Disorders of the Thyroid Gland
Thyroid gland

- T4 = thyroxine
- T3 = triiodothyronine
- Two lobes connected by an isthmus
- TSH anterior pituitary
- TRH hypothalamic
- Endocrine feedback loop
- TSH used for the diagnosis of hyperthyroidism (TSH↓) and hypothyroidism (TSH↑)
Physical examination

- Examination of the neck → inspection
- Sitting position
- Obvious masses
- Palpation of thyroid behind the patient
- Asking to swallow sips of water
- Thyroid size, location, consistency of nodules, bruit over the thyroid, goiter
- Lymphadenopathy in the cervical and supraclavicular regions
Laboratory evaluation

- TSH screening test: suppressed, normal, elevated
- T4 and T3
- Circulating Abs against TPO and Tg → autoimmune thyroid disease
- TSI Abs → stimulate TSH-R → Graves´ disease
Radioiodine Uptake and Thyroid Scanning

- Iodine (I123, I125, I131)
- Tc 99m pertechnetate
- Graves’ disease: nuclear imaging → enlarged gland + increased tracer uptake distributed homogeneously
- Toxic adenoma: focal areas of increased uptake + suppressed tracer intake in the remainder of the gland
- Multinodular goiter: enlarged gland + multiple areas of increased and decreased tracer uptake
- Subacute thyroiditis: very low uptake
- Cold nodules: decreased tracer uptake → malignant 5-10%
Thyroid Ultrasound

- Nodular thyroid disease
- Cysts > 3 mm
- Ultrasound-guided FNA biopsy
Hypothyroidism

- Iodine deficiency
- Hashimoto's thyroiditis
- Treatment of hyperthyroidism
Congenital Hypothyroidism

- 1 in 4000 newborns
- Neonatal hypothyroidism ← thyroid gland dysgenesis
- TSH↑, T4↓
- Treatment: T4 10-15 μg/kg per day
Symptoms of Hypothyroidism

- Tiredness, weakness
- Dry skin
- Feeling cold
- Hair loss
- Difficulty concentrating, poor memory
- Constipation
- Weight gain with poor appetite
- Dyspnea
- Hoarse voice
- Menorrhagia
- Parethesia, impaired hearing
Signs of Hypothyroidism

- Dry skin, cool peripheral extremities
- Puffy face, hands, and feet ← myxedema
- Diffuse alopecia
- Bradycardia
- Peripheral edema
- Serous cavity effusions
- Carpal tunnel syndrome
Autoimmune Hypothyroidism

- Hashimoto’s thyroiditis, or goiter → goitrous thyroiditis
- Subclinical hypothyroidism
- Clinical hypothyroidism
- Annual incidence: 4 per 1000 patients
- Mean age: 60 years
Pathogenesis

- Hashimoto's: marked lymphocytic infiltration → activated CD4+ and CD8+ T cells and B cells
- Abs to Tg and TPO
Clinical Manifestations

- Goiter: irregular, firm in consistency
- No pain
- Dry skin, sweating↓
- Myxedema: skin thickening without pitting
- Pretibial myxedema, puffy face
- Hair loss, alopecia
- Constipation and weight gain
- Bradycardia
Clinical Manifestations 2.

- Pericardial effusion
- Pleural effusion
- Memory and concentration ↓
- Hoarse voice
Laboratory Evaluation

- TSH↑
- T4 and T3↓
- Abs to TPO
- FNA biopsy
- CPK↑
- Cholesterol and TG↑
- Anemia (normocytic)
Treatment of Hypothyroidism

- Levothyroxine (T4): 1,6 μg/kg body weight/day
- 50-150 μg/day
- Myxedema coma: Levothyroxine 500 μg iv./nasogastric tube, Liothyronine (T3) iv./nasogastric tube, external warming, Hydrocortisone iv. 50 mg every 6 h, ventilatory support
Thyrotoxicosis

- Hyperthyroidism
- State of thyroid hormone excess
- Graves’ disease
- Toxic multinodular goiter
- Toxic adenoma
Graves’ Disease

- 60-80% of thyrotoxicosis
- 20 and 50 years of age
- Elderly: symptoms may be subtle
Symptoms of Thyrotoxicosis

- Hyperactivity, irritability, nervousness, insomnia
- Heat intolerance and sweating
- Palpitations
- Fatigue and weakness
- Weight loss with increased appetite
- Diarrhea
- Polyuria
- Oligomenorrhea, loss of libido
Signs of Thyrotoxicosis

- Sinus tachycardia, atrial fibrillation
- Tremor
- Goiter → thyroid gland diffusely enlarged, firm consistency
- Warm, moist skin
- Muscle weakness, proximal myopathy
- Graves' ophthalmopathy, enlarged extraocular muscles, lid retraction, proptosis, periorbital edema, diplopia, compression of the optic nerve
- Gynecomastia
Laboratory Evaluation

- TSH↓
- T3 and T4↑
- Microcytic anemia
- Thrombocytopenia
- SeBi↑
- Liver enzymes↑
- Positive TSH-R Abs
- Positive TPO Abs
Clinical Course

- Clinical features worsen without treatment
- Ophthalmopathy worsens over the initial 3-6 months
Treatment of Graves’ Disease

- Antithyroid drugs: Methimazole, Propylthiouracil, Carbimazole
- Radioiodine (I131) treatment for elderly patients
- Subtotal or near-total thyroidectomy
- Propranolol or Bisoprolol
- Ophthalmopathy: artificial tears, high-dose steroids, Prednisone, Methylprednisolone, Cyclosporine, orbital decompression, external beam radiotherapy of the orbits
Treatment of Thyrotoxic crisis

