بسم الله الرحمن الرحيم
BENIGN THYROID DISORDERS

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• The Objectives of this lecture
• A brief reminder of the anatomy and physiology of the thyroid gland
• Discuss the different types of Benign Thyroid Disorders
  • 1- Swellings or Goiters;
  •   - Diffuse or Multi-Nodular Goiter
  •   - Solitary Thyroid Nodule
  • 2- Disorders of Function
  •   - Hypo-Thyroidism
  •   - Hyper-Thyroidism
• Clinically assessing and Investigating the thyroid gland
• Management of Patients with Thyrotoxicosis
• The different Surgical options
• Hypothyroidism, Hashimoto’s thyroiditis
OBJECTIVES

• Understand the anatomy and physiological functions of the thyroid gland
• Discuss the causes and types of goiters; MNG, toxic nodular goiter, toxic nodule
• Assessing and Investigating the thyroid gland
• Pathophysiology and management of Grave’s disease
• Discuss the treatment strategies for thyrotoxicosis; surgery, radioiodine, anti-thyroid drugs
• Understand the differences among various types of surgical strategies; lobectomy, S/T thyroidectomy, near-total thyroidectomy, total thyroidectomy
• Brief account about hypothyroidism, Hashimoto’s thyroiditis
PBL

- SWELLING IN THE NECK
- DYSPHAGIA
- DIFFICULTY BREATHING
- HYPO/HYPER-FUNCTION
- NECK PAIN
THYROID ANATOMY

- SHAPE
- POSITION
ANATOMY

The Thyroid gland develops from 2 sources :-

• The Thyroglossal Duct (Base of Tongue at Foramen Cecum)
  •  ⬤Pyramidal Lobe + Isthmus.
• Ultimo-branchial Bodies
  •  ⬤ Lateral Lobes
ANATOMY

CONGENITAL ANOMALIES

• Agenesis
• Incomplete Descent
• Thyroglossal Cyst / Fistula
• Extended Descent
• Retrosternal Thyroid
ANATOMY

ARTERIAL SUPPLY

- Superior Thyroid
- Inferior Thyroid
- Thyroidae ima
- Esophageal and Tracheal branches
ANATOMY

VENOUS DRAINAGE

• Superior Thyroid
• Middle Thyroid
• Inferior Thyroid
ANATOMY

LYMPHATIC DRAINAGE

– Deep Cervical
– Pre-Tracheal
– Pre-Laryngeal (Delphian)
ANATOMY

RELATIONS

- PARATHYROID GLANDS
  - Superior
  - Inferior
ANATOMY

RELATIONS

- RECURRENT LARYNGEAL NERVE
THYROID PHYSIOLOGY

- Biosynthesis
- Release
- Transport
- Feedback

The hypothalamus and the pituitary in the brain control the normal secretion of thyroid hormones which in turn controls metabolism.
PHYSIOLOGY

BIOSYNTHESIS OF THYROID HORMONES:

1. Iodide Trapping and concentration
2. Oxidation of iodide to iodine
3. Iodine Organification (linkage with tyrosine)
4. Coupling of Iodotyrosines to form T3 and T4
RELEASE OF HORMONES:

1. Hydrolysis of Thyroglobulin
2. Passage of Iodotyrosin into Circulation
PHYSIOLOGY

TRANSPORT:

1. TBG
2. TBA
3. Free T3 & T4
PHYSIOLOGY

FEEDBACK CONTROL:

▪ Positive (central)
  Hypothalamus secretes TRH

▪ Negative (peripheral)
  Free T4 suppresses TSH
THYROID DISEASE

• Functional Abnormalities
• Masses
• Both
TYPES OF GOITERS (THYROID ENLARGEMENT)

- MULTINODULAR GOITER
- DIFFUSE GOITER
- SOLITARY THYROID NODULE
- TOXIC NODULE
ASSESSMENT OF THYROID DISEASE

• HISTORY
• EXAMINATION
• LAB (TFT)
• IMAGING
  • - NUCLEAR SCAN (\(^{123}\text{I}\))
  • - U/S
• FNAC
• FURTHER IMAGING
  • - C.T.
  • - M.R.I.
HISTORY

