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Diploma in Pharmacy 2nd Year
Pharmacology
Important Questions
Chapter 10 : Hormones and Hormones Antagonists

Chapter 10
Hormones and Hormones Antagonists
IMPORTANT Questions

Q1. Classify the Hormones ?

Ans.

Hormones

- → The word Hormone has originated from a Greek word Hormaein which meant to impel.
- → Thus, hormone is a substance which is secreted by specialised cells and transported to a distant site to exert its action upon specific tissues.
- → Hormones are synthesised and discharged by endocrine glands directly into the blood-circulation without the intervention of a duct therefore known as ductless glands.
- → If a hormone acts on other endocrine gland or tissue, it just stimulates or inhibits its function.

Classification

1) **Pituitary :**
   i. **Anterior Pituitary :**
      - Growth Hormone (GH) and Prolactin (Pri).
      - Adrenocorticotropic Hormone (ACTH. Corticotropin).
      - Thyroid Stimulating Hormone (TSH. Thyrotropin),
      - Gonadotropins Follicle Stimulating Hormone (FSH) and Luteinizing Hormone (LH).

   ii. **Posterior Pituitary :**
      - Oxytocin,
      - Antidiuretic Hormone (ADH, Vasopressin).
2) **Thyroid :** Thyroxine (T_4). Triiodothyronine (T) and Calcitonin.
3) **Parathyroid:** Parathormone (PTH).
4) **Pancreas:** Insulin and Glucagon.
5) **Adrenals:**
   i. **Cortex**
      - Glucocorticoids (hydrocortisone),
      - Mineralocorticoids (aldosterone),
      - Sex steroids (dehydroepiandrosterone).

   ii. **Medulla:** Adrenaline and Noradrenaline
6) **Gonads:**
      - Androgens (testosterone).
      - Estrogens (estradiol).
      - Progestins (progesterone).

Q2. Write about the Hormone Antagonists.

Ans.

Hormone Antagonists

→ Hormone antagonists are the chemical substances that prevent the function of the endocrine glands, the biosynthesis of their secreted hormones, or the action of hormones upon their specific sites.

Examples of hormone Antagonists

- LH-RK Antagonist
- Antiandrogen
- Antioestrogen etc,.

Q3. Discuess about the Thyroid Hormones.

Ans.

Thyroid Hormones

→ The thyroid gland releases triiodothyronine (T_3) and thyroxine (T_4). These hormones play an important role in regulation of your weight, energy levels, internal temperature, skin, hair, nail growth, metabolism and is an important part of the endocrine system.

→ Thyroid hormones are released by thyroid gland and regulated by TSH (Thyroid stimulating hormone)

→ which is released by anterior pituitary gland .

→ Thyroid hormones :

- T_3 (Triiodothyronine)
- T_4 (Thyroxine)

→ Reverse triiodothyronine (RT_3).

- Calcitonin

Physiological Roles

- Thyroid hormones play a vital role in regulating metabolism, energy expenditure, and body temperature.
- They also influence heart rate, respiratory rate, and other vital functions.
- They play a role in growth and development, particularly in the development of the brain and nervous system

Pathological Roles

- Hypothyroidism occurs when the thyroid gland doesn't produce enough hormones. This can result in a variety of symptoms, including fatigue, weight gain, and sensitivity to cold.
- Hyperthyroidism occurs when the thyroid gland produces too much hormone. This can result in symptoms such as weight loss, rapid heartbeat, and sensitivity to heat.
- Thyroid disorders can be caused by a variety of factors, including autoimmune disorders, iodine deficiency, and certain medications

Clinical Uses

- ✓ Thyroid hormone replacement therapy is used to treat hypothyroidism, a condition where the thyroid gland is not producing enough hormones.
- ✓ Thyroid hormones can also be used to treat thyroid cancer, by suppressing the production of thyroid-stimulating hormone.
- ✓ Thyroid hormones are also used to treat goiter, a condition where the thyroid gland enlarges, by reducing the size of the gland.
- ✓ Hyperthyroidism can be treated with medications that reduce thyroid hormone production or block the effects of thyroid hormones.
- ✓ Thyroid function tests can be used to diagnose thyroid disorders.
- ✓ Radioactive iodine therapy can be used to treat hyperthyroidism by destroying the thyroid gland.

