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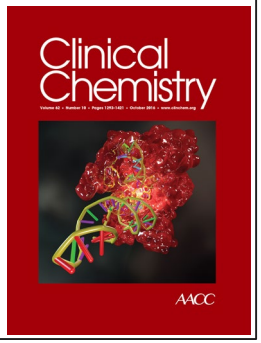
Better health through laboratory medicine.

PEARLS OF LABORATORY MEDICINE

Hypothyroidism

Zahra Shajani-Yi, PhD

Dartmouth-Hitchcock Medical Center



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Hypothyroidism

- Deficiency in thyroid hormone secretion and action
- 1-5% of the population
- Five to eight times more prevalent in women
- Risk increases with age
- Diagnosis based upon laboratory testing

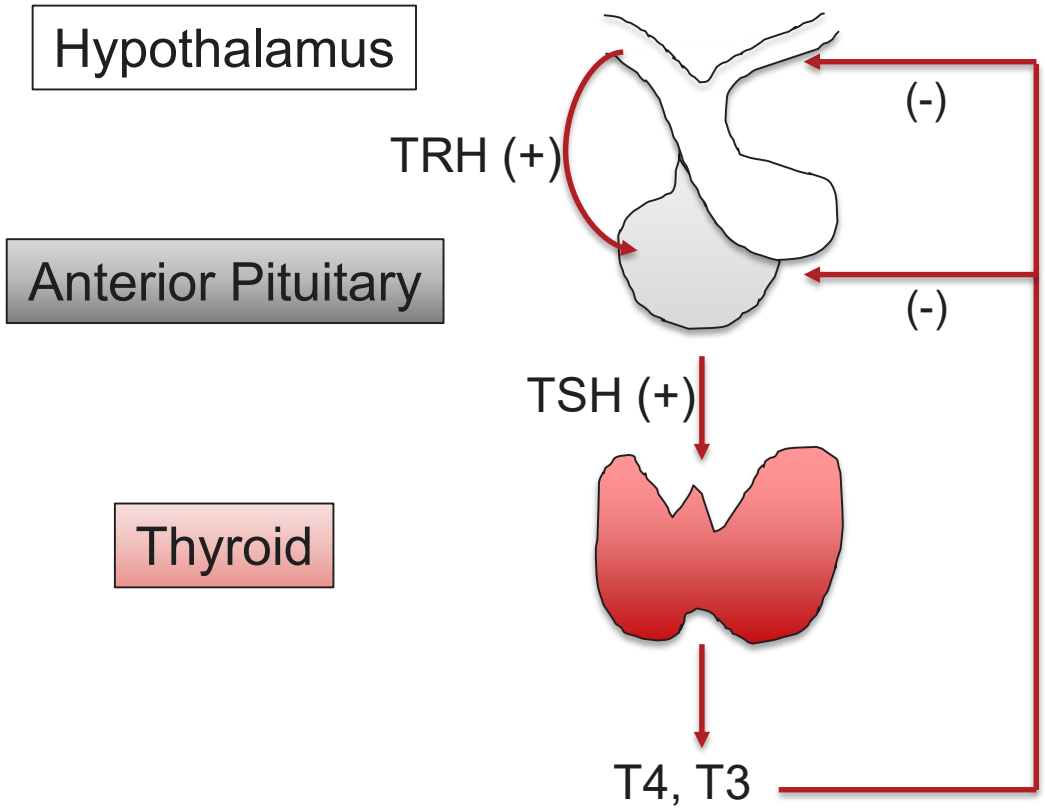
Clinical Symptoms

- Fatigue
- Somnolence
- Cold Intolerance
- Weight gain
- Constipation
- Shortness of breath
- Muscle weakness
- Hoarseness
- Hair Loss
- Menstrual Abnormalities
- Infertility
- Delayed puberty
- Cognitive dysfunction
- Mental delay
- Growth failure