• Thyroid nodule
• Clinical Outline
• A comprehensive **history and physical examination** provides the foundation for decision making in the management of thyroid nodules. A number of **features** in the patient's history and physical examination significantly influence the statistical probability of malignancy in a thyroid nodule.
HISTORY

– Symptoms
– Hoarseness
– Exposure to Radiation
– F.H.
– I deficiency area
– Goitrogens
Factors suggesting a benign diagnosis include the following:

1. Family history of autoimmune disease (eg, Hashimoto thyroiditis)
2. Family history of benign thyroid nodule or goiter
3. Presence of thyroid hormonal dysfunction (eg, hypothyroidism, hyperthyroidism)
4. Pain or tenderness associated with nodule
5. Soft, smooth, and mobile nodule
HISTORY

• Factors suggesting a malignant diagnosis include the following:
  
  • 1- **Age** <20 yrs or >70 yrs
  • 2- **Male**
  • 3- **Solid nodules** > 3cm
  • 4- **dysphagia or dysphonia**
  • 5- **History of neck irradiation**
  • 6- **History of thyroid carcinoma**
  • 7- **Firm, hard, or immobile nodule**
  • 8- **Presence of cervical lymphadenopathy**
EXAMINATION

– Inspection
– Palpation (from behind)
  ➢ Mass
    ▪ Uniform enlargement
    ▪ Unilateral Mass
    ▪ Cx L.N.
– Percussion
– Auscultation
LABORATORY

• Thyroid function tests (TFT)
  – TSH (Thyrotropin)
  – Total Thyroxin TT\textsubscript{4} and Free Thyroxin FT\textsubscript{4}
  – Total Triiodothyronine TT\textsubscript{3} and Free Triiodothyronine FT\textsubscript{3}
LABORATORY

- If Hashimoto’s Thyroiditis is suspected from family history ;-
  - Anti-Thyroid PerOxidase (anti-TPO) antibody
  - Anti-Thyroglobulin (anti-Tg) antibody levels.
Imaging studies

- Thyroid scintigraphy (radionuclide scanning)
- Ultrasonography
- CT scanning or MRI
Imaging studies

- Thyroid scintigraphy (radionuclide scanning)
  - Not performed routinely
  - Hot, Warm, or Cold based on isotope uptake.
  - Hot nodules are rarely malignant.
ASSESSMENT OF THYROID DISEASE

- NUCLEAR SCAN ($^{123}$I)
Imaging studies

- **Ultrasonography**
  - Highly sensitive (re: size and number of nodules).
  - Cannot on its own distinguish benign from malignant.
  - Can be helpful in guiding FNAB (nonpalpable or small nodules)
ASSESSMENT OF THYROID DISEASE

• U/S
Fine-needle aspiration biopsy FNAB

- The most important step in the diagnostic evaluation of thyroid nodules.
- Highly accurate
  - mean sensitivity higher than 80%
  - mean specificity higher than 90%.
- Accuracy depends on:
  1 - The cytopathologist's expertise and experience
  2 - The technical skill of the physician performing FNAB
- Highly cost-effective
ASSESSMENT OF THYROID DISEASE

- FNAC
Fine-needle aspiration biopsy FNAB

• Limitations of FNAB include:-
  • 1- Hypocellular aspirates
  • (in cystic nodules or poor technique).
  • 2- Follicular lesions
  • 3- Hürthle cells lesions
Fine-needle aspiration biopsy FNAB

• The recommended thyroid FNAB diagnostic categories in the Bethesda System for Reporting Thyroid Cytopathology and the respective risk of malignancy associated with each include:
  • 1- Benign  < 1%
  • 2- Atypia of undetermined significance  5-10%
  • 3- Follicular neoplasm  20-30%
  • 4- Suspicious for malignancy  50-75%
  • 5- Malignancy  100%
  • 6- Nondiagnostic
Imaging studies

• **CT scanning or MRI**
  - Not cost-effective as initial evaluation tools.
  - May be useful in assessing retrosternally extending masses.
  - CT scan–guided FNAB may be required in some cases.
  - Useful in assessing malignant spread
Imaging studies

• C.T.
Imaging studies

- M.R.I.
THYROID DISEASE

- Masses
- Functional Abnormalities
- Both
GOITRE

Definition:

= Enlargement of the Thyroid Gland
GOITRE

TYPES / CAUSES:

- PHYSIOLOGICAL
- IODINE DEFICIENCY
- INGESTION OF GOITROGENS
- THYROTOXIC
- MULTINODULAR
- MALIGNANT
- THYROIDITIS
GOITRE

PHYSIOLOGICAL:

- Puberty
- Pregnancy
- Menopause
GOITRE

IODINE DEFICIENCY

Endemic Goitre
GOITRE

INGESTION OF GOITROGENS

• Turnips, Cauliflower, Soyabeans, Fluoride excess, Calcium excess (prevent iodine uptake & synthesis of Thyroxin)
• Anti-Thyroid Treatment
• Lithium salts (for depression)
GOITRE

THYROTOXIC

❑ Autoimmune (Graves’ Disease)
❑ Multinodular Toxic (Plummer’s disease)
GOITRE

MULTINODULAR GOITRE:
GOITRE

MALIGNANT GOITRE:
- Papillary Carcinoma
- Follicular Carcinoma
- Medullary Carcinoma
- Anaplastic Carcinoma
- Lymphoma
GOITRE

THYROIDITIS:
- Acute Thyroiditis
- Subacute Thyroiditis
- Chronic Specific Thyroiditis
- Chronic Non-specific Thyroiditis
GOITRE

THYROIDITIS:

- Acute Thyroiditis
GOITRE

THYROIDITIS:

- Subacute Thyroiditis (De Quervain’s Disease)
  - ? Viral
GOITRE

THYROIDITIS:

- Chronic Specific Thyroiditis (Tuberculosis and Syphilis)
GOITRE

THYROIDITIS:

- Chronic Non-specific Thyroiditis:
  - Hashimoto’s Disease
    - Autoimmune
    - May be familial
  - Riedle’s Disease
DISORDERS OF FUNCTION

- HYPERTHYROIDISM
- and THYROTOXIC CRISIS
- HYPOTHYROIDISM
- and HASHIMOTO’S
HYPERTHYROIDISM (THYROTOXICOSIS):

- **Primary**
  - Graves’ disease
  - Plummer’s disease

- **Secondary**
  - TSH secreting pituitary adenoma

- **Other causes**
  - Thyroiditis--leak of thyroid hormone
  - Factitious hyperthyroidism
  - Functioning Thyroid CA wit mets
Graves' disease is a common cause of hyperthyroidism, an over-production of thyroid hormone, which causes enlargement of the thyroid and other symptoms such as exophthalmos, heat intolerance and anxiety.
GRAVES’ DISEASE

- 6F:1M
- Autoimmune (Anti-thyroid antibodies)
- Genetic Factors
- Extra-Thyroidal manifestations
PLUMMER’S DISEASE

• Toxic Nodular Goitre
• Milder than Graves’ disease
• No extra-Thyroidal manifestations
• No anti-thyroid antibodies
DISORDERS OF FUNCTION

- TREATMENT:
  - ANTI-THYROID Rx
  - RADIO-THERAPY
  - SURGERY
Thyroid storm (Thyrotoxic crisis)

- A life-threatening, Fatal hypermetabolic state if left untreated.
- Excessive release of thyroid hormones in thyrotoxic patients.
- Precipitated by Several factors including trauma and surgery.
- May be the initial presentation of thyrotoxicosis in undiagnosed Pts.
- Presentation includes fever, tachycardia, hypertension, neurological and GI abnormalities.
- Hypertension may be followed by congestive heart failure that is associated with hypotension and shock.
- Diagnosis is primarily clinical.
Thyroid storm (Thyrotoxic crisis)

- History
  - Previously diagnosed thyrotoxicosis.
  - Symptoms of hyperthyroidism.
- General symptoms
  - Fever
  - Profuse sweating
  - Adequate feeding and weight loss
  - Respiratory distress
  - Fatigue (more common in older adolescents)
Thyroid storm (Thyrotoxic crisis)

- GI symptoms
- Nausea and vomiting
- Diarrhea
- Abdominal pain
- Jaundice
- Neurologic symptoms
- Anxiety (more common in older adolescents)
- Altered behavior
- Seizures, coma
Thyroid storm (Thyrotoxic crisis)

- **Differential Diagnoses**
- Anxiety Disorder: Panic Disorder
- Heart Failure, Congestive
- Hypertension
- Hyperthyroidism
- Pheochromocytoma
- Supraventricular Tachycardia, Atrial Ectopic Tachycardia
Thyroid storm (Thyrotoxic crisis)

