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Endocrine System Drugs

Pharmacology

Insulin, oral antidiabetic drugs, thyroid hormones, antithyroid drugs, corticosteroids, sex hormones and drugs affecting calcium metabolism.

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CHAPTER 12 / PHARMACOLOGY 12. Endocrine System Drugs

1. Introduction

Endocrine medicines replace deficient hormones, modify hormone synthesis or secretion, block hormone action or alter metabolic pathways. Many require individualized dosing and laboratory monitoring because physiological effects extend across organ systems.

2. Insulin

Insulin is a peptide hormone that promotes glucose uptake in insulin-sensitive tissues, reduces hepatic glucose production and supports anabolism. It is essential for type 1 diabetes and is used in many patients with type 2 diabetes and selected acute metabolic conditions.

Type	Examples	Approximate clinical role
Rapid acting	Insulin lispro, aspart, glulisine	Mealtime and correction coverage; product-specific timing.
Short acting	Regular human insulin	Mealtime coverage; selected monitored IV protocols.
Intermediate acting	NPH insulin	Basal coverage with a defined peak; hypoglycaemia risk.
Long / ultra-long acting	Glargine, detemir, degludec	Basal coverage; duration differs by preparation.
Premixed	Human or analogue premixed formulations	Fixed basal and mealtime components; less dosing flexibility.

Insulin nursing responsibilities

- Verify insulin type, concentration (for example U-100 versus other strengths), delivery device and prescribed units. Use compatible syringes or pens; never share a pen.

- Check glucose, meal timing, intake, illness and the ordered regimen. Do not assume basal insulin should be omitted when a patient is fasting, especially in type 1 diabetes.

- Rotate injection sites within an appropriate area and inspect for lipohypertrophy. Follow product storage instructions; protect insulin from freezing and excessive heat.

- Monitor for hypoglycaemia: sweating, tremor, hunger, palpitations, confusion, seizures or loss of consciousness. If awake and safe to swallow, follow the oral glucose protocol; if unable to swallow, use emergency guidance, parenteral glucose or prescribed glucagon. Do not give oral liquids to an unconscious patient.

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- IV insulin is high alert; use standardized concentrations, infusion pumps and frequent glucose and electrolyte monitoring as ordered.

3. Non-insulin antidiabetic drugs

Class / examples	Mechanism	Risks and monitoring
Biguanide - metformin	Reduces hepatic glucose production; improves insulin sensitivity	GI symptoms, B12 deficiency; renal review and acute illness precautions.
Sulfonylurea - glimepiride, gliclazide	Stimulates pancreatic insulin release	Hypoglycaemia, weight gain.
DPP-4 inhibitors - sitagliptin, linagliptin	Prolong endogenous incretin activity	Drug-specific renal adjustment; selected adverse effects including rare pancreatitis.
SGLT2 inhibitors - empagliflozin, dapagliflozin	Increase urinary glucose excretion	Genital infections, volume depletion, euglycaemic ketoacidosis; sick-day/perioperative instructions.
GLP-1 receptor agonists - semaglutide, liraglutide	Glucose-dependent insulin effects, reduced appetite, slower gastric emptying	GI symptoms, dehydration; formulation-specific and procedural considerations.
Thiazolidinedione - pioglitazone	Improves insulin sensitivity through PPAR-gamma	Weight gain, fluid retention, fractures; caution in heart failure.
Alpha-glucosidase inhibitor - acarbose	Delays carbohydrate digestion	Flatulence, diarrhoea; meal timing.

Some GLP-1 therapies are injectable; semaglutide also has oral formulations. These agents are not substitutes for insulin in type 1 diabetes. Treatment choice considers glucose, cardiovascular and renal disease, hypoglycaemia risk and access. Diabetic ketoacidosis (DKA) needs urgent protocol-based fluid, insulin and electrolyte treatment; potassium monitoring is essential.

4. Thyroid and antithyroid drugs

Levothyroxine is synthetic T4 used for hypothyroidism. Administer consistently according to formulation instructions, commonly on an empty stomach; iron and calcium interfere with absorption. Monitor TSH and free T4 as indicated. Excess replacement may cause palpitations, tremor, weight loss and atrial arrhythmias.