Q4. Classify the Anti-Thyroid Drugs.

Ans.

Anti-thyroid Drugs

- → Anti-thyroids are the drugs which block the formation of thyroid hormone or prevent their secretion .
- → It is also called Thyroid Antagonist or Thionamide drugs .

Classification

1) **Inhibit Hormone Synthesis (Anti-thyroid Drugs) :**
   - Propylthiuracil
   - Methimazole
   - Carbimazole
2) **Inhibit Iodide Trapping (Ionic Inhibitors) :**
   - i) Thiocyanates (-SCN)
   - ii) Perchlorates ($-ClO_4$)
   - iii) Nitrates ($-NO_3$)
3) **Inhibit Hormone Release :**
   - i) Iodine
   - ii) Iodides of Na and K
   - iii) Organic iodide
4) **Destroy Thyroid Tissue :** Radioactive iodine

Q5. What are Parathormone ? Write the physiological role, pathological role, clinical uses of of Parathormone.

Ans.

Parathormone (Parathyroid Hormone, PTH)

→ Parathormone (PTH) is a hormone produced by the parathyroid glands that plays a crucial role in maintaining calcium and phosphate levels in the body.

→ Parathormone aslo called Parathyroid hormone (PTH)

Physiological Role

- PTH increases blood calcium levels by increasing bone resorption, which releases calcium into the bloodstream. It also decreases excretion of calcium by the kidneys and increases absorption of calcium from the intestines.
- PTH stimulates the production of active vitamin D, which promotes intestinal absorption of calcium and phosphate.
- PTH also regulates phosphate levels in the body by decreasing reabsorption of phosphate by the kidneys.

Pathological role

- Low level of parathormone indicates the Hypoparathyroidism , and it increases the phosphorus level in blood .
- High Production of parathormone indicates Hyperparathyroidism which causes Increase blood calcium level , that can lead to kidney stone , bone thinning , (osteoporosis) and causes weakness of body and fatigue.

Clinical uses

✓ PTH can be used as a diagnostic tool to differentiate between primary and secondary hyperparathyroidism.

✓ PTH analogs, such as teriparatide, can be used to treat osteoporosis by increasing bone formation.

✓ PTH can be used in the treatment of hypoparathyroidism to increase blood calcium levels.

Q6. Write the physiological role, pathological role, clinical uses of Calcitonin.

Ans.

Calcitonin

→ Calcitonin is a hormone , secreted by thyroid gland , and acts just opposite to PTH (parathyroid Hormone) and reduces calcium level .

Physiological Role

- Calcitonin helps to regulate calcium and phosphate homeostasis in the body.
- It decreases the concentration of calcium and phosphate in the blood by inhibiting the activity of osteoclasts, which are cells that break down bone tissue and release calcium and phosphate into the blood.
- Calcitonin also increases the excretion of calcium and phosphate in the urine

Pathological Role

- If too much calcitonin found in blood it may be a sign of thyroid cancer , which is called MTC (Medullary Thyroid Cancer)
- Low level of Calcitonin during or after thyroid cancer treatment means that your cancer treatment is effective . or may be due to a problem in thyroid gland , pituitary or in hypothalamus .

Clinical Uses

- ✓ Calcitonin is used as a medication to treat osteoporosis, a condition in which bones become weak and brittle. It works by inhibiting bone resorption and promoting bone formation.
- ✓ It is also used to treat hypercalcemia (high levels of calcium in the blood) associated with malignancy, as it can help to lower blood calcium levels.
- ✓ Calcitonin can also be used to relieve pain associated with osteoporosis or vertebral fractures.

Q7. Discuess brief note on Vitamin D ?

Ans.

Vitamin D

- → Vitamin D is a fat-soluble vitamin that plays an important role in the body's calcium and phosphate homeostasis.
- → Sources of vitamin D are foods and exposure to sun light , but it biologically inactive , and by hydrolisation process of the body becomes active . Vitamin D3 and D 2 are most essential for Human body .