- Life-threatening
- Large doses of Propylthiouracil orally or by nasogastric tube
- Iodide, Potassium iodide, Sodium iodide iv.
- Propranolol
- Dexamethasone
- Cooling
- Oxygen
- Iv. fluids
Thyroiditis

- Acute: bacterial infection (Staphylococcus, Streptococcus, Enterobacter), fungal infection (Candida, Aspergillus), radiation thyroiditis after I131 treatment, Amiodarone

- Subacute: viral, mycobacterial infection

- Chronic: Hashimoto’s thyroiditis
Acute Thyroiditis

- Rare
- Suppurative infection
- Thyroid pain
- Small, tender goiter
- Fever
- Erythema over the thyroid
Subacute Thyroiditis

- De Quervain’s thyroiditis
- Granulomatous thyroiditis
- Viral thyroiditis
- Radioactive iodine uptake low or undetectable
- Painful and enlarged thyroid
- Fever
- ESR↑ WBC↑
- FNA biopsy

Treatment: Aspirin (600 mg every 6 h), NSAID, steroids, Prednisone (40 mg/day)
Chronic Thyroiditis

- TPO Abs
- Hashimoto’s thyroiditis
- Firm or hard, nontender goiter
Diseases of the Parathyroid Gland

- 4 parathyroid glands
- PTH (parathyroid hormone)
- Calcium
- Vitamin D: 1,25-dihydroxyvitamin D
- PTH acts → bone and kidney
- Calcitonin: hypocalcemic peptide hormone
- PTHrP (parathyroid hormone-related protein) → hypercalcemia in malignancies
Causes of Hypercalcemia

I. Parathyroid-related
   A. Primary hyperparathyroidism
      1. Solitary adenomas
      2. Multiple endocrine neoplasia
   B. Lithium therapy
   C. Familial hypocalciuric hypercalcemia

II. Malignancy-related
   A. Solid tumor with metastases (breast)
   B. Solid tumor with humoral mediation of hypercalcemia (lung, kidney)
   C. Hematologic malignancies (multiple myeloma, lymphoma, leukemia)
Causes of Hypercalcemia 2.

III. Vitamin D-related
   A. Vitamin D intoxication
   B. ↑1,25 (OH)2 D, sarcoidosis and other granulomatous diseases
   C. Idiopathic hypercalcemia of infancy

IV. Associated with high bone turnover
   A. Hyperthyroidism
   B. Immobilization
   C. Thiazides
   D. Vitamin A intoxication
Causes of Hypercalcemia

V. Associated with renal failure
   A. Severe secondary hyperparathyroidism
   B. Aluminium intoxication
   C. Milk-alkali syndrome
Clinical features of Hypercalcemia

- Asymptomatic
- Fatigue, depression, mental confusion, anorexia, nausea, vomiting, constipation, increased urination, short QT interval, cardiac arrhythmias
- Calcium level > 2.9-3 mmol/L
- Severe hypercalcemia > 3.7-4.5 mmol/L, medical emergency → coma, cardiac arrest
Primary Hyperparathyroidism

- PTH↑
- Ca↑ P↓
- Recurrent nephrolithiasis
- Peptic ulcers
- Mental changes
- Extensive bone resorption
- Hypercalcemic parathyroid crisis
Etiology

- Parathyroid solitary adenomas
- Chronic renal failure $\rightarrow$ secondary hyperparathyroidism $\rightarrow$ parathyroid tumor
- Hereditary syndromes and multiple parathyroid tumors: part of multiple endocrine neoplasia syndrome
Signs and Symptoms of Hyperparathyroidism

- Asymptomatic 50-80%
- Recurrent nephrolithiasis → calcium oxalate, calcium phosphate
- Nephrocalcinosis
- Decreased renal function
- Bone→ ostitis fibrosa cystica
- Bone density↓
- Fracture risk↑
- Severe neuropsychiatric manifestations
- Proximal muscle weakness, atrophy of muscles
- Duodenal ulcer
- Pancreatitis
Diagnosis

- PTH↑
- Ca↑ P↓ or normal
Treatment of Hyperparathyroidism

- Medical surveillance versus surgical treatment

- Se Ca 3.7-4.5mmol/L + PTH↑ → surgery

- Most patients: hypercalcemia mild → no surgical/medical treatment → monitoring
Treatment of Malignancy-related Hypercalcemia

- Reduction of tumor mass
Hypercalcemia associated with Renal Failure

- Severe secondary hyperparathyroidism
- PTH↑
- Parathyroid gland hyperplasia
- Osteomalacia → PTH↑
- Bone pain → renal osteodystrophy
Treatment of Hypercalcemic States

- **Hydration**: Saline
- **Forced diuresis**: Furosemide, Ethacrynic acid
- **Calcitonin**
- **Bisphosphonates**: Etidronate, Pamidronate, Alendronate, Zolendronate, Risedronate
- **Steroids?**
- **Dialysis**
Hypocalcemia

- Se Ca < 2.1 mmol/L
- PTH Absent
  - Hereditary or acquired hypoparathyroidism
- PTH Ineffective
  - Chronic renal failure, Intestinal malabsorption
- PTH Overwhelmed
  - Tumor lysis, Acute renal failure, Rhabdomyolysis
Clinical symptoms of Hypocalcemia

- Muscle spasms
- Carpopedal spasm, laryngeal spasm
- Facial grimacing
- Irritability, psychosis
- QT interval prolonged
Treatment of Hypoparathyroidism

- High oral calcium intake
- Replacement with vitamin D