Carbimazole (converted to methimazole), methimazole and propylthiouracil (PTU) reduce thyroid hormone synthesis; PTU also reduces peripheral T4 to T3 conversion. Fever or sore throat may signal agranulocytosis and requires urgent assessment and blood counts; jaundice may indicate hepatic injury. Pregnancy-specific drug choices require specialist advice. Radioactive iodine has selected indications and is contraindicated during pregnancy; radiation precautions apply.

5. Corticosteroids

Glucocorticoids (hydrocortisone, prednisolone, dexamethasone) regulate gene transcription and reduce inflammation; they are also used for hormone replacement in adrenal insufficiency. Mineralocorticoid fludrocortisone supports sodium retention in selected adrenal insufficiency. Adverse effects include hyperglycaemia, hypertension, infection risk, osteoporosis, mood changes, GI effects and hypothalamic-pituitary-adrenal suppression. Long-term therapy may require a gradual taper. Patients with adrenal insufficiency need prescribed sick-day rules and emergency treatment education.

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6. Sex hormones and reproductive drugs

Oestrogens and progestogens are used in contraception and selected hormone replacement regimens. Testosterone is used in defined deficiency states; monitor product-specific effects and contraindications. GnRH agonists or antagonists modify gonadotropin release for selected reproductive or oncological indications. Hormonal treatment requires risk assessment for thrombosis, malignancy and pregnancy when relevant; see Chapter 17.

7. Drugs affecting calcium and bone metabolism

Drug group	Use / action	Nursing points
Calcium, vitamin D	Replace deficiency and support bone health	Check intake, renal status; excess causes hypercalcaemia.
Bisphosphonates	Alendronate, zoledronic acid; inhibit bone resorption	Oral administration instructions, oesophageal irritation, renal review, rare jaw osteonecrosis.
Denosumab	RANKL inhibition	Hypocalcaemia, dental risk; plan continuity or transition to avoid rebound fracture risk.
Calcitonin / calcimimetics	Selected calcium disorders; cinacalcet reduces PTH	Monitor calcium, symptoms and indication.

8. Examination questions

Long answer questions

1. 1. Classify insulin and non-insulin antidiabetic medicines with nursing care.
2. 2. Describe thyroid drugs and corticosteroids with adverse effects.

Short answer questions

- Hypoglycaemia; metformin; SGLT2 inhibitors; levothyroxine; antithyroid drugs; bisphosphonates.

Very short answer questions

- Essential therapy for type 1 diabetes? - Insulin.
- Which antidiabetic class increases urinary glucose loss? - SGLT2 inhibitors.
- One synthetic thyroid hormone? - Levothyroxine.

9. Quick revision

Insulin is high alert. Check meal timing, glucose and formulation. Thyroid treatment is lab guided. Glucocorticoids can suppress adrenal function. Calcium-modifying drugs require monitoring for abnormal calcium.

Conclusion

Endocrine pharmacology requires integration of hormone physiology, laboratory results, medication timing, patient education and early recognition of metabolic emergencies.

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Practice questions

Choose one best answer. The answer key and explanations follow the questions.

1. Which metabolic action is produced by insulin?

A. Increases urinary glucose excretion by blocking SGLT2

B. Delays carbohydrate digestion in the intestine

C. Blocks thyroid hormone synthesis

D. Promotes glucose uptake and reduces hepatic glucose production

2. What is the primary glucose-lowering mechanism of SGLT2 inhibitors?

A. Increase urinary glucose excretion

B. Directly replace circulating insulin

C. Inhibit carbohydrate digestion in the gut

D. Stimulate thyroid hormone release

3. A patient with suspected hypoglycaemia is unconscious. Which action follows the chapter's safety guidance?

A. Place food in the patient's mouth

B. Use emergency guidance for parenteral glucose or prescribed glucagon

C. Give oral glucose liquid immediately

D. Offer a sugary drink through a straw

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Answer key and explanations

1. D - Promotes glucose uptake and reduces hepatic glucose production

Insulin promotes glucose uptake in sensitive tissues and suppresses hepatic glucose production.

2. A - Increase urinary glucose excretion

SGLT2 inhibitors lower glucose by increasing its excretion in urine.

3. B - Use emergency guidance for parenteral glucose or prescribed glucagon

An unconscious patient cannot safely receive oral liquids; emergency non-oral treatment is required.

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