Endocrine System Drugs

The endocrine system maintains homeostasis by using hormones as chemical messengers.

Hormones are used as replacement therapy, as antineoplastics, and for their natural therapeutic effects.

The hypothalamus and the pituitary gland secrete hormones that control other endocrine organs.

Hypothalamus and Pituitary
- Hypothalamus secretes chemicals called releasing factors or hormones.
- They travel via blood vessels a short distance to anterior pituitary gland.
- The releasing factors tell the pituitary which hormone to release.
- After the pituitary releases the appropriate hormone, it travels to its target organ to cause its effect.

The thyroid gland controls the basal metabolic rate and affects virtually every cell in the body.

Thyroid disorders may be treated by administering thyroid hormone or by decreasing the activity of the thyroid gland.

Hypothyroidism
- Common disease caused by insufficient secretion of either TSH or thyroid hormone.
- Symptoms: slowed body metabolism, slurred speech, bradycardia, weight gain,
Hypothyroidism
• Causes: autoimmune disease, surgical removal of the gland, or aggressive treatment with antithyroid drugs
• Treatment with natural or synthetic thyroid hormone

Hyperthyroidism
• Symptoms: increased body metabolism, tachycardia, weight loss, high body temperature, and anxiety.
• Graves’ disease. A particularly severe form of hyperthyroidism is called

Hyperthyroidism
• Treatment
  – Surgical removal of thyroid gland - thyroidectomy
  – Antithyroid medications or ionizing radiation to kill or inactivate some of the hyperactive thyroid cells
  – Antithyroid agents are sometimes given 10 to 14 days prior to thyroidectomy to decrease bleeding during surgery

Glucocorticoids are released during periods of stress and influence carbohydrate, lipid, and protein metabolism in most cells

Feedback control of the adrenal cortex

Glucocorticoids are prescribed for adrenocortical insufficiency and a wide variety of other conditions

Adrenocortical Insufficiency
• Lack of adequate corticosteroid production
  – Hyposcretion by the adrenal cortex
  – Inadequate secretion of ACTH from the pituitary
• Symptoms: hypoglycemia, fatigue, hypotension, and GI disturbances such as anorexia, vomiting, and diarrhea

Adrenocortical Insufficiency
• Primary adrenocortical insufficiency Addison’s disease deficiency of both glucocorticoids and mineralocorticoids

Secondary Adrenocortical Insufficiency
• Result from long-term therapy with glucocorticoids.
  – The pituitary receives a message through the negative feedback mechanism to stop secreting ACTH
  – Without stimulation from ACTH, the adrenal cortex shrinks in size and stops secreting endogenous glucocorticoids
Secondary Adrenocortical Insufficiency

• Result from long-term therapy with glucocorticoids
  – If a patient abruptly discontinues the glucocorticoid medication, the shrunken adrenal glands will not be able to secrete enough glucocorticoids, and symptoms of adrenocortical insufficiency will appear

Disorders That May Be Treated With Corticosteroids

• Allergies, Asthma, Seasonal Rhinitis
• Skin disorders - contact dermatitis and rashes
• Neoplastic disease Hodgkin’s, leukemia, lymphoma
• Shock
• Rheumatic disorders rheumatoid arthritis, ankylosing spondylitis, bursitis

Disorders That May Be Treated With Corticosteroids

• Post-transplant surgery
• Chronic inflammatory bowel disease
• Adrenal insufficiency
• Hepatic, neurological, and renal disorders characterized by edema

Why does administration of glucocorticoids for extended periods result in adrenal atrophy?

