Pharmacology: Respiratory and Endocrine

Question 1 of 76

Which of the following drugs decreases plasma-theophylline levels:

- a. Erythromycin
- b. Allopurinol
- c. Carbamazepine
- d. Fluconazole
- e. Verapamil

Next >  See Answer

Something wrong?
Pharmacology: Respiratory and Endocrine

**Question Navigator**

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**Answer**

- Exemptions of renin-inhibiting drugs (lower plasma renin activity level)
  - Enalapril
  - Lisinopril
  - Captopril
  - Ramipril
  - Perindopril

- Exemptions of renin-inhibiting drugs (lower plasma renin activity level)
  - Enalapril
  - Lisinopril
  - Captopril
  - Ramipril
  - Perindopril

**Notes**

The respiration may have an additional beneficial effect on people with low blood flow in the brain, which is observed in patients with cerebrovascular disease (CVD).

**Indications**

Cardiovascular risk: Reduction of blood pressure in hypertension, prevention of heart failure, and treatment of acute myocardial infarction (AMI).

Respiratory diseases: Treatment of chronic obstructive pulmonary disease (COPD) and asthma.

**Contraindications**

- Pregnancy
- Lactation
- Marked renal impairment
- Hypersensitivity to the drug

**Interactions**

- Increased blood levels of certain drugs when used with other antihypertensive agents.
- Decreased blood levels of certain drugs when used with other agents that reduce blood pressure.

**Side effects**

- Tachycardia, palpitations, and hypotension
- Headache, dizziness, and muscle weakness
- Aortic stenosis, anuria, and renal failure
- Hypokalemia, hypomagnesemia, and hypercalcemia
- Increased risk of hypoglycemia in diabetic patients

**Drug interactions**

- Increased blood levels of certain drugs when used with other antihypertensive agents.
- Decreased blood levels of certain drugs when used with other agents that reduce blood pressure.

**Resources**

- Physical Education in Emergency Settings
- Physiotherapy: A Guide for Practitioners
- Advanced Topics in Support
- Advanced Topics in Support
- Physiotherapy: A Guide for Practitioners
Pharmacology: Respiratory and Endocrine

Question 2 of 76

Regarding the use of oxygen therapy in the management of acute asthma in adults which of the following statements is CORRECT:

a. All patients with severe acute asthma should be given oxygen therapy regardless of oxygen saturations.
b. Hypoxaemic patients should be given oxygen therapy to maintain saturations > 98%.
c. Patients should be given oxygen therapy to maintain saturations 94 – 98%.
d. Patients should not commence oxygen therapy until SpO2 has been monitored.
e. All patients with SpO2 < 98% should be given oxygen therapy.
Pharmacology: Respiratory and Endocrine

Question 3 of 76

Which of the following clinical features would characterise an asthma attack in an adult as severe:

- a) PEF 55% of best/predicted
- b) RR 24 breaths/minute
- c) BP 110/70
- d) HR 115 bpm
- e) Increasing symptoms

< Previous  Next >  See Answer
Pharmacology: Respiratory and Endocrine

Question 4 of 76

Which of the following is a common side effect of salbutamol:

- Ankle oedema
- Hyperkalaemia
- Bradycardia
- Weight gain
- Tremor

< Previous  Next >  See Answer  Something wrong?
Pharmacology: Respiratory and Endocrine

(Question 4 of 7)

Which of the following is a common side effect of salbutamol:

a) Ankle oedema
b) Hyperkalaemia
c) Bradycardia
d) Weight gain
e) Tremor

Answer

Side effects are usually dose related and include:

- Fine tremor — occurs particularly in the hands and is usually worse in the first few days of treatment.
- Palpitations and tachycardia
- Headache
- Seizure
- Anxiety
- Hypokalaemia
- Cardiac arrhythmia and paradoxical bronchospasms (rare)
- Acute angle-closure glaucoma
- QT-interval prolongation

Notes

Selective beta-2 agonists act directly on beta-2 receptors, causing smooth muscle relaxation and dilation of the airways.

Mild to moderate symptoms of asthma respond rapidly to the inhalation of a selective short-acting beta2 agonist such as salbutamol or terbutaline sulfate. Short-acting beta-2 agonists have a rapid onset of action (15 minutes) and their effects last for up to 4 hours. Salbutamol or terbutaline sulfate can be given intravenously for severe or life-threatening acute asthma; patients should be carefully monitored and the dose adjusted according to response and heart rate.

Short-acting beta-2 agonists are used for immediate relief of asthma symptoms, while some long-acting (2 agonists e.g. salmeterol) are added to an inhaled corticosteroid in patients requiring prophylactic treatment.

Caution

Beta-2 agonists should be used with caution in people with:

- Cardiovascular disease including arrhythmias and hypertension (beta-2 agonists may cause an increased risk of arrhythmias and significant changes to blood pressure and heart rate).
- Diabetes (risk of hyperglycaemia and ketoadosis, especially with intravenous use)
- Hyperthyroidism (beta-2 agonists may stimulate thyroid activity)
- Hypokalaemia (potentially serious hypokalaemia may result from beta-2 agonist therapy; this effect may be potentiated in severe asthma by concomitant treatment with theophylline, corticosteroids, diuretics and by hyperparathyroidism)
- Susceptibility to QT-interval prolongation
- Concomitant disorders

Interactions

Hypokalaemia may be potentiated by concomitant treatment with theophylline and its derivatives, corticosteroids, and diuretics. This in turn may predispose to toxicity in patients taking dipirone.

Side effects

Side effects are usually dose related and include:

- Fine tremor — occurs particularly in the hands and is usually worse in the first few days of treatment.
- Palpitations and tachycardia
- Headache
- Seizure
- Anxiety
- Hypokalaemia
- Cardiac arrhythmia and paradoxical bronchospasms (rare)
- Acute angle-closure glaucoma
- QT-interval prolongation

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Pharmacology: Respiratory and Endocrine

Question 5 of 76

A 10 year old patient, with a known allergy to nuts, is brought into ED with wheezing and difficulty in breathing, after eating cake at a birthday party. You suspect anaphylaxis. What is the appropriate dose of adrenaline to administer to this patient:

- a) 50 milligrams intramuscularly
- b) 5 milligrams intramuscularly
- c) 500 micrograms intramuscularly
- d) 300 micrograms intramuscularly
- e) 150 micrograms intramuscularly
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**Notes**

**Nutritional**
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Pharmacology: Respiratory and Endocrine

Question 6 of 76

Ipratropium bromide should be used with caution in patients with which of the following conditions:

- Convulsive disorders
- Prostatic hyperplasia
- Hypokalaemia
- Diabetes mellitus
- Hyperthyroidism

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Pharmacology: Respiratory and Endocrine

Question 4 of 76

Ipratropium bromide should be used with caution in patients with which of the following conditions:

- a) Convulsive disorders
- b) Prostatic hyperplasia
- c) Hypokalaemia
- d) Diabetes mellitus
- e) Hyperthyroidism

Answer

Ipratropium bromide should be used with caution in:

- Men with prostatic hyperplasia and bladder-outflow obstruction (worsened urinary retention has been reported in elderly men)
- People with chronic kidney disease (CKD) stages 3 and above (because of the risk of drug toxicity)
- People with angle-closure glaucoma (rebulised mist of antimuscarinic drugs can precipitate or worsen acute angle-closure glaucoma)

Notes

Ipratropium bromide, a short-acting antimuscarinic bronchodilator, causes bronchodilation by blocking the cholinergic nerves in the airways.

Ipratropium bromide can provide short-term relief in chronic asthma, but short-acting beta-2 agonists act more quickly and are preferred. Ipratropium bromide by nebulisation can be added to other standard treatment in life-threatening asthma or if acute asthma fails to improve with standard therapy.

The aerosol inhalation of ipratropium bromide may be used for short-term relief in mild COPD in patients who are not using a long-acting antimuscarinic drug. Its maximal effect occurs 30–60 minutes after use; its duration of action is 3 to 6 hours and bronchodilation can usually be maintained with treatment 3 times a day.

Caution

Ipratropium bromide should be used with caution in:

- Men with prostatic hyperplasia and bladder-outflow obstruction (worsened urinary retention has been reported in elderly men)
- People with chronic kidney disease (CKD) stages 3 and above (because of the risk of drug toxicity)
- People with angle-closure glaucoma (rebulised mist of antimuscarinic drugs can precipitate or worsen acute angle-closure glaucoma)

Interactions

There are no important drug interactions with inhaled muscarinic antagonists.

Side effects

Inhaled antimuscarinics are generally well tolerated as they are poorly absorbed systemically.

Their adverse effects include:

- Dry mouth and abnormal taste in the mouth
- Nasal congestion and dryness of nasal mucosa
- Acute angle-closure glaucoma (reported in people on nebulised ipratropium)
Pharmacology: Respiratory and Endocrine

Question 7 of 76

Regarding theophylline, which of the following statements is CORRECT:

- Theophylline is an antimuscarinic bronchodilator.  
- Theophylline is effective in acute exacerbations of COPD.  
- Theophylline is predominantly cleared by the kidneys.  
- Clearance of theophylline is increased in smokers.  
- Theophylline may cause severe hyperkalaemia and potassium levels should be monitored.

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Pharmacology: Respiratory and Endocrine

Question 7 of 7

Reporting theophylline, which of the following statements is CORRECT?

a) Theophylline is a respiratory decongestant.
b) Theophylline is effective in acute exacerbation of COPD.
c) Theophylline is predominantly cleared by the kidneys.
d) Theophylline is one of the most commonly used bronchodilators.
e) Theophylline may cause severe hyperparathyroidism in patients with osteoporosis.

Answer

The primary phytoplanktonic concentration is decreased in cases, and by alcohol consumption. Theophylline is a xanthine analog which inhibits phosphodiesterase, resulting in decreased tissue concentrations of cyclic adenosine monophosphate (cAMP).

Theophylline is metabolized in the liver, and if to lower therapeutic levels. The plasma theophylline concentration is decreased in heart failure, hepatic impairment, in critical patients to have a lower than the normal. An addional or dosage may be necessary to achieve target accumulation. The plasma theophylline concentration is increased in smokers, due to the oral absorption.

Contraindications

Theophylline should not be prescribed to:

- Patients with coronary artery disease
- Patients with hyperthyroidism or myasthenia gravis
- Children concurrently receiving epinephrine
- Infants under 6 months of age

Caution

Theophylline should be used with caution in patients with:

- Cardiovascular disease or other cardiac disease
- Hepatic impairment
- Hyperthyroidism
- Hypoparathyroidism
- Plastic ulcer
- Risk of hypercalcemia

Interactions

Hypocalcemia may be potentiated by concurrent therapy with other bronchodilator medications, which includes oral contraceptives and tolbutamide.

Examples of enzyme-inducing drugs (lower plasma theophylline level)

- Carbamazepine
- Chlorpromazine
- Phenytoin
- Theophylline
- Chloral hydrate
- Diazepam
- Monoamine oxidase inhibitors

Examples of enzyme-inhibiting drugs (lower plasma theophylline level)

- Enalaprilat
- Clonidine
- Glibenclamide
- Flavopiridol
- Verapamil
- Atorvastatin

Side effects

- Tachycardia, palpitations, and arrhythmias
- CNS stimulation, tremor, headache, insomnia, sedation, confusion
- GI irritation, nausea, vomiting, and diarrhea
- Hypocalcemia (potentially serious hypocalcemia may result from bronchodilator therapy. This effect may be potentiated in severe asthma by concurrent treatment with theophylline and its derivatives, corticosteroids, and diuretics, and by hypocalcemia)

Mechanism of action

In most individuals, a plasma theophylline concentration of 10 - 20 mg/L (50 - 110 mcg/mL) is normal. The plasma theophylline concentration of 1 - 10 mg/L is relatively effective. Theophylline is excreted in the urine, and with increased frequency of dosing higher concentrations are achieved. Plasma theophylline concentrations are monitored by determining urinary concentrations. This may be done every 3 days after an acute dose adjustment.

Dosage

Theophylline bronchodilator cause vomiting (which may be severe and last up to 24 hours), urination, palpitations, swelling of the face, chest pain, and dyspnea. Secretory effects include nausea, vomiting, diarrhea, and abdominal pain. More serious effects include convulsions, convulsions, and anaphylaxis. Severe hypocalcemia may develop rapidly.

Resources

- University of Tennessee College of Pharmacy
- American College of Obstetricians and Gynecologists

Instructions

- Click on the correct answer.
- Continue with the next question.
- Submit answer.
Pharmacology: Respiratory and Endocrine

Question 8 of 76

Which of the following is NOT a typical side effect of theophylline:

- [ ] a. Hypokalaemia
- [ ] b. Headache
- [ ] c. Bradycardia
- [ ] d. Convulsions
- [ ] e. Gastric irritation

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Question Navigator

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4. Answered
5. Answered
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7. Answered
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10. ...
11. ...
12. ...

Something wrong?
Pharmacology: Respiratory and Endocrine

Question: Which of the following is NOT a typical side-effect of theophylline:
- a) Hypertension
- b) Nausea
- c) Bradycardia
- d) Coughing
- e) Goitrous neoplasms

Answer: Side-effects include:
- Tachyphylaxis and cardiac arrhythmias
- CHF stabilisation, irreversible bronchoconstriction
- Goitrous neoplasms, osteomalacia and diaphoresis
- Hypokalaemia (potentially serious): hypo-kalaemia may result from beta-2 agonists therapy; this effect may be potentiated in severe asthmatics by concurrent treatment with theophylline and its derivatives, corticosteroids, and diuretics, as well as hypothyroidism.

Notes: Theophylline may cause an add-on bronchodilatory effect when used in conjunction with oral or inhaled beta-2 agonists. Theophylline is currently used in those with bronchial obstruction and the effects of chronic obstructive pulmonary disease (COPD). However, it is not a substitute for beta-2 agonists.

Indications:
- It is used as a bronchodilator in asthma and atopic COPD, to maintain clinical control of chronic lung disease and asthma.

Contraindications:
- Theophylline should not be prescribed to:
  - People on warfarin
  - People with hepatic enzyme induction
  - Children concurrently receiving intravenous diuretics

Cautions:
- Theophylline should be used with caution in patients with:
  - Chronic obstructive pulmonary disease (COPD)
  - Heart disease
  - Hypothyroidism

Interactions:
- Hypokalaemia may be potentiated by concurrent therapy with beta-2 agonists, corticosteroids and diuretics.

Exercise of caution may be required by concurrent therapy with theophylline and:
- In some instances, theophylline may be used as an alternative to beta-2 agonists.

Examples of theophylline-halting drugs (lower plasma theophylline level):
- Theophylline
- Contra-indication
- Caffeine
- Fluoxetine
- Warfarin
- Cimetidine

Examples of theophylline-inducing drugs (lower plasma theophylline level):
- Propranolol
- Theophylline
- Theophylline
- Carbamazepine
- Phenytoin
- Rifampicin
- St John's Wort

Side effects:
- Tachyphylaxis and cardiac arrhythmias
- CHF stabilisation, irreversible bronchoconstriction
- Goitrous neoplasms, osteomalacia and diaphoresis
- Hypokalaemia (potentially serious): hypo-kalaemia may result from beta-2 agonists therapy; this effect may be potentiated in severe asthmatics by concurrent treatment with theophylline and its derivatives, corticosteroids, and diuretics, as well as hypothyroidism.

Medication requirements:
- In most individuals, a plasma theophylline concentration of 20 - 25 mg/dL (1 - 2.5 micromol/L) is required for satisfactory bronchodilatation, although a single plasma theophylline concentration of 17 - 19 mg/dL (1.1 - 1.3 micromol/L) may be effective. Adverse effects often occur with serum theophylline concentrations exceeding 20 mg/dL (1.3 micromol/L) and below 20 mg/dL (1.3 micromol/L) and severely increase at concentrations above 25 mg/dL (1.7 micromol/L).

Phosphate-theophylline concentrations should be measured 5 days after starting oral treatment and at least 5 days after any dose adjustment.

Dose:
- Theophylline concentrations may cause ventricular arrhythmias or may be seen in severe and intractable, asthmatic, bronchospastic, and hyperthermic. More severe effects are haemorrhagic, convulsions, and supraventricular and ventricular arrhythmias. Severe hypothyroidism may develop rapidly.

Resources:
- The North American Thoracic Society
- American Thoracic Society
- European Respiratory Society
- American Academy of Allergy

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Pharmacology: Respiratory and Endocrine

Question 9 of 76

What is the mechanism of action of cetirizine:

a. H1-receptor antagonist
b. Histamine agonist
c. H2-receptor antagonist
d. Leukotriene receptor antagonist
e. Muscarinic antagonist

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Pharmacology: Respiratory and Endocrine

Question 4 of 9

What is the mechanism of action of cetirizine:

- a) H1-receptor antagonist
- b) Histamine agonist
- c) H2-receptor antagonist
- d) Lisuridine receptor antagonist
- e) Muscarinic antagonist

Answer

Cetirizine is a competitive inhibitor at the H1-receptor (an anti-histamine).

Notes

Antihistamines are competitive inhibitors at the H1-receptor (in contrast to H2-receptor antagonists used to decrease gastric acid secretion). They act to relax histamine-induced bronchoconstriction, block the vasodilator effect of histamine, inhibit histamine-induced increases in capillary permeability and block mucus secretion and sensory nerve stimulation.

Histamine (H1)-receptor antagonists are well absorbed after oral administration. The effects of these agents are usually seen in 30 minutes (with maximal effects at 1 - 2h); the duration of action is 3 - 8 hours for first-generation compounds and 3 - 24 hours for second-generation compounds.

H1-receptor antagonists are metabolised in the liver; many reduce microsomal enzymes and alter their own metabolism and that of other drugs.

Indications

- Allergic rhinitis and conjunctivitis
- Urticarial rashes, pruritus, insect bites and stings
- Angioedema
- Anaphylaxis (second line adjunct to adrenaline)
- Nausea/vomiting and prevention of motion sickness
- Insomnia

Chlorphenamine

All older antihistamines cause sedation but alimemazine tartrate and promethazine may be more sedating whereas chlorphenamine maleate and cyclizine may be less so. This sedating activity is sometimes used to manage the pruritus associated with some allergies or used to manage occasional insomnias. There is little evidence that any one of the older, 'sedating' antihistamines is superior to another and patients vary widely in their response.

Cetirizine

The newer antihistamines e.g. cetirizine cause less sedation and psychomotor impairment than the older antihistamines because they are much less lipid soluble and penetrate the blood brain barrier only to a slight extent.

Cautions

Antihistamines should usually be avoided in acute porphyrias (although some antihistamines are thought to be safe).

Antihistamines should be used with caution in epilepsy, preexisting hypotension, urinary hypertension, hepatic impairment and susceptibility to angle-closure glaucoma.

Side effects (significantly reduced with second generation agents)

Elderly patients and children are more susceptible to side-effects.

Common side-effects of antihistamines may include:

- Anticholinergic effects (blurred vision, dry mouth, urinary retention)
- Headache
- Gastrointestinal disturbances
- Psychomotor impairment (dizziness, dizziness and loss of appetite)

Drowsiness may affect performance of skilled tasks (e.g. cycling or driving); sedating effects are enhanced by alcohol and opioid analgesics.
Pharmacology: Respiratory and Endocrine

Question 10 of 76

Which of the following is NOT a mineralocorticoid effect of corticosteroids:

- a. Hypertension
- b. Oedema
- c. Potassium loss
- d. Calcium loss
- e. Hyperglycaemia

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Pharmacology: Respiratory and Endocrine

Source: By Dr.

About which of the following is NOT a respiratory or endocrine side effect of corticosteroids:

- Hypertension
- Insulin resistance
- Minor epistaxis
- Prostatitis
- Urticaria

Notes

In comparing the relative potencies of corticosteroids in their effect on their respective side effects, it is useful that high doses lead to high levels of side effects. This advantage of corticosteroids is accompanied by low-dose low-endocrine side effects.

Risk Inflammatory Gastrointestinal: Equivalent and inflammatory doses of corticosteroids:

Prednisone 5 mg / Day / Intravenous / Hydrocortisone: 1 mg / Day.

This does not relate to other inflammatory or endocrine effects.

Side effects:

- Hypertension
- Insulin resistance
- Minor epistaxis
- Prostatitis
- Urticaria

Notes

Increased serum levels of corticosteroids are linked to various functions of the adrenocortical glucocorticoid and mineralocorticoid side effects. Mineralocorticoid side effects are more severe with hydrocortisone, but severe hypertension may be avoided with the high-dose low-endocrine glucocorticoids. Better emphasis and treatment, and occur severe with mildly hydrocorticosteroid and mineralocorticoid.

Mineralocorticoid side effects include:

- Sodium retention
- Hypertension
- Hypokalemia
- Fluid retention
- Oliguria
- Renal failure

Obstetric indications:

During pregnancy, use corticosteroids, particularly with saline use, at an increased dosage and for 48 hours after falling asleep. Painful uterine contractions following an oral pregnancy test lead to increased labor. Therefore, evaluation is frequently repeated and the drug may be administered to the pregnant patient, usually after the neonatal respiratory tract. Therefore, administration of corticosteroids in the late stage of pregnancy is contraindicated.

The combination of an adenosine receptor antagonist, (such as betaxolol, a beta-blocker, or disopyramide) significantly reduces the risk of premature labor.

Pregnant women take corticosteroids instead of a corticosteroid that may prevent a contraindication or reduce the risk of premature labor.

Diplopia:

Pregnant courses of corticosteroids increase the risk of hypothyroidism and adrenal insufficiency. The clinical presentation of these effects may be delayed.

Unless they first stop smoking, patients taking oral or parenteral corticosteroids for purposes other than replacement therapy may develop a mild degree of asthma. Manifestations of this condition include increased respiratory noise, rapid breathing, and a feeling of breathlessness.

Patients with a history of asthma or bronchitis, or who develop coughing when taking corticosteroids, should be instructed to continue their usual medication. Corticosteroids taken during pregnancy may result in premature labor.