• **Laboratory Studies**
• A Clinical Diagnosis, do not delay treatment pending laboratory confirmation.
• **1- Thyroid studies:**
• Consistent with hyperthyroidism.
• Performed only in undiagnosed patients
• Test results are not received immediately and are unhelpful for crisis management.
Thyroid storm (Thyrotoxic crisis)

- **Laboratory Studies**
- **2- CBC count:**
  - Mild leukocytosis, with a left shift.
- **3- Liver function tests (LFTs):**
  - Nonspecific abnormalities such as elevated ALT, AST, LDH, CK, Alk Phos. and serum bilirubin.
- **4- ABG and electrolytes:**
  - to assess and monitor short-term management.
- **5- Hypercalcemia:**
  - May occur from thyrotoxicosis
Thyroid storm (Thyrotoxic crisis)

- **Imaging Studies**
  - The following imaging studies may be indicated:
  - 1- **Chest radiography:**
    - May reveal cardiac enlargement or pulmonary edema due to congestive heart failure.
  - 2- **CT scanning:**
    - Head CT scanning may be necessary to exclude other neurologic conditions if diagnosis is uncertain.
  - 3- **Other Tests:**
    - ECG in monitoring for cardiac arrhythmias, esp. atrial fibrillation, less commonly, atrial flutter and ventricular tachycardia may also occur.
Thyroid storm (Thyrotoxic crisis)

- **Medical Care (In an ICU setting)**
  - 1- Initial stabilization
  - Immediately provide supplemental oxygen, ventilatory support, and intravenous fluids. (Dextrose solutions)
  - 2- Correct electrolyte abnormalities.
  - 3- Treat cardiac arrhythmia, if necessary.
  - 4- Control hyperthermia by ice packs and cooling blankets and acetaminophen
  - 5- Propranolol
Thyroid storm (Thyrotoxic crisis)

• **Medical Care**
  
  6- **Antithyroid medications** to block further synthesis of thyroid hormones (THs).
  
  High-dose **propylthiouracil** (PTU) is preferred because of its early onset of action and capacity to inhibit peripheral conversion of T4 to T3.
  
  PTU should be reserved for use in those who cannot tolerate other treatments such as methimazole, radioactive iodine, or surgery.
  
  PTU is considered as a second-line drug therapy, except in patients who are allergic or intolerant to methimazole, or for women who are in the first trimester of pregnancy.
Thyroid storm (Thyrotoxic crisis)

- The FDA recommends the following criteria be considered for prescribing PTU:
  - Reserve PTU use during first trimester of pregnancy, or in patients who are allergic to or intolerant of methimazole.
  - Closely monitor PTU therapy for signs and symptoms of liver injury, especially during the first 6 months after initiation of therapy.
  - PTU should not be used in pediatric patients unless the patient is allergic to or intolerant of methimazole, and no other treatment options are available.
Thyroid storm (Thyrotoxic crisis)

- **7-** Administer iodine compounds (Lugol iodine or potassium iodide) orally or via a nasogastric tube to block the release of THs (at least 1 h after starting antithyroid drug therapy). If available, intravenous radiocontrast dyes can be effective in this regard. These agents are particularly effective at preventing peripheral conversion of T4 to T3.

- **8-** Administer glucocorticoids to decrease peripheral conversion of T4 to T3. To prevent relative adrenal insufficiency due to hyperthyroidism.

- **9-** Treat the underlying condition, if any, that precipitated thyroid storm and exclude comorbidities such as diabetic ketoacidosis and adrenal insufficiency. Infection should be treated with antibiotics.