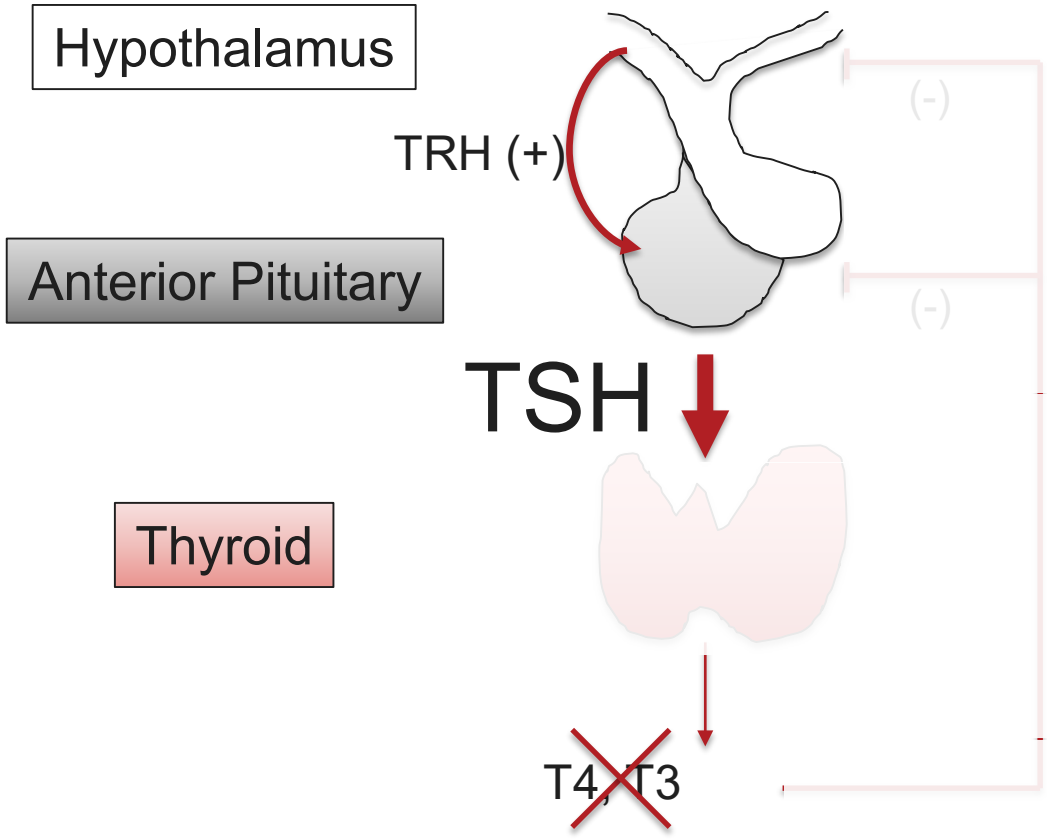
Clinical Signs

- Bradycardia
- Goiter
- Hypotension
- Puffy eyes
- Cool and or dry skin
- Mild Jaundice
- Edema
- Myopathy
- Delayed bone age in children
- Congestive Heart Failure or Coma (severe cases)