Prednisone, a corticosteroid, is a potent anti-inflammatory agent used in the management of chronic inflammatory conditions, such as lupus erythematosus disseminatus. It is associated with a number of side effects, including hypertension, diabetes, peptic ulceration, and skin rash. Prednisone is a potent anti-inflammatory agent used in the management of chronic inflammatory conditions, such as lupus erythematosus disseminatus. It is associated with a number of side effects, including hypertension, diabetes, peptic ulceration, and skin rash. Prednisone is a potent anti-inflammatory agent used in the management of chronic inflammatory conditions, such as lupus erythematosus disseminatus. It is associated with a number of side effects, including hypertension, diabetes, peptic ulceration, and skin rash. Prednisone is a potent anti-inflammatory agent used in the management of chronic inflammatory conditions, such as lupus erythematosus disseminatus. It is associated with a number of side effects, including hypertension, diabetes, peptic ulceration, and skin rash. Prednisone is a potent anti-inflammatory agent used in the management of chronic inflammatory conditions, such as lupus erythematosus disseminatus. It is associated with a number of side effects, including hypertension, diabetes, peptic ulceration, and skin rash.
Pharmacology: Respiratory and Endocrine

Question 11 of 76

Which of the following types of food is most commonly implicated in anaphylactic reactions:

- a. Eggs
- b. Milk
- c. Nuts
- d. Shellfish
- e. Chickpeas

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Pharmacology: Respiratory and Endocrine

Answer

Anaphylaxis

Anaphylactic shock triggers are air, heat, and non-thermal allergens. Delayed allergic reactions are not uncommon. Examples include drug allergy, occupational asthma, and anaphylaxis to foods. Symptoms range from mild (e.g., urticaria, hives, itching, and sneezing) to severe (e.g., bronchospasm, hypotension, shock). Anaphylactic shock requires immediate medical attention.

Notes

Anaphylaxis occurs in four stages: (1) urticaria, (2) hypotension, (3) shock, and (4) death. The pre-syncope stage is characterized by symptoms such as flushing, abdominal pain, and diarrhea. The hypotension stage is characterized by symptoms such as palpitations, nausea, and vomiting. The shock stage is characterized by symptoms such as dyspnea, tachypnea, and hypothermia. The death stage is characterized by symptoms such as respiratory arrest and cardiac arrest.

Global facts

Anaphylaxis is the result of an immune response characterized by IgE-mediated release of mediators from mast cells and basophils. Symptoms of anaphylaxis can vary in severity and may include skin symptoms, respiratory symptoms, gastrointestinal symptoms, and cardiovascular symptoms. Anaphylaxis can be treated with adrenaline (epinephrine) and antihistamines.

Introduction to management

- Diagnose: Provide the diagnosis of anaphylaxis, identify the trigger, and assess the severity of the reaction.
- Treat: Administer adrenaline (epinephrine) and antihistamines, monitor the patient's vital signs, provide support for the airway, and manage any underlying conditions.
- Prevent: Implement strategies to prevent anaphylaxis, including education and patient counseling.

Contraindications of treatment

- Emergency treatment should not be delayed, but it should be focused on a clinical diagnosis of anaphylaxis.
- When diagnosing anaphylaxis, it is important to consider the patient's history, physical examination, and laboratory tests.
- Treatment should be initiated promptly, but it should be continued until the patient is stable.
- Antihistamines should be administered if the patient has symptoms of anaphylaxis, but they should not be used as a substitute for adrenaline (epinephrine).
- Corticosteroids should be administered if the patient has symptoms of anaphylaxis, but they should not be used as a substitute for adrenaline (epinephrine).
Pharmacology: Respiratory and Endocrine

Question 12 of 76

Which of the following drug classes is most commonly implicated in anaphylactic reactions:

- a. Thrombolytic drugs
- b. ACE inhibitors
- c. Local anaesthetics
- d. NSAIDs
- e. Opioids
Pharmacology: Respiratory and Endocrine

Introduction

Objective of the following drug classes is to treat certain conditions. They can be used to:

- Treat asthma
- Treat diabetes
- Treat high blood pressure
- Treat heart failure
- Treat other conditions

Anesthesia

Anesthesia is given to patients who are about to undergo a surgical procedure. It is used to prevent pain and memory loss during surgery. There are several types of anesthesia:

- General anesthesia
- Regional anesthesia
- Local anesthesia

Notes

The following points should be noted:

- Anesthesia is essential for patient safety.
- Proper monitoring is crucial during anesthesia.
- Patients can experience side effects.

Global cases

Anesthesia is a vital component of modern medicine. It is used worldwide to treat patients. The use of anesthesia has increased significantly in recent years.

- In low-income countries, access to anesthesia is limited.
- In high-income countries, anesthesia is widely available.

Indications of anesthesia

- Intravenous agents
- Oral agents
- Inhalation agents

Anesthetics

- General anesthetics
- Regional anesthetics
- Local anesthetics

Emergency equipment

Emergency equipment is necessary to handle unexpected situations during anesthesia.

- Ventilators
- Defibrillators
- Intravenous infusion pumps

Contraindications of anesthesia

- Severe heart conditions
- Severe respiratory conditions
- Severe hepatic conditions
- Severe renal conditions

Q1: What are the purposes of anesthesia?
A1: To prevent pain, to prevent memory loss, and to sedate patients.

Q2: What are the types of anesthesia?
A2: General anesthesia, regional anesthesia, and local anesthesia.

Q3: What are the indications of anesthesia?
A3: Intravenous agents, oral agents, and inhalation agents.

Q4: What are the contraindications of anesthesia?
A4: Severe heart conditions, severe respiratory conditions, severe hepatic conditions, severe renal conditions.

References

- Anesthesiology: A Comprehensive Textbook
- Anesthesia: A Comprehensive Review and Practice
- Anesthesia: A Critical Care Approach

Further Reading

- American Society of Anesthesiologists
- World Health Organization
- National Institute for Health and Care Excellence

Author:

[Name]

Date:

[Date]

Footnote:

[Footnote]
Pharmacology: Respiratory and Endocrine

Question 13 of 76

Which of the following is NOT an indication for an antihistamine:

- [ ] a. Anaphylaxis
- [ ] b. Nausea and vomiting
- [ ] c. Allergic rhinitis
- [ ] d. Insomnia
- [ ] e. Gastrooesophageal reflux disease

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Pharmacology: Respiratory and Endocrine

Question: Which of the following is NOT an indication for an antihistamine:

- a) Anaphylaxis
- b) Nausea and vomiting
- c) Allergic reactions
- d) Insomnia
- e) Gastroesophageal reflux disease

Answer:
Antihistamines are competitive inhibitors at the H1 receptor (in contrast to H2 receptor antagonists used to decrease gastric acid secretion in gastroesophageal reflux disease).

Indications:
- Allergic rhinitis and conjunctivitis
- Urticaria/eczema, pruritus, insect bites and stings
- Angioedema
- Anaphylaxis (second line adjunct to adrenaline)
- Nausea/vomiting and prevention of motion sickness
- Insomnia

Notes:
Antihistamines are competitive inhibitors at the H1 receptor (in contrast to H2 receptor antagonists used to decrease gastric acid secretion). They act to relax histamine-induced bronchoconstriction, block the vasodilator effect of histamine, inhibit histamine-induced increase in capillary permeability and block mucous secretion and sensory nerve stimulation.

Histamine (H3) receptor antagonists are well absorbed after oral administration. The effects of these agents are usually seen in 50 minutes with maximal effects at 1–2 h. The duration of action is 3–8 hours for first-generation compounds and 3–24 hours for second-generation compounds.

H1-receptor antagonists are metabolized in the liver; many induce microsomal enzymes and alter their own metabolism and that of other drugs.

Indications:
- Allergic rhinitis and conjunctivitis
- Urticaria/eczema, pruritus, insect bites and stings
- Angioedema
- Anaphylaxis (second line adjunct to adrenaline)
- Nausea/vomiting and prevention of motion sickness
- Insomnia

Chlorphenamine
All other antihistamines cause sedation but also minimize tinnitus and promethazine may be more sedating whereas chlorphenamine makes you feel and drowsy may be less so. This sedating activity is sometimes used to manage the pruritus associated with some allergies or used to manage emotional insomnia. There is little evidence that any one of the older, ‘sedating’ antihistamines is superior to another and patients vary widely in their response.

Cetirizine
The newer antihistamines e.g. cetirizine cause less sedation and psychomotor impairment than the older antihistamines because they are much less lipid soluble and penetrate the blood-brain barrier to a slight extent.

Cautions
Antihistamines should usually be avoided in acute porphyria (although some antihistamines are thought to be safe).

Antihistamines should be used with caution in epilepsy, prostatic hypertrophy, uterine hyperplasia, hepatic impairment and susceptibility to angle-closure glaucoma.

Side effects (significantly reduced with second-generation agents)
Elderly patients and children are more susceptible to side effects.

Common side effects of antihistamines may include:
- Anticholinergic effects (blurred vision, dry mouth, urinary retention)
- Headache
- Gastrointestinal disturbances
- Psychomotor impairment (sedation, dizziness and loss of appetite)

Drowsiness may affect performance of skilled tasks (e.g. cycling or driving); sedating effects are enhanced by alcohol and opiate analgesics.
Pharmacology: Respiratory and Endocrine

Question 14 of 76

A 19 year old student presents to ED with severe acute asthma. You prescribe a salbutamol and ipratropium bromide nebuliser. What is the most appropriate dose of salbutamol to prescribe initially for this patient:

- a) 10 mg every 10 minutes
- b) 5 mg every 15 – 30 minutes
- c) 2.5 mg every 10 – 20 minutes
- d) 0.5 mg every 20 – 30 minutes
- e) 0.5 mcg every 10 – 2 minutes

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Pharmacology: Respiratory and Endocrine

Question 15 of 76

Hydrocortisone would be most useful for which of the following conditions:

- a. Raised intracranial pressure secondary to malignancy
- b. Neuropathic postural hypotension
- c. Mineralocorticoid replacement in Addison's disease
- d. Long-term suppression in rheumatoid arthritis
- e. Emergency management of anaphylaxis

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Pharmacology: Respiratory and Endocrine

Question: What condition would be most useful for which of the following conditions?

- Bronchodilator
- Antibacterial
- Antihypertensive
- Antidiabetic

Answer: Bronchodilator

The study of the pharmacological properties of bronchodilation, and the resulting clinical use, makes it useful for diseases such as chronic bronchitis. However, since bronchodilation can be used for a wide range of conditions, its use is limited to a short duration of treatment. For chronic diseases, it is important to avoid bronchodilation as it can lead to the development of side effects.

Notes: In the case of chronic conditions, bronchodilation is not recommended due to its long-term effects. It is recommended to use bronchodilators for short-term use under medical supervision.

B) In which of the following conditions would the use of bronchodilators be contraindicated?

- Bronchial asthma
- Chronic obstructive pulmonary disease
- Acute respiratory distress syndrome
- Chronic lung disease

Answer: Chronic obstructive pulmonary disease

The use of bronchodilators is contraindicated in chronic obstructive pulmonary disease as it can lead to an increase in airway resistance and worsen the condition.

Notes: In chronic obstructive pulmonary disease, bronchodilators should be avoided as they can worsen the condition.

C) Which of the following conditions would benefit from the use of a bronchodilator?

- Asthma
- Bronchiectasis
- Acute bronchitis
- Chronic obstructive pulmonary disease

Answer: Asthma

The use of bronchodilators is beneficial in asthma as it can help relax the muscles in the airways and reduce the symptoms of asthma.

Notes: Bronchodilators are recommended for the acute and chronic treatment of asthma.

D) Which of the following conditions would be treated with an antihypertensive medication?

- Hypertension
- Hypercholesterolemia
- Diabetes mellitus
- Bronchial asthma

Answer: Hypertension

The use of antihypertensive medications is recommended for the treatment of hypertension, as it helps to lower blood pressure and reduce the risk of heart disease and stroke.

Notes: Antihypertensive medications should be taken regularly under medical supervision.

E) Which of the following conditions would be treated with an antibiotic medication?

- Acute bronchitis
- Chronic obstructive pulmonary disease
- Bronchiectasis
- Pneumonia

Answer: Pneumonia

The use of antibiotics is recommended for the treatment of pneumonia, as it helps to kill the bacteria that cause pneumonia and prevent further complications.

Notes: Antibiotics should be taken under the supervision of a healthcare provider.

F) Which of the following conditions would be treated with an antidiabetic medication?

- Type 1 diabetes
- Type 2 diabetes
- Gestational diabetes
- Prediabetes

Answer: Type 2 diabetes

The use of antidiabetic medications is recommended for the treatment of type 2 diabetes, as it helps to control blood sugar levels and reduce the risk of complications.

Notes: Antidiabetic medications should be taken under the supervision of a healthcare provider.

G) Which of the following conditions would benefit from the use of a bronchodilator and an antihypertensive medication?

- Asthma with hypertension
- Chronic obstructive pulmonary disease with hypercholesterolemia
- Acute bronchitis with hypercholesterolemia
- Chronic obstructive pulmonary disease with diabetes mellitus

Answer: Asthma with hypertension

The use of bronchodilators and antihypertensive medications is recommended for the treatment of asthma with hypertension, as it helps to relax the muscles in the airways and lower blood pressure.

Notes: Antihypertensive and bronchodilator medications should be taken under the supervision of a healthcare provider.

H) Which of the following conditions would benefit from the use of an antibiotic medication and an antidiabetic medication?

- Pneumonia with type 1 diabetes
- Pneumonia with type 2 diabetes
- Bronchiectasis with prediabetes
- Acute bronchitis with gestational diabetes

Answer: Pneumonia with type 2 diabetes

The use of antibiotics and antidiabetic medications is recommended for the treatment of pneumonia with type 2 diabetes, as it helps to kill the bacteria that cause pneumonia and control blood sugar levels.

Notes: Antibiotics and antidiabetic medications should be taken under the supervision of a healthcare provider.

I) Which of the following conditions would benefit from the use of a bronchodilator and an antidiabetic medication?

- Asthma with prediabetes
- Chronic obstructive pulmonary disease with type 1 diabetes
- Acute bronchitis with type 2 diabetes
- Bronchiectasis with gestational diabetes

Answer: Asthma with prediabetes

The use of bronchodilators and antidiabetic medications is recommended for the treatment of asthma with prediabetes, as it helps to relax the muscles in the airways and control blood sugar levels.

Notes: Antidiabetic and bronchodilator medications should be taken under the supervision of a healthcare provider.

J) Which of the following conditions would benefit from the use of an antibiotic medication and an antihypertensive medication?

- Pneumonia with hypertension
- Bronchiectasis with hypercholesterolemia
- Acute bronchitis with hypercholesterolemia
- Chronic obstructive pulmonary disease with diabetes mellitus

Answer: Pneumonia with hypertension

The use of antibiotics and antihypertensive medications is recommended for the treatment of pneumonia with hypertension, as it helps to kill the bacteria that cause pneumonia and lower blood pressure.

Notes: Antibiotics and antihypertensive medications should be taken under the supervision of a healthcare provider.

K) Which of the following conditions would benefit from the use of a bronchodilator and an antidiabetic medication?

- Asthma with type 1 diabetes
- Chronic obstructive pulmonary disease with type 2 diabetes
- Acute bronchitis with gestational diabetes
- Bronchiectasis with prediabetes

Answer: Asthma with type 1 diabetes

The use of bronchodilators and antidiabetic medications is recommended for the treatment of asthma with type 1 diabetes, as it helps to relax the muscles in the airways and control blood sugar levels.

Notes: Antidiabetic and bronchodilator medications should be taken under the supervision of a healthcare provider.

L) Which of the following conditions would benefit from the use of an antibiotic medication and an antihypertensive medication?

- Pneumonia with hypertension
- Bronchiectasis with hypercholesterolemia
- Acute bronchitis with hypercholesterolemia
- Chronic obstructive pulmonary disease with diabetes mellitus

Answer: Pneumonia with hypertension

The use of antibiotics and antihypertensive medications is recommended for the treatment of pneumonia with hypertension, as it helps to kill the bacteria that cause pneumonia and lower blood pressure.

Notes: Antibiotics and antihypertensive medications should be taken under the supervision of a healthcare provider.

M) Which of the following conditions would benefit from the use of a bronchodilator and an antidiabetic medication?

- Asthma with type 1 diabetes
- Chronic obstructive pulmonary disease with type 2 diabetes
- Acute bronchitis with gestational diabetes
- Bronchiectasis with prediabetes

Answer: Asthma with type 1 diabetes

The use of bronchodilators and antidiabetic medications is recommended for the treatment of asthma with type 1 diabetes, as it helps to relax the muscles in the airways and control blood sugar levels.

Notes: Antidiabetic and bronchodilator medications should be taken under the supervision of a healthcare provider.

N) Which of the following conditions would benefit from the use of an antibiotic medication and an antihypertensive medication?

- Pneumonia with hypertension
- Bronchiectasis with hypercholesterolemia
- Acute bronchitis with hypercholesterolemia
- Chronic obstructive pulmonary disease with diabetes mellitus

Answer: Pneumonia with hypertension

The use of antibiotics and antihypertensive medications is recommended for the treatment of pneumonia with hypertension, as it helps to kill the bacteria that cause pneumonia and lower blood pressure.

Notes: Antibiotics and antihypertensive medications should be taken under the supervision of a healthcare provider.

O) Which of the following conditions would benefit from the use of a bronchodilator and an antidiabetic medication?

- Asthma with type 1 diabetes
- Chronic obstructive pulmonary disease with type 2 diabetes
- Acute bronchitis with gestational diabetes
- Bronchiectasis with prediabetes

Answer: Asthma with type 1 diabetes

The use of bronchodilators and antidiabetic medications is recommended for the treatment of asthma with type 1 diabetes, as it helps to relax the muscles in the airways and control blood sugar levels.

Notes: Antidiabetic and bronchodilator medications should be taken under the supervision of a healthcare provider.

P) Which of the following conditions would benefit from the use of an antibiotic medication and an antihypertensive medication?

- Pneumonia with hypertension
- Bronchiectasis with hypercholesterolemia
- Acute bronchitis with hypercholesterolemia
- Chronic obstructive pulmonary disease with diabetes mellitus

Answer: Pneumonia with hypertension

The use of antibiotics and antihypertensive medications is recommended for the treatment of pneumonia with hypertension, as it helps to kill the bacteria that cause pneumonia and lower blood pressure.

Notes: Antibiotics and antihypertensive medications should be taken under the supervision of a healthcare provider.
Pharmacology: Respiratory and Endocrine

Question 16 of 76

A 35 year old woman presents to ED with an acute asthma attack and you are asked to prescribe steroids. What is the most appropriate dose of oral prednisolone to prescribe for this patient:

- a) 20 mg daily
- b) 30 mg daily
- c) 40 mg daily
- d) 60 mg daily
- e) 80 mg daily

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Pharmacology: Respiratory and Endocrine

Question 17 of 76

Which of the following is a common side effect of ipratropium bromide:

a. Ankle oedema
b. Oral candidiasis
c. Bradycardia
d. Dry mouth
e. Tremor

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Pharmacology: Respiratory and Endocrine

Question 17 of 76

Which of the following is a common side effect of ipratropium bromide:

a) Ankle oedema  
b) Oral candidiasis  
c) Bradycardia  
d) Dry mouth  
e) Tremor

Answer

Inhaled antimuscarinics are generally well tolerated as they are poorly absorbed systemically.

Their adverse effects include:

- Dry mouth and abnormal taste in the mouth
- Nasal congestion and dryness of nasal mucosa
- Acute angle-closure glaucoma (reported in people on nebulised ipratropium)

Notes

Ipratropium bromide, a short-acting antimuscarinic bronchodilator, causes bronchodilation by blocking the cholinergic nerves in the airways.

Ipratropium bromide can provide short-term relief in chronic asthma, but short-acting beta-2 agonists act more quickly and are preferred. Ipratropium bromide by nebulisation can be added to other standard treatment in life-threatening asthma or if acute asthma fails to improve with standard therapy.

The aerosol inhalation of ipratropium bromide may be used for short-term relief in mild COPD in patients who are not using a long-acting antimuscarinic drug. Its maximal effect occurs 30 – 60 minutes after use; its duration of action is 3 to 6 hours and bronchodilation can usually be maintained with treatment 3 times a day.

Cautions

Ipratropium bromide should be used with caution in:

- Men with prostatic hyperplasia and bladder-outflow obstruction (worsened urinary retention has been reported in elderly men)
- People with chronic kidney disease (CKD) stages 3 and above (because of the risk of drug toxicity)
- People with angle-closure glaucoma (nebulised mist of antimuscarinic drugs can precipitate or worsen acute angle-closure glaucoma)

Interactions

There are no important drug interactions with inhaled muscarinic antagonists.

Side effects

Inhaled antimuscarinics are generally well tolerated as they are poorly absorbed systemically.

Their adverse effects include:

- Dry mouth and abnormal taste in the mouth
- Nasal congestion and dryness of nasal mucosa
- Acute angle-closure glaucoma (reported in people on nebulised ipratropium)
Pharmacology: Respiratory and Endocrine

Question 18 of 76

A 19 year old student presents to ED with severe acute asthma. You prescribe a salbutamol and ipratropium bromide nebuliser. What is the most appropriate dose of ipratropium bromide to prescribe initially for this patient:

a) 1 mg 4 – 6 hourly
b) 0.05 mg every 2 hours
c) 0.5 mg 4 – 6 hourly
d) 2.5 mg 2 – 4 hourly
e) 5 mg hourly

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Pharmacology: Respiratory and Endocrine

Dexamethasone would be most useful for which of the following conditions:

- (a) Raised intracranial pressure secondary to malignancy
- (b) Mineralocorticoid replacement in adrenal insufficiency
- (c) Long-term suppression in rheumatoid arthritis
- (d) Topical use in eczema
- (e) Emergency management of anaphylaxis

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9 Answered
10 Answered
11 Answered
12 Answered

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Pharmacology: Respiratory and Endocrine

Answer

Dexamethasone has two high glucocorticoids in conjunction with significant respiratory effects. This makes it particularly useful for patients who need respiratory support in situations where non-invasive methods are ineffective or contraindicated. Dexamethasone also has a long duration of action so this makes it suitable for use in patients who cannot be monitored closely. It is the first line of choice for the treatment of respiratory distress syndrome.
Pharmacology: Respiratory and Endocrine

Question 20 of 76

What is the mechanism of action of salbutamol:

- a Muscarinic antagonist
- b Selective beta-1 agonist
- c Selective beta-2 agonist
- d Alpha-1 antagonist
- e Alpha-2 agonist

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Question Navigator

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6 Answered
7 Answered
8 Answered
9 Answered
10 Answered
11 Answered
12 Answered

Something wrong?
Pharmacology: Respiratory and Endocrine

What is the mechanism of action of salbutamol:

a) Muscarinic antagonist
b) Selective beta-1 agonist
c) Selective beta-2 agonist ✓
d) Alpha-1 antagonist
e) Alpha-2 agonist

Answer
Salbutamol is a selective beta-2 agonist which acts directly on beta-2 receptors causing smooth muscle relaxation and dilation of the airways.

Notes
Selective beta-2 agonists act directly on beta-2 receptors, causing smooth muscle relaxation and dilation of the airways.

Mild to moderate symptoms of asthma respond rapidly to the inhalation of a selective short-acting beta-2 agonist such as salbutamol or terbutaline sulfate. Short-acting beta-2 agonists have a rapid onset of action (15 minutes) and their effects last for up to 4 hours. Salbutamol or terbutaline sulfate can be given intravenously for severe or life-threatening acute asthma; patients should be carefully monitored and the dose adjusted according to response and heart rate.

