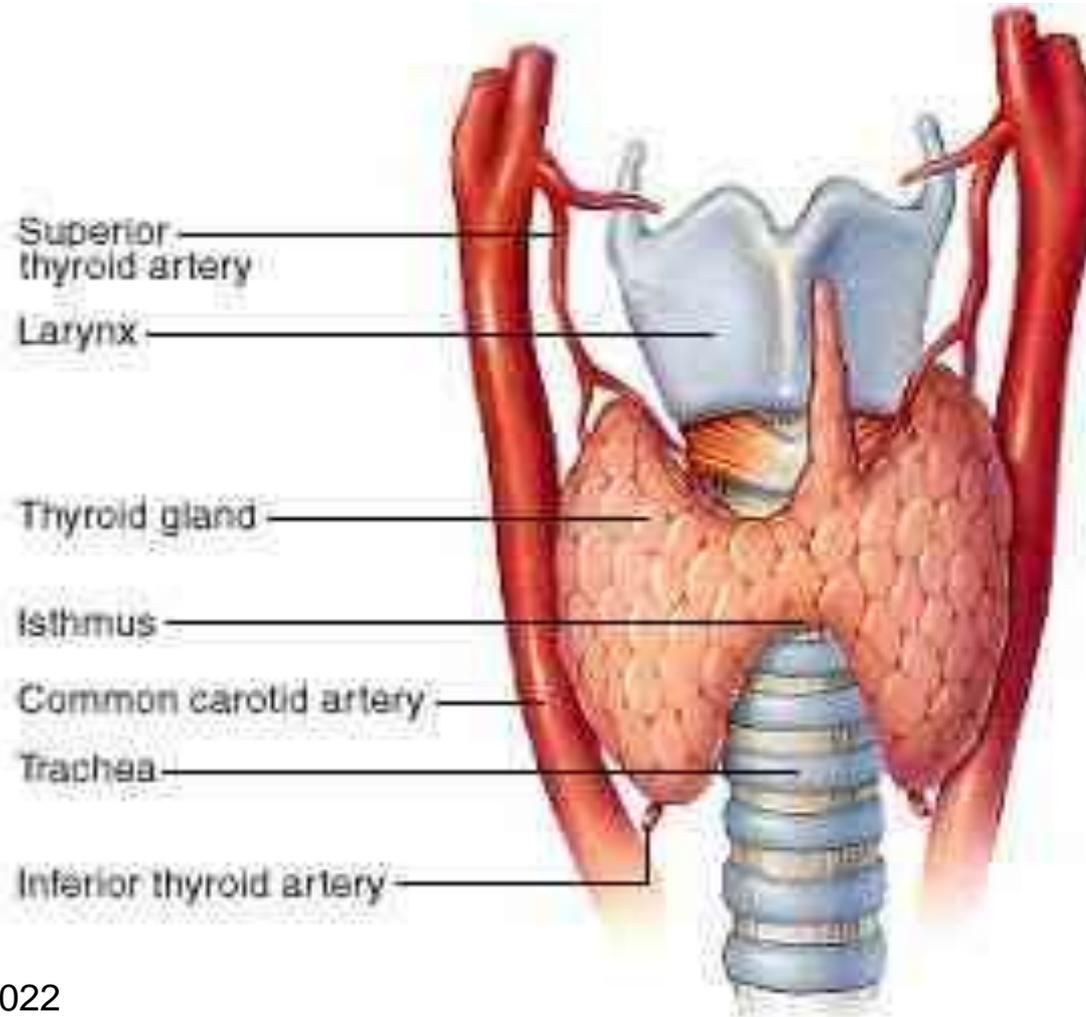


Thyroid hormones and Anti-thyroid drugs

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Thyroid gland



Thyroid Hormones

- ❑ **Thyroxine (T4)**
- ❑ **Triiodothyronine (T3)**
- ❑ **Calcitonin**

Thyroid Disorders

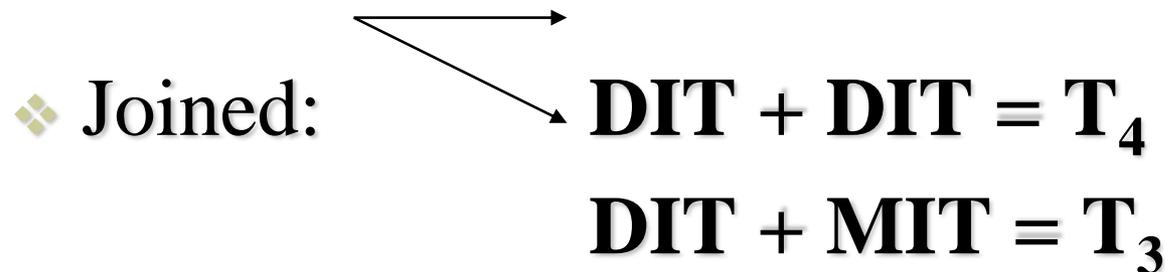
- ❖ Hyperthyroidism
- ❖ Hypothyroidism
- ❖ Hashimoto's thyroiditis
- ❖ Goitre (thyroid enlargement)
- ❖ Malignancy

