Therapeutic areas – Part 3

Endocrinology

Module 4 Topic 6_3

Endocrinology

- Endocrine system consists of a group of glands and organs that regulate and control various body functions by producing and secreting hormones
- hormones serve as messengers, controlling and coordinating activities throughout the body
- *Endocrine* glands release their hormones directly into the *bloodstream*

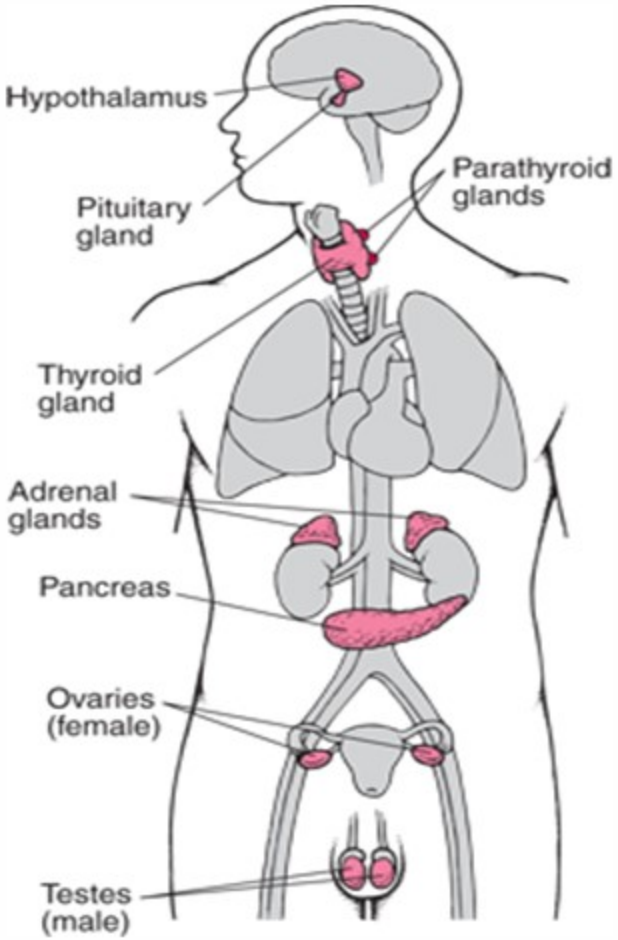
Endocrinology

Major Endocrine Glands

- Hypothalamus
- Pituitary gland
- Thyroid gland
- Parathyroid glands
- Islet cells of the pancreas
- Adrenal glands
- Testes in men, and the ovaries in women
- Pancreas is both an endocrine and exocrine gland

Endocrinology

Major Endocrine Glands



Endocrinology

Major Hormones

Produced by	Hormone	Function
Hypothalamus	Thyrotropin-releasing hormone	Stimulates the release of thyroid-stimulating hormone and prolactin
	Gonadotropin-releasing hormone	Stimulates release of luteinizing hormone and follicle-stimulating hormone
	Corticotropin-releasing hormone	Stimulates release of adrenocorticotropic hormone
	Growth hormone–releasing hormone	Stimulates release of growth hormone
	Somatostatin	Inhibits release of growth hormone, thyroid-stimulating hormone, and insulin

Endocrinology

Produced by	Hormone	Function
Pituitary gland	Vasopressin (antidiuretic hormone)	Causes kidneys to retain water and, along with aldosterone, helps control blood pressure
	Corticotropin (ACTH)	Controls the production and secretion of hormones by the adrenal glands
	Growth hormone	Controls growth and development Promotes protein production
	Luteinizing hormone and follicle-stimulating hormone	Control reproductive functions, including the production of sperm and semen in men and egg maturation and menstrual cycles in women Control male and female sexual characteristics (including hair distribution, muscle formation, skin texture and thickness, voice, and perhaps even personality traits)
	Oxytocin	Causes muscles of the uterus to contract during childbirth and after delivery and stimulates contractions of milk ducts in the breast, which move milk to the nipple
	Prolactin	Starts and maintains milk production in the ductal glands of the breast (mammary glands)
	Thyroid-stimulating hormone	Stimulates the production and secretion of hormones by the thyroid gland

Endocrinology

Produced by	Hormone	Function
Parathyroid glands	Parathyroid hormone	Controls bone formation and the excretion of calcium and phosphorus
Thyroid gland	Thyroid hormone	Regulates the rate at which the body functions (metabolic rate)
	Calcitonin	Tends to decrease blood calcium levels and helps regulate calcium balance
Adrenal glands	Aldosterone	Helps regulate salt and water balance by causing the kidneys to retain salt and water and excrete potassium
	Cortisol	Has widespread effects throughout the body Especially has anti-inflammatory action Maintains blood sugar level, blood pressure, and muscle strength Helps control salt and water balance
	Dehydroepiandrosterone (DHEA)	Has effects on bone, mood, and the immune system
	Epinephrine and norepinephrine	Stimulate the heart, lungs, blood vessels, and nervous system