Short acting beta-2 agonists are used for immediate relief of asthma symptoms, while some long-acting beta-2 agonists (e.g. salmeterol) are added to an inhaled corticosteroid in patients requiring prophylactic treatment.

Cautions
Beta-2 agonists should be used with caution in people with:

- Cardiovascular disease including arrhythmias and hypertension (beta-2 agonists may cause an increased risk of arrhythmias and significant changes to blood pressure and heart rate)
- Diabetes (risk of hyperglycaemia and ketoadiabisis, especially with intravenous use)
- Hyperthyroidism (beta-2 agonists may stimulate thyroid activity)
- Hypokalaemia (potentially serious hypokalaemia may result from beta-2 agonist therapy; this effect may be potentiated in severe asthma by concomitant treatment with theophylline, corticosteroids, diuretics and by hypocalcaemia)
- Susceptibility to QT-interval prolongation
- Convulsive disorders

Interactions
Hypokalaemia may be potentiated by concomitant treatment with theophylline and its derivatives, corticosteroids, and diuretics. This in turn may predispose to toxicity in patients taking digoxin.

Side effects
Side effects are usually dose related and include:

- Fine tremor — occurs particularly in the hands and is usually worse in the first few days of treatment.
- Palpitations and tachycardia
- Headache
- Seizure
- Anxiety
- Hypokalaemia
- Cardiac arrhythmia and paradoxical bronchospasm (rare)
- Acute angle-closure glaucoma
- QT-interval prolongation
Pharmacology: Respiratory and Endocrine

Question 21 of 76

Regarding the management of diabetic ketoacidosis (DKA), which of the following statements is INCORRECT:

- a. Potassium should be included in the fluid as long as the potassium level remains < 5.5 mmol/L.
- b. Established subcutaneous long-acting insulin therapy should be continued concomitantly.
- c. Blood ketone concentration should fall by at least 0.5 mmol/litre/hour.
- d. Blood glucose concentration should fall by at least 3 mmol/litre/hour.
- e. Insulin may be discontinued once blood glucose has fallen below 10 mmol/L.

See Answer

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Pharmacology: Respiratory and Endocrine

Question 3 of 76

Regarding the management of diabetic ketoacidosis (DKA), which of the following statements is INCORRECT:

a) Potassium should be included in the fluid as long as the potassium level remains < 5.5 mmol/L.

b) Established subcutaneous long-acting insulin therapy should be continued concurrently.

c) Blood ketone concentration should fall by at least 0.5 mmol/L/hour.

d) Blood glucose concentration should fall by at least 3 mmol/L/hour.

e) Insulin may not discontinue once blood glucose has fallen below 10 mmol/L.

Answer

The insulin infusion should be continued until blood ketone concentration is below 0.3 mmol/Litre, blood pH is above 7.3 and the patient is able to eat and drink; ideally the insulin infusion should be stopped about 4 hours after giving subcutaneous first-acting insulin and a meal.

Notes

Diabetic ketoacidosis (DKA) consists of the biochemical triad of ketoacidemia (ketosis), hyperglycaemia, and acidaemia.

Pathophysiology

DKA usually occurs as a consequence of absolute or relative insulin deficiency that is accompanied by an increase in counter-regulatory hormones (i.e. glucagon, cortisol, growth hormone, catecholamines). This increase in hormonal imbalance enhances hepatic gluconeogenesis and glucagon-mediated insulin sensitivity and gluconeogenesis. Enhanced lipolysis increases serum free fatty acids which are then metabolized as an alternative energy source in the process of ketogenesis. This results in accumulation of large quantities of ketone bodies and subsequent metabolic acidosis. Fluid depletion occurs due to osmotic diuresis secondary to hyperglycaemia, vomiting, and inability to take fluid due to a diminished level of consciousness.

Diagnosis

- Ketone level > 3 mmol/L, or significant ketonuria (more than 2+ on a standard urine stick).
- Blood glucose > 11.0 mmol/L, or known diabetes mellitus.
- Bicarbonate (HCO₃⁻) < 13 mmol/L, and/or venous pH < 7.3.

Management of diabetic ketoacidosis in adults

- Intravenous fluids
  - If SBP is below 90 mmHg (adjusted for age, sex, and medication as appropriate), 500 mL, sodium chloride 0.9% should be given by intravenous infusion over 10 - 15 minutes, and repeated if SBP < 90 mmHg.
  - When SBP is greater than 90 mmHg, sodium chloride infusion should be continued at a rate that replaces deficit and provides maintenance.
- Potassium replacement
  - Potassium chloride 60 mmol/L should be included in the fluids (as long as the serum potassium level > 5.5 mmol/L, and if the patient is passing urine) and the plasma potassium concentration maintained between 3.5 - 5.5 mmol/L (measured at 60 minutes, 2 hours, and 2 hours thereafter, and hourly if outside the normal range).
- Insulin
  - An intravenous infusion should be started at a concentration of 1 U/mL at a fixed rate of 0.1 units/hour.
  - Established subcutaneous long-acting insulin therapy should be continued concurrently.
- Blood ketone and blood glucose concentrations should be checked hourly and the insulin infusion rate adjusted accordingly. Blood ketone concentrations should fall by at least 0.5 mmol/Litre/hour and blood glucose concentration should fall by at least 3 mmol/Litre/hour.
- Glucose
  - Once blood glucose concentration falls below 14 mmol/Litre, glucose 10% should be given by intravenous infusion into a large vein through a large-gauge needle at a rate of 125 mL/hour, in addition to the sodium chloride 0.9% infusion.

The insulin infusion should be continued until blood ketone concentration is below 0.3 mmol/Litre, blood pH is above 7.3 and the patient is able to eat and drink; ideally the insulin infusion should be stopped about 4 hours after giving subcutaneous first-acting insulin and a meal.

The management of hyperosmolar hyperglycaemic state or hyperosmolar hyperglycaemic nonketotic coma is similar to that of diabetic ketoacidosis, although lower rates of insulin are usually necessary and slower rehydration may be required.
Pharmacology: Respiratory and Endocrine

Question 22 of 76

Which of the following drugs does NOT increase plasma-theophylline levels:

- Ciprofloxacin (a)
- Clarithromycin (b)
- Verapamil (c)
- Cimetidine (d)
- Rifampicin (e)

< Previous  Next >  See Answer  Something wrong?
Pharmacology: Respiratory and Endocrine

Which of the following drugs does NOT increase plasma thyroxine levels?

- Dopaminergic
- Cholinergic
- Noradrenergic
- Serotoninergic
- Histaminergic

**Answer**

Example of non-selective inhibiting drugs (intra-plasma thyroxine levels)

- Dopaminergic
- Cholinergic
- Noradrenergic
- Serotoninergic
- Histaminergic

Example of non-selective inducing drugs (intra-plasma thyroxine levels)

- Dopaminergic
- Cholinergic
- Noradrenergic
- Serotoninergic
- Histaminergic

**Notes**

Theophylline may have an additional bronchodilator effect when used in concomitant with small doses of beta agonists. Theophylline is aused in patients with mild to moderate bronchial asthma in increased dose concentrations of chronic obstructive pulmonary disease (COPD).

Theophylline is metabolized in the liver, and has a narrow therapeutic index. The plasma theophylline concentration is increased in heart failure, hepatic impairment, in elderly patients, in cirrhosis, to avoid toxicity. Administration of theophylline may be necessary to avoid toxic accumulation. The plasma theophylline concentration is decreased in children, and the elderly.

**Indications**

It is used in chronic obstructive airways and is not generally effective in exacerbations of chronic obstructive pulmonary disease, but is used rarely for severe or life-threatening acute asthma given to facilitate ventilation in aminophylline, a mixture of theophylline with theobromine, which is 20 times more slowly acted than theophylline alone.

**Contraindications**

Theophylline should not be prescribed to:

- Patients with hypertension
- Patients with hyperexcitability or excitability
- Children concurrently receiving aminophylline
- Patients under 18 months of age

**Caution**

Theophylline should be used with caution in people with:

- Cardiac arrhythmias or other cardiac disease
- Hepatic impairment
- Seizure
- Hypertension
- Hypokalemia
- Anticonvulsants
- Beta-blockers

**Interactions**

Hypoglycemia may be potentiated by concurrent treatment with beta-2 agonists, corticosteroids and diuretics.

Excretion of furosemide may be potentiated by concurrent treatment with diuretics.

There is an increased risk of convulsions when theophylline is given with quinolones.

**Flowchart of response inhibiting drugs (intra-plasma thyroxine levels)**

- Dopaminergic
- Cholinergic
- Noradrenergic
- Serotoninergic
- Histaminergic

**Flowchart of response inducing drugs (intra-plasma thyroxine levels)**

- Dopaminergic
- Cholinergic
- Noradrenergic
- Serotoninergic
- Histaminergic

**Side effects**

Side effects include:

- Tachycardia
- Palpitations
- Anemia
- Peripheral edema
- Bradycardia
- Arrhythmias

**Hypersensitivity**

Hypersensitivity to theophylline has not been reported. However, some patients report adverse effects to theophylline.

**Pharmacokinetic considerations**

In most individuals, the plasma theophylline concentration is 10 - 20 mg/L (50 - 100 nmol/L). There is no single saturation of bronchodilator, although lower plasma theophylline concentration of 1 - 15 mg/L (25 - 50 nmol/L) may cause bronchoconstriction. Adverse effects occur when the plasma 10 - 20 mg/L (50 - 100 nmol/L) increase the frequency and severely increase at concentrations above 25 mg/L.

Pharmacokinetic information is used to prescribe and monitor adrenal acts and at least 3 days after any dose adjustment.

**Doses**

Theophylline is administered in doses of 25 - 100 mg/kg, although its use in bronchodilator, agitation, arrhythmias, dizziness, decreased sleep, fever, headache, and hypothermia. Other serious adverse events are hyperkalemia, hypercalcemia, and hyperglycemia. Severe hypokalemia may develop rapidly.

**Resources**

- Primary Care College of Biology
- University of Emergency Medicine
- Advanced Topics in Support
- Advanced Topics in Support
- Pharmacology

- Advanced Topics in Support
- Emergency Medicine
- University of Emergency Medicine
- Advanced Topics in Support
- Pharmacology

- Advanced Topics in Support
- Emergency Medicine
- University of Emergency Medicine
- Advanced Topics in Support
- Pharmacology

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Pharmacology: Respiratory and Endocrine

Question 23 of 76

Glucagon is contraindicated in which of the following:

- a. Arrhythmias
- b. Pheochromocytoma
- c. Liver disease
- d. Cushing's disease
- e. Severe hypertension

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Pharmacology: Respiratory and Endocrine

Question 23 of 76
Glucagon is contraindicated in which of the following:

- a) Achalasia
- b) Pheochromocytoma
- c) Liver disease
- d) Coughing-cough
- e) Severe hypertension

Answer
Glucagon is contraindicated in pheochromocytoma.

Notes
Management of hypoglycaemia in adults

- In adults who are conscious, cooperation and can swallow:
  - Give 15 - 20 g quick acting carbohydrate of the patient's choice where possible e.g. 90 - 120 mL of Lucozade or 5 - 7 Dentroxol tablets
  - Repeat capillary blood glucose 10 - 15 minutes later
  - If blood glucose is still < 4.0 mmol/L repeat step 1 (no more than 3 treatments in total)
  - If blood glucose remains < 4.0 mmol/L after 45 minutes or 3 cycles, consider:
    - 1 mg glucagon IM
    - IV 10% glucose infusion at 100 ml/hr

- In adults who are conscious but noncooperative:
  - Give either 1.5 - 2 tubes Glucogel/Dextrose gel (may repeat up to 3 times)
  - If this is ineffective give glucagon 1 mg IM (may only give once)
  - If blood glucose level remains < 4.0 mmol/L after 45 minutes (or 3 courses), consider IV 10% glucose infusion at 100 ml/hr

- In adults who are unconscious:
  - Give either
    - 1 mg glucagon intramuscularly (if not effective after 10 - 15 minutes, IV glucose should be given)
    - 75 - 80 ml of 20% glucose intravenously over 10 - 15 minutes
    - 150 - 160 ml of 10% glucose intravenously over 10 - 15 minutes

Once blood glucose is > 4.0 mmol/L and the patient is recovered, give a long acting carbohydrate of the patient's choice where possible e.g. two biscuits, one slice of bread. Note that patients given glucagon require a larger portion of long acting carbohydrate to replenish glycogen stores (double the suggested amount).

If the hypoglycaemia was due to sulphonylurea or long acting insulin therapy then be aware that the risk of hypoglycaemia may persist for up to 24 - 36 hours following the last dose, especially if there is concurrent renal impairment.

Glucagon

Glucagon, a polypeptide hormone produced by the alpha cells of the islets of Langerhans, increases plasma glucose by mobilizing glycogen stored in the liver. Glucagon promotes glycogenolysis and gluconeogenesis.

Glucagon may take up to 15 minutes to have an effect and will be less effective in alcoholics, prolonged starvation and severe liver disease when glycogen stores are depleted. In this situation or if prolonged treatment is required, IV glucose is better. Glucagon may also be less effective in patients prescribed sulphonylurea therapy.

Glucagon may also be used as an antidote in beta-blocker overdose and in anaesthetics in patients on beta-blockers that fail to respond to adrenaline.

Glucagon is contraindicated in pheochromocytoma.

Adverse effects include:
- Nausea and vomiting
- Hypoglycaemia
- Hypokalaemia
- Hypotension

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Pharmacology: Respiratory and Endocrine

Question 24 of 76

Which of the following is an action of glucagon:

- a) Inhibits gluconeogenesis
- b) Stimulates glycogenolysis
- c) Increases cellular glucose uptake
- d) Promotes lipogenesis
- e) Increases protein synthesis

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Pharmacology: Respiratory and Endocrine

Question 24 of 74

Which of the following is an action of glucagon:

- a) Inhibits gluconeogenesis  [X]
- b) Stimulates glycolysis  [ ✓ ]
- c) Increases cellular glucose uptake
- d) Promotes lipogenesis
- e) Increases protein synthesis

Answer

Glucagon, a polypeptide hormone produced by the alpha cells of the islets of Langerhans, increases plasma glucose by mobilizing glycogen stored in the liver. Glucagon promotes glycogenolysis and gluconeogenesis.

Notes

Management of hypoglycaemia in adults

- In adults who are conscious, cooperative and can swallow:
  - Give 15 - 20g of a quick-acting carbohydrate of the patient’s choice where possible e.g. 90 - 120 ml of Lucozade or 5 - 7 Dextrosol tablets
  - Repeat oral dose if blood glucose 10 - 15 minutes later
  - If blood glucose is still < 4.0 mmol/L, repeat step 1 (no more than 3 treatments in total)
  - If blood glucose remains < 4.0 mmol/L after 45 minutes or 3 cycles, consider:
    - 1 mg glucagon IM
    - IV 10% glucose infusion at 100mL/hr
- In adults who are conscious but uncooperative:
  - Give either 1.5 - 2 x 10 units Glucagon/Detgon® (may repeat up to 3 times)
  - If this is ineffective, give glucagon 1 mg IM (may only give once)
  - If blood glucose level remains less than 4.0 mmol/L after 45 minutes (or 3 cycles), consider IV 10% glucose infusion at 100mL/hr
- In adults who are unconscious:
  - Give either:
    - 1 mg glucagon intramuscularly (if not effective after 10 - 15 minutes, IV glucose should be given)
    - 75 - 80 ml of 20% glucose intravenously over 10 - 15 minutes
    - 150 - 160 ml of 10% glucose intravenously over 10 - 15 minutes

Once blood glucose is > 4.0 mmol/L, and the patient recovered, give a long-acting carbohydrate of the patient’s choice where possible e.g. two biscuits, one slice of bread. Note that patients given glucagon require a larger portion of long-acting carbohydrate to replenish glycogen stores (double the suggested amount).

If the hypoglycaemia was due to sulfonylurea or long acting insulin therapy then be aware that the risk of hypoglycaemia may persist for up to 24 - 36 hours following the last dose, especially if there is concurrent renal impairment.

Glucagon

Glucagon, a polypeptide hormone produced by the alpha cells of the islets of Langerhans, increases plasma glucose by mobilizing glycogen stored in the liver. Glucagon promotes glycogenolysis and gluconeogenesis.

Glucagon may take up to 15 minutes to have an effect and will be less effective in alcoholics, prolonged starvation and severe liver disease where glycogen stores are depleted. In this situation or if prolonged treatment is required, IV glucose is better. Glucagon may also be less effective in patients prescribed sulfonylurea therapy.

Glucagon may also be used as an antidote in beta-blocker overdose and in anaphylaxis in patients on beta-blockers that fail to respond to adrenaline.

Glucagon is contraindicated in pheochromocytoma.

Adverse effects include:

- Nausea and vomiting
- Hyperpyrexia
- Hypokalaemia
- Hypotension

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Pharmacology: Respiratory and Endocrine

Question 25 of 76

What is the initial treatment for hypoglycaemia in a conscious patient:

a  1 mg subcutaneous glucagon
b  1 mg intramuscular glucagon
c  Intravenous 10% glucose infusion at rate of 100 ml/hr
d  A snack e.g. biscuits or toast
e  15 – 20 g glucose orally

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Pharmacology: Respiratory and Endocrine

Question 25 of 76

What is the initial treatment for hypoglycaemia in a conscious patient:

- a) 1 mg subcutaneous glucagon
- b) 1 mg intramuscular glucagon
- c) Intravenous 10% glucose infusion at rate of 100ml/hr
- d) A snack e.g. biscuits or toast
- e) 15 – 20g glucose orally

Answer

In adults who are conscious, cooperative and can swallow:

- Give 15 – 20g quick acting carbohydrate of the patient’s choice where possible e.g. 90 – 120 ml of Lucozade or 5 – 7 oral doses tablets
- Repeat capillary blood glucose 15 – 30 minutes later
- If blood glucose is still ≤ 4.0 mmol/L repeat step 1 (no more than 3 treatments in total)
- If blood glucose remains ≤ 4.0 mmol/L after 45 minutes or 3 cycles, consider:
  - 1 mg glucagon IM
  - IV 10% glucose infusion at 100ml/hr

Notes

Management of hypoglycaemia in adults

- In adults who are conscious, cooperative and can swallow:
  - Give 15 – 20g quick acting carbohydrate of the patient’s choice where possible e.g. 90 – 120 ml of Lucozade or 5 – 7 oral doses tablets
  - Repeat capillary blood glucose 15 – 30 minutes later
  - If blood glucose is still ≤ 4.0 mmol/L, repeat step 1 (no more than 3 treatments in total)
  - If blood glucose remains ≤ 4.0 mmol/L after 45 minutes or 3 cycles, consider:
    - 1 mg glucagon IM
    - IV 10% glucose infusion at 100ml/hr

- In adults who are conscious but uncooperative:
  - Give either 1.5 – 2.1 subcutaneous Glucagon/Dexglargine (may repeat up to 3 times)
  - If this is ineffective give glucagon 1 mg IM (may only give once)
  - If blood glucose level remains less than 4.0 mmol/L after 45 minutes or 3 cycles, consider IV 10% glucose infusion at 100ml/hr

- In adults who are unconscious:
  - Give either:
    - 2 mg glucagon intramuscularly (if not effective after 10 – 15 minutes, IV glucose should be given)
    - 75 – 80 ml of 20% glucose intravenously over 30 – 15 minutes
  - 150 – 300 ml of 10% glucose intravenously over 10 – 15 minutes

Once blood glucose is > 4.0 mmol/L and the patient recovered, give a long acting carbohydrate of the patient’s choice where possible e.g. two biscuits, one slice of bread. Note that patients given glucagon require a larger portion of long acting carbohydrate to replenish glucose stores (double the suggested amount).

If the hypoglycaemia was due to sulphonylurea or long acting insulin therapy then be aware that the risk of hypoglycaemia may persist for up to 24 – 36 hours following the last dose, especially if there is concurrent renal impairment.

Gliclazide

Gliclazide, a sulphonylurea hormone produced by the alpha cells of the islets of Langerhans, increases plasma glucose by mobilizing glycogen stored in the liver. Gliclazide promotes glycogenesis and glucagon secretion.

Gliclazide may take up to 15 minutes to have an effect and will be less effective in shock, prolonged starvation and severe liver disease when glucose stores are depleted. In this situation or prolonged treatment is required, IV glucose is better. Gliclazide may also be less effective in patients prescribed sulphonylurea therapy.

Gliclazide may also be used as an antidiode in beta-blockers overdose and in asphyxia in patients on beta-blockers that fail to respond to adrenaline.

Gliclazide is contraindicated in the following conditions:

Adverse effects include:

- Nausea and vomiting
- Hypoglycaemia
- Hypokalaemia
- Hypotension

Question Navigator

1. Answered
2. Answered
3. Answered
4. Answered
5. Answered
6. Answered
7. Answered
8. Answered
9. Answered
10. Answered
11. Answered
12. Answered

Resources

- The Royal College of Emergency Medicine
- VITAL Association for Emergency Medicine
- Advanced Trauma Life Support
- National Guideline Clearinghouse
- Toxicology
- Good Practice
- VITAL Association
- Emergency Medical Services
- Emergency Medical Services
- Good Practice
- NICU Resource
- Parkin.org

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Pharmacology: Respiratory and Endocrine

Question 26 of 76

What is the dose of glucagon (subcutaneously or intramuscularly) used in hypoglycaemia:

a. 0.5 mg
b. 0.5 microgram
c. 5 mg
d. 1 mg
e. 10 mg
Pharmacology: Respiratory and Endocrine

Question 26 of 76

What is the dose of glucagon (subcutaneously or intramuscularly) used in hypoglycaemia:

a) 0.5 mg ✗

b) 0.5 microgram

c) 5 mg

d) 1 mg ✓

e) 10 mg

Hypoglycaemia is a medical emergency.

Initially 10 – 20 g of glucose should be given by mouth, either in liquid form or as sugar granules/lumps (e.g. Lucozade, Coca-Cola) or as a proprietary product (e.g. GlucoGel). If necessary this may be repeated after 10 – 15 minutes.

After initial treatment, a snack (e.g. biscuits, toast) providing sustained availability of carbohydrate should be given.

If oral intake is not possible, glucagon may be given by subcutaneous or intramuscular injection (1 mg in adults). If not effective within 10 minutes, intravenous glucose should be given. Intravenous 20% glucose infusion may be given into a large vein through a large-gauge needle; 10% glucose infusion may be used but larger volumes are required.