Physiological considerations

- ❖ Dietary iodine is absorbed
- ❖ Circulates as iodide in blood
- ❖ Taken up by cells of the thyroid gland
- ❖ Concentrated up to 200 times

In the thyroid gland

- ❖ Iodide is oxidized & activated into iodine
- ❖ Combines with tyrosine on thyroglobulin
- ❖ Monoiodotyrosine & Diiodotyrosine are formed



Physiological considerations

- ❖ 2-month storage of T_4
- ❖ Daily production:
 - T_4 : 75 μg
 - T_3 : 25 μg
- ❖ 80 % of circulating T_3 are derived from T_4 by deiodination in peripheral tissues

Physiological considerations

- ❖ Liberation of T_4 and T_3 :
 - Regulated by TSH
- ❖ TSH: regulated by TRH in hypothalamus
- ❖ TRH: affected by:
 - Stress, disease, food deprivation
 - Environmental temperature
 - Thyroid H level (-ve feedback inhibition)

Comparison between T₄ & T₃

- T₃ has:
 - ❖ Rapid onset of action
 - ❖ Shorter duration
 - ❖ Five times more potent than T₄
 - ❖ T₄ → t_{1/2} about 7 days
 - ❖ T₃ → t_{1/2} about 2 day

Actions of thyroid hormones

- ❖ Regulation of growth & development
- ❖ Calorigenic effect and body temp control
- ❖ Metabolic effects (catabolic):
 - Increase metabolism of Carbohydrate, fat, protein
- ❖ Effects on body systems:
 - ❖ **GIT:** excess causing diarrhea, deficiency causing constipation
 - ❖ **CVS:** positive chronotropic and inotropic effects
 - ❖ **CNS:** deficiency cause mental retardation

Therapeutic uses of Thyroxine (T4)

- ❖ Replacement therapy:
 - Hypothyroidism
- ❖ Diffuse non-toxic goiter:
 - Prevent TSH release & increase in size
- ❖ Hashimoto's thyroiditis: to correct hypothyroid state
- ❖ With anti-thyroid therapy:
 - Suppress increase in thyroid size secondary to increased TSH release

Therapeutic uses of T3

- ❖ Not used routinely
- ❖ Used sometimes carefully for rapid effects in:
 - Hypothyroid (Myxoedema) coma
 - Hypothyroid psychosis
 - Severe hypothyroidism
- ❖ Avoided in the presence of heart disease

Adverse effects of thyroid hormones

- ❖ Arrhythmias (tachycardia, ectopics)
- ❖ Anginal attacks
- ❖ Hyperthyroidism with high doses
- ❖ Muscle pain (myalgia)

Anti-thyroid Drugs

- ❖ Thiourea derivatives (Thionamide)
 - Carbimazole, Propylthiouracil, Methimazole
- ❖ Iodide
- ❖ Radioactive iodine I ¹³¹

Thiourea derivatives (thionamides)

- ❑ Carbimazole
- ❑ Methimazole: it is a metabolite of carbimazol
- ❑ Propylthiouracil

Carbimazole

- ❖ Inhibits thyroid hormones synthesis:
 - Prevents binding of iodine to tyrosine to form iodotyrosines
 - Prevents coupling of iodotyrosines to form H
- ❖ $t_{1/2}$ about 6 hrs
- ❖ Crosses placenta
- ❖ Secreted in milk
- ❖ Once daily because its duration of action is 30h

Adverse effects

- ❖ Rash
- ❖ Arthralgia
- ❖ Agranulocytosis & thrombocytopenia
 - Recognized idiosyncrotic adverse effect
 - May develop suddenly
- ❖ Liver damage

Propylthiouracil

- ❖ Similar to carbimazole but it also:
 - Inhibits peripheral metabolism of T_4 into T_3
- ❖ $t_{1/2}$ about 2 hrs
- ❖ Less placental crossing
- ❖ Less secretion in milk
 - Preferable in pregnancy & lactation

Iodide

- ❖ Oral iodide is well absorbed
- ❖ Daily requirement: 100 μg
 - Deficiency: → Non-toxic goiter because of reduction TH synthesis and activation of TSH
 - Excess: → Goitre: with increased function
- ❖ Therapeutic uses of iodide:
 - Preparation for surgery: decrease TH
 - Less size, less vascular gland
 - Treatment of thyrotoxic crisis:
 - Inhibits thyroid H release

Adverse effects

- ❖ Allergy
- ❖ Iodism:
 - Metallic taste, flu-like illness
 - Pain in salivary glands
 - Rashes

Treatment of thyrotoxicosis

❖ Medical:

- Anti-thyroid drug (carbimazole, propylthiouracil)
- Propranolol

❖ Surgical:

- Surgical preparation by propranolol & iodide

❖ Radioactive iodine I¹³¹

Drug-induced goiter

- ❑ Antithyroid drugs:

- ❖ Iodide

- ❖ Lithium

- ❖ Amiodarone

- ❑ Food-induced:

- ❖ Cabbage