Pathological Roles

- Vitamin D helps the body absorb and utilize calcium and phosphorus, which are essential for building and maintaining strong bones and teeth.
- It also regulates the immune system and promotes the growth and differentiation of cells, including those in the skin and bone.
- Vitamin D may also have a role in reducing the risk of certain cancers, autoimmune diseases, and cardiovascular disease.

Pathological Role

- Vitamin D deficiency can lead to rickets in children, which is a condition characterized by weak and deformed bones. In adults, a deficiency can lead to osteomalacia, which causes weak bones and muscle weakness.
- Low levels of vitamin D have also been linked to an increased risk of falls, fractures, and other musculoskeletal disorders.

Clinical Uses

- ✓ Vitamin D supplements are often prescribed to individuals who are at risk of deficiency, such as those with limited sun exposure, older adults, and people with certain medical conditions or medications that interfere with vitamin D absorption.
- ✓ Vitamin D supplements may also be used to treat osteoporosis, a condition characterized by weakened bones.
- ✓ Vitamin D may have a role in the prevention and treatment of other conditions, such as multiple sclerosis, depression, and chronic pain, but more research is needed to fully understand its potential benefits.

Q8. Write about Insulin.

Ans.

Insulin

→ Insulin is a hormone secreted by pancreas and control the glucose level in blood stream and helps in utilisation of glucose by body tissues.

Physiological role

- Insulin helps to regulate blood glucose levels by promoting the uptake and storage of glucose in the liver, muscle, and adipose tissue.
- It promotes the synthesis of glycogen in the liver and muscle, and inhibits the breakdown of glycogen in these tissues.
- Insulin also enhances the uptake of amino acids by the muscle, which promotes protein synthesis and tissue growth.
- Additionally, insulin inhibits lipolysis in adipose tissue, which reduces the release of free fatty acids into the bloodstream

Pathological role

- In type 1 diabetes, the beta cells in the pancreas are destroyed, leading to a lack of insulin production and uncontrolled hyperglycemia.
- In type 2 diabetes, the body becomes resistant to the effects of insulin, leading to elevated blood glucose levels.
- Other conditions such as insulinoma (a rare tumor of the pancreas that secretes excess insulin) and insulin resistance syndromes can also result in abnormal insulin secretion or function

Clinical Uses

- ✓ Insulin is a mainstay treatment for type 1 diabetes and may also be used in certain cases of type 2 diabetes when other medications have failed.
- ✓ It may also be used in gestational diabetes and other forms of diabetes that occur during pregnancy.
- ✓ In some cases, insulin therapy may be used in critical care settings to manage hyperglycemia and maintain normal glucose levels.
- ✓ Insulin may also be used off-label for bodybuilding and athletic performance enhancement, although this practice is not recommended and can be dangerous.

Q9. What are the Oral hypoglycemic agents ? Write the classification, physiological role, pathological role, clinical uses ?

Ans.

Oral hypoglycemic agents

- → Oral hypoglycemic agents (OHAs) are medications used to treat type 2 diabetes by lowering blood glucose levels.
- → These agents work by increasing insulin sensitivity, increasing insulin secretion, or reducing glucose production in the liver

Classification

- **Sulfonylurea :** Tolbutamide , Glibenclamide , Glimepiride . They stimulate release of insulin .
- **Biguanides :** Metformin , Phenformin , Buformine . they increase the insulin action
- **Meglitinide analogues :** Repaglinide , Nateglinide . They directly stimulate the pancreas to release the insuline
- **Thiazolidinediones :** Rosiglitazne , Pioglitazone . They decreases the blood sugar level without increasing the insu lin secretion .
- **α -Glucosidase Inhibitors :** Miglitol , Voglibose . They inhibit the digestion of carbohydrates and decrease blood sugar level .

Physiological role

- OHAs work by improving the body's response to insulin, which is a hormone that regulates blood sugar levels.
- OHAs can reduce insulin resistance and increase insulin sensitivity, which helps the body use glucose more effectively and lower blood sugar levels.
- OHAs can also reduce glucose production in the liver, which can help control fasting blood sugar levels.

Pathological role

- OHAs are used to treat type 2 diabetes, which is a chronic condition characterized by high blood sugar levels due to insulin resistance and/or insufficient insulin secretion
- Type 2 diabetes can lead to complications such as cardiovascular disease, kidney disease, nerve damage, and vision loss if not properly managed.