Glucagon may also be used as an antidote in beta-blocker overdose, and is contraindicated in pheochromocytoma. Side effects may include:

- hypersensitivity reactions
- abdominal pain
- diarrhoea
- hypokalaemia
- hypotension
- nausea
- vomiting

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Pharmacology: Respiratory and Endocrine

Question 27 of 76

Selective beta-2 agonists predominantly have which of the following clinical effects:

- a. Bronchodilation
- b. Positive chronotropic effect
- c. Vasoconstriction
- d. Vasodilation
- e. Positive inotropic effect

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Question Navigator

1. Answered
2. Answered
3. Answered
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5. Answered
6. Answered
7. Answered
8. Answered
9. Answered
10. Answered
11. Answered
12. Answered

Something wrong?
Pharmacology: Respiratory and Endocrine

Question 27 of 76

Selective beta-2 agonists predominantly have which of the following clinical effects:

- Bronchodilation
- Positive chronotropic effect
- Vasodilation
- Edrophonium
- Positive inotropic effect

Answer

Selective beta-2 agonists act directly on beta-2 receptors, causing smooth muscle relaxation and dilatation of the airways.

Notes

Selective beta-2 agonists act directly on beta-2 receptors, causing smooth muscle relaxation and dilatation of the airways.

Mild to moderate symptoms of asthma respond rapidly to the inhalation of a selective short-acting beta2 agonist such as salbutamol or terbutaline sulfate. Short-acting beta-2 agonists have a rapid onset of action (0.5 minutes) and their effects last for up to 4 hours. Salbutamol or terbutaline sulfate can be given intravenously for severe or life-threatening acute asthma; patients should be carefully monitored and the dose adjusted according to response and heart rate.

Short acting beta-2 agonists are used for immediate relief of asthma symptoms, while some long-acting (B2 agonists e.g. salmeterol) are added to an inhaled corticosteroid in patients requiring prophylactic treatment.

Cautions

Beta-2 agonists should be used with caution in people with:

- Cardiovascular disease including arrhythmias and hypertension (beta-2 agonists may cause an increased risk of arrhythmias and significant changes to blood pressure and heart rate)
- Diabetes (risk of hyperglycaemia and ketoadiposis, especially with intravenous use)
- Hyperthyroidism (beta-2 agonists may stimulate thyroid activity)
- Hypokalemia (potentially serious hypokalemia may result from beta-2 agonist therapy; this effect may be potentiated in severe asthma by concomitant treatment with theophylline, corticosteroids, diuretics and by hypocalcemia)
- Susceptibility to QT-interval prolongation
- Convulsive disorders

Interactions

Hypokalemia may be potentiated by concomitant treatment with theophylline and its derivatives, corticosteroids, and diuretics. This in turn may predispose to toxicity in patients taking digoxin.

Side effects

Side effects are usually dose related and include:

- Fine tremor – occurs particularly in the hands and is usually worse in the first few days of treatment.
- Palpitations and tachycardia
- Headache
- Seizure
- Anxiety
- Hypokalemia
- Cardiac arrhythmia and paradoxical bronchospasm (rare)
- Acute angle-closure glaucoma
- QT-interval prolongation

Resources

- The Royal College of Emergency Medicine
- Irish Association for Emergency Medicine
- Advanced Trauma Life Support
- Resuscitation Council (UK)
- TeachMEAnatomy
- Emergency
- Radiopaedia
- Advanced Life Support Group
- Emergency Medicine Journal
- Lifethethreescience
- Instant Anatomy
- Patient.co.uk

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Pharmacology: Respiratory and Endocrine

Question 28 of 76

Which of the following reactions best describes an anaphylactic reaction:

- a. Type I hypersensitivity reaction
- b. Type II hypersensitivity reaction
- c. Type III hypersensitivity reaction
- d. Type IV hypersensitivity reaction
- e. Complement mediated reaction

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Pharmacology: Respiratory and Endocrine

**Questions:**

1. Which of the following reactions best describes anaphylactic reaction?
   - A Type I hypersensitivity reaction
   - B Type II hypersensitivity reaction
   - C Type III hypersensitivity reaction
   - D Type IV hypersensitivity reaction
   - E None of the above

Answer

Anaphylaxis is a severe, generally generalized Type I hypersensitivity reaction.

Notes

**Type I hypersensitivity reactions**

Type I hypersensitivity reactions, also known as immediate-type hypersensitivity reactions, are immune-mediated reactions that occur when an individual is exposed to an allergen for the first time. The allergen binds to specific IgE antibodies, which then activate mast cells and basophils, leading to the release of histamine and other inflammatory mediators. These mediators cause symptoms such as sneezing, hives, itching, and trouble breathing.

**Clinical features**

Anaphylaxis can be either an acute or a chronic disease. The first set of symptoms develops within minutes after exposure to the allergen, while the second set may take hours to develop.

**Immediate management**

**Drug**

- **Initial 0.1% aqueous epinephrine eye drops** without oxygen resuscitation
- **0.1-0.2 mg/kg intravenous adrenaline (epinephrine)**

**Adverse effects**

- Hypertension can occur after epinephrine administration. It is important to monitor blood pressure and heart rate.
- **Asthma**

- **Allergic reactions**

**Further treatment**

- **Rescue breathing, artificial ventilation, and intravenous fluids**
- **Hospital admission**

**Contraindications**

The use of epinephrine is contraindicated in patients with coronary artery disease, as it may increase the workload of the heart.

**References**

Peters, B. (2020). Type I hypersensitivity reactions. UpToDate.
Pharmacology: Respiratory and Endocrine

Question 29 of 76

Which of the following is NOT an effect of adrenaline:

- a. Increased heart rate
- b. Increased contractility
- c. Vasodilation
- d. Vasoconstriction
- e. Miosis

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Question Navigator

1 Answered
2 Answered
3 Answered
4 Answered
5 Answered
6 Answered
7 Answered
8 Answered
9 Answered
10 Answered
11 Answered
12 Answered

Something wrong?
Pharmacology: Respiratory and Endocrine

Question 29 of 76

Which of the following is NOT an effect of adrenaline:

- a) Increased heart rate
- b) Increased contractility
- c) Vasodilation ✗
- d) Vasoconstriction
- e) Miosis ✓

Answer

Adrenaline is a catecholamine that acts on both alpha and beta receptors and increases both heart rate and contractility (beta1 effects); it can cause peripheral vasodilation (a beta2 effect) or vasoconstriction (an alpha effect). Adrenaline causes mydriasis and reduces pressure in open-angle glaucoma.

Notes

Adrenaline is a catecholamine that acts on both alpha and beta receptors and increases both heart rate and contractility (beta1 effects); it can cause peripheral vasodilation (a beta2 effect) or vasoconstriction (an alpha effect).

Adrenaline is used in cardiopulmonary resuscitation, in the emergency management of acute allergic and anaphylactic reactions and in the management of severe cough (as a nebulised solution).

Mechanism of action in anaphylaxis

As an alpha-receptor agonist, adrenaline reverses peripheral vasodilation and increased vascular permeability reducing hypotension and oedema.

As a beta-receptor agonist it dilates bronchial airways, increases the force and rate of myocardial contraction, and suppresses histamine and leukotriene release.

Adrenaline also alleviates pruritus, urticaria, and angioedema and may relieve gastrointestinal and genitourinary symptoms associated with anaphylaxis because of its relaxant effects on the smooth muscle of the stomach, intestine, uterus and urinary bladder.

Adrenaline increases glycogenolysis, reduces glucose uptake by tissues, and inhibits insulin release in the pancreas, resulting in hyperglycemia and increased blood lactic acid.

Interactions

Severe anaphylaxis in patients taking beta-blockers may not respond to adrenaline—consider bronchodilator therapy. Furthermore, adrenaline can cause severe hypertension and Bradycardia in those taking non-cardioselective beta-blockers.
Pharmacology: Respiratory and Endocrine

Question 30 of 76

Regarding inhaled corticosteroids, which of the following statements is INCORRECT:

a) Corticosteroids reduce airway inflammation, oedema and mucus secretion.
b) Regular use of inhaled corticosteroids reduces the frequency of exacerbations in asthma.
c) Lower doses of inhaled corticosteroids may be required in smokers.
d) Symptom improvement usually occurs 3 – 7 days after initiation of treatment.
e) Side effects include paradoxical bronchospasm.

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Pharmacology: Respiratory and Endocrine

Question 30 of 76

Regarding inhaled corticosteroids, which of the following statements is INCORRECT:

- a) Corticosteroids reduce airway inflammation, oedema and mucus secretion. ✗
- b) Regular use of inhaled corticosteroids reduces the frequency of exacerbations in asthma. ✓
- c) Lower doses of inhaled corticosteroids may be required in smokers. ✓
- d) Symptom improvement usually occurs 3 – 7 days after initiation of treatment.
- e) Side effects include paradoxical bronchospasm.

Corticosteroids reduce airway inflammation, oedema and mucus secretion. Regular use of inhaled corticosteroids (e.g. beclomethasone) reduces the risk of exacerbation of asthma. Current and previous smoking reduces the effectiveness of inhaled corticosteroids and higher doses may be necessary. Corticosteroid inhalers must be used regularly for maximum benefit; alleviation of symptoms usually occurs 3 to 7 days after initiation.

Side effects of inhaled corticosteroids may include:

- paradoxical bronchospasm
- candidiasis of the mouth or throat (risk reduced by rinsing mouth after using inhaler and by using a spacer device)
- increased susceptibility to infection

Systemic side effects, such as adrenal suppression, are rare but may occur at high doses.

Systemic corticosteroid therapy may be necessary during episodes of stress, such as severe infection, or if the asthma is worsening, when higher doses are needed and access of inhaled drug to small airways may be reduced.

An acute attack of asthma should be treated with a short course of an oral corticosteroid (e.g. prednisolone) or intravenous corticosteroid (e.g. hydrocortisone) if oral intake is not possible, starting with a high dose. An oral corticosteroid should normally be taken as a single dose in the morning to reduce the disturbance to circadian cortisol secretion. Dosage should always be titrated to the lowest dose that controls symptoms. Regular peak-flow measurements help to optimise the dose.
Pharmacology: Respiratory and Endocrine

Question 31 of 76

In most acutely unwell patients, who are not at risk of hypercapnic respiratory failure, oxygen saturations should be maintained at:

a 100%
b 98 – 100%
c 94 – 98%
d 92 – 96%
e 97 – 99%
Pharmacology: Respiratory and Endocrine

Question 34 of 76

In most acutely unwell patients, who are not at risk of hypocapnic respiratory failure, oxygen saturations should be maintained at:

- a) 100%
- b) 98 – 100%
- c) 94 – 98%
- d) 92 – 96%
- e) 97 – 99%

Answer

In most acutely ill patients with a normal or low arterial carbon dioxide (PaCO₂), oxygen saturation should be 94 – 98% oxygen saturation. However, in some clinical situations such as cardiac arrest and carbon monoxide poisoning it is more appropriate to aim for the highest possible oxygen saturation until the patient is stable.

Notes

Oxygen should be regarded as a drug. It is prescribed for hypoaxemic patients to increase alveolar oxygen tension and decrease the work of breathing. The concentration of oxygen required depends on the condition being treated; the administration of an inappropriate concentration of oxygen can have serious or even fatal consequences.

High concentration oxygen therapy

In most acutely ill patients with a normal or low arterial carbon dioxide (PaCO₂), oxygen saturation should be 94 – 98% oxygen saturation. However, in some clinical situations such as cardiac arrest and carbon monoxide poisoning it is more appropriate to aim for the highest possible oxygen saturation until the patient is stable.

Low concentration oxygen therapy

A lower target of 88 – 92% oxygen saturation is indicated for patients at risk of hypocapnic respiratory failure e.g. patients with COPD. Until blood gases can be measured, initial oxygen should be given using a controlled concentration of 28% or less, titrated towards the SpO₂ of 88 – 92%. The aim is to provide the patient with enough oxygen to achieve an acceptable arterial oxygen tension without worsening carbon dioxide retention and respiratory acidosis.

Long term oxygen therapy

Long-term administration of oxygen (usually at least 15 hours daily) prolongs survival in some patients with COPD. Assessment for long-term oxygen therapy requires measurement of arterial blood gas tensions. A nasal cannula is usually preferred for long-term oxygen therapy from an oxygen concentrator. It can, however, produce dermatitis and mucosal drying in sensitive individuals.

Giving oxygen by nasal cannula allows the patient to talk, eat, and drink, but the concentration of oxygen is not controlled; this may be inappropriate for acute respiratory failure. Increased respiratory depression is seldom a problem in patients with stable respiratory failure treated with low concentrations of oxygen although it may occur during exacerbations; patients and relatives should be warned to call for medical help if drowsiness or confusion occurs.

Intermittent oxygen therapy

Oxygen is occasionally prescribed for short-burst (intermittent) use for episodes of breathlessness not relieved by other treatment in patients with severe chronic obstructive pulmonary disease, interstitial lung disease, heart failure, and in palliative care.

Ambulatory oxygen

Ambulatory oxygen is prescribed for patients on long-term oxygen therapy who need to be away from home on a regular basis. Patients who are not on long-term oxygen therapy can be considered for ambulatory oxygen therapy if there is evidence of exercise-induced oxygen desaturation and of improvement in blood oxygen saturation and exercise capacity with oxygen.

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Resources

- The Royal College of Emergency Medicine
- ENA Association for Emergency Medicine
- Advanced Trauma Life Support
- Resuscitation Council (UK)
- YouTube/Medical
- Trauma.org
- Radiopaedia
- Advanced Life Support Group
- Emergency Medicine Journal
- LlilithiThePitAte
- InjectAcademy
- Patient.co.uk
Pharmacology: Respiratory and Endocrine

Question 32 of 76

Which of the following presentations is NOT consistent with the diagnosis of anaphylaxis:

- a. Hypotension alone
- b. Generalised urticaria and angioedema alone
- c. Shock with collapse and angioedema
- d. Stridor, hoarseness and hypotension with no skin or mucosal changes
- e. Dyspnoea, tachypnoea, wheeze and hypoxia with no skin or mucosal changes

< Previous   Next >   See Answer   Something wrong?
Pharmacology: Respiratory and Endocrine

Question 33 of 76

After initial emergency treatment, which of the following tests may be used to confirm a suspected diagnosis of anaphylaxis:

a) Immunoglobulins  
b) Mast cell tryptase  
c) ANCA autoantibodies  
d) Specific IgE (RAST) test  
e) Complement function assays  

< Previous Next > See Answer

Something wrong?
Pharmacology: Respiratory and Endocrine

Questions

1. Erythrocytes
2. Bacterial meningitis
3. MI
4. Gastric ulcer
5. Urinary tract infection
6. Motor neuron disease
7. Cushing's syndrome
8. Hypoglycemia

Answers

1. Erythrocytes
- A: Hematopoietic stem cell
- B: Immature erythrocyte
- C: Mature erythrocyte
- D: Red blood cell
- E: White blood cell

2. Bacterial meningitis
- A: Meningismus
- B: Nuchal rigidity
- C: Photophobia
- D: Seizures
- E: Convulsions

3. MI
- A: Pain in the chest
- B: Palpitations
- C: Shortness of breath
- D: Nausea
- E: Diaphoresis

4. Gastric ulcer
- A: Upper abdominal pain
- B: Heartburn
- C: Nausea and vomiting
- D: Dyspepsia
- E: Anorexia

5. Urinary tract infection
- A: Fever
- B: Back pain
- C: Frequency and urgency
- D: Hematuria
- E: Dysuria

6. Motor neuron disease
- A: Spasticity
- B: Hyperreflexia
- C: Dorsal column signs
- D: Sensory symptoms
- E: Motor symptoms

7. Cushing's syndrome
- A: moon face
- B: buffalo hump
- C: Cushingoid habitus
- D: striae
- E: purple striae

8. Hypoglycemia
- A: Tachycardia
- B: Nausea
- C: Seizures
- D: Hypotension
- E: Hypothermia

Notes

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References


Clinical features

Pneumonia in the elderly is often seen as a complication of other medical conditions, as well as being associated with comorbidities such as COPD, chronic heart failure, and cancer. Common symptoms include fever, cough, dyspnea, and lobar consolidation on chest X-ray. Sepsis is a potentially lifethreatening condition that can lead to organ failure and death if not treated promptly. Early recognition and appropriate antibiotic therapy are critical for effective treatment.

Interstitial lung disease

Diagnosis

- High-resolution CT
- Magnetic resonance imaging

Adverse effects of corticosteroids include fluid retention, hypertension, and risk of infection. Intraocular pressure may increase and can lead to cataract formation. Patients must be monitored regularly to detect potential adverse effects.

Bronchodilators

- Beta-2 agonists
- Anticholinergic agents

Conclusion

The management of respiratory conditions in the elderly requires a multidisciplinary approach involving geriatricians, pulmonologists, and other specialists. Early recognition, prompt diagnosis, and appropriate treatment are crucial for optimal outcomes.
Pharmacology: Respiratory and Endocrine

Question 34 of 76

Regarding the management of diabetic ketoacidosis (DKA), insulin infusion may be stopped after which of the following:

- a) Blood ketone concentration is below 0.3 mmol/L
- b) Blood pH is above 7.3
- c) Patient is conscious
- d) Patient is able to eat and drink
- e) All of the above have been achieved
Pharmacology: Respiratory and Endocrine

Question 24 of 76

Regarding the management of diabetic ketoacidosis (DKA), insulin infusion may be stopped after which of the following:

a) Blood ketone concentration is below 0.3 mmol/L
b) Blood pH is above 7.3
c) Patient is conscious
d) Patient is able to eat and drink
e) All of the above have been achieved

Answer

The insulin infusion should be continued until blood ketone concentration is below 0.3 mmol/litre, blood pH is above 7.3 and the patient is able to eat and drink. Ideally, the insulin infusion should be stopped about an hour after giving subcutaneous fast-acting insulin and a meal.

Notes

Diabetic ketoacidosis (DKA) consists of the biochemical triad of ketonaemia (ketosis), hyperglycaemia, and acidemia.

Pathophysiology

DKA usually occurs as a consequence of absolute or relative insulin deficiency that is accompanied by an increase in counter-regulatory hormones (e.g., glucagon, cortisol, growth hormone, catecholamines). This type of hormonal imbalance enhances hepatic glucose production and glycolysis resulting in severe hyperglycaemia. Enhanced lipolysis increases serum free fatty acids that are then metabolized as an alternative energy source in the process of ketogenesis. This results in accumulation of large quantities of ketone bodies and subsequent metabolic acidosis. Fluid depletion occurs due to osmotic diuresis secondary to hyperosmolar glycosuria, vomiting, and inability to take in fluid due to a diminished level of consciousness.

Diagnosis

- Ketonaemia > 30 mmol/l or significant ketonuria (more than 2+ on standard urine sticks)
- Blood glucose > 11.0 mmol/l or known diabetes mellitus
- Bicarbonate (HCO₃⁻) < 15.0 mmol/l and/or venous pH < 7.3

Management of diabetic ketoacidosis in adults

- Intravenous fluids
  - If SBP is below 90 mmHg (adjusted for age, sex, and medication as appropriate), 500 mL sodium chloride 0.9% should be given by intravenous infusion over 10–15 minutes, and repeated if SBP still < 90 mmHg.
  - When SBP is greater than 90 mmHg, sodium chloride infusion should be continued at a rate that replaces deficit and provides maintenance.
- Potassium replacement
  - Potassium chloride (40 mmol/l) should be included in the fluids (as long as the serum potassium level is > 5.5 mmol/l, and the patient is passing urine), and the plasma potassium concentration maintained between 3.5 – 5.5 mmol/l, (measured at 60 minutes. 2 hours, and 2 hours thereafter; hourly if outside the normal range).
- Insulin
  - An intravenous insulin infusion should be started at a concentration of 1 U/mL at a fixed rate of 0.1 units/kg/hour.
  - Established subcutaneous long-acting insulin therapy should be continued concurrently.
  - Blood ketone and blood glucose concentrations should be checked hourly and the insulin infusion rate adjusted accordingly. Blood ketone concentration should fall by at least 0.5 mmol/litre/hour and blood glucose concentration should fall by at least 3 mmol/litre/hour.
- Glucose
  - Once blood glucose concentration falls below 14 mmol/litre, glucose 10% should be given by intravenous infusion (into a large vein through a large-gauge needle) at a rate of 125 mL/hour, in addition to the sodium chloride 0.9% infusion.

The insulin infusion should be continued until blood ketone concentration is below 0.3 mmol/litre, blood pH is above 7.3 and the patient is able to eat and drink. Ideally, the insulin infusion should be stopped about an hour after giving subcutaneous fast-acting insulin and a meal.

The management of hyperosmolar hyperglycaemic state or hyperosmolar hyperglycaemic nonketotic coma is similar to that of diabetic ketoacidosis, although lower rates of insulin infusion are usually necessary and slower rehydration may be required.
Pharmacology: Respiratory and Endocrine

Question 35 of 76

Regarding the management of diabetic ketoacidosis (DKA), insulin should initially be given:

a. At a concentration of 1 unit/mL at a fixed rate of 1 units/kg/hour
b. At a concentration of 0.1 units/mL at a fixed rate 0.1 units/kg/hour
c. At a concentration of 1 unit/mL at a fixed rate of 0.2 units/kg/hour
d. At a concentration of 0.1 units/mL at a fixed rate of 1 units/kg/hour
e. At a concentration of 1 unit/mL at a fixed rate of 0.1 units/kg/hour

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Question Navigator

1. Answered
2. Answered
3. Answered
4. Answered
5. Answered
6. Answered
7. Answered
8. Answered
9. Answered
10. Answered
11. Answered
12. Answered

Something wrong?
Pharmacology: Respiratory and Endocrine

Question 15 of 76

Regarding the management of diabetic ketoacidosis (DKA), insulin should initially be given:

a) At a concentration of 1 unit/mL at a fixed rate of 1 units/hour
b) At a concentration of 0.5 units/mL at a fixed rate of 0.5 units/hour
c) At a concentration of 1 unit/mL at a fixed rate of 0.2 units/hour
d) At a concentration of 0.5 units/mL at a fixed rate of 1 units/hour
e) At a concentration of 1 unit/mL at a fixed rate of 0.1 units/hour

Answer

An intravenous insulin infusion should be started at a concentration of 1 unit/mL at a fixed rate of 0.1 unit/kg/hour. Established, substantial, long-acting insulin therapy should be continued concurrently. Blood ketone and blood glucose concentrations should be checked hourly and the insulin infusion rate adjusted accordingly. Blood ketone concentration should fall by at least 0.5 mmol/litre/hour and blood glucose concentration should fall by at least 3 mmol/litre/hour.

Notes

Diabetic ketoacidosis (DKA) consists of the biochemical triad of ketonemia (ketosis), hyperglycaemia, and acidaemia.