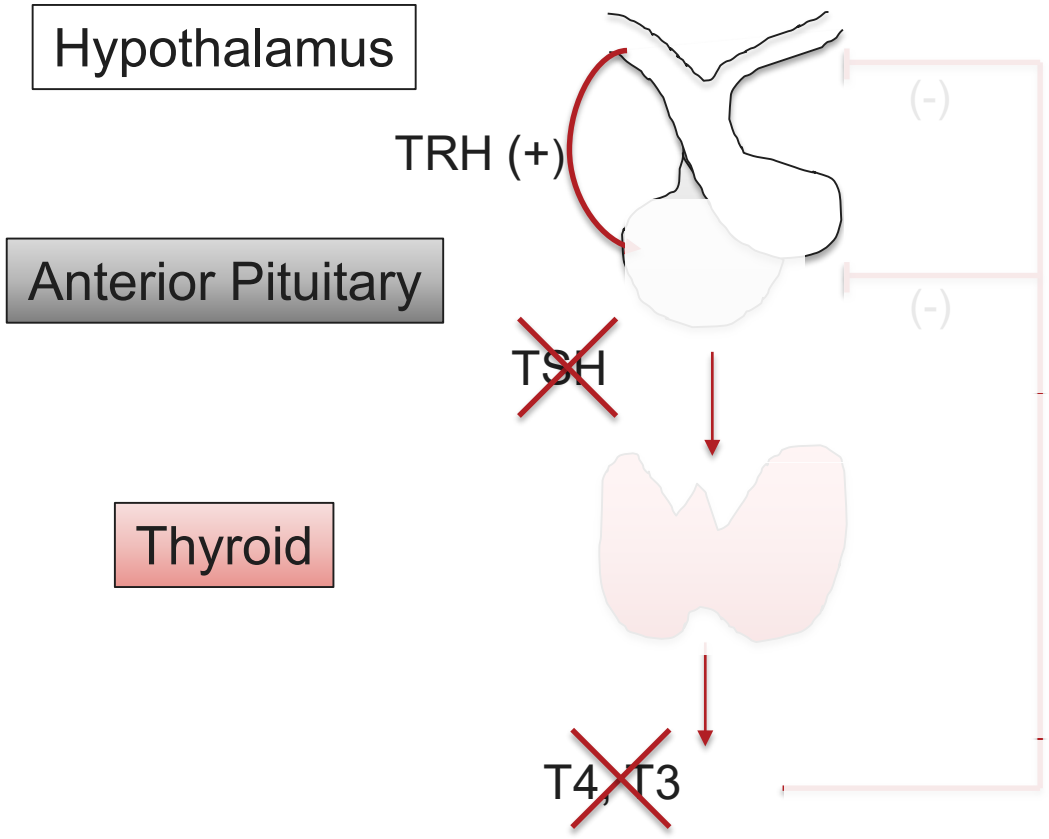
Regulation of Thyroid Hormone Synthesis



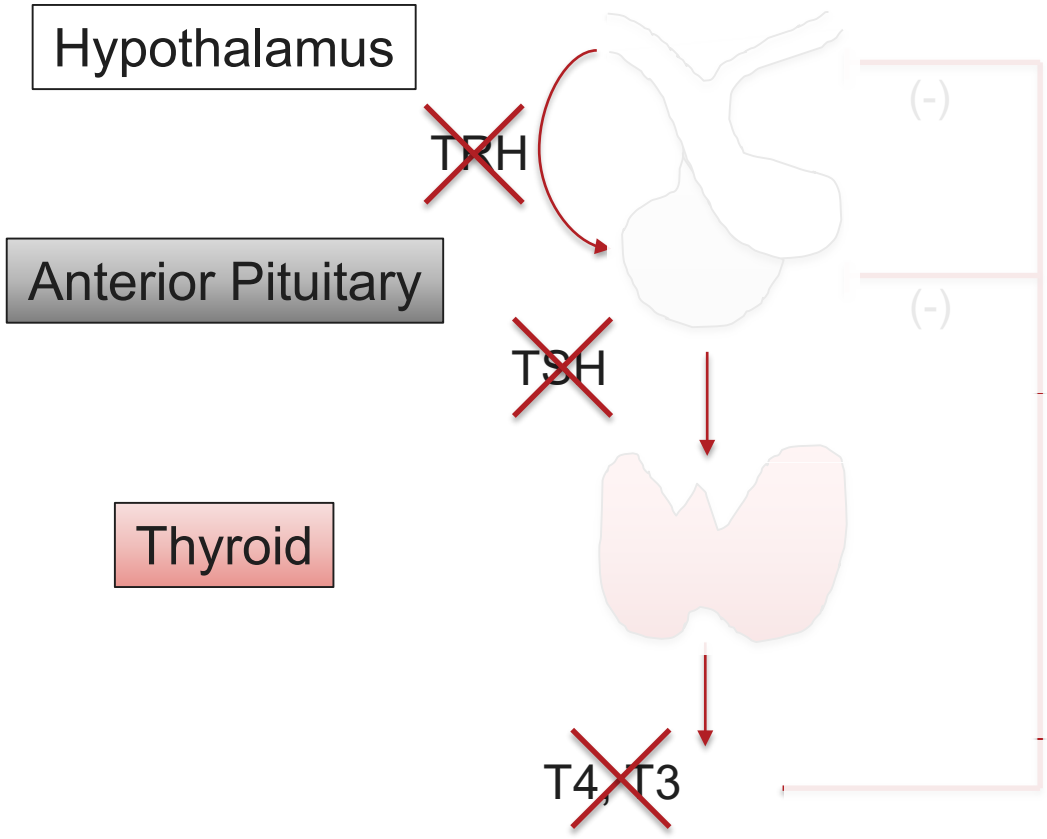
Primary Hypothyroidism



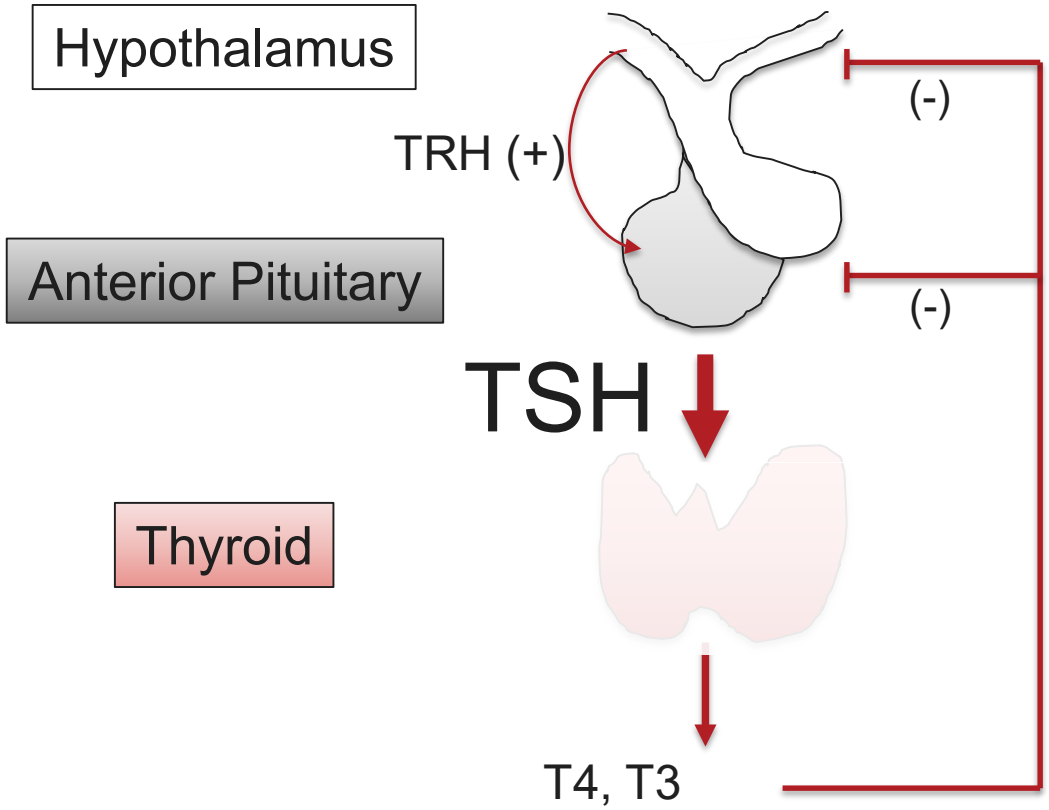
(Secondary) Central Hypothyroidism



(Tertiary) Central Hypothyroidism



Subclinical Hypothyroidism



Subclinical Hypothyroidism

- Normal free T4, Increased TSH
- Very common and increases with age
- High risk of progression to primary hypothyroidism
  - High TSH concentration
  - Presence of anti-thyroid peroxidase (anti-TPO) antibodies
- Treatment : Thyroid hormone (free T4) replacement
  - For TSH ≥ 10 mIU/L: Yes
  - For TSH between 4.5-10 mIU/L: Controversial

Hypothyroidism Classifications

- Primary Hypothyroidism
- Central Hypothyroidism
  - Secondary
  - Tertiary

Primary hypothyroidism accounts for 95% of hypothyroidism cases

- Subclinical Hypothyroidism

	TSH	Free T4	Total T3
Primary	High	Low	Low
Secondary	Low	Low	Low
Subclinical	High	Normal	Normal