Of the many pituitary and hypothalamic hormones, only a few have clinical applications as drugs

Pituitary And Hypothalamic Hormones

• Growth hormone somatotropin,
  – Stimulates the growth of nearly every cell in the body

Pituitary And Hypothalamic Hormones

• Antidiuretic hormone (ADH) Vasopressin
  – Secre ted from the posterior pituitary gland
  – Conserves water in the body
  – Acts on the collecting ducts in the kidney to increase water reabsorption
  – Three preparations
  • vasopressin (Pitressin), desmopressin (DDAVP, Stimate), and lypressin (Diapid)

Insulin and glucagon are secreted by the pancreas

Insulin

• Regulated by a number of chemical, hormonal, and nervous factors
• Level of glucose in the blood
  – Glucose levels are high (hyperglycemia), the pancreas is stimulated to secrete insulin
  – The islet cells stop secreting insulin when blood glucose is low (hypoglycemia) or when high levels of insulin send the pancreas a message to stop secreting the hormone

33  Insulin
• Action
  – Affects carbohydrate, fat, and protein metabolism
  – Assist in glucose transport Without insulin, glucose cannot enter cells

34  Glucagon
• When levels of glucose are low, glucagon is secreted
• Maintain adequate levels of glucose in the blood between meals
• It has a hyperglycemic effect: its presence moves glucose from cells, primarily in the liver, to the blood

35  Insulin, glucagon, and blood glucose

36  Type 1 Diabetes Symptoms
• Hyperglycemia - fasting blood glucose greater than 126 mg/dl
  • Polyuria - excessive urination
  • Polyphagia - increase in hunger
  • Polydipsia - increased thirst
  • Glucosuria - high levels of glucose in the urine
  • Weight loss
  • Fatigue

37  Type 1 Diabetes Treatment
• Treated by dietary restrictions and insulin injections
  • Combination of proper meal planning, exercise, and insulin
  • Food must be eaten regularly, every 4 to 5 hours
  • Regular, moderate exercise helps the cellular responsiveness to insulin

38  Insulin Preparations (con't)

39  Oral Hypoglycemic Medications
• Sulfonylureas
  • Biguanides

40  Type 2 Diabetes
• Controlled through lifestyle changes and oral hypoglycemic agents
  • Capable of secreting insulin, although in amounts that are too small
  • Insulin receptors in the target tissues have become insensitive or resistant to the hormone
  • Proper diet and exercise can sometimes increase the sensitivity of insulin receptors to the point that drug therapy is unnecessary
• Thiazolidinediones
• Alpha-glucosidase inhibitors
• Meglitinides
• Dipeptidyl-peptase 4

Why are oral hypoglycemic drugs ineffective for treating type 1 diabetes?

Testosterone, estrogen, and progesterone are the primary hormones contributing to the growth, health, and maintenance of the reproductive system

Estrogen
• Synthesized in ovaries
• estradiol, estrone, and estriol
• Responsible for the maturation of the reproductive organs and for the appearance of the secondary sex characteristics in women

Estrogen
• Metabolic effects on nonreproductive tissues, including the brain, kidneys, blood vessels, and skin

Progestins/Progesterone
• Secreted by ovary
• Functions
  – In combination with estrogen, promotes breast development
  – Monthly changes in the ovaries and uterus known as the menstrual cycle

Progestins/Progesterone
• Levels fall sharply at the end of the cycle, a portion of the inner lining of the uterus, the endometrium, is shed, menstrual bleeding occurs
  – During pregnancy, progesterone secreted by the placenta maintains a healthy endometrium for the fetus and prevents premature labor contractions

Regulation from Pituitary
• Follicle-stimulating hormone (FSH)
  – Regulates sperm or egg production.
• Leutinizing hormone (LH).
  – Females
• Triggers the release of the egg, a process known as ovulation
• Promotes the secretion of estrogen and progesterone by the ovary
  – In males
• Interstitial cell-binding hormone—regulates the production of testosterone

53  Control of the reproductive hormones

54  Hormone Replacement Therapy
• Menopause
  – Permanent cessation of menses
  – Lack of estrogen secretion by the ovaries.
• HRT Common over last 20 years

55  Hormone Replacement Therapy
• Concerns
  – Increased risk of coronary artery disease
  – Stroke
  – Venous thromboembolism
• Women are now encouraged to discuss alternatives with their healthcare provider

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Estrogens have been used for replacement therapy and in the treatment of prostate cancer

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