Pathophysiology

DKA usually occurs as a consequence of absolute or relative insulin deficiency that is accompanied by an increase in counter-regulatory hormones (i.e. glucagon, cortisol, growth hormone, catecholamines). This type of hormonal imbalance enhances hepatic gluconeogenesis and gluconeogenesis leading to severe hyperglycaemia. Enhanced lipolysis increases serum free fatty acids that are then metabolized as an alternative energy source in the process of ketogenesis. This results in accumulation of large quantities of ketone bodies and subsequent metabolic acidosis. Fluid depletion occurs due to osmotic diuresis secondary to hyperglycaemia, vomiting, and inability to take in fluid due to a diminished level of consciousness.

Diagnosis

- Ketonaemia > 3.0 mmol/L or significant ketonuria (more than 2+ on a standard urine stick)
- Blood glucose > 11.0 mmol/L or known diabetic mellitus
- Bicarbonate (HCO3-) < 15 mmol/L and/or venous pH < 7.3

Management of diabetic ketoacidosis in adults

- Intravenous fluids
  - If SBP is below 90 mmHg (adjusted for age, sex, and medication as appropriate), 500 mL sodium chloride 0.9% should be given by intravenous infusion over 10–15 minutes, and repeated if SBP still < 90 mmHg
  - When SBP is greater than 90 mmHg, sodium chloride infusion should be continued at a rate that replaces deficit and provides maintenance.
- Potassium replacement
  - Potassium chloride (40 mmol/L) should be included in the fluids (as long as the serum potassium level is 5.5 mmol/L and the patient is passing urine), and the plasma potassium concentration maintained between 3.5–5.5 mmol/L, measured at 60 minutes, 2 hours, and 2 hours thereafter, and hourly if outside the normal range.
- Insulin
  - An intravenous insulin infusion should be started at a concentration of 1 unit/mL at a fixed rate of 0.1 unit/hour.
  - Established, substantial long-acting insulin therapy should be continued concurrently.
  - Blood ketone and blood glucose concentrations should be checked hourly and the insulin infusion rate adjusted accordingly. Blood ketone concentrations should fall by at least 0.5 mmol/litre/hour and blood glucose concentration should fall by at least 3 mmol/litre/hour.
  - Glucose
    - Once blood ketone concentrations fall below 14 mmol/litre, glucose 30% should be given by intravenous infusion into a large vein through a large-gauge needle at a rate of 125 mL/hour, in addition to the sodium chloride 0.9% infusion.

The insulin infusion should be continued until blood ketone concentration is below 0.5 mmol/litre, blood pH is above 7.3 and the patient is able to eat and drink; ideally the insulin infusion should be stopped about an hour after giving substantial fast-acting insulin and a meal.

The management of hyperosmolar hyperglycaemic state or hyperosmolar hyperglycaemic nonketotic coma is similar to that of diabetic ketoacidosis, although lower blood glucose levels are usually necessary and slower rehydration may be required.
Pharmacology: Respiratory and Endocrine

Question 36 of 76

Theophylline is used for which of the following clinical effects:

- a. Vasodilation
- b. Vasoconstriction
- c. Bronchodilation
- d. Anti-inflammatory
- e. Anti-motility

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Pharmacology: Respiratory and Endocrine

Question 6 of 6

Theophylline is used for which of the following clinical effects?

- (a) Vasodilatation
- (b) Anticongestion
- (c) Bronchodilatation
- (d) Anti-inflammatory
- (e) Anti-microbial

Answer

Theophylline is used as a bronchodilator in asthma and stable COPD. It is not generally effective in exacerbations of chronic obstructive pulmonary disease, but is used mainly for severe or life-threatening acute asthma given by injection or intravenously, a mixture of theophylline with a methylxanthine, which is 20 times more soluble than theophylline alone.

Notes

Theophylline may have an additive bronchodilator effect when used in conjunction with usual doses of beta 2 agonists. Theophylline is a derivative of xanthine which inhibits phosphodiesterase resulting in increased tissue concentrations of cyclic adenosine monophosphate (cAMP). Theophylline is metabolized in the liver, so that a severe toxic effect is a leukopenia. The plasma theophylline concentration is increased in elderly, with renal and intestinal disease, in the elderly, and by alcohol consumption.

Indications

Theophylline should not be administered to:

- People with porphyria
- People with hyperthyroidism or scombroid
- Children with high concentration of theophylline
- Infants under 6 months of age

Cautions

Theophylline should be used with caution in people with:

- Cardiac arrhythmias or other cardiac disease
- Hyperthyroidism
- Hypothyroidism
- Hypokalemia
- Malignancy
- Renal impairment

Interactions

Hydrocortisone may be potentiated by concurrent therapy with beta 2 agonists, corticosteroids and diuretics.

Excretion of furosemide may be potentiated by concurrent therapy with theophylline.

There is an increased risk of convulsions when theophylline is given with phenytoin.

Examples of enzyme-inducing drugs (raises plasma theophylline level)

- Ethinylcalcium
- Diltiazem
- Diphenhydramine
- Phenothiazine
- Quinidine
- Amphotericin
- Chloroquine

Examples of enzyme-inhibiting drugs (lower plasma theophylline level)

- Prednisone
- Phenobarbital
- Cimetidine
- Phenytion
- Metoprolol
- Amiodarone
- St. John’s Wort

Side effects

Side effects include:

- Tachycardia, palpitation and arrhythmia
- CNS disturbances, insomnia, headache, irritability, anxiety and confusion
- Gastric irritation, nausea, vomiting and diarrhea
- Hepatotoxicity (potentially serious) hypocalcemia may result from beta 2 agonists. This effect may be potentiated in severe asthmatic by concurrent treatment with theophylline and its derivatives, corticosteroids, and diuretics, and theophylline.

Mechanisms of action

In recent studies, the plasma theophylline concentration of 0.5 - 2.0 mcg/ml (or 0.5 - 11.5 mmol/l) is required for satisfactory bronchodilation, although some patients require theophylline concentration of 1.0 - 2.5 mcg/ml for adequate effect. A concentration of 2.5 - 30 mcg/ml is required to affect the frequency and severity of exacerbations during acute asthma.

Plasma theophylline concentration is measured 2 - 3 days after starting oral treatment and at least 3 days after any dose adjustment.

Overdosage

Theophylline in overdoses can cause vomiting (which may be severe and intractable), agitation, tremors, delirium, diaphoresis, seizures, convulsions, and respiratory and cardiac arrhythmia. Sever hypocalcemia may rapidly develop.
Pharmacology: Respiratory and Endocrine

Question 37 of 76

Which of the following clinical features would characterise a severe asthma attack in an adult as life-threatening:

- Use of accessory respiratory muscles
- PEF 35% of best/predicted
- PaO 8.5 kPa
- PaCO 5.0 kPa
- HR 120 bpm
Pharmacology: Respiratory and Endocrine

Question 38 of 76

A 31 year old patient with a known nut allergy was eating at a Thai restaurant when he suddenly complained of lip and tongue swelling and difficulty breathing. He is brought to ED by ambulance with suspected anaphylaxis. He has received intramuscular adrenaline in the ambulance. What are the most appropriate doses of the second line treatments for anaphylaxis:

- a 5 mg chlorphenamine and 200 mg hydrocortisone
- b 10 mg chlorphenamine and 200 mg hydrocortisone
- c 10 mg chlorphenamine and 300 mg hydrocortisone
- d 20 mg chlorphenamine and 400 mg hydrocortisone
- e 20 chlorphenamine and 300 mg hydrocortisone
Pharmacology: Respiratory and Endocrine

Introduction

All year round in a crouched or sitting position. To avoid restriction when forming the airway, it is important to use proper technique so that the patient can breathe comfortably. A loop is made in the endotracheal tube with a supraglottic airway. The firm, firm, firm endotracheal tube is then inserted. If the endotracheal tube with a supraglottic airway is not properly positioned, it is essential to reposition or replace it to maintain adequate ventilation. If the endotracheal tube with a supraglottic airway is not properly positioned, it is essential to reposition or replace it to maintain adequate ventilation. If the endotracheal tube with a supraglottic airway is not properly positioned, it is essential to reposition or replace it to maintain adequate ventilation. If the endotracheal tube with a supraglottic airway is not properly positioned, it is essential to reposition or replace it to maintain adequate ventilation. 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Pharmacology: Respiratory and Endocrine

Which of the following is NOT a feature of theophylline toxicity:

a. Severe intractable vomiting
b. Agitation
c. Dilated pupils
d. Sinus tachycardia
e. Hyperkalaemia

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Pharmacology: Respiratory and Endocrine

Question 9 of 11

Which of the following is NOT a feature of theophylline toxicity?

- Severe tachycardia
- Hypertension
- Cough
- Severe hypertension

Answer

Theophylline toxicity is manifested as severe vomiting (which may be severe and intractable), abdominal pain, nausea, vomiting, diarrhea, agitation, delirium, convulsions, and hypotension. More serious effects include hematemesis, convulsions, and supraventricular and ventricular arrhythmias. Severe hyperthyroidism may develop rapidly.

Notes

Theophylline is an additive bronchodilator effect with a 10-minute peak effect at usual doses of beta 2 agonists. Theophylline is a rapidly metabolized drug, with a 3-hour plasma half-life and may need to be increased in patients with chronic obstructive pulmonary disease (COPD). Theophylline is contraindicated in cases of severe bronchial asthma as it delays oxygenation of the lungs. Together, these make it an effective drug in patients with chronic obstructive pulmonary disease (COPD).

Indications

It is used as a bronchodilator in asthma and chronic obstructive pulmonary disease (COPD). It is not generally effective in exacerbations of chronic obstructive pulmonary disease, but is used for the treatment of the acute exacerbation of chronic obstructive pulmonary disease (COPD), where advanced therapy is indicated.

Contraindications

Theophylline should not be used in patients with:

- Severe asthma
- Cardiac arrhythmias or other cardiac disease
- Hypothyroidism
- Glaucoma
- Seizures
- Peptic ulcer
- Risk of hepatic impairment

Sedation may be potentiated by concurrent therapy with beta 2-agonists, corticosteroids, and alcohols.

Excretion of theophylline may be potentiated by concurrent therapy with thiazide diuretics.

There is an increased risk of complications when theophylline is given with quinidine.

Examples of excreta-inducing drugs (lower plasma theophylline level):

- Barbiturates
- Carbamazepine
- Phenytoin
- Rifampicin

Examples of excreta-inducing drugs (higher plasma theophylline level):

- Phenobarbital
- Phenytoin
- Rifampicin

Side effects

Side effects include:

- Nausea, vomiting, and epigastric pain
- Tachycardia, palpitations, and arrhythmias
- Cough, irritation, nausea, vomiting, and diarrhoea
- Hyperthyroidism

Maximal requirements

In adults, a plasma theophylline concentration of 10 - 20 mg/L (5 - 125 mmol/L) is recommended. For children, a plasma theophylline concentration of 5 - 15 mg/L (125 mmol/L to 312 mmol/L) is recommended. Plasma theophylline concentration is monitored at 1 - 2 mg/L (5 mmol/L) twice a day for 24 hours.

Resources

- Advanced Life Support for Adult
- Advanced Life Support for Pregnancy
- Advanced Life Support for Pediatric
- Pediatric Advanced Life Support
Pharmacology: Respiratory and Endocrine

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Which of the following is NOT an action of insulin:

a. Increased gluconeogenesis
b. Increased glycogenesis
c. Increased lipogenesis
d. Increased cellular potassium uptake
e. Increased protein synthesis

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Pharmacology: Respiratory and Endocrine

Question 48776
Which of the following is NOT an action of insulin:

a) Increased glucagon secretion
b) Decrease glucagon secretion
c) Increased glucose metabolism (gluconeogenesis)
d) Increased protease synthesis

d) Increased colonic sodium uptake

d) Increased colonic sodium uptake

d) Increased colonic sodium uptake

d) Increased colonic sodium uptake

Answer
Insulin acts to:

• Increase colonic glucose uptake
• Decrease glucagon secretion
• Increase glucose metabolism (gluconeogenesis)
• Increase amino acid synthesis
• Increase protease synthesis
• Decrease protease synthesis
• Increase colonic sodium uptake
• Decrease colonic sodium uptake

Notes
Insulin acts as a key role in the regulation of carbohydrates, fat, and protein metabolism.

Insulin actions:

• Increases glucose uptake
• Decreases glucagon secretion
• Increases glucose metabolism (gluconeogenesis)
• Increases amino acid synthesis
• Increases protease synthesis
• Decreases protease synthesis
• Increases colonic sodium uptake
• Decreases colonic sodium uptake

Insulin administration:
Insulin is administered by parenteral injections, and must therefore be given by injection, the subcutaneous route is ideal in most circumstances. In insulin released by the upper arms, thighs, buttocks, or abdomen; absorption from sites may be increased or decreased depending on the area of injection. Generally, subcutaneous insulin injection sites other than the abdomen (thigh or buttocks) may occur but can be eliminated by using different injection sites in rotation. Local allergic reactions are rare.

Insulin preparations:
Insulin preparations can be divided into three types:

1. Short-acting insulin with a relatively rapid onset of action, variable half-life, used to treat diabetics for DKA (diabetic ketoacidosis) and rapid-acting insulin analogues, such as insulin lispro (Eli Lilly, Inc.
2. Intermediate-acting insulin (e. long-acting)
3. Slow-acting insulin (g. long-acting)

Soluble insulin is injected into the subcutaneous tissue, insulin is in a rapid-release form of insulin (i.e., 60 min duration), and peak action occurs at 2-4 hours, and a duration of action of 3-12 hours. Both rapid and intermediate, soluble insulin has a very short half-life of about 5-10 minutes and is effective for periods of 6-12 hours.

The rapid acting human insulin analogues have a faster onset and shorter duration of action than regular insulin and is used to reduce, compared to soluble insulin, fasting and postprandial blood glucose concentrations are a little higher, and peak blood glucose concentration is in little lower, and hypoglycemia occurs slightly less frequently. When soluble insulin is administered, intermediate- and short-acting insulin have a faster action of approximately 1-2 hours, a minimal effect at 1-2 hours, and a duration of action of 3-12 hours.

Treatment regimes:
The aim of treatment is to achieve the best possible control of blood glucose concentrations while avoiding hypoglycemia. Maintenance of insulin preparations may be required and appropriate combinations have been tailored to the individual patient.

Insulin regimes should be tailored to the individual patient and include:

• Once-daily SC injection (lelvel with a sustained-release solution of short acting insulin or rapid-acting insulin analogues as in an insulin injection or the long-acting insulin)
• Multiple daily SC injections (such as short acting insulin or rapid-acting insulin analogues given before meals with intermediate-acting or long-acting insulin or twice daily)
• Continuous subcutaneous insulin delivery

Insulin requirements may be increased by infection, stress, surgery or surgical trauma, and during pregnancy. Requirements may be decreased in those with certain endocrine disorders, such as Addison’s disease, hypopituitarism, or those with burns.

Implications of diabetes on fertility:
Loss of weight by hypoglycemia among insulin-injecting women can be a serious hazard, especially for those with these existing conditions. Very tight control of diabetes tends to decrease the risk of hypoglycemic episodes and an increase in the frequency of hypoglycemic episodes may cause hypoglycemic awareness. Bloodstream infection can also cause hypoglycemia. In addition to diabetes, lifestyle choices and diabetes that can affect fertility include:

• Oral antidiabetic drugs

Oral antidiabetic drugs are used to treat type 2 diabetes mellitus. They should be prescribed and if the patient fails to respond to these by 3 months, it might be necessary to consider other options such as weight loss or sulfonylureas, which are also insulinotropic agents and increase in physical activity. They should be used to augment the effect of diet and exercise, and not to replace them.

Resources

• The Royal College of Emergency Physicians
• National Institute for Health and Care Excellence
• The Royal College of Emergency Physicians
• The Royal College of Emergency Physicians
• The Royal College of Emergency Physicians
• The Royal College of Emergency Physicians

• Advanced Life Support Group
• Emergency Response (24/7)
• LMIC/Pharmacology
• Advanced Life Support Group
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Pharmacology: Respiratory and Endocrine

In acutely unwell patients who are at risk of hypercapnic respiratory failure, oxygen saturations should be maintained at:

- a 88 – 90%
- b 96 – 98%
- c 92 – 94%
- d 88 – 92%
- e 94 – 98%
Pharmacology: Respiratory and Endocrine

In acutely unwell patients who are at risk of hypercapnic respiratory failure, oxygen saturations should be maintained at:

a) 88 - 90%
b) 96 - 98%
c) 92 - 94%  ✗
d) 88 - 92%
e) 94 - 98%

Answer

A lower target of 88 - 92% oxygen saturation is indicated for patients at risk of hypercapnic respiratory failure, e.g., patients with COPD. Until blood gases can be measured, initial oxygen should be given using a controlled concentration of 28% or less, titrated towards the SpO2 of 88 - 92%. The aim is to provide the patient with enough oxygen to achieve an acceptable arterial oxygen tension without worsening carbon dioxide retention and respiratory acidosis.

Notes

Oxygen should be regarded as a drug. It is prescribed for hypoxemic patients to increase alveolar oxygen tension and decrease the work of breathing. The concentration of oxygen required depends on the condition being treated; the administration of an inappropriate concentration of oxygen can have serious or even fatal consequences.

High concentration oxygen therapy

In most acutely ill patients with a normal or low arterial carbon dioxide (PaCO₂), oxygen saturation should be 94 - 98% oxygen saturation. However, in some clinical situations such as cardiac arrest and carbon monoxide poisoning it is more appropriate to aim for the highest possible oxygen saturation until the patient is stable.

Low concentration oxygen therapy

A lower target of 88 - 92% oxygen saturation is indicated for patients at risk of hypercapnic respiratory failure, e.g., patients with COPD. Until blood gases can be measured, initial oxygen should be given using a controlled concentration of 28% or less, titrated towards the SpO2 of 88 - 92%. The aim is to provide the patient with enough oxygen to achieve an acceptable arterial oxygen tension without worsening carbon dioxide retention and respiratory acidosis.

Long term oxygen therapy

Long-term administration of oxygen (usually at least 35 hours daily) prolongs survival in some patients with COPD. Assessment for long-term oxygen therapy requires measurement of arterial blood gas tensions. A nasal cannula is usually preferred for long-term oxygen therapy from an oxygen concentrator. It can, however, produce dermatitis and mucosal drying in sensitive individuals.

Giving oxygen by nasal cannula allows the patient to talk, eat, and drink, but the concentration of oxygen is not controlled; this may not be appropriate for acute respiratory failure. Increased respiratory depression is seldom a problem in patients with stable respiratory failure treated with low concentrations of oxygen although it may occur during exacerbations: patients and relatives should be warned to call for medical help if drowsiness or confusion occurs.

Intermittent oxygen therapy

Oxygen is occasionally prescribed for short-burst (intermittent) use for episodes of breathlessness not relieved by other treatment in patients with severe chronic obstructive pulmonary disease, interstitial lung disease, heart failure, and in palliative care.

Ambulatory oxygen

Ambulatory oxygen is prescribed for patients on long-term oxygen therapy who need to be away from home on a regular basis. Patients who are not on long-term oxygen therapy can be considered for ambulatory oxygen therapy if there is evidence of exercise-induced oxygen desaturation and if improvement in blood oxygen saturation and exercise capacity with oxygen.

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Pharmacology: Respiratory and Endocrine

What is the mechanism of action of ipratropium bromide:

- a. Beta-2 agonist
- b. Muscarinic antagonist
- c. Muscarinic agonist
- d. Beta-blocker
- e. Alpha-agonist

< Previous  Next >  See Answer  Something wrong?
Pharmacology: Respiratory and Endocrine

Question 42 of 76

What is the mechanism of action of ipratropium bromide:

a) Beta-2 agonist
b) Muscarinic antagonist

c) Muscarinic agonist
d) Beta-blocker
e) Alpha-agonist

Answer

Ipratropium bromide, a short-acting antimuscarinic bronchodilator, causes bronchodilation by blocking the cholinergic nerves in the airways.

Notes

Ipratropium bromide, a short-acting antimuscarinic bronchodilator, causes bronchodilation by blocking the cholinergic nerves in the airways.

Ipratropium bromide can provide short-term relief in chronic asthma, but short-acting beta-2 agonists act more quickly and are preferred. Ipratropium bromide by nebulisation can be added to other standard treatment in life-threatening asthma or if acute asthma fails to improve with standard therapy.

The aerosol inhalation of ipratropium bromide may be used for short-term relief in mild COPD in patients who are not using a long-acting antimuscarinic drug. Its maximal effect occurs 30–60 minutes after use; its duration of action is 3 to 6 hours and bronchodilation can usually be maintained with treatment 3 times a day.

Cautions

Ipratropium bromide should be used with caution in:

- Men with prostatic hyperplasia and bladder-outflow obstruction (worsened urinary retention has been reported in elderly men)
- People with chronic kidney disease (CKD) stages 3 and above (because of the risk of drug toxicity)
- People with angle-closure glaucoma (nebulised mist of antimuscarinic drugs can precipitate or worsen acute angle-closure glaucoma)

Interactions

There are no important drug interactions with inhaled muscarinic antagonists.

Side effects

Inhaled antimuscarinics are generally well tolerated as they are poorly absorbed systemically.

Their adverse effects include:

- Dry mouth and abnormal taste in the mouth
- Nasal congestion and dryness of nasal mucosa
- Acute angle-closure glaucoma (reported in people on nebulised ipratropium)
Pharmacology: Respiratory and Endocrine

Question 43 of 76

Which of the following is NOT a glucocorticoid effect of corticosteroids:

- a. Hyperglycaemia
- b. Osteoporosis
- c. Muscle wasting
- d. Peptic ulceration
- e. Hypertension

< Previous  Next >  See Answer  Something wrong?
Pharmacology: Respiratory System

**Question:** Which of the following NOT a pharmacological effect of corticosteroids?

**Options:**
- A) Hyperglycemia
- B) Cushing's syndrome
- C) Fatigue
- D) Psychosis
- E) Adrenarche

**Answer:**
- E) Adrenarche

**Notes:**
Corticosteroids are anti-inflammatory agents that work by inhibiting the synthesis of pro-inflammatory cytokines and reducing the number of immune cells in the inflamed tissue. They are used to treat a wide range of conditions, including asthma, allergies, and inflammatory bowel disease. Corticosteroids are typically administered orally or by injection. They work by reducing inflammation in the body, which can help to relieve symptoms such as swelling, pain, and redness. Corticosteroids are also used to treat certain forms of cancer, such as leukemia and lymphoma. They can also be used to treat certain types of skin conditions, such as psoriasis and eczema. Corticosteroids are generally safe and effective when used as directed, but they can cause a number of side effects, including weight gain, muscle weakness, and increased risk of infection. It is important to follow the instructions provided by your healthcare provider when using corticosteroids, and to report any side effects to your doctor immediately.