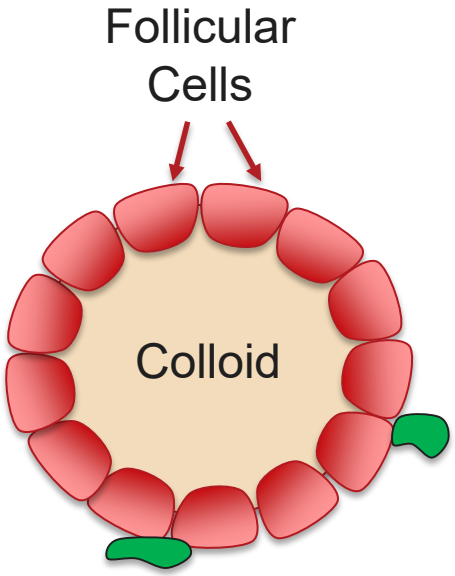
Main Causes of Primary Hypothyroidism

- Endogenous Causes
  - Autoimmune thyroid disease (AITD)
    - Hashimoto thyroiditis
    - Postpartum thyroiditis
  - Congenital
  - Consumptive

- Exogenous Causes
  - Iodine excess/deficiency
  - Drug-induced
  - Surgical removal or radiation therapy
  - Viral or bacterial thyroiditis

Autoimmune Hypothyroidism (AITD)

- Hashimoto thyroiditis
  - Also known as chronic autoimmune thyroiditis
  - Destruction of the thyroid follicular cells
  - Diffuse lymphocytic infiltration of the thyroid
  - >90 percent of patients have autoantibodies to thyroid peroxidase (TPO) or thyroglobulin (Tg)
  - May first present as transient hyperthyroidism (Hashitoxicosis)



Autoimmune Hypothyroidism (AITD)

- Postpartum thyroiditis
  - Often presents as transient hypothyroidism
  - Most women recover within one year postpartum
  - Consequence of a decline in immunosuppression after delivery
    - ~ 5% pregnancies,
    - ~10% of pregnancies in women with type 1 diabetes
    - Increased risk for women with TPO Ab

Congenital Hypothyroidism

- Most common congenital endocrine disorder
- Leads to intellectual disability if untreated
- At birth clinical signs are subtle
- Newborn screening
  - Initial T4; follow-up TSH if indicated
    - Would miss subclinical hypothyroidism
  - Initial TSH, confirmatory testing if indicated
    - Would miss central hypothyroidism

Iodine-induced Hypothyroidism

- Iodine deficiency
  - most common cause of hypothyroidism worldwide
  - most common cause of goiter
  - maternal hypothyroidism

- Iodine excess
  - Sudden exposure can cause hypothyroidism by
    - inhibiting iodide organification
    - inhibiting synthesis and release of thyroid hormones
    - known as the Wolff-Chaikoff effect

  - Permanent hypothyroidism can develop in patients with autoimmune thyroid dysfunction

Causes of Central Hypothyroidism

- Tumor
- Trauma
- Post-surgical damage
- Post-infection damage
- Subarachnoid hemorrhage
- Hereditary disorders (very rare)

Treatment and Prognosis

- Oral Administration of synthetic T4
- Proper dosing reverses all symptoms
- Prognosis with treatment is excellent with little to no increase in mortality rate
- Combination T4/T3 treatment is currently not recommended

Summary

- Hypothyroidism is a deficiency in thyroid hormone secretion and action

- Laboratory testing of TSH, free T4 and thyroid auto-antibodies are essential in establishing a diagnosis

	TSH	Free T4	Total T3
Primary	High	Low	Low
Secondary	Low	Low	Low
Subclinical	High	Normal	Normal

References

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Disclosures/Potential Conflicts of Interest

Upon Pearl submission, the presenter completed the Clinical Chemistry disclosure form. Disclosures and/or potential conflicts of interest:

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- **Patents:** None Declared

Related Pearls of Laboratory Medicine

- Thyroid Hormone Synthesis and Transport
- Thyrotoxicosis
- Thyroid Hormone Testing

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