**Thyroid Gland Defects - Dr. Tara**

### Thyroid Pituitary Axis
- TRH secreted in the hypothalamus stimulates production and secretion of TSH
- TSH stimulates secretion of T3, T4
- T4 has negative feedback on secretion of TSH & TRH

### Hypothyroidism
- Congenital
  - agenesis, dysplasia, or ectopy
  - defects in the organification of iodine
- Autoimmune destruction (Hashimoto thyroiditis)

### Epidemiology
- Incidence
  - Primary 1:400
  - Pituitary or hypothalamic 1:60,000-140,000
- Morbidity
  - Mental retardation
  - Growth delay
- Sex
  - 2:1 female-to-male

### Clinical features of congenital hypothyroidism
*Most infants are asymptomatic at birth and may need 6-12 wk to present with symptoms*
- Prolonged gestation
- Elevated birth weight
- Delayed deification after birth, constipation
- Prolonged indirect jaundice
- Poor feeding, poor management of secretions
- Hypothermia
- Decreased activity level
- Noisy respirations
- Hoarse cry

### Physical finding of congenital hypothyroidism
- Bradycardia
- Elevated weight, Sluggish behavior
- Rare cry or hoarse cry
- Large fontanelles
- Myxedema of the eyelids, hands, and/or scrotum
- Large protruding tongue
- Goiter, Umbilical hernia
- Delayed relaxation of deep tendon reflexes
- Cool dry skin
- Enlarged cardiac silhouette
- Hypothermia
Clinical features of Acquired hypothyroidism

- Goiter
- Slow growth, delayed osseous maturation, and increased weight
- Lethargy
- Dry skin, and puffiness
- Sleep disturbance, typically obstructive sleep apnea
- Cold intolerance and Constipation
- Sexual pseudoprecocity which resolves with thyroid treatment
- Galactorrhea in primary hypothyroidism

Physical findings of acquired hypothyroidism

- Decreased growth velocity
- Bradycardia
- Mild obesity
- Immature upper-to-lower body proportions
- Dry coarse hair
- Delayed dentition
- Precocious sexual development
- Cool, dry, carotenemic skin
- Brittle nails
- Delayed relaxation phase of deep tendon reflexes
- Goiter formation

TSH Level

- Physiologic surge within 30 min after birth and peak within 24hr > mIU/L 70mg/dl
- Drop to less than 10 mIU/L within the first 3 days
- Beyond the neonatal period drops to < 6 mIU/L

Investigations:

- Serum TSH
- Serum total T4
- Serum total T3
- Serum free T4 (or T3)
- Antithyroid antibody; Thyroglobulin, Thyroid peroxidase & TSH receptor antibodies

<table>
<thead>
<tr>
<th>Primary Hypothyroidism</th>
<th>Secondary Hypothyroidism</th>
<th>Low TBG</th>
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<tbody>
<tr>
<td>TSH</td>
<td>↑</td>
<td>Normal or ↓</td>
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<tr>
<td>T3</td>
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<td>Free T4</td>
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Treatment of congenital hypothyroidism

- Treatment should be initiated, immediately after obtaining blood for confirmatory tests after a positive screening test
- Delaying treatment after 6 weeks is associated with risk of delayed cognitive development
- Newborns with elevated TSH should be treated empirically with thyroid hormone replacement until they are aged 2 years then reassessed
- Thyroid tests should be measured 2 to 4 weeks after treatment is begun, every 1 to 2 months in the first 6 months of life, every 3 to 4 months between 6 months and 3 years of age, and regularly thereafter.

Treatment of chronic lymphocytic thyroiditis

- 20% of children recover to the euthyroid state
- After treatment beyond puberty, a 6-month trial off therapy should be considered, with monitoring of TSH and T4 levels every 3 months
- If serum TSH levels rise above the reference range, treatment should be resumed and continued for life
- Patients should undergo yearly monitoring of thyroid function

Hyperthyroidism

- Results from excessive secretion of thyroid hormone leading to accelerated metabolism in the peripheral tissues.
- Mainly due to Graves disease
- Rare in children

Causes

- Graves disease
- Toxic adenoma, toxic nodular goiter
- McCune-Albright syndrome
- Subacute (viral) thyroiditis
- Chronic lymphocytic thyroiditis
- Bacterial thyroiditis
- Pituitary adenoma
- Pituitary resistance to T4

Graves disease

- Triad of; hyperthyroidism, ophthalmopathy, and dermopathy
- Caused by thyroid-stimulating immunoglobulins
- Initial stimulus for the formation of TSI is not known

Symptoms

- Weight loss, despite excellent appetite
- Sweating
- Hyperactivity
- Heat intolerance
- Palpitations
- Fatigue
- Diarrhea
- Insomnia
- Deterioration in handwriting
- Hyperactivity and deteriorating school performance
Physical examination

- Nontender, symmetric enlargement of the thyroid gland (99%)
- Thyroid bruit 53%
- Tachycardia (82%) and wide pulse pressure (50%)
- Exophthalmos (proptosis) (66%),
- Smooth sweaty skin
- Tremor or muscle fasciculations
- Exaggerated deep-tendon reflexes (DTRs)
- Proximal muscle weakness
- Systemic hypertension
- Accelerated growth and early epiphyseal closure

Lab test

- T4
- T3
- Free T4
- Thyroid-stimulating hormone (TSH)
- CBP
- Technetium 99m (99m Tc) or 123I scan
- Graves disease have elevated levels of T4, T3, and low or undetectable levels of TSH.
- Elevated TSH level in a patient with thyrotoxicosis is extremely unusual and indicates altered regulation at the level of the pituitary gland

Associations between Graves and other autoimmune diseases

- Diabetes mellitus
- Addison disease
- Systemic lupus erythematosus
- Rheumatoid arthritis
- Myasthenia gravis
- Vitiligo
- Immune thrombocytopenic purpura
- Pernicious anemia
- Is more common in patients with trisomy 21

Neonatal Graves disease

- >1% of all cases of hyperthyroidism
- Frequency is equal in males and females
- Nearly all patients have a maternal history of Graves disease
- Caused by the transplacental passage of TSI
- Rarely, the mother has a history of (Hashimoto) thyroiditis
- These babies can be treated with methimazole, which is given to the mother.
- Self-limited and resolves when the child is aged 3-4 months
Symptoms of neonatal hyperthyroidism

- tachycardia, wide pulse pressure
- irritability, tremor
- hyperphagia with poor weight gain
- some may have exophthalmos and goiter.
- congestive heart failure (in severe cases)
- craniosynostosis and developmental delay (long term affects)

Complications

- Congestive heart failure
- Craniosynostosis (neonates)
- Developmental delay (neonates)
- Hypothyroidism

Treatment

- Depend on severity of disease and child age, options include;
- Antithyroid medication
- Radioiodine ablation
- Thyroidectomy
- Treatment of choice in pediatrics is antithyroid medication mainly Methimazol
- Propylthiouracil has more adverse effects

Warning

- Patients should be instructed to discontinue antithyroid medication and page the treating physician if they develop signs or symptoms of:
  - neutropenia (fever greater than 101°F, sore throat, mouth lesions, other concerning symptoms of infection)
  - hepatitis (right upper quadrant pain, jaundice) Blood tests (a complete blood count with differential and/or liver function tests) should be obtained urgently