*Editor's Note:*
- **Side effects:**
  - Weight gain
  - Increased appetite
  - Mood changes
  - Fatigue
  - Muscle weakness
  - Increased risk of infections

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**Note:**
- **FRCPEM Success**
  - **Join Group:**
  - **FRCPEM Success:**
    - **Join Group:**
Pharmacology: Respiratory and Endocrine

Question 44 of 76

What is the mechanism of action of chlorphenamine:

- a. H1-receptor antagonist
- b. Histamine agonist
- c. H2-receptor antagonist
- d. Leukotriene receptor antagonist
- e. Muscarinic antagonist

< Previous  Next >  See Answer  Something wrong?
Pharmacology: Respiratory and Endocrine

Question 4: 4/6

What is the mechanism of action of chlorphenamine?

- a) Histamine antagonist
- b) Histamine agonist
- c) H1-receptor antagonist
- d) Loxotolamine receptor antagonist
- e) Muscarinic antagonist

Answer

Chlorphenamine is a competitive inhibitor at the H1-receptor (an anti-histamine).

Notes

Antihistamines are competitive inhibitors at the H1-receptor (in contrast to H2-receptor antagonists used to decrease gastric acid secretion). They act to relax histamine-induced bronchoconstriction, block the vasodilator effect of histamine, inhibit histamine-induced increases in capillary permeability and block mucus secretion and sensory nerve stimulation.

Histamine (H1)-receptor antagonists are well absorbed after oral administration. The effects of these agents are usually seen in 30 minutes (with maximal effects at 1 – 2h); the duration of action is 3 – 8 hours for first-generation compounds and 3 – 24 hours for second-generation compounds.

H1-receptor antagonists are metabolised in the liver; many reduce microsomal enzymes and alter their own metabolism and that of other drugs.

Indications

- Allergic rhinitis and conjunctivitis
- Urticarial rashes, pruritus, insect bites and stings
- Angioedema
- Anaesthesics (second line adjunct to adrenaline)
- Nausea/vomiting and prevention of motion sickness
- Insomnia

Chlorphenamine

All older antihistamines cause sedation but alimemazine tartrate and promethazine may be more sedating whereas chlorphenamine maleate and cyclizine may be less so. This sedating activity is sometimes used to manage the pruritus associated with some allergies or used to manage occasional insomnia. There is little evidence that any of the older, ‘sedating’ antihistamines is superior to another and patients vary widely in their response.

Cetirizine

The newer antihistamines e.g. cetirizine cause less sedation and psychomotor impairment than the older antihistamines because they are much less lipid soluble and penetrate the blood brain barrier only to a slight extent.

Cautions

Antihistamines should usually be avoided in acute asthmatics (although some antihistamines are thought to be safe).

Antihistamines should be used with caution in epilepsy, prostatic hypertrophy, urinary hypertension, hepatic impairment and susceptibility to angle-closure glaucoma.

Side effects (significantly reduced with second-generation agents)

Elderly patients and children are more susceptible to side effects.

Common side effects of antihistamines may include:

- Anticholinergic effects (blurred vision, dry mouth, urinary retention)
- Headache
- Gastrointestinal disturbances
- Psychomotor impairment (sedation, dizziness and loss of appetite)

Drowsiness may affect performance of skilled tasks (e.g. cycling or driving); sedating effects are enhanced by alcohol and opioid analgesics.
Pharmacology: Respiratory and Endocrine

Question 45 of 76

Regarding the management of diabetic ketoacidosis (DKA), glucose should be given in addition to insulin once blood-glucose concentration falls below:

- 20 mmol/L
- 18 mmol/L
- 14 mmol/L
- 10 mmol/L
- 8 mmol/L
Pharmacology: Respiratory and Endocrine

Question 42 of 76

Regarding the management of diabetic ketoadiposis (DKA), glucose should be given in addition to insulin once blood-glucose concentration falls below:

- 20 mmol/L
- 18 mmol/L ✗
- 14 mmol/L ✓
- 10 mmol/L
- 8 mmol/L

Answer

Once blood glucose concentration falls below 14 mmol/litre, glucose 10% should be given by intravenous infusion (into a large vein through a large-gauge needle) at a rate of 125 ml/hour, in addition to the sodium chloride 0.9% infusion.

Notes

Diabetic ketoadiposis (DKA) consists of the biochemical triad of ketonemia (ketosis), hyperglycaemia, and acidemia.

Pathophysiology

DKA usually occurs as a consequence of absolute or relative insulin deficiency that is accompanied by an increase in counter-regulatory hormones (i.e., glucagon, cortisol, growth hormone, catecholamines). This type of hormonal imbalance enhances hepatic gluconeogenesis and glycogenolysis resulting in severe hyperglycaemia. Enhanced lipolysis increases serum free fatty acids that are then metabolised as an alternative energy source in the process of ketogenesis. This results in accumulation of large quantities of ketone bodies and subsequently metabolic acidosis. Fluid depletion occurs due to osmotic diuresis secondary to hyperglycaemia, vomiting, and inability to take in fluid due to a diminished level of consciousness.

Diagnosis

- Ketonemia > 3.0 mmol/l or significant ketonuria (more than 2+ on standard urine sticks)
- Blood glucose > 11.0 mmol/l or known diabetes mellitus
- Bicarbonate (HCO₃⁻) < 15.0 mmol/l and/or venous pH < 7.3

Management of diabetic ketoadiposis in adults

- Intravenous fluids
  - If SBP is below 90 mmHg (adjusted for age, sex, and medication as appropriate), 500 ml sodium chloride 0.9% should be given by intravenous infusion over 10 - 15 minutes, and repeated if SBP still < 90 mmHg
  - When SBP is greater than 90 mmHg, sodium chloride infusion should be continued at a rate that replaces deficit and provides maintenance.
- Potassium replacement
  - Potassium chloride (40 mmol/l) should be included in the fluids as long as the serum potassium level is < 5.5 mmol/l, and the patient is passing urine, and the plasma potassium concentration maintained between 3.5 - 5.5 mmol/l (measured at 60 minutes, 2 hours, and 2 hourly thereafter; and hourly outside the normal range).
- Insulin
  - An intravenous insulin infusion should start at a concentration of 1 U/ml, at a fixed rate of 0.1 units/kg/hour.
  - Established subcutaneous long-acting insulin therapy should be continued concurrently.
  - Blood lactate and blood glucose concentrations should be checked hourly and the insulin infusion rate adjusted accordingly. Blood lactate concentration should fall by at least 0.5 mmol/litre/hour and blood glucose concentration should fall by at least 3 mmol/litre/hour.
- Glucose
  - Once blood glucose concentration falls below 14 mmol/litre, glucose 10% should be given by intravenous infusion (into a large vein through a large-gauge needle) at a rate of 125 ml/hour, in addition to the sodium chloride 0.9% infusion.

The insulin infusion should be continued until blood ketone concentration is below 0.3 mmol/litre, blood pH is above 7.3 and the patient is able to eat and drink; ideally the insulin infusion should be stopped about an hour after giving subcutaneous fast-acting insulin and a meal.

The management of hyperosmolar hyperglycaemic state or hyperosmolar hyperglycaemic nonketotic coma is similar to that of diabetic ketoadiposis, although lower rates of insulin infusion are usually necessary and slower rehydration may be required.
Pharmacology: Respiratory and Endocrine

Question 46 of 76

Regarding selective beta-2 agonists, which of the following statements is INCORRECT:

a. Hypokalaemia may be potentiated by concomitant treatment with theophylline.

b. Beta-2 agonists may inhibit thyroid activity.

c. Beta-2 agonists should be used with caution in diabetes due to a risk of hyperglycaemia and ketoacidosis.

d. Beta-2 agonists should be used with caution in those with a susceptibility to QT-interval prolongation.

e. Beta-2 agonists cause an increased risk of arrhythmias and should be used with caution in patients with cardiovascular disease.
Pharmacology: Respiratory and Endocrine

Question 46 of 76

Regarding selective beta-2 agonists, which of the following statements is INCORRECT:

a) Hypokalaemia may be potentiated by concomitant treatment with theophylline.

b) Beta-2 agonists may inhibit thyroid activity.

c) Beta-2 agonists should be used with caution in diabetes due to a risk of hyperglycaemia and ketosisosis.

d) Beta-2 agonists should be used with caution in those with a susceptibility to QT-interval prolongation.

e) Beta-2 agonists cause an increased risk of arrhythmias and should be used with caution in patients with cardiovascular disease.

Answer

Beta-2 agonists should be used with caution in people with:

- Cardiovascular disease including arrhythmias and hypertension (beta-2 agonists may cause an increased risk of arrhythmias and significant changes to blood pressure and heart rate).
- Diabetes (risk of hyperglycaemia and ketosisosis, especially with intravenous use).
- Hyperthyroidism (beta-2 agonists may stimulate thyroid activity).
- Hypokalaemia (potentially serious hypokalaemia may result from beta-2 agonist therapy, this effect may be potentiated in severe asthma by concomitant treatment with theophylline, corticosteroids, diuretics and/or hypocalcemic disorders).
- Susceptibility to QT-interval prolongation.
- Convulsive disorders.

Notes

Selective beta-2 agonists act directly on beta-2 receptors, causing smooth muscle relaxation and dilatation of the airways. Mild to moderate symptoms of asthma respond rapidly to the inhalation of a selective short-acting beta2-agonist such as salbutamol or terbutaline sulphate. Short-acting beta-2 agonists have a rapid onset of action (15–30 minutes) and their effects last for up to 4 hours. Salbutamol or terbutaline sulphate can be given intravenously for severe or life-threatening acute asthma; patients should be carefully monitored and the dose adjusted according to response and heart rate.

Short-acting beta-2 agonists are used for immediate relief of asthma symptoms, while some long-acting beta2 agonists (e.g., salmeterol) are used as inhaled corticosteroids in patients requiring prophylactic treatment.

Cautions

Beta-2 agonists should be used with caution in people with:

- Cardiovascular disease including arrhythmias and hypertension (beta-2 agonists may cause an increased risk of arrhythmias and significant changes to blood pressure and heart rate).
- Diabetes (risk of hyperglycaemia and ketosisosis, especially with intravenous use).
- Hyperthyroidism (beta-2 agonists may stimulate thyroid activity).
- Hypokalaemia (potentially serious hypokalaemia may result from beta-2 agonist therapy, this effect may be potentiated in severe asthma by concomitant treatment with theophylline, corticosteroids, diuretics and/or hypocalcemic disorders).
- Susceptibility to QT-interval prolongation.
- Convulsive disorders.

Interactions

Hypokalaemia may be potentiated by concomitant treatment with theophylline and its derivatives, corticosteroids, and diuretics. This in turn may predispose to toxicity in patients taking digoxin.

Side effects

Side effects are usually dose related and include:

- Fine tremor – occurs particularly in the hands and is usually worst in the first few days of treatment.
- Polyphonia and tachycardia.
- Headache.
- Dizziness.
- Anxiety.
- Hypokalaemia.
- Cardiac arrhythmia and proarrhythmia (brachycardia, tachycardia).
- Acute angle closure glaucoma.
- QT-interval prolongation.
Pharmacology: Respiratory and Endocrine

Question 47 of 76

Regarding adrenaline, which of the following statements is CORRECT:

a. Adrenaline only acts on alpha receptors.
b. Adrenaline only acts on beta receptors.
c. Adrenaline has positive chronotropic but negative inotropic effects.
d. Adrenaline can cause vasodilation or vasoconstriction.
e. Adrenaline is only used in the management of cardiopulmonary resuscitation.
Pharmacology: Respiratory and Endocrine

Question 47 of 76

Regarding adrenaline, which of the following statements is CORRECT:

a) Adrenaline only acts on alpha receptors. ✗
b) Adrenaline only acts on beta receptors.
c) Adrenaline has positive chronotropic but negative inotropic effects.
d) Adrenaline can cause vasodilation or vasoconstriction. ✔
e) Adrenaline is only used in the management of cardiopulmonary resuscitation.

Answer

Adrenaline is a catecholamine that acts on both alpha and beta receptors and increases both heart rate and contractility (beta1 effects); it can cause peripheral vasodilation (a beta2 effect) or vasoconstriction (an alpha effect). Adrenaline is used in cardiopulmonary resuscitation, in the emergency management of acute allergic and anaphylactic reactions and in the management of severe croup (as a nebulised solution).

Notes

Adrenaline is a catecholamine that acts on both alpha and beta receptors and increases both heart rate and contractility (beta1 effects); it can cause peripheral vasodilation (a beta2 effect) or vasoconstriction (an alpha effect).

Adrenaline is used in cardiopulmonary resuscitation, in the emergency management of acute allergic and anaphylactic reactions and in the management of severe croup (as a nebulised solution).

Mechanism of action in anaphylaxis

As an alpha-receptor agonist, adrenaline reverses peripheral vasodilation and increased vascular permeability reducing hypotension and oedema.

As a beta-receptor agonist it dilates bronchial airways, increases the force and rate of myocardial contraction, and suppresses histamine and leukotriene release.

Adrenaline also alleviates pruritus, urticaria, and angioedema and may relieve gastrointestinal and genitourinary symptoms associated with anaphylaxis because of its relaxer effects on the smooth muscle of the stomach, intestine, uterus and urinary bladder.

Adrenaline increases glycogenolysis, reduces glucose uptake by tissues, and inhibits insulin release in the pancreas, resulting in hyperglycaemia and increased blood lactic acid.

Interactions

Severe anaphylaxis in patients taking beta-blockers may not respond to adrenaline — consider bronchodilator therapy. Furthermore, adrenaline can cause severe hypertension and bradycardia in those taking non-cardioselective beta-blockers.
Pharmacology: Respiratory and Endocrine

Which of the following has the most potent glucocorticoid effect:

a. Prednisolone
b. Fludrocortisone
c. Hydrocortisone
d. Methylprednisolone
e. Dexamethasone

< Previous  Next >  See Answer  Something wrong?
Pharmacology: Respiratory and Endocrine

Question 1

Which of the following is the most potent glucocorticoid effect?

A. Prednisolone
B. Dexamethasone
C. Hydrocortisone
D. Metyrapone
E. Desmopressin

Answer

Dexamethasone and betamethasone are the least potent glucocorticoid (inflammatory) effect.

Notes

In comparing the relative potencies of corticosteroids in terms of their anti-inflammatory effects, it is worth noting that high glucocorticoid activity is beneficial in an adverse device is incompletely related to lower inter-stressor effects.

Anti-inflammatory activity

Equivalent anti-inflammatory doses of corticosteroids.

Prednisolone 1 mg = Dexamethasone 0.75 mg = Hydrocortisone 20 mg

This does not rule out anti-glucocorticoid effects, nor their deleterious effects.

Side Effects

Corticosteroids or glucocorticoids can exaggerate the normal oral physiology of the respiratory tract, leading to aeroallergic respiratory and asthma-like side effects. Minor side effects of glucocorticoids are rare but can be avoided with fluimucil, however, a significant glucocorticoid with mild effects through glucocorticoids, beta-2 agonists and desmopressin, are safer or unrelated as long as it is not related to adverse effects of systemic importance.

Mild/Intermediate side effects include:

- Hypertension
- Insulin resistance
- + water retention and electrolyte changes
- + potassium loss
- + blood loss

Glucocorticoid side effects include:

- + weight gain
- Hyperglycaemia and diabetes
- + cataracts and exophthalmos
- + acne rosacea
- + acne rosacea
- + psychiatric reactions

Side effects can be minimized by using low-dose oral doses for the lower side effects possible. The suppression of aldosterone and salt retention and suppression of prostatic implants, which are significant on long-term use, makes glucocorticoids a useful treatment for chronic lung disease. Mild/intermediate side effects can be minimized with doses of glucocorticoids, and aminoglycosides in these cases used for their side effects.

Advantages of glucocorticoids

Doses are low. Dose-related suppression of prostatic implants, which are significant on long-term use, makes glucocorticoids a useful treatment for chronic lung disease.

Dexamethasone is used in chronic inflammatory diseases, and successful at suppressing prostatic implants, which are significant on long-term use, makes glucocorticoids a useful treatment for chronic lung disease.

Dexamethasone can suppress the immune system, and can be used as an adjuvant to corticosteroids and treatment of glaucoma.

Dexamethasone is a corticosteroid used in chronic inflammatory diseases. A low-dose dexamethasone is used in chronic inflammatory diseases. A low-dose dexamethasone is used in chronic inflammatory diseases. A low-dose dexamethasone is used in chronic inflammatory diseases.
Pharmacology: Respiratory and Endocrine

Question 49 of 76

Regarding the management of diabetic ketoacidosis (DKA), once the blood-glucose concentration falls below 14 mmol/L, glucose should be given alongside insulin as:

- **a** 10% glucose intravenous infusion at a rate of 125 mL/hour
- **b** 20% glucose intravenous infusion at a rate of 125 mL/hour
- **c** 10% glucose intravenous infusion at a rate of 250 mL/hour
- **d** 5% glucose intravenous infusion at a rate of 125 mL/hour
- **e** 5% glucose intravenous infusion at a rate of 250 mL/hour
Pharmacology: Respiratory and Endocrine

Question 4 of 10

Regarding the management of diabetic ketoacidosis (DKA), once the blood-glucose concentration falls below 14 mmol/L, glucose should be given alongside insulin as:

- a) 10% glucose intravenous infusion at a rate of 125 mL/hour
- b) 20% glucose intravenous infusion at a rate of 125 mL/hour
- c) 10% glucose intravenous infusion at a rate of 250 mL/hour
- d) 5% glucose intravenous infusion at a rate of 125 mL/hour
- e) 5% glucose intravenous infusion at a rate of 250 mL/hour

Answer

Once blood-glucose concentration falls below 14 mmol/L, glucose 10% should be given by intravenous infusion (into a large vein through a large-gauge needle) at a rate of 125 mL/hour, in addition to the sodium chloride 0.9% infusion.

Notes

Diabetic ketoacidosis (DKA) consists of the biochemical triad of ketonaemia (ketosis), hyperglycaemia, and acidaemia.

Pathophysiology

DKA usually occurs as a consequence of absolute or relative insulin deficiency that is accompanied by an increase in counter-regulatory hormones (i.e., glucagon, cortisol, growth hormone, catecholamines). This type of hormonal imbalance enhances hepatic gluconeogenesis and glycogenolysis resulting in severe hyperglycaemia. Enhanced lipolysis increases serum free fatty acids that are then metabolized as an alternative energy source in the process of ketogenesis. This results in accumulation of large quantities of ketone bodies and subsequent metabolic acidosis. Fluid depletion occurs due to osmotic diuresis secondary to hyperglycaemia, vomiting, and inability to take in fluid due to a diminished level of consciousness.

Diagnosis

- Ketonaemia > 3.0mmol/L or significant ketonuria (more than 2+ on standard urine sticks)
- Blood glucose ≥ 11.1mmol/L or known diabetes mellitus
- Bicarbonate (HCO₃⁻) ≤ 15.0mmol/L, or venous pH < 7.3

Management of diabetic ketoacidosis in adults

- Intravenous fluids
  - If SBP is below 90 mmHg (adjusted for age, sex, and medication as appropriate), 500 mL sodium chloride 0.9% should be given by intravenous infusion over 10 – 15 minutes, and repeated if SBP still < 90 mmHg.
  - When SBP is greater than 90 mmHg, sodium chloride infusion should be continued at a rate that replaces deficit and provides maintenance.

- Potassium replacement
  - Potassium chloride (40 mmol/L) should be included in the fluids (as long as the serum potassium level ≥ 5.5 mmol/L, and the patient is passing urine), and the plasma potassium concentration maintained between 3.5 – 5.5 mmol/L, (measured at 60 minutes, 2 hours, and 2 hours thereafter; and hourly if outside the normal range).

- Insulin
  - An intravenous insulin infusion should be started at a concentration of 1 L/mmol/L, at a fixed rate of 0.1 units/kg/hour.
  - Established subcutaneous long-acting insulin therapy should be continued concomitantly.
  - Blood ketone and blood glucose concentrations should be checked hourly and the insulin infusion rate adjusted accordingly. Blood ketone concentration should fall by at least 0.5 mmol/L/hour and blood glucose concentration should fall by at least 3 mmol/L/hour.

- Glucose
  - Once blood-glucose concentration falls below 14 mmol/L, glucose 10% should be given by intravenous infusion (into a large vein through a large-gauge needle) at a rate of 125 mL/hour, in addition to the sodium chloride 0.9% infusion.

The insulin infusion should be continued until blood ketone concentration is below 0.3 mmol/L, blood pH is above 7.3, and the patient is able to eat and drink. Ideally, the insulin infusion should be stopped about an hour after giving subcutaneous fast-acting insulin and a meal.

The management of hyperosmolar hyperglycaemic state or hyperosmolar hyperglycaemic nonketotic coma is similar to that of diabetic ketoacidosis, although lower rates of insulin infusion are usually necessary and slower rehydration may be required.
Pharmacology: Respiratory and Endocrine

Question 50 of 76

Regarding theophylline, which of the following statements is INCORRECT:

a. There is an increased risk of convulsions when theophylline is given with quinolones.
b. Theophylline in overdose may cause severe and intractable vomiting.
c. Both the frequency and severity of adverse effects increase at plasma-theophylline concentrations above 20 mg/litre.
d. Theophylline is associated with an increased risk of tendon damage, including rupture.
e. Theophylline should not be prescribed to people with porphyria.
Pharmacology: Respiratory and Endocrine

Question 1.4.10

Regarding theophylline, which of the following statements is INCORRECT?

- a. There is an increased risk of convulsions when theophylline is given with quinolones.
- b. Theophylline overdose may cause severe and frequently vomiting.
- c. Both the frequency and severity of asthmatic attacks increase in plasma theophylline concentrations above 20 mg/l.
- d. Theophylline is associated with an increased risk of tendon damage, including rupture.
- e. Theophylline should not be prescribed to people with porphyria.

**Answer**

Theophylline is not recognised as a cause of tendon damage or rupture, unlike quinolones. This remaining statement is false but not incorrect.

**Notes**

Theophylline may also have an additional bronchodilator effect when used in conjunction with small doses of beta-2 agonists. Theophylline is a weak central cAMP phosphodiesterase resulting in increased bronchial relaxation of cardiac, adrenergic nervous system.

Theophylline is metabolised to its active form, theobromine, which has a longer plasma half-life. The plasma theophylline concentration is increased in heart failure, hepatic impairment, in elderly females in lower and in the elderly. As a result, dosage may need to be reduced to avoid such concurrent increases. The plasma theophylline concentration is determined in smokers, unlike asthma concentrations.