- **10-** Rarely, as a life-saving measure, plasmapheresis has been used to treat thyroid storm in adults.
Thyroid storm (Thyrotoxic crisis)

- Note that:
  - Iodine preparations should be discontinued once the acute phase resolves.
  - Glucocorticoids should be weaned.
  - The dose of thioamides adjusted to maintain thyroid function in the normal range.
  - Beta-blockers may be discontinued once thyroid function normalizes.
  - If the patient is given PTU during treatment of thyroid storm, this should be switched to methimazole at the time of discharge unless methimazole is contraindicated.
Thyroid storm (Thyrotoxic crisis)

- **Medication Summary**
- Reduce hyperadrenergic effects of thyroid hormone (TH) on peripheral tissues with use of beta-blockers (eg, propranolol, labetalol);
- Decrease further synthesis of THs with antithyroid medications (eg, propylthiouracil [PTU], methimazole);
- Decrease hormonal release from the thyroid, using iodides;
- Prevent further TH secretion and peripheral conversion of T4 to T3, using glucocorticoids or iodinated radiocontrast dyes when available.
Thyroid storm (Thyrotoxic crisis)

- **Drugs used in treating Thyroid Storm:**
  - **1- Propylthiouracil (PTU)**
  - Inhibits synthesis of TH by preventing organification and trapping of iodide to iodine and by inhibiting coupling of iodotyrosines; also inhibits peripheral conversion of T4 to T3, an important component of management.
Thyroid storm (Thyrotoxic crisis)

- **2- Methimazole**
  - At least 10 times more potent than PTU on a weight basis.
  - Inhibits synthesis of TH by preventing organification of iodide to iodine and coupling of iodotyrosines but does not inhibit peripheral conversion of T4 to T3.
  - May be used instead of PTU in thyroid storm if iodinated radiocontrast agents are used in conjunction to prevent the conversion of T4 to T3 or if the condition is not life-threatening.
Thyroid storm (Thyrotoxic crisis)

- **3- Iodides**
  - **Potassium iodide and Lugol Solution**
  - Iodides inhibit the release of TH from the thyroid gland. Precede iodide administration with thionamides by at least 1 hour to prevent increased intrathyroidal TH synthesis. Iodinated radiographic contrast dyes that contain ipodate (Oragrafin) or iopanoic acid (Telepaque) have also been used and effectively prevent conversion of T4 to T3.
Thyroid storm (Thyrotoxic crisis)

- **4- Propranolol**
  - A nonselective beta–adrenergic antagonist. Decreases heart rate, myocardial contractility, BP, and myocardial oxygen demand. Often the only adjunctive drug needed to control thyroid storm symptoms.
  - The mainstay therapy to control autonomic effects of TH. Beta-blockers also block peripheral conversion of T4 to T3.
  - Beta-blockers should be used with caution in congestive cardiac failure and thyrotoxic cardiomyopathy.
**Thyroid storm (Thyrotoxic crisis)**

- **5- Hydrocortisone**
- May help ameliorate decreased adrenal reserve.
- Blocks conversion of T4 to T3.
SOLITARY THYROID NODULE

CAUSES:

- Adult Adenoma
- Cystadenoma
- Fetal Adenoma
- Malignant Nodule
- Toxic Nodule (Plummer’s Disease)
- Prominent Nodule of Multinodular Goitre
- Tuberculoma
- Syphilitic Gumma
- Localised Hashimoto’s Disease
- Localised Riedle’s Disease
- Thyroglossal cyst in isthmus

Diagram:

1. History of radiation
   - Yes
   - FNAC
     - Malignant
       - Thyroidectomy
     - Suspicious
       - 123I scanning
         - Cold
           - Thyroxine Tx
         - Hot
           - Nodule Regresses
             - Yes
             - Continue follow-up
             - No
               - Thyroidectomy
               - Rebiopsy
             - Benign
   - No
2. FNAC
   - Malignant
     - Thyroidectomy
   - Suspicious
     - 123I scanning
       - Cold
         - Thyroxine Tx
       - Hot
         - Nodule Regresses
           - Yes
           - Continue follow-up
           - No
             - Thyroidectomy
             - Rebiopsy
   - Benign
SOLITARY NODULE

• HIGH RISK GROUP:
  – Low dose Radiation at childhood
  – Child and Elderly
  – Solid nodule
  – Cyst > 4cm
  – Cold nodule
SURGICAL OPTIONS

- LOBECTOMY and Isthmusectomy
- SUBTOTAL (NEAR TOTAL) THYROIDECTOMY
- TOTAL THYROIDECTOMY
DISORDERS OF FUNCTION

HYPOTHYROIDISM

- coarse and thin hair
- mental slowing
- apathy
- tiredness
- pale puffy face
- hoarse voice
- goitre
- slowing of activity
- muscle weakness in upper arms and legs
- bowel - constipation
- weight gain
- intolerance to cold
- decreased sweating
- cold, dry skin