Endocrinology

Produced by	Hormone	Function
Pancreas	Glucagon	Raises the blood sugar level
	Insulin	Lowers the blood sugar level Affects the processing (metabolism) of sugar, protein, and fat throughout the body
Kidneys	Erythropoietin	Stimulates red blood cell production
	Renin	Controls blood pressure
Ovaries	Estrogen	Controls the development of female sex characteristics and the reproductive system
	Progesterone	Prepares the lining of the uterus for implantation of a fertilized egg and readies the breasts to secrete milk
Testes	Testosterone	Controls the development of male sex characteristics and the reproductive sy

Endocrinology

Produced by	Hormone	Function
Kidneys	Erythropoietin	Stimulates red blood cell production
Digestive tract	Cholecystokinin	Controls gallbladder contractions that cause bile to enter the intestine Stimulates release of digestive enzymes from the pancreas
	Glucagon-like peptide	Increases insulin release from pancreas
	Ghrelin	Controls growth hormone release from the pituitary gland Causes sensation of hunger
Adipose (fat) tissue	Resistin	Blocks the effects of insulin on muscle
	Leptin	Controls appetite
Placenta	Chorionic gonadotropin	Stimulates ovaries to continue to release progesterone during early pregnancy
	Estrogen and progesterone	Keep uterus receptive to fetus and placenta during pregnancy

Endocrinology

Hypothalamic-pituitary axis (HPA)

- Hypothalamus secretes several hormones that control the pituitary gland.
- Pituitary gland, also called the master gland, in turn controls the functions of many other endocrine glands
- Pituitary controls the rate at which it secretes hormones through a feedback loop in which the blood levels of other endocrine hormones signal the pituitary to slow down or speed up

Endocrine disorders

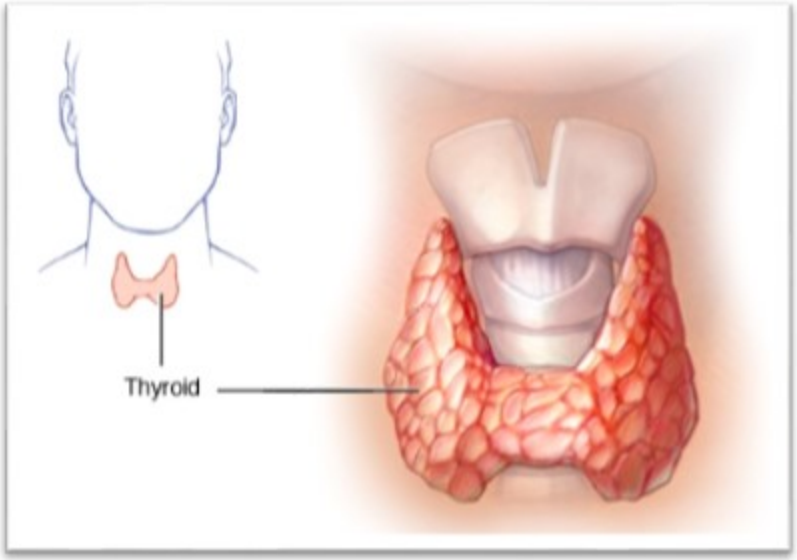
Endocrine disorders include -

- Hyperthyroidism
- Hypothyroidism
- Cushing disease (Oversecretion of glucocorticoids)
- Addison disease
- Acromegaly
- Short stature in children
- Diabetes mellitus

Endocrine disorders

Hyperthyroidism

- Hyperthyroidism occurs when the thyroid makes too much T4, T3, or both
- Symptoms and signs
  - Rapid heart rate
  - Elevated blood pressure
  - Hand tremors
  - Excessive sweating
  - Low tolerance for heat
  - Frequent bowel movements
  - Weight loss, and in women, irregular menstrual cycles
  - **Goitre**
  - **Exophthalmos**



Endocrine disorders

Treatment

- Antithyroid medications, such as methimazole stop the thyroid from making hormones
- Also, beta-blockers such as propranolol can help control the rapid pulse, sweating, anxiety, and high blood pressure
- Radioactive iodine effectively destroys the cells that produce thyroid hormones
- Surgery
  - Necessary to take thyroid hormone supplements to prevent hypothyroidism

Endocrine disorders

Hypothyroidism

- Hypothyroidism (underactive thyroid) - condition in which the thyroid gland doesn't produce enough of hormones
- Women are more likely to have hypothyroidism
- **Symptoms and signs** may include:
  - Fatigue
  - Constipation
  - Weight gain
  - Hoarseness
  - Elevated blood cholesterol level
  - Thinning hair
  - Depression
  - Pain, stiffness or swelling in joints
  - Heavier than normal or irregular menstrual periods
  - Myxedema - life-threatening low blood pressure, unresponsiveness and even coma

