Thyroid Disorders: Hypothyroidism and Hyperthyroidism - Comprehensive Overview

1 Definition

Thyroid disorders involve dysfunction of the thyroid gland, leading to abnormal thyroid hormone production. **Hypothyroidism** is characterized by insufficient thyroid hormone production, resulting in a slowed metabolism. **Hyperthyroidism** is marked by excessive thyroid hormone production, causing an accelerated metabolism. Both conditions affect multiple organ systems and require targeted management.

2 Etiopathogenesis

- **Hypothyroidism**:
  - **Primary Causes**: Hashimotos thyroiditis (autoimmune destruction), iodine deficiency, thyroidectomy, radioactive iodine therapy, or congenital thyroid dysgenesis.
  - **Secondary Causes**: Pituitary dysfunction (e.g., hypopituitarism) leading to reduced TSH secretion.
  - **Risk Factors**: Female gender, age >60, autoimmune diseases (e.g., type 1 diabetes), postpartum period, or family history.
- **Hyperthyroidism**:
  - **Primary Causes**: Graves disease (autoimmune stimulation of TSH receptors), toxic multinodular goiter, toxic adenoma, or thyroiditis (e.g., subacute, postpartum).
  - **Secondary Causes**: TSH-secreting pituitary adenoma (rare).
  - **Other Causes**: Excessive iodine intake, medications (e.g., amiodarone), or exogenous thyroid hormone use.
  - **Risk Factors**: Female gender, stress, smoking, family history of autoimmune disease.

3 Clinical Manifestations

- **Hypothyroidism**:

  - Fatigue, weight gain, cold intolerance.
  - Dry skin, hair loss, brittle nails.
  - Constipation, muscle cramps, joint pain.
  - Menstrual irregularities, infertility.
  - Cognitive impairment, depression.
  - **Complications**: Myxedema coma (severe), pericardial effusion, dyslipidemia.
- **Hyperthyroidism**:
  - Weight loss despite increased appetite, heat intolerance, sweating.
  - Palpitations, tachycardia, atrial fibrillation.
  - Tremors, anxiety, irritability.
  - Diarrhea, frequent bowel movements.
  - Menstrual irregularities, reduced fertility.
  - Goiter, exophthalmos (Graves disease).
  - **Complications**: Thyroid storm (severe), heart failure, osteoporosis.

4 Pathophysiology

The pathophysiology of thyroid disorders involves altered thyroid hormone production affecting metabolic processes. The flowchart below illustrates the mechanisms for hypothyroidism and hyperthyroidism.

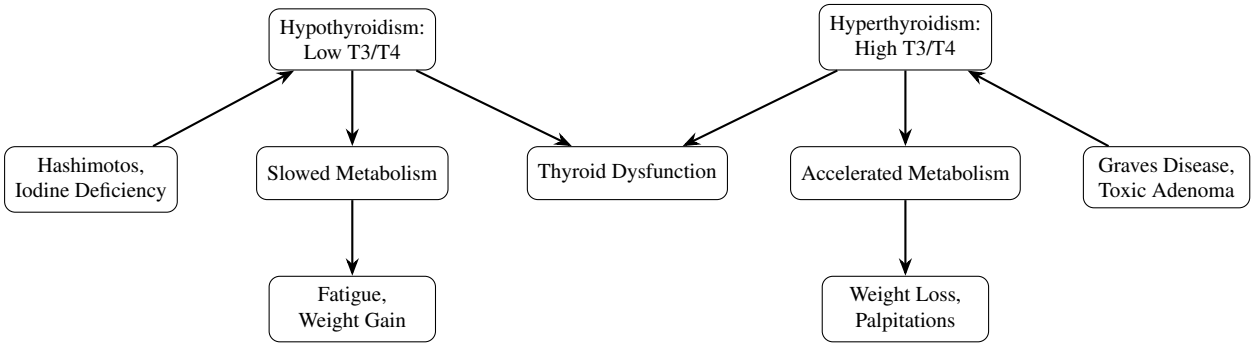

Figure 1: Pathophysiology of Thyroid Disorders

5 Symptoms

- **Hypothyroidism**:
  - Fatigue, lethargy, cold intolerance.
  - Weight gain, constipation.
  - Dry skin, hair loss, hoarseness.

  - Depression, memory impairment.
  - Bradycardia, muscle weakness.
- **Hyperthyroidism**:
  - Weight loss, heat intolerance, excessive sweating.
  - Palpitations, nervousness, tremors.
  - Increased appetite, diarrhea.
  - Insomnia, irritability.
  - Lid lag, stare, or proptosis (Graves disease).

6 Diagnosis

Diagnosis relies on clinical evaluation and thyroid function tests:

- **Hypothyroidism**:
  - **Lab Tests**: Elevated TSH, low free T4 (primary); low TSH and T4 (secondary).
  - **Autoantibodies**: Anti-thyroid peroxidase (TPO) or anti-thyroglobulin in Hashimotos.
  - **Other**: Lipid profile (dyslipidemia), anemia, elevated creatine kinase.
- **Hyperthyroidism**:
  - **Lab Tests**: Suppressed TSH, elevated free T4 and/or T3.
  - **Autoantibodies**: TSH receptor antibodies (TRAb) in Graves disease.
  - **Imaging**: Thyroid ultrasound or radioactive iodine uptake scan to identify cause (e.g., diffuse uptake in Graves, nodular uptake in adenoma).
- **Clinical Evaluation**: Assess symptoms, goiter, eye signs (Graves), and risk factors.

7 Nonpharmacological Management

Lifestyle and supportive measures complement medical therapy:

- **Hypothyroidism**:
  - **Diet**: Ensure adequate iodine intake (150 mcg/day); avoid goitrogenic foods (e.g., raw cruciferous vegetables) in excess.
  - **Exercise**: Regular physical activity to manage weight and improve energy.
  - **Patient Education**: Emphasize medication adherence and regular monitoring.
- **Hyperthyroidism**:
  - **Diet**: Adequate calorie and calcium intake to counter weight loss and bone loss.
  - **Smoking Cessation**: Reduces risk of Graves ophthalmopathy.

  - **Stress Management**: Relaxation techniques (e.g., yoga) to manage anxiety.
  - **Eye Care**: Artificial tears, sunglasses for Graves ophthalmopathy.
- **Monitoring**: Regular follow-up to assess thyroid function and complications.

8 Pharmacological Management

Medications aim to normalize thyroid hormone levels and manage symptoms:

- **Hypothyroidism**:
  - **Levothyroxine (T4)**: First-line, dosed 1.6 mcg/kg/day (e.g., 50–200 mcg/day), adjusted based on TSH levels. Taken on an empty stomach.
  - **Monitoring**: TSH every 6–8 weeks until normalized, then annually.
  - **Adjunctive**: Treat associated conditions (e.g., statins for dyslipidemia).
- **Hyperthyroidism**:
  - **Antithyroid Drugs**: Methimazole (10–30 mg/day) or propylthiouracil (PTU, 100–300 mg/day, preferred in pregnancy). Inhibits thyroid hormone synthesis.
  - **Beta-Blockers**: E.g., propranolol (10–40 mg 3–4 times/day) for symptom control (tachycardia, tremors).
  - **Radioactive Iodine (I-131)**: For definitive treatment in Graves or toxic nodules; may lead to hypothyroidism.
  - **Surgery**: Thyroidectomy for large goiter, nodules, or antithyroid drug intolerance.
  - **Other**: Glucocorticoids (e.g., prednisone) for severe Graves ophthalmopathy; cholestyramine for severe hyperthyroidism.