Primary hypothyroidism: thyroid can't produce amount of hormones pituitary calls for
Secondary hypothyroidism: thyroid isn't being stimulated by pituitary to produce hormones

Symptoms of hypothyroidism
DISORDERS OF FUNCTION

- **HYPOTHYROIDISM**

  - Hypothyroidism
    - In hypothyroidism, the thyroid gland can be small or large (goiter), depending on the cause of low levels of thyroid hormone.
    - Atrophied thyroid

  - Symptoms:
    - Slow heartbeat
    - Arthritis
cold intolerance
depression
dry skin
fatigue
forgetfulness
heavy menstrual periods
infertility
muscle aches

  - Hypothyroidism:
    - Hair loss
    - Bulging eyes
    - Sweating
    - Enlarged thyroid (goiter)
    - Rapid heartbeat
    - Difficulty sleeping
    - Heat intolerance
    - Infertility
    - Irritability
    - Muscle weakness
    - Nervousness
    - Scant menstrual periods
    - Weight loss
    - Frequent bowel movements
    - Warm, moist palms
    - Tremor of fingers
    - Weight gain
    - Constipation
    - Brittle nails
HASHIMOTO'S THYROIDITIS

• - An autoimmune thyroid disease
• - The most common cause of hypothyroidism in the United States in individuals older than 6 years.
HASHIMOTO'S THYROIDITIS

• **Symptoms and Signs**
  • Hypothyroidism typically has an **insidious onset** with subtle signs and symptoms that progress to more advanced signs and symptoms over months to years.
  • Hypothyroidism may also be **subclinical**, diagnosed on routine screening of thyroid function.
  • Patients may have **nonspecific symptoms** that are difficult to attribute to thyroid dysfunction.
  • May not improve with thyroid hormone supplementation.
HASHIMOTO'S THYROIDITIS

- Early nonspecific symptoms may include the following:
  - Fatigue
  - Constipation
  - Dry skin
  - Weight gain
HASHIMOTO'S THYROIDITIS

- More advanced/florid symptoms may include the following:
  - Cold intolerance
  - Voice hoarseness and pressure symptoms in the neck from thyroid enlargement
  - Slowed movement and loss of energy
  - Decreased sweating
  - Mild nerve deafness
  - Peripheral neuropathy
  - Galactorrhea
  - Depression, dementia, and other psychiatric disturbances
  - Memory loss
  - Joint pains and muscle cramps
  - Hair loss
  - Menstrual irregularities
  - Sleep apnea and daytime somnolence
HASHIMOTO'S THYROIDITIS

• **Signs include :-**
  - Puffy face and periorbital edema
  - Cold, dry skin, which may be rough and scaly
  - Peripheral nonpitting edema of hands and feet
  - Thickened and brittle nails (may appear ridged)
  - Bradycardia
  - Elevated blood pressure (typically diastolic hypertension)
  - Diminished tendon reflexes with a prolonged relaxation phase
  - Macroglossia
  - Slow speech
  - Ataxia
HASHIMOTO'S THYROIDITIS

- **Laboratory studies:**
  - **Serum TFT levels:**
    - Low T4 levels, Low T3 level and high TSH levels
  - **Thyroid autoantibodies:**
    - Presence anti-TPO (anti-thyroid peroxidase) and anti-Tg (anti-thyroglobulin) antibodies
    - 10-15% of patients with Hashimoto thyroiditis may be antibody negative
HASHIMOTO'S THYROIDITIS

• Imaging tests
  - Ultrasonogram

• Procedures
  - FNAB:
  - Hashimoto thyroiditis is a histologic diagnosis.
  - To exclude malignancy or the presence of a thyroid lymphoma
HASHIMOTO'S THYROIDITIS

• **Management**
  - Thyroid hormone replacement, usually for life.
  - Indications for surgery include the following:
    - 1- A large goiter with obstructive symptoms, such as dysphagia, voice hoarseness, and stridor, caused by extrinsic obstruction of airflow
    - 2- Presence of a malignant nodule, as demonstrated by cytologic examination
    - 3- Presence of a lymphoma diagnosed on fine-needle aspiration
    - 4- Cosmetic reasons (eg, large, unsightly goiters)