**Contraindications**

- Theophylline should not be prescribed to people with:
  - Peptic ulcer disease
  - People with hyperuricaemia or gout
  - Children currently receiving myocardial
  - Infants under 6 months of age

**Caution**

Theophylline should be used with caution in patients with:

- Cardiovascular disease
- Cardiac arrhythmias
- Hepatic impairment
- Epilepsy
- Hypertension
- Hyperthyroidism
- Porphyria
- Peptic ulcer disease
- Risk of hepatotoxicity

**Interventions**

- Hypokalaemia may be prevented by concurrent use with beta-2 agonists, corticosteroids and diuretics.

**Excretion of lithium**

- Lithium may be affected by concurrent theophylline therapy with lithium.

There is an increased risk of convulsions when theophylline is given with:

- Examples of enzyme inhibiting drugs (raise plasma theophylline level):
  - Phenytoin
  - Carbamazepine
  - Fenofibrate
  - Fluvastatin
  - Vasoconstrictors
  - Anticoagulants
  - Fluvoxamine
- Examples of enzyme inducing drugs (lower plasma theophylline level):
  - Primidone
  - Phenytoin
  - Carbamazepine
  - Phenytoin
  - Fluvastatin
  - Vasoconstrictors
  - Anticoagulants

**Side effects**

- Tachycardia, palpitations and arrhythmias
- CNS stimulation: anxiety, irritability, insomnia and confusion
- Gastrointestinal: nausea, vomiting and diarrhoea
- Nausea, vomiting and diarrhoea
- Hypokalaemia (potentially cardiac arrhythmias may result from beta-2 agonists); this effect may be potentiated by enzyme-inhibiting concurrent use with theophylline and its derivatives, corticosteroids, and diuretics, and by hypokalaemia.

**Monitoring requirements**

In severe or individual, otherwise theophylline concentration is 10 – 20 mg/l (50 – 100 ng/ml). Theophylline is immunosuppressive for mineralocorticoids and may cause mineralocorticoid side effects. A steady effect can be achieved in the range 10 – 20 mg/l and both the frequency and severity of convulsions above 20 mg/l.

Planar theophylline concentration is measured 5 days after starting oral treatment and at least 3 days after any dose adjustment.

**Overdosage**

Theophylline in overdose can cause vomiting (which may decrease intracellular, agitations, myoclonus,ifficiency, and hallucinations. Among serious effects are: respiratory depression, convulsions, and subsequent asystol and ventricular arrhythmias. Severe hypokalaemia may develop rapidly.

Resources

- The Royal College of Emergency Medicine
- Joint UK Committee for Emergency and Urgent Care
- Resuscitation Council (UK)
- Tendons.org

- Advanced Life Support Group
- Emergency Medicine Journal
- Uptodate
- BMJ
- British Neonatology

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Pharmacology: Respiratory and Endocrine

Question 51 of 76

Which of the following corticosteroids has the most potent mineralocorticoid effect:

- a) Betamethasone
- b) Fludrocortisone
- c) Hydrocortisone
- d) Methylprednisolone
- e) Dexamethasone

< Previous  Next >  See Answer

Something wrong?
Pharmacology: Respiratory and Endocrine

**Respiratory Effects**

- **Inhalation**: Exposure to high concentrations of gases, dusts, or fumes can irritate the respiratory tract, leading to **sneezing**, **coughing**, and **difficulty breathing**.
- **Skin irritation**: Direct contact with the skin can cause **redness**, **itching**, and **rash**.

**Endocrine Effects**

- **Hypoglycemia**: Prolonged exposure to low blood sugar levels can lead to **fatigue** and **weakness**.
- **Diabetes**: Chronic exposure to high blood sugar levels can lead to **diabetes mellitus**.
- **Renal effects**: Exposure to heavy metals can cause **renal failure**.

**Other Effects**

- **Central nervous system**: Exposure can lead to **dizziness**, **nausea**, and **vomiting**.
- **Gastrointestinal**: Exposure can cause **abdominal pain**, **diarrhea**, and **constipation**.

**Precautions**

- **Avoid contact with skin and eyes**.
- **Wear protective clothing**.
- **Use proper ventilation**.

**Emergency Procedures**

- **Seek medical attention** immediately in case of exposure.
- **Provide supportive care** as needed.

**Routes of Exposure**

- **Inhalation**: Exposure to airborne particles.
- **Respiratory**: Exposure to gases or vapors.
- **Skin**: Direct contact with the skin.
- **Eye**: Exposure to fluids.

**Health Effects**

- **Immediate effects**: Symptoms may occur within minutes of exposure.
- **Delayed effects**: Symptoms may occur days to weeks after exposure.

**Medical Management**

- **Supportive care**: Provide appropriate medical treatment based on symptoms.

**Toxicological**

- **Metabolism**: Metabolized primarily in the liver.
- **Excretion**: Excreted mainly through the kidneys.

**Pregnancy Consideration**

- **Safe use**: Consider the potential risks to the developing fetus.

**Animal Studies**

- **Fertility**: Exposure may affect fertility and reproductive health.

**References**

- [NLM](https://www.nlm.nih.gov)
- [WHO](https://www.who.int)

**Resources**

- [American Lung Association](https://www.lung.org)
- [American Diabetes Association](https://www.diabetes.org)
- [National Institutes of Health](https://www.nih.gov)

**Question Navigator**

1. Answered
2. Answered
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4. Answered
5. Answered
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7. Answered
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Pharmacology: Respiratory and Endocrine

Question 52 of 76

Regarding inhaled corticosteroids, which of the following statements is CORRECT:

- **a** Symptom improvement usually occurs about 12 hours after initiation of treatment.
- **b** Inhaled corticosteroids do not cause systemic side effects.
- **c** They should be taken as and when required for worsening of asthma.
- **d** Inhaled corticosteroids should be given at a higher dose during an acute attack of asthma.
- **e** The mouth should be rinsed out with water after using an inhaled corticosteroid.
Pharmacology: Respiratory and Endocrine

Question 1 of 18

Regarding inhaled corticosteroids, which of the following statements is CORRECT:

a) Symptom improvement usually occurs about 12 hours after initiation of treatment.

b) Inhaled corticosteroids do not cause systemic side effects.

c) They should be taken as and when required for worsening of asthma.

d) Inhaled corticosteroids should be given at a higher dose during an acute attack of asthma.

e) The mouth should be rinsed with water after using an inhaled corticosteroid.

Answer

Inhaled corticosteroids can cause oral candidiasis and patients should be advised to rinse their mouth out with water after using the inhaler. Systemic corticosteroids, not increased inhaled corticosteroids should be given during an acute attack of asthma. Inhaled corticosteroids must be used regularly for maximum benefit, not as and when alleviation of symptoms usually occurs 3 to 7 days after initiation. Systemic adverse effects may occur rarely, particularly if high doses are prescribed for long periods of time or in concomitant use of other corticosteroid preparations.

Notes

Corticosteroids reduce airway inflammation and hence oedema and mucus secretion. Regular use of inhaled corticosteroids (e.g. budesonide) reduces the risk of exacerbation of asthma.

An inhaled corticosteroid is used regularly for prophylaxis of asthma when patients require a beta-2 agonist more than twice a week, or if symptoms disturb sleep at least once a week, or if the patient has suffered an exacerbation in the last 2 years requiring systemic corticosteroid. Corticosteroid inhalers must be used regularly for maximum benefit; addition of symptoms usually occurs 3 to 7 days after initiation.

Current and previous smoking reduces the effectiveness of inhaled corticosteroids and higher doses may be necessary.

Contraindications

There are no contraindications to the use of inhaled corticosteroids.

Inhaled corticosteroids should be used with caution in people with tuberculosis (potential for exacerbation or reactivation) or uncontrolled systemic fungal, bacterial, parasitic or viral infection.

Adverse effects

Local adverse effects of inhaled corticosteroids include:

- Oral candidiasis, sore mouth, dysphonia, hoarseness (patients should be advised to rinse their mouth with water after inhalation)
- Paradoxical bronchospasm (very rare and usually mild)

Systemic adverse effects may occur rarely, particularly if high doses are prescribed for long periods of time or in concomitant use of other corticosteroid preparations.

Systemic adverse effects include:

- Reduced bone mineral density predisposing the person to osteoporosis
- Bruising, ecchymosis, and haemorrhage
- Adrenal suppression, adrenal insufficiency, coma, and death — very rare, this has been reported in children taking long-term inhaled corticosteroids
- Psychological and behavioral changes (such as psychomotor hyperactivity, sleep disorders, anxiety, depression, and aggression)
- Growth suppression in children — this does not seem to occur with recommended doses of inhaled corticosteroids

Systemic corticosteroid therapy in asthma

Systemic corticosteroid therapy may be necessary during episodes of illness, such as severe infection, or if the asthma is worsening, when higher doses are needed and access of inhaled drug to small airways may be reduced; patients may need a reserve supply of corticosteroid tablets.

An acute attack of asthma should be treated with a short course of an oral corticosteroid (e.g. prednisolone) or intravenous corticosteroid (e.g. hydrocortisone). Oral intake is not possible, starting with a high dose. An oral corticosteroid should normally be taken as a single dose in the morning to reduce the disturbance to circadian cortisol secretion.
Pharmacology: Respiratory and Endocrine

Question 53 of 76

Plasma theophylline concentration is decreased by which one of the following:

a. Hepatic impairment
b. Obesity
c. Alcohol consumption
d. Heart failure
e. Fever

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Pharmacology: Respiratory and Endocrine

Question 53 of 53

Plasma theophylline concentration is decreased by which of the following:

a. Hepatic impairment
b. Renal disease
c. Alcohol consumption
d. Heart failure

e. Fever

Answer

Theophylline is metabolized in the liver, and thus a liver impairment. The plasma theophylline concentration is increased in intermittent attacks, hepatic impairment, and renal insufficiency. A reduction in dose may be necessary to avoid toxic accumulation. The plasma theophylline concentration is decreased in smokers, and by alcohol consumption.

Notes

Theophylline is an additional bronchodilator effect when used in conjunction with usual doses of beta-2 agonists. Theophylline is a prodrug which is hydrolyzed to theophylline, resulting in increased tissue concentrations of cyclic adenosine monophosphate (cAMP). Theophylline is metabolized in the liver, as does long-term theophylline use. The plasma theophylline concentration is increased in patients with hepatic disease, renal insufficiency, or in the elderly. A reduction in dose may be necessary to avoid toxic accumulation. The plasma theophylline concentration is decreased in smokers, and by alcohol consumption.

Indications

It is used as a bronchodilator in asthma and chronic obstructive pulmonary disease (COPD). It is not generally effective in exacerbations of chronic obstructive pulmonary disease, but it is used to prevent the worsening acute attack given its effect on cAMP; as a vasodilator, the mixture of theophylline with sodium pentolamine, which is 20 times more potent than theophylline alone.

Contraindications

Theophylline should not be used in:

- People with peptic ulcer
- People with hyperglycemia or on warfarin
- Children with severe liver cirrhosis
- Infants under 6 months of age

Cautions

Theophylline should be used with caution in people with:

- Cardiac arrhythmias or other cardiac disease
- Hypertensive requirement
- Glaucoma
- Hyperthyroidism
- Hypercalcemia
- Pephlerosis
- Risk of psychosis

Interactions

Hypokalemia may be potentiated by concurrent therapy with beta-2 agonists, corticosteroids, and electrons.

Excretion of furosemide may be potentiated by concurrent therapy with theophylline.

Examples of enzyme-inducing drugs (lower plasma theophylline level)

- Phenobarbital
- Phenytoin
- Carbamazepine
- Rifampicin
- Ethinyl estradiol

Examples of enzyme-inhibiting drugs (raise plasma theophylline level)

- Enzyme inhibitors
- Carbamazepine
- Phenytoin
- Ethinyl estradiol

Side effects

Side effects include:

- Tachycardia, palpitations, and arrhythmias
- CTMC intolerance, nausea, headache, dizziness, and drowsiness
- Gastric tract irritation, nausea, vomiting, and diarrhea
- Hypokalemia (potentially serious); hypocalcaemia may result from beta-2 agonist therapy. This effect may be potentiated in severe asthmatic by concurrent treatment with theophylline and its derivatives, corticosteroids, and bronchodilators. Atebrin, and phenylephrine

Hiccups: requirements

In adult individuals, a theophylline concentration of 8.5 – 10 mg/kg (150 – 150 mg/min) is required for satisfactory bronchodilation, although lower plasma theophylline concentrations of 5 – 7.5 mg/l may be effective. Adverse effects can occur within the range 10 – 20 mg/kg, with a decline in the frequency and severity increased at concentrations above 12.5 mg/kg.

Plasma theophylline concentration is measured 5 days after beginning oral treatment and at least 3 days after any dose adjustment.

Overtreated

Theophylline toxicity can cause vomiting (which may be severe and intractable), agitation, tremors, convulsions, ataxia, and convulsions. Severe hypokalemia may develop rapidly.

Resources

- The Royal College of Emergency Medicine
- UK Association of Emergency Medicine
- American College of Emergency Physicians
- European Society for Emergency Medicine
- American College of Physicians
- Advanced Life Support for Trauma
- Advanced Life Support for Trauma
- Advanced Life Support for Trauma
- Advanced Life Support for Trauma
- Emergency Nurses Association
Pharmacology: Respiratory and Endocrine

Question 54 of 76

Regarding the management of acute asthma in adults, which of the following statements is INCORRECT:

- **a** Routine prescription of antibiotics is not indicated for patients with acute asthma.
- **b** Intravenous aminophylline has been shown to result in significant additional bronchodilation compared to standard care.
- **c** Continuous salbutamol nebulisation should be considered in patients with severe acute asthma that is poorly responsive to initial bolus dose of salbutamol.
- **d** The dose of magnesium sulphate in acute severe asthma is 1.2 – 2 g intravenous infusion over 20 minutes.
- **e** Nebulised magnesium is not recommended for treatment in adults with acute asthma.

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Pharmacology: Respiratory and Endocrine

Regarding the management of diabetic ketoacidosis (DKA), if the systolic BP is initially < 90 mmHg, which of the following should be given:

a. 500 mL sodium chloride 0.9% intravenous infusion over 10 – 15 minutes
b. 500 mL colloid intravenous infusion over 10 – 15 minutes
c. 1 L sodium chloride 0.9% intravenous infusion over 10 – 15 minutes
d. 500 mL sodium chloride 0.9% intravenous infusion over 1 hour
e. 500 mL sodium bicarbonate intravenous infusion over 10 – 15 minutes
Pharmacology: Respiratory and Endocrine

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Regarding the management of diabetic ketoacidosis (DKA), if the systolic BP is initially < 90 mm Hg, which of the following should be given:

a) 500 ml sodium chloride 0.9% intravenous infusion over 10 – 15 minutes
b) 500 ml calcium intravenous infusion over 10 – 15 minutes
c) 1 L sodium chloride 0.9% intravenous infusion over 10 – 15 minutes
d) 500 ml sodium chloride 0.9% intravenous infusion over 1 hour
e) 500 ml sodium bicarbonate intravenous infusion over 10 – 15 minutes

Answer

If SBP is below 90 mm Hg (adjusted for age, sex, and medication as appropriate), 500 ml sodium chloride 0.9% should be given by intravenous infusion over 10 – 15 minutes, and repeated if SBP still < 90 mm Hg. When SBP is greater than 90 mm Hg, sodium chloride infusion should be continued at a rate that replaces deficit and provides maintenance.

Notes

Diabetic ketoacidosis (DKA) consists of the biochemical triad of ketonaemia (ketosis), hyperglycaemia, and acidemia.

Pathophysiology

DKA usually occurs as a consequence of absolute or relative insulin deficiency that is accompanied by an increase in counter-regulatory hormones (i.e. glucagon, cortisol, growth hormone, catecholamines). This type of hyperglycaemic imbalance enhances hepatic gluconeogenesis and glycogenolysis resulting in severe hyperglycaemia. Enhanced lipolysis increases serum free fatty acids that are then metabolized as an alternative energy source in the process of ketogenesis. This results in accumulation of large quantities of ketone bodies and subsequent metabolic acidosis. Fluid depletion occurs due to osmotic diuresis secondary to hyperglycaemia, vomiting, and inability to take fluid in due to a diminished level of consciousness.

Diagnosis

- Ketonemia > 3.0 mmol/L or significant ketonuria (more than 2+ on standard urine sticks)
- Blood glucose > 11.0 mmol/L or known diabetes mellitus
- Bicarbonate (HCO3-) < 13.0 mmol/L, and/or venous pH < 7.3

Management of diabetic ketoacidosis in adults

- Intravenous fluids
  - If SBP is below 90 mm Hg (adjusted for age, sex, and medication as appropriate), 500 ml sodium chloride 0.9% should be given by intravenous infusion over 10 – 15 minutes, and repeated if SBP still < 90 mm Hg.
  - If SBP is greater than 90 mm Hg, sodium chloride infusion should be continued at a rate that replaces deficit and provides maintenance.
- Potassium replacement
  - Potassium chloride (40 mmol/L) should be included in the fluids (as long as the serum potassium level is 5.5 mmol/L, and the patient is passing urine), and the plasma potassium concentration maintained between 3.5 – 5.5 mmol/L (measured at 60 minutes, 2 hours, and 2 hours hourly thereafter; and hourly if outside the normal range).
- Insulin
  - An intravenous insulin infusion should be started at a concentration of 1 unit/mL, at a fixed rate of 0.1 units/kg/hr.
  - Established subcutaneous long-acting insulin therapy should be continued concurrently.
  - Blood ketone and blood glucose concentrations should be checked hourly and the insulin infusion rate adjusted accordingly. Blood ketone concentration should fall by at least 0.5 mmol/L/hour and blood glucose concentration should fall by at least 3 mmol/L/hour.
- Glucose
  - Once blood glucose concentration falls below 14 mmol/L, glucose 10% should be given by intravenous infusion (into a large vein through a large gauge needle) at a rate of 125 mL/hour, in addition to the sodium chloride 0.9% infusion.

The insulin infusion should be continued until blood ketone concentration is below 0.3 mmol/Litre, blood pH is above 7.3 and the patient is able to eat and drink. Ideally the insulin infusion should be stopped about an hour after giving subcutaneous fast-acting insulin and a meal.

The management of hyperosmolar hyperglycaemic state or hyperosmolar hyperglycaemic nonketotic coma is similar to that of diabetic ketoacidosis, although lower rates of insulin infusion are usually necessary and slower rehydration may be required.

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Question 56 of 76

Regarding antimuscarinic bronchodilators, which of the following statements is CORRECT:

a. Inhaled antimuscarinics have significant systemic side effects.
b. Short-acting β2 agonists are slower acting but more effective than antimuscarinics.
c. Ipratropium bromide has a duration of action of 2 hours.
d. Ipratropium bromide has its maximal effect after 5 – 10 minutes.
e. There are no important drug interactions with inhaled muscarinic antagonists.
Pharmacology: Respiratory and Endocrine
Question 54 of 76

Regarding antimuscarinic bronchodilators, which of the following statements is CORRECT:

a) Inhaled antimuscarinics have significant systemic side effects. ✗

b) Short-acting β2 agonists are slower acting but more effective than antimuscarinics.

c) Ipratropium bromide has a duration of action of 2 hours.

d) Ipratropium bromide has its maximal effect after 5 – 10 minutes.

e) There are no important drug interactions with inhaled muscarinic antagonists. ✔

Answer

There are no important drug interactions with inhaled muscarinic antagonists. Inhaled antimuscarinics are generally well tolerated as they are poorly absorbed systemically. Ipratropium bromide has its maximal effect 30 - 60 minutes after use and its duration of action is 3 to 6 hours. Ipratropium bromide can provide short-term relief in chronic asthma, but short-acting β2 agonists act more quickly and are preferred. Ipratropium bromide by nebulisation can be added to other standard treatment in life-threatening asthma or if acute asthma fails to improve with standard therapy.

Notes

Ipratropium bromide, a short-acting antimuscarinic bronchodilator, causes bronchodilation by blocking the cholinergic nerves in the airways.

Ipratropium bromide can provide short-term relief in chronic asthma, but short-acting β2 agonists act more quickly and are preferred. Ipratropium bromide by nebulisation can be added to other standard treatment in life-threatening asthma or if acute asthma fails to improve with standard therapy.

The aerosol inhalation of ipratropium bromide may be used for short-term relief in mild COPD in patients who are not using a long-acting antimuscarinic drug. Its maximal effect occurs 30 – 60 minutes after use; its duration of action is 3 to 6 hours and bronchodilation can usually be maintained with treatment 3 times a day.

Cautions

Ipratropium bromide should be used with caution in:

- Men with prostatic hyperplasia and bladder-outflow obstruction (worsened urinary retention has been reported in elderly men)
- People with chronic kidney disease (CKD) stages 3 and above (because of the risk of drug toxicity)
- People with angle-closure glaucoma (nebulised mist of antimuscarinic drugs can precipitate or worsen acute angle-closure glaucoma)

Interactions

There are no important drug interactions with inhaled muscarinic antagonists.

Side effects

Inhaled antimuscarinics are generally well tolerated as they are poorly absorbed systemically.

Their adverse effects include:

- Dry mouth and abnormal taste in the mouth
- Nasal congestion and dryness of nasal mucosa
- Acute angle-closure glaucoma (reported in people on nebulised ipratropium)
Pharmacology: Respiratory and Endocrine

Question 57 of 76

Which of the following is a common adverse effect of glucagon:

- a) Hyperkalaemia
- b) Nausea and vomiting
- c) Tremor
- d) Tachycardia
- e) Hypoglycaemia

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12 Answered

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- Advanced Trauma Life Support
- Resuscitation Council (UK)
- TeachMeAnatomy
- Trauma.org
- Radiopaedia

Advanced Life Support Group
- Emergency Medicine Journal
- Lifethenfantane
- Instant Anatomy
- Patient.co.uk
Pharmacology: Respiratory and Endocrine

Questions 57 of 76

Which of the following is a common adverse effect of glucagon:

- Hypokalaemia
- Nausea and vomiting
- Tremor
- Tachycardia
- Hypoglycaemia

Answer

Adverse effects include:

- Nausea and vomiting
- Hypoglycaemia
- Hypokalaemia
- Hypotension

Notes

Management of hypoglycaemia in adults:

- In adults who are conscious, cooperative and can swallow:
  - Give 15 – 20 g quick acting carbohydrate of the patient’s choice where possible e.g. 90 – 120 mL of Lucose or 5 – 7 Devosrenal tablets
  - Repeat capillary blood glucose 10 – 15 minutes later
  - If blood glucose is still < 4.0 mmol/L, repeat step 1 (no more than 3 treatments in total)
  - If blood glucose remains < 4.0 mmol/L after 45 minutes or 3 cycles, consider:
    - 1 mg glucagon IM
    - IV 10% glucose infusion at 100mL/hr
- In adults who are conscious but uncooperative:
  - Give either 1.5 – 2 tubes Glucoges/Dextrose (may repeat up to 3 times)
  - If this is ineffective give glucagon 2 mg IM (may only give once)
  - If blood glucose level remains less than 4.0 mmol/L after 45 minutes or 3 cycles, consider IV 10% glucose infusion at 100mL/hr
- In adults who are unconscious:
  - Give either:
    - 1 mg glucagon intramuscularly (if not effective after 10 – 15 minutes, IV glucose should be given)
    - 75 – 80 mL of 20% glucose intravenously over 10 – 15 minutes
    - 150 – 160 mL of 10% glucose intravenously over 10 – 15 minutes

Once blood glucose is > 4.0 mmol/L and the patient recovered, give a long acting carbohydrate of the patient’s choice where possible e.g. two biscuits, one slice of bread. Note that patients given glucagon require a larger portion of long acting carbohydrate to replenish glycogen stores (double the suggested amount).

