



Hypothyroidism

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Learning Objectives:

- 1- Describe different classes of drugs used in hypothyroidism and their mechanism of action.
- 2- Understand their pharmacological effects clinical uses and adverse effects
- 3- Recognize treatment of special cases of hypothyroidism such as myxedema coma

Color index:

Important

Note

Extra

Mind Map

Treatment of Hypothyroidism

Levothyroxine
(T₄)

Liotrix
(T₃ + T₄)
Mnemonic:
Trix (mix)

Liothyronine
(T₃)

Mind Map

Dr. Yieldz Note: it's important to know the differences between the 3 drugs

Treatment of Hypothyroidism

Levothyroxine (T₄)

mnemonic:
LEVO (4 letters) → T₄

Liothyronine (T₃)

Mnemonic:
LIO (3 letters) → T₃

Liotrix (T₃ + T₄)

Mnemonic:
Trix (mix)

Hypothyroidism

Thyroid gland does not produce enough hormones

Congenital: In children leads to:

- Delay in growth (**Dwarfism**)
- Delay in intellectual development (**cretinism**)

primary

secondary

- People who are most at risk include those over age 50 & mainly in **females**
- Prevalence is 14/1000 females and 1/1000 males
- Diagnosed by **low** plasma levels of **T₃ & T₄** and **TSH**



Pictured: Cretinism

Causes of Hypothyroidism

Primary Hypothyroidism (inadequate function of the gland itself)	Secondary Hypothyroidism
<ul style="list-style-type: none"> ● Iodine deficiency is the most common cause of hypothyroidism and endemic goiter worldwide. ● Autoimmune: Hashimoto's thyroiditis (enlarged, inflamed hypofunctioning thyroid) ● Radioactive iodine (hyperthyroidism treatment) ● Post thyroidectomy ● Antithyroid drugs (CMZ , PTU) ● Other drugs(lithium, amiodarone) ● Subacute thyroiditis ● Thyroid carcinoma 	<p style="text-align: center;">Impairment of higher cortical centers</p> <ul style="list-style-type: none"> ● Hypothalamic disease ● Pituitary disease

Manifestations of Hypothyroidism

Early Manifestations	Late Manifestations
<p>Opposite to hyperthyroidism</p> <ul style="list-style-type: none"> ● Fatigue and lack of energy ● Cold intolerance ● Constipation ● Weakness ● Muscle or joint pain ● Paleness ● Thin, brittle hair and fingernails(characteristic) 	<ul style="list-style-type: none"> ● Decreased sense of taste and smell. (Reminder: this is also an ADR of methimazole, hyperthyroidism drug) ● Dry flaky skin ● Hoarseness ● Menstrual disorders ● Puffy face, hands, and feet ● Thinning of eyebrows

Treatment of Hypothyroidism

Replacement therapy with synthetic thyroid hormone preparations :

Drug	LEVOTHYROXINE (T4)
M.O.A	Synthetic form of thyroxine (T4), <u>drug of choice</u> for replacement therapy.
P.K	<ul style="list-style-type: none"> • Stable and has a long half life (7 days) advantage • Administered once daily. advantage • Restore normal thyroid levels within 2-3 weeks • Absorption is increased when hormone is given on <u>empty stomach</u> • Parenteral preparation (for emergency) and oral preparation. • Oral preparations available from 0.025 to 0.3 mg tablets • Levothyroxine is given in a dose of 12.5 – 25 µg/day for two weeks and then increased every two weeks. • Major pathway of thyroid hormone metabolism is through sequential deiodination • 80% of circulating T3 is derived from peripheral T4 by monoiodination. • The liver is the major site of degradation for both T4 and T3 • 80% of the daily dose of T4 is deiodinated to yield equal amounts of T3 and rT3 (reverse T3 ,which is inactive)
Clinical Uses	<p>Hypothyroidism, regardless of etiology including :</p> <ul style="list-style-type: none"> ❖ Congenital ❖ Hashimoto thyroiditis ❖ Pregnancy <p>Recommended for routine lifelong replacement therapy</p>
ADR Of overdose	<ul style="list-style-type: none"> • In children: restlessness , insomnia , accelerated bone maturation • In adult: cardiac arrhythmia (tachycardia , atrial fibrillation), tremor , restlessness ,headache , change in appetite, weight loss ,heat intolerance , muscle pain

Precaution:

In **old patients** and in patients with **cardiac problems** because it causes **tachycardia** , treatment is started with reduced dosage.

Treatment of Hypothyroidism

Replacement therapy with synthetic thyroid hormone preparations :

Drug	LIOETHYRONINE (T3) :
P.K	<ul style="list-style-type: none"> • More potent (3-4 times) and rapid onset of action than levothyroxine • oral preparation available are 5-50µg tablets - parenteral use 10µg/ml
Disadvantage + Precaution	<ul style="list-style-type: none"> • has a short half life - not recommended for routine replacement therapy (requires multiple daily doses) (T4 has a long duration of action) • should be avoided in cardiac patients
Drug	Liotrix
M.O.A	Combination of synthetic T4 & T3 in a ratio 4:1 that attempt to mimic the natural hormonal secretion
Disadvantage	<p>The major limitations to this product are:</p> <ul style="list-style-type: none"> - High cost - Lack of therapeutic rationale because 35% of T4 is peripherally converted to T3

Myxedema coma

- Life -threatening hypothyroidism
- The treatment of choice is loading dose of **levothyroxine** intravenously 300-400µg initially followed by 50µg daily maintenance dose
- I.V. liothyronine T3 for rapid response but it may provoke **cardiotoxicity**
- I.V. hydrocortisone may be used in case of **adrenal and pituitary insufficiency**. When there is a disturbance in the regulatory axis

Hypothyroidism and pregnancy

In pregnant hypothyroid patient 20-30 % increase in thyroxine is required because of

1. **elevated maternal thyroxine binding globulin (TBG) induced by estrogen**
2. **early development of fetal brain which depends on maternal thyroxine**

MCQs

1-What is the drug of choice in cases of severe hypothyroidism “ myxedema coma”?

- a) I.V Liothyronine
- b) Oral Levothyroxine
- c) I.V hydrocortisone
- d) I.V Levothyroxine

2- which of the following drugs has a rapid onset of action but could provoke cardiotoxicity?

- a) Liotrix
- b) Levothyroxine
- c) Liothyronine
- d) Hydrocortisone.

3- which of the following is a limitation of Liotrix?

- A) High cost.
- B) Cardiotoxicity
- C) Multiple daily doses
- D) Hypersensitivity reactions

4- which of the following is a common side effect of levothyroxine overdose?

- a) Dry skin
- b) Constipation
- c) Decreased sense of taste and smell
- d) Weight loss

5- all of the following statements are TRUE about levothyroxine except:

- a) Administered once daily.
- b) Best absorbed on empty stomach.
- c) Has a short half life.
- d) Restores normal thyroid function within 2-3 weeks

SAQ

Q) What is myxedema coma? And how is it managed?

Myxedema coma is a condition of life threatening hypothyroidism , it is managed by:

- 1- loading dose of levothyroxine intravenously
- 2- I.V liothyronine for rapid response.
- 3- I.V hydrocortisone in case of adrenal and pituitary insufficiency.

MCQ
answers:
1)D
2)C
3)A
4)D
5)C



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References:

✓ Doctors' slides and notes



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