Clinical uses

- ✓ OHAs are used in conjunction with lifestyle modifications such as diet and exercise to manage type 2 diabetes.
- ✓ Different types of OHAs are available, including biguanides, sulfonylureas, meglitinides, thiazolidinediones, DPP-4 inhibitors, GLP-1 receptor agonists, and SGLT-2 inhibitors.
- ✓ The choice of OHA depends on various factors such as the patient's age, health status, kidney function, and other medications they may be taking.
- ✓ OHAs are typically used as first-line therapy for most patients with type 2 diabetes, and insulin therapy may be added later if blood sugar levels are not adequately controlled.
- ✓ OHAs can also be used to manage prediabetes and gestational diabetes, which are conditions characterized by elevated blood sugar levels but not as high as in type 2 diabetes.

Q10. Give brief note on Estrogen ?

Ans.

Estrogen

- → Estrogen or Oestrogen is a female sex hormone produce by the ovary , adrenal gland and placenta (During pregnancy) .
- → This is responsible for development and control of reproductive system and secondary sex characteristic in females .
- → Note : any natural or synthetic substance which mimics the effect of natural hormone is called estrogen .

Physiological roles

- **Development and maintenance of female reproductive organs :** Estrogen plays a vital role in the development of female reproductive organs such as the uterus, fallopian tubes, and vagina. It also helps in maintaining the function and health of these organs.
- **Development of secondary sexual characteristics :** Estrogen is responsible for the development of secondary sexual characteristics in females such as the growth of breasts, distribution of body fat, and changes in body hair.
- **Bone health :** Estrogen helps maintain bone density and prevent osteoporosis in both men and women.
- **Cardiovascular health :** Estrogen has a protective effect on the cardiovascular system by reducing the risk of heart disease.
- **Brain function :** Estrogen has an important role in cognitive function, memory, and mood regulation.

Pathological role

- **Breast Cancer :** High levels of estrogen can promote the growth of breast cancer cells.
- **Endometrial Cancer :** Estrogen can increase the risk of endometrial cancer if the levels are not balanced.
- **Blood Clots :** Estrogen can increase the risk of blood clots, which can lead to deep vein thrombosis or pulmonary embolism.
- **Ovarian Cancer :** Estrogen can increase the risk of ovarian cancer.

Clinical uses

- ✓ Hormone replacement therapy: Estrogen is used in hormone replacement therapy (HRT) to alleviate symptoms of menopause such as hot flashes, vaginal dryness, and mood swings.
- ✓ Contraception: Estrogen is used in combination with progestin as an oral contraceptive.
- ✓ Osteoporosis treatment: Estrogen is sometimes used to treat osteoporosis in postmenopausal women.
- ✓ Gender-affirming hormone therapy: Estrogen is used in gender-affirming hormone therapy for transgender women to develop feminine characteristics.

Q11. What are the Progesterone ? Write the physiological role, pathological role, clinical uses of Progesterone ?

Ans.

Progesterone

→ Progesterone is a steroid hormone that plays a significant role in the menstrual cycle, pregnancy, and overall reproductive health

Physiological Role

- **Menstrual Cycle :** Progesterone prepares the uterus for implantation and maintains the lining of the uterus during the second half of the menstrual cycle.
- **Pregnancy :** Progesterone plays a crucial role in maintaining a healthy pregnancy by thickening the uterus lining, preventing the uterus from contracting and helping the body prepare for breastfeeding.
- **Breast Development :** Progesterone works with estrogen to promote breast development during puberty and pregnancy.
- **Bone Health :** Progesterone is essential for maintaining bone health and reducing the risk of osteoporosis

Pathological Role

- **Hormonal Imbalance :** A lack of progesterone can cause menstrual irregularities and infertility in women.
- **Miscarriage :** Low progesterone levels in early pregnancy can increase the risk of miscarriage.