- Increased sensitivity to cold
- Dry skin
- Puffy face
- Muscle weakness
- Muscle aches, and stiffness
- Slowed heart rate
- Impaired memory

Endocrine disorders

Hypothyroidism

- Causes
  - Autoimmune disease e.g. Hashimoto's disease
  - Thyroid surgery / radiation therapy
  - Iodine deficiency
- Treatment
  - Daily oral levothyroxine

Endocrine disorders

Cushing disease or syndrome

- Occurs when the body is exposed to high levels of the hormone cortisol
- Cortisol, produced in the adrenal glands, helps regulate blood pressure, keeps cardiovascular system functioning normally
- Cortisol also helps body respond to stress and regulates the metabolism of proteins, fats, and carbohydrates in the diet

Endocrine disorders

Cushing disease (contd)

- Hallmark signs of Cushing syndrome
  - Fatty hump between shoulders ('buffalo hump')
  - Rounded face ('moon face')
  - Pink or purple stretch marks on skin
  - Thinning, fragile skin that bruises easily
  - Slow healing of cuts, insect bites and infections
- Causes
  - Pituitary adenoma - excess ACTH
  - Adrenal adenoma / carcinoma
  - Taking high doses of corticosteroids for long duration as in Rheumatoid arthritis, asthma, organ transplant

Endocrine disorders

Cushing disease (contd)

- Treatment
  - Reducing corticosteroid use
  - Surgery
  - Radiation therapy
  - Medications to control excessive production of cortisol e.g. ketoconazole, mifepristone in patients with co-existing type 2 DM

Endocrine disorders

Addison's disease

- Occurs when body produces insufficient amounts of hormones cortisol (glucocorticoid) and often aldosterone (mineralocorticoid)
- **Symptoms**
  - Extreme fatigue
  - Weight loss, decreased appetite
  - Low blood pressure
  - Salt craving
  - Low blood sugar
  - Nausea, diarrhea or vomiting
  - Abdominal pain

Endocrine disorders

Addison's disease (contd)

- **Symptoms**
  - Muscle or joint pains
  - Irritability
  - Depression
  - Body hair loss or sexual dysfunction in women
  - Darkening of skin (hyperpigmentation)

Endocrine disorders

Addison's disease (contd)

- Primary adrenal insufficiency
  - Adrenal cortical damage
  - Tuberculosis
  - Other infections of the adrenal glands
  - Spread of cancer to the adrenal glands
  - Bleeding into the adrenal glands
- Secondary adrenal insufficiency
  - Inadequate production of ACTH due to pituitary diseases
  - abrupt stoppage of corticosteroid therapy

Endocrine disorders

Addison's disease (contd)

- **Treatment**
  - Hydrocortisone, prednisone or cortisone acetate used to replace cortisol
  - Fludrocortisone to replace aldosterone
- **Addisonian crisis** - low blood pressure, low blood levels of sugar and high blood levels of potassium
  - Treatment - intravenous injections of:
    - Hydrocortisone
    - Saline solution
    - Sugar (dextrose)

Endocrine disorders

Acromegaly

- Hormonal disorder that develops when pituitary gland produces too much growth hormone during adulthood
- **Symptoms**
  - Most common sign is enlarged hands and feet
  - Changes in the shape of face, such as a protruding lower jaw and brow, an enlarged nose, thickened lips
  - Enlarged tongue
  - Coarse, oily, thickened skin
  - Excessive sweating and body odor
  - Increased chest size (barrel chest)

Endocrine disorders

Acromegaly (contd)

- **Causes**
  - Pituitary adenoma
  - Nonpituitary tumors e.g. lungs, pancreas or adrenal glands that produce GH or GH-RH
- **Treatment**
  - Surgery
  - Drugs
    - Somatostatin analogues e.g. octreotide
    - Dopamine agonists e.g. bromocriptine
  - Radiation

Endocrine disorders

Short stature in children

- Children whose height is considerably below average compared to the height of their peers
- **Causes**
  - Constitutional Growth Delay ("late bloomers")
  - Genetics - Down syndrome, Turner syndrome
  - Diseases e.g. growth hormone deficiency (GHD), hypothyroidism, heart disease, asthma, diabetes, kidney problems, sickle cell anemia, rickets, malnutrition

Endocrine disorders

Short stature in children (contd)

- **Treatment**
  - Treatment for short stature depends on the cause
  - Thyroid hormone replacement can be used to treat hypothyroidism.
  - Growth hormone injections can treat GHD and a number of other conditions, including Turner syndrome and chronic kidney failure