

Effects of thyroid hormones

- 1) Metabolism
- 2) Development (in young)

Metabolism

Action:

- ☛ \uparrow O_2 consumption (\uparrow heat production) calorogenic; in most tissues except (adult brain, spleen, lymph nodes, uterus, gonads, pituitary: \downarrow O_2 consumption)

Mechanism:

- ☛ \uparrow Size and number of mitochondria
- ☛ \uparrow Na^+ - K^+ ATPase
- ☛ \uparrow Respiratory enzymes (oxidative enzymes): uncoupling of oxidative phosphorylation

Secondary effects

1) CHO, fat, protein ↑ utilization for energy

☛ CHO

- ↑ Glucose absorption
- ↑ Gluconeogenesis
- ↑ Glycogenolysis
- ↑ Glucose utilization

☛ Fat

- Lipolysis → ↑ FFA
- ↓ LDL (↑ LDL receptors in liver)

☛ Protein

- Normal level → anabolism
- Excess → catabolism

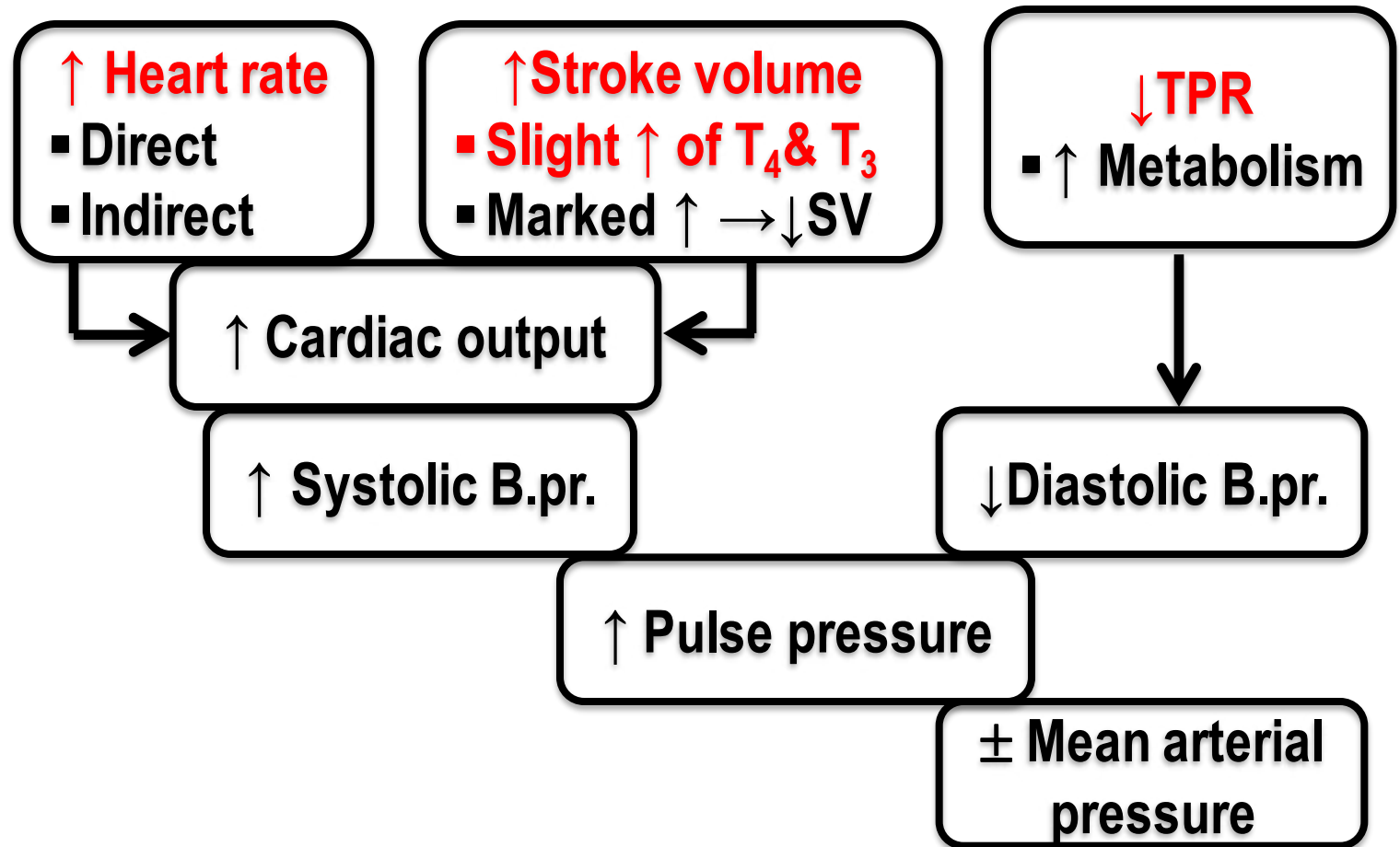
☛ **Vitamin** → ↑ requirement

	Output	Blood glucose	Utilization
Insulin	↓	↓	↑
Other hormones	↑	↑	↓
T4 & T3	↑	±	↑

Cardiomyopathy
Thyrotoxic Myopathy

2) Body systems (Thermogenesis & ↑ sensitivity to catecholamines)

◎ CVS



◎ CNS

- Nervousness, alertness, wakefulness (insomnia) due to ↑ sensitivity of reticular activating system to catecholamine