Clinical Uses

- ✓ **Hormone Replacement Therapy (HRT) :** Progesterone is used in combination with estrogen in HRT to manage menopausal symptoms, such as hot flashes, vaginal dryness, and mood swings.
- ✓ **Infertility Treatment :** Progesterone supplements are used to support the early stages of pregnancy in women who have difficulty conceiving.
- ✓ **Premenstrual Syndrome (PMS) :** Progesterone supplements can alleviate symptoms of PMS, such as bloating, breast tenderness, and mood swings.
- ✓ **Endometriosis :** Progesterone therapy can help to manage the symptoms of endometriosis, such as pelvic pain and heavy periods.
- ✓ **Menstrual Disorders :** Progesterone is sometimes used to treat menstrual disorders, such as heavy or irregular periods.

Q12. Write the physiological role, pathological role, clinical uses of Oxytocin ?

Ans.

Oxytocin

→ Oxytocin is a hormone produced by the hypothalamus and released from the posterior pituitary gland. It plays a crucial role in a wide range of physiological processes, including childbirth, lactation, and social bonding.

Physiological Role

- **Labor and Delivery :** Oxytocin stimulates uterine contractions, facilitating labor and delivery. It also plays a role in the dilation of the cervix during childbirth.
- **Lactation :** Oxytocin helps stimulate the let-down reflex, which enables milk to be released from the mammary glands during breastfeeding.
- **Social Bonding :** Oxytocin has been linked to social bonding, particularly between mother and child, and between romantic partners. It promotes trust, empathy, and affection, which is why it is often referred to as the "love hormone."

Pathological Role

- **Autism :** Research suggests that individuals with autism have lower levels of oxytocin, which may contribute to social difficulties and a lack of emotional connection with others
- **Anxiety and Depression :** Oxytocin has been shown to have anxiolytic (anti-anxiety) and antidepressant effects in animal models and human studies.
- **Eating Disorders :** There is some evidence that oxytocin may play a role in the regulation of food intake and body weight, and its use has been explored as a potential treatment for anorexia and bulimia

Clinical Uses

- ✓ **Induction of Labor :** Oxytocin is commonly used to induce labor in women who have gone past their due dates or have medical conditions that require early delivery.
- ✓ **Postpartum Hemorrhage :** Oxytocin is also used to prevent and treat postpartum hemorrhage by promoting uterine contractions.
- ✓ **Breastfeeding :** Oxytocin nasal spray has been used to improve lactation and milk ejection in breastfeeding mothers.
- ✓ **Autism :** Research is ongoing to explore the potential use of oxytocin as a treatment for social and communication difficulties in individuals with autism.
- ✓ **Anxiety and Depression :** Oxytocin is being investigated as a potential treatment for anxiety and depression, particularly in individuals who do not respond well to traditional medications.

Q13. What are the Corticosteroids ? Write the physiological role, pathological role, clinical uses of Corticosteroids.

Ans.

Corticosteroids

→ Corticosteroids are a class of hormones produced naturally by the adrenal cortex, which play a crucial role in maintaining the normal functioning of the body. They are also available in synthetic form for therapeutic use.

→ There are two main types of corticoster oids glucocoticoids (Cortisol) and mineralocorticoids (Aldosterone) .

Physiological roles

- Corticosteroids help regulate the body's metabolism of carbohydrates, fats, and proteins.
- They regulate the body's response to stress, by increasing blood sugar levels, blood pressure, and suppressing the immune response.
- They also play a role in maintaining the balance of salt and water in the body.

Pathological roles

- Inflammatory disorders such as rheumatoid arthritis, asthma, and other autoimmune disorders can cause inflammation, swelling, and pain. Corticosteroids can help to suppress the immune response and reduce inflammation
- Allergic reactions can also cause inflammation, and corticosteroids can help to reduce symptoms such as itching, swelling, and hives.
- Corticosteroids can also be used to treat certain types of cancer, by slowing down the growth of cancer cells

Clinical uses

• Corticosteroids are commonly used to treat inflammation and pain associated with rheumatoid arthritis, lupus, and other autoimmune disorders.

• They are also used to treat severe allergic reactions, such as anaphylaxis, and to reduce swelling and inflammation associated with asthma and other respiratory conditions.

• Corticosteroids can be used to treat skin conditions such as eczema and psoriasis, and to reduce inflammation and pain associated with certain types of cancer

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