⊙ **Respiratory system**

- ↑Rate and depth of breathing (↑ metabolism → ↓ PO_2 and ↑ PCO_2)

⊙ **GIT**

- ↑ Motility & appetite

Growth and development (young)

⊙ **Mental**

- In utero and 1st few years
- Deficient thyroid hormones → mental retardation

⊙ **Physical**

- Dwarf (bone more than soft tissue)

⊙ **Sexual**

- Sterile

Disorders of thyroid hormones secretion

(hypothyroidism and hyperthyroidism)

◎ Causes

Hypothyroidism

1) Primary (thyroid)

- Chronic thyroiditis
(Hashimoto's thyroiditis)
- Chronic I₂ deficiency
- Drugs (antithyroid)
- Congenital
- Surgery and irradiation

2) Secondary (pituitary)

- ↓TSH

3) Tertiary (hypothalamus)

- ↓TRH

Hyperthyroidism

1) Thyroidal

- Grave's disease
Autoimmune disease
TSHR stimulating antibody
- Acute thyroiditis
- Multinodular goitre
- Toxic adenoma

2) Suprathyroidal

- Pituitary adenoma (↑TSH)

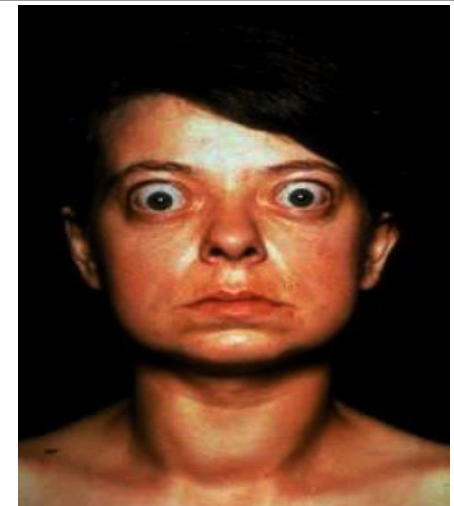
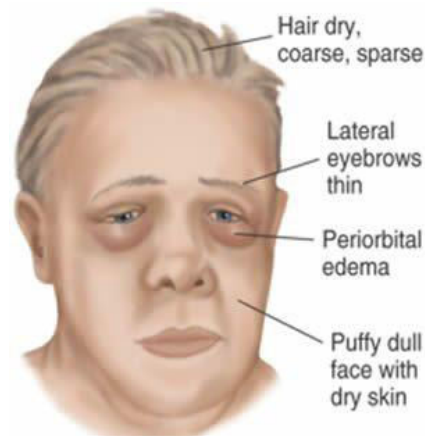
3) Excess levothyroxine therapy

◎ Features

		Hypothyroidism	Hyperthyroidism
1	Calorigenesis	<ul style="list-style-type: none">▪ ↓ Calorigenesis (↓ BMR)▪ Cold intolerance▪ ↑ Body weight (↓ appetite)	<ul style="list-style-type: none">▪ ↑ Calorigenesis (↑ BMR)▪ Hot intolerance▪ ↓ Body weight (↑ appetite)
2	Skin	<ul style="list-style-type: none">▪ Non pitting edema Myxedema (edema+mucin)▪ Dry▪ Cold▪ Yellow or pale (anemia and carotenemia)	<ul style="list-style-type: none">▪ Sweating (for heat elimination)▪ Warm (↑ blood flow)▪ Flushed (vasodilation)
3	Muscle	Weakness and fatigue	<ul style="list-style-type: none">▪ Weakness and tirednessProtein catabolism (thyrotoxic myopathy)

4	Body systems	↓ Activity	↑ Activity
	<ul style="list-style-type: none"> ▪ CNS ▪ CVS ▪ GIT ▪ Resp 	<ul style="list-style-type: none"> ▪ Slow movement, slow thought, somnolence ▪ Bradycardia ▪ Constipation ▪ Bradypnea 	<ul style="list-style-type: none"> ▪ Nervousness, insomnia, tremor ▪ Tachycardia ▪ Diarrhea ▪ Tachypnea

5	Others	Specific related to age <ul style="list-style-type: none"> ▪ Cretinism ▪ Myxedema (sever adult hypothyroidism) 	<ul style="list-style-type: none"> ▪ Goiter ▪ May exophthalmos
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⊙ Laboratory

Hypothyroidism			Hyperthyroidism		
	T ₃ T ₄	TSH		T ₃ T ₄	TSH
Primary	↓	↑	Thyroidal	↑	↓
Secondary	↓	↓	Suprathyroidal	↑	↑

⊙ Treatment

Hypothyroidism	Hyperthyroidism
Levothyroxine	Medical <ul style="list-style-type: none"> ▪ Antithyroid drugs ▪ B blockers
	Radioactive iodine
	Surgery (subtotal thyroidectomy)

Cretinism

- Hypothyroidism in infant
- Born a symptomatic (thyroxine from mother)

⊙ Mental

- Mental retardation

⊙ Physical

- Dwarf (bone more than soft tissue)

⊙ Sexual

- Sterile and impotence

⊙ Special features

- Eye (swollen eyelids)
- Nose (depressed)
- Tongue (large protruded)
 - ☞ Difficulty in breathing and swallowing
- Abdomen (pot belly)



- Treatment is by thyroxine soon after birth to prevent mental retardation (after 2 years BBB impermeable to thyroxine)