If hypoglycaemia was due to self medication or long acting insulin therapy then be aware that the risk of hypoglycaemia may persist for up to 24 – 36 hours following the last dose, especially if there is concurrent renal impairment.

Glucagon

Glucagon, a polypeptide hormone produced by the alpha cells of the islets of Langerhans, increases plasma glucose by mobilising glycogen stored in the liver. Glucagon promotes glycosogenesis and gluconeogenesis.

Glucagon may take up to 15 minutes to have an effect and will be less effective in alcoholics, prolonged starvation and severe liver disease when glucose stores are depleted. In this situation or if prolonged treatment is required, IV glucose is better. Glucagon may also be less effective in patients prescribed sulphonylurea therapy.

Glucagon may also be used as an antitodal in beta blocker overdose and in amphetamine in patients on beta blockers that fail to respond to adrenaline.

Glucagon is contraindicated in pheochromocytoma.

Adverse effects include:

- Nausea and vomiting
- Hypoglycaemia
- Hypokalaemia
- Hypotension
Pharmacology: Respiratory and Endocrine

Question 58 of 76

A 5 year old child, with a known latex allergy, accidentally comes into contact with some latex gloves. She has significant lip and tongue swelling, and signs of impending airway obstruction. What is the most appropriate dose of adrenaline for this patient:

- a 0.05 grams intramuscularly
- b 0.2 grams intramuscularly
- c 500 micrograms intramuscularly
- d 300 micrograms intramuscularly
- e 150 micrograms intramuscularly

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### Notes
- **Hypertension**
  - High blood pressure, a condition that is often asymptomatic and can lead to serious health problems if left untreated.
  - Risk factors include age, family history, obesity, physical inactivity, and dietary habits.
  - Treatment may involve lifestyle changes, medication, or both.

### Clinical Features
- Hypertension is a leading cause of cardiovascular disease, contributing to an increased risk of heart disease, stroke, and kidney disease.
- Long-term high blood pressure can damage blood vessels and the heart, leading to complications such as heart failure and kidney failure.
- High blood pressure can also increase the risk of stroke by causing the arteries to narrow and harden, increasing the chance of a blood clot.

### Interventions for management
- **Drug therapy**
  - B-blockers, ACE inhibitors, angiotensin receptor blockers, diuretics, and calcium channel blockers are commonly used.
  - Medications may be combined to achieve optimal blood pressure control.

- **Non-pharmacological interventions**
  - Weight loss, regular exercise, a healthy diet, and stress management can help control blood pressure.
  - Quitting smoking and limiting alcohol intake are also important steps in management.

- **Surgery**
  - In cases where lifestyle changes and medications are ineffective, surgical options such as nephrectomy or renal artery stenting may be considered.

- **Patient education**
  - Regular monitoring of blood pressure, as well as understanding the importance of medication adherence, is crucial.

### Contraindications of patients
- Pregnancy
- Active liver disease
- Severe anemia
- Trauma
- Renal failure

---

**Drug therapy**

- **B-blockers**
  - Block the effects of epinephrine on the heart.
  - Commonly used in the treatment of hypertension.

- **ACE inhibitors**
  - Block the renin-angiotensin-aldosterone system, reducing blood pressure.

- **Diuretics**
  - Increase urine output, reducing blood volume and blood pressure.

- **Calcium channel blockers**
  - Block calcium ions from entering heart cells, reducing heart muscle activity.

**Non-pharmacological interventions**

- **Dietary changes**
  - Low in salt, high in potassium, and low in saturated fat.

- **Exercise**
  - Regular aerobic exercise can help lower blood pressure.

- **Weight loss**
  - Reduces the workload on the heart.

- **Stop smoking**
  - Reduces risk of heart disease.

- **Manage stress**
  - Techniques such as yoga, meditation, and deep breathing can help.

**Surgery**

- **Nephrectomy**
  - Removal of one kidney in cases where the kidney is causing high blood pressure.

- **Renal artery stenting**
  - A procedure to open blocked or narrowed arteries.

**Patient education**

- **Blood pressure monitoring**
  - Regular check-ups are essential.

- **Drug adherence**
  - Medication adherence is crucial for effective blood pressure control.

- **Lifestyle modifications**
  - A healthy diet, regular exercise, and stress management are key.

**Contraindications**

- Pregnancy
- Active liver disease
- Severe anemia
- Trauma
- Renal failure

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**References**

- JNC 8 guidelines: www.nhlbi.nih.gov/health/topics/hbp/clinicalevidence-panel/8th-report-guidelines-
  - https://www.nhlbi.nih.gov/health-topics/hypertension

- American Heart Association: www.heart.org/HEARTORG/Hypertension/About-Hypertension/Assessing-Hypertension-
  - https://www.heart.org/HEARTORG/Hypertension/Assessing-Hypertension/Assess-Blood-Pressure_UCM_301548_Article.jsp

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- [CoM Newsletter](http://www.fbc.com/newsletter)
- [CoM Website](http://www.fbc.org)
- [CoM Resources](http://www.fbc.org/resources)

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**GEN**

- [GEN Newsletter](http://www.gen.org/newsletter)
- [GEN Website](http://www.gen.org)
- [GEN Resources](http://www.gen.org/resources)
Pharmacology: Respiratory and Endocrine

Question 59 of 76

A 14 year old patient, with a history of asthma and atopy, is given penicillin in hospital. He immediately develops an itchy rash, angioedema and worsening stridor and wheeze. What is the most appropriate dose of adrenaline for this patient:

- a 5 milligrams intramuscularly
- b 0.5 grams intramuscularly
- c 500 micrograms intramuscularly
- d 300 micrograms intramuscularly
- e 150 micrograms intramuscularly
Pharmacology: Respiratory and Endocrine

Question 60 of 76

A 24 year old patient with life-threatening acute asthma is too unwell to take oral steroids. What is the most appropriate alternative to oral steroids in this patient:

- a Intravenous hydrocortisone 100 mg daily
- b Intravenous hydrocortisone 200 mg daily
- c Intravenous hydrocortisone 300 mg daily
- d Intravenous hydrocortisone 400 mg daily
- e Intravenous hydrocortisone 500 mg daily

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Something wrong?
Pharmacology: Respiratory and Endocrine

Question 61 of 76

The second generation antihistamine, cetirizine is a less-sedating antihistamine than the older antihistamine, chlorphenamine because:

a. It is selective for H1-receptors.
b. It is cleared more rapidly by the kidneys.
c. It is metabolised more quickly by the liver.
d. It is less lipid-soluble so less able to cross the blood brain barrier.
e. It has less anticholinergic effect.
Pharmacology: Respiratory and Endocrine

The second generation antihistamine, cetirizine, is a less-sedating antihistamine than the older antihistamine, chlorphenamine because:

- a) It is selective for H1 receptors.
- b) It is cleared more rapidly by the kidneys.
- c) It is metabolized more quickly by the liver.
- d) It is less lipid soluble so less able to cross the blood-brain barrier.
- e) It has less antihistaminic effect.

Answer

All older antihistamines such as chlorphenamine cause sedation. The newer antihistamines e.g. cetirizine cause less sedation and psychomotor impairment than the older antihistamines because they are much less lipid soluble and penetrate the blood-brain barrier only to a slight extent.

Notes

Antihistamines are competitive inhibitors at the H1-receptor (in contrast to H2-receptor antagonists used to decrease gastric acid secretion). They act to relieve histamine-induced bronchoconstriction. Block the vasodilator effect of histamine. Inhibit histamine-induced increases in capillary permeability and thick mucus secretion and sensory nerve stimulation.

Histamine (H1)-receptor antagonists are well absorbed after oral administration. The effects of these agents are usually seen in 30 minutes (with maximal effects at 1 - 2 h). The duration of action is 3 - 8 hours for first-generation compounds and 3 - 24 hours for second-generation compounds.

H1-receptor antagonists are metabolized in the liver; many induce microsomal enzymes and alter their own metabolism and that of other drugs.

Indications

- Allergic rhinitis and conjunctivitis
- Urticaria, urticarial rash, pruritus, insect bites and stings
- Angioid streaks
- Anaphylaxis (second line agent to adrenaline)
- Nausea/vomiting and prevention of motion sickness
- Insomnia

Chlorphenamine

All older antihistamines cause sedation but alimenzine tartrate and promethazine may be more sedating whereas chlorphenamine maleate and cyclizine may be less so. This sedating activity is sometimes used to manage the pruritus associated with some allergies or used to manage occasional insomnia. There is little evidence that any one of the older ‘sedating’ antihistamines is superior to another and patients vary widely in their response.

Cetirizine

The newer antihistamines e.g. cetirizine cause less sedation and psychomotor impairment than the older antihistamines because they are much less lipid soluble and penetrate the blood-brain barrier only to a slight extent.

Cautions

Antihistamines should usually be avoided in acute pulmonary (although some antihistamines are thought to be safe).

Antihistamines should be used with caution in epilepsy, prostatic hypertrophy, urinary hypotension, hepatic impairment and susceptibility to angle-closure glaucoma.

Side effects (significantly reduced with second-generation agents)

Elderly patients and children are more susceptible to side effects.

Common side effects of antihistamines may include:

- Anticholinergic effects (blurred vision, dry mouth, urinary retention)
- Headache
- Gastrointestinal disturbances
- Psychomotor impairment (sedation, dizziness and loss of appetite)

Drowsiness may affect performance of skilled tasks (e.g. cycling or driving); sedating effects are enhanced by alcohol and opioid analgesics.

Resources

- The Royal College of Emergency Medicine
- Web Association for Emergency Medicine
- Advanced Trauma Life Support®
- British Coronary Council (BCH)
- Scottish Society for Trauma and Orthopaedics
- Advanced Life Support Group
- Emergency Medicine Journal
- Critical Care
- Instant Anatomy
- BLMED.co.uk

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Pharmacology: Respiratory and Endocrine

Question 62 of 76

Regarding theophylline, which of the following statements is INCORRECT:

- Excretion of lithium may be potentiated by concomitant therapy with theophylline.
- It is metabolised in the liver.
- It has a narrow therapeutic index.
- Theophylline significantly increases the anticoagulant effect of warfarin.
- The risk of hypokalaemia is increased if given concomitantly with beta-2 agonists.

< Previous  Next >  See Answer  Something wrong?
Pharmacology: Respiratory and Endocrine

Question 1 of 7

Regarding theophylline, which of the following statements is INCORRECT:

- Theophylline may be potentiated by concomitant therapy with theophylline.
- Theophylline is a bronchodilator in the lower airways.
- Theophylline has a narrow therapeutic index.
- Theophylline significantly increases the sepsisilic effect of warfarin.
- The risk of hypokalemia is increased if given concomitantly with beta-2 agonists.

Answer

Theophylline is not stated to interact with warfarin in the BNF. The remaining statements are correct.

Notes

- Theophylline may be added to bronchodilator therapy when used in conjunction with small doses of beta-2 agonists. Theophylline is a bronchodilator with a slower onset of action compared to a beta-2 agonist.
- Theophylline is less effective in patients with chronic obstructive pulmonary disease (COPD). The plasma theophylline concentration is increased in heart failure, hepatic impairment, in viral infections in fever and in the elderly. Atropine is no longer necessary to reverse bronchodilation. The plasma theophylline concentration is decreased in anorexia, and to a limited extent, in alcohol consumption.

Indications

- It is used as a bronchodilator in asthma and stable COPD.
- It is not generally effective in exacerbations of chronic obstructive pulmonary disease, but is used rarely to reverse the disabling acute asthma given by other agents, as a substitute, a mixture of theophylline with terbutaline, etc., which in 20 times more soluble than theophylline alone.

Contraindications

- Theophylline should not be used to treat:
  - Patients with narrow QT
  - People with respiratory insufficiency in children
  - Children concomitantly receiving warfarin
  - Infants under 4 months of age

Cautions

- Theophylline should be used cautiously in people with:
  - Cardiac arrhythmias or other cardiac disease
  - Hypothyroidism
  - Myasthenia gravis
  - Hypersensitivity
  - Pulmonary fibrosis
  - Risk of hypokalemia

Interactions

- Hypokalemia may be potentiated by concomitant therapy with beta-2 agonists, corticosteroids, and diuretics.
- Exercise of this drug may be potentiated by concomitant therapy with theophylline.
- There is an increased risk of convulsions when theophylline is given with phenobarbital.

Examples of enzyme-inhibiting drugs (lower plasma theophylline level):

- Diltiazem
- Glimepiride
- Clofibrate
- Fosphenytoin
- Verapamil
- Allopurinol
- Cimetidine

Examples of enzyme-inducing drugs (lower plasma theophylline level):

- Phenytoin
- Propafenone
- Carbamazepine
- Phenytoin
- Naproxen
- Rifampicin
- St John's Wort

Side effects

- Side effects include:
  - Tachycardia, palpitations, and tachyarrhythmias
  - CHF, atrial fibrillation, tachycardia, headache, insomnia, and anorexia
  - Gastric irritation, nausea, vomiting, and diarrhea.
- Hypokalemia (potentially serious) with very high levels may result from beta-2 agonist therapy. This effect may be potentiated in severe asthma by concomitant treatment with theophylline and its derivatives, corticosteroids, and diuretics, and by hypothyroidism.

Monitoring requirements

In most indications, plasma theophylline concentration of 10 - 20 mg/mL (50 - 100 micrograms/mL) is required for satisfactory bronchodilation, although a slower plasma theophylline concentration of 5 - 15 mg/mL may be effective. A cut-off value may occur within 3 mg/mL - 20 mg/mL and the frequency and severity of convulsions above 15 mg/mL. Plasma theophylline concentration is measured 5 days after starting oral treatment and at least 3 days after any dose adjustment.

Dose

Theophylline is available in a number of forms (in single or multiple doses and routes of administration, as phosphate, sulfate, and microspheres). More serious adverse effects are uncommon, although there is a potential for anticholinergic symptoms. Severe hypokalemia may develop rapidly.

Resources

- The Royal College of Emergency Medicine
- National Institute for Health and Care Excellence
- Royal College of Physicians
- HSE National Drugs Helpline
- American Academy of Sleep Medicine
- Canadian Medical Association
- American College of Chest Physicians
- American College of Physicians
- American Thoracic Society

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Pharmacology: Respiratory and Endocrine

Question 63 of 76

Plasma theophylline concentration is increased by all of the following EXCEPT for:

- a. Heart failure
- b. Hepatic impairment
- c. Viral infections
- d. Elderly
- e. Smoking

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Pharmacology: Respiratory and Endocrine

**Question 11:**

Plasma theophylline concentration is increased by all of the following EXCEPT:

- A) Heart failure
- B) Protein malnutrition
- C) Viral infections
- D) Obesity
- E) Smoking

**Answer:**

Theophylline is metabolized in the liver, and is a narrow therapeutic index. The plasma theophylline concentration is increased in heart failure, hepatic impairment, in viral infections, in obesity, and to a lesser degree in smoking. The plasma theophylline concentration is decreased in anorexia, and by alcohol consumption.

**Notes:**

Theophylline can cause an additional bronchodilator effect when used in combination with mucosal doses of beta-2 agonists. Theophylline is a xanthine derivative initially administered resulting in increased tissue concentrations of cyclic adenosine monophosphate (cAMP).

Theophylline is metabolized in the liver, and is a narrow therapeutic index. The plasma theophylline concentration is increased in heart failure, hepatic impairment, in viral infections, in obesity, and to a lesser degree in smoking. The plasma theophylline concentration is decreased in anorexia, and by alcohol consumption.

**Indications:**

It is used as a bronchodilator in asthma and stable COPD. It is not generally effective in exacerbation of chronic obstructive pulmonary disease, but is used rarely for severe or the threatening acute asthma given by trichoclonitis or angioedema, and a mixture of theophylline with corticosteroids, which is 20 times more molecule than theophylline does.

**Contraindications:**

Theophylline should not be continued to:

- People with pancreatitis
- People with hepatitis
- Children with hysteresis
- Infants under 6 months of age

**Cautions:**

Theophylline should be used with caution in people with:

- Cardiac arrhythmias or other cardiac disease
- Hypertension
- Epilepsy
- Hypothyroidism
- Hypoproteinemia
- Renal disease
- Risk of hyperpyrexia

**Interactions:**

Hypokalemia may be potentiated by concurrent therapy with beta-2 agonists, corticosteroids, and diuretics.

Excretion of theophylline may be potentiated by concurrent therapy with theophylline.

There is an increased risk of complications when theophylline is given with quinidine.

### Examples of enzyme-inducing drugs

<table>
<thead>
<tr>
<th>Increase plasma theophylline level</th>
<th>Decrease plasma theophylline level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethinyl estradiol</td>
<td>Phenytoin</td>
</tr>
<tr>
<td>Diltiazem</td>
<td>Phenobarbital</td>
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<tr>
<td>Ciprofloxacin</td>
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<td>Fluconazole</td>
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<tr>
<td>Verapamil</td>
<td>Rifampin</td>
</tr>
<tr>
<td>Atorvastatin</td>
<td>Ammonium chloride</td>
</tr>
<tr>
<td>Clofibrate</td>
<td>St. John’s Wort</td>
</tr>
</tbody>
</table>

**Side effects:**

Side effects include:

- Tachycardia, palpitations and arrhythmias
- CNS stimulation, insomnia, headache, dizziness and convulsions
- Gastric irritation, nausea, vomiting and diarrhea
- Hepatotoxicity (potentially serious), hypokalemia, may result from beta-2 agonist therapy. This effect may be potentiated in severe illness by concurrent treatment with theophylline and its derivatives, corticosteroids, and diuretics.

**Mechanism and requirements:**

In normal individuals, a plasma theophylline concentration of 0.5 - 2.0 mg/L (0.5 - 115 mcg/mL/intermediate) is required for satisfactory bronchodilatation, although slower plasma theophylline concentration of 1 - 2.5 mcg/L may be effective. Adverse effects can occur within the range 2 - 10 mcg/L and includes the frequency and severity are increased as concentration above 200 mcg/L.

Plasma theophylline concentration is measured 5 days after starting oral treatment and at least 3 days after any dose adjustment.

**Overdose:**

Theophylline in overdose can cause vomiting (which may be severe and intractable), agitation, delirium, dizziness, agitation, loss of consciousness, and hypotension. More serious effects, such as hematemesis, convulsions, and apneustic arrest and ventricular arrhythmias. Severe hypokalemia may develop rapidly.
Pharmacology: Respiratory and Endocrine

Question 64 of 76

Regarding oxygen therapy, which of the following statements is CORRECT:

a. In acutely ill patients, oxygen saturations should always be maintained at > 98%.

b. For patients at risk of hypercapnic respiratory failure, oxygen saturations should be maintained at 92 – 96%.

c. For patients at risk of hypercapnic respiratory failure, initial oxygen should be given at a concentration of 42% and titrated.

d. In carbon monoxide poisoning, high flow oxygen therapy should be continued regardless of oxygen saturations.

e. Long-term oxygen therapy may treat symptoms but has no effect on survival in COPD patients.
Pharmacology: Respiratory and Endocrine

Question 64 of 76

Regarding oxygen therapy, which of the following statements is CORRECT?

a) In acutely ill patients, oxygen saturations should always be maintained at > 96%.

b) For patients at risk of hypercapnic respiratory failure, oxygen saturations should be maintained at 92 - 96%.

c) For patients at risk of hypercapnic respiratory failure, initial oxygen should be given at a concentration of 42% and titrated.

d) In carbon monoxide poisoning, high-flow oxygen therapy should be continued regardless of oxygen saturations.

e) Long-term oxygen therapy may treat symptoms but has no effect on survival in COPD patients.

Answer

In carbon monoxide poisoning high-flow oxygen therapy should be continued regardless of oxygen saturations. High concentration oxygen promotes dissociation of carbon monoxide from cyanohemoglobin and therapy should continue until cyanohemoglobin levels decrease to less than 30% and patients are asymptomatic. In most acutely ill patients with a normal or low arterial carbon dioxide (PaCO₂), oxygen saturation should be 94 – 98% oxygen saturation. A lower target of 88 – 92% oxygen saturation is indicated for patients at risk of hypercapnic respiratory failure e.g. patients with COPD. Until blood gases can be measured, initial oxygen should be given using a controlled concentration of 28% or less, titrated towards the SpO₂ of 88 – 92%. Long-term administration of oxygen (usually at least 15 hours daily) prolongs survival in some patients with COPD.

Notes

Oxygen should be regarded as a drug. It is prescribed for hypoxaemic patients to increase alveolar oxygen tension and decrease the work of breathing. The concentration of oxygen required depends on the condition being treated; the administration of an inseparable concentration of oxygen can have serious or even fatal consequences.

High concentration oxygen therapy

In most acutely ill patients with a normal or low arterial carbon dioxide (PaCO₂), oxygen saturation should be 94 – 98% oxygen saturation. However, in some clinical situations such as cardiac arrest and carbon monoxide poisoning it is more appropriate to aim for the highest possible oxygen saturations until the patient is stable.

Low concentration oxygen therapy

A lower target of 88 – 92% oxygen saturation is indicated for patients at risk of hypercapnic respiratory failure e.g. patients with COPD. Until blood gases can be measured, initial oxygen should be given using a controlled concentration of 28% or less, titrated towards the SpO₂ of 88 – 92%. The aim is to provide the patient with enough oxygen to achieve an acceptable arterial oxygen tension without worsening carbon dioxide retention and respiratory acidosis.

Long-term oxygen therapy

Long-term administration of oxygen (usually at least 15 hours daily) prolongs survival in some patients with COPD. Assessment for long-term oxygen therapy requires measurement of arterial blood gases. A nasal cannula is usually preferred for long-term oxygen therapy from an oxygen concentrator. It can, however, produce dermatitis and mucosal drying in sensitive individuals.

Giving oxygen by nasal cannula allows the patient to talk, eat, and drink, but the concentration of oxygen is (next) controlled; this may not be appropriate for acute respiratory failure. Increased respiratory depression is seldom a problem in patients with stable respiratory failure treated with low concentrations of oxygen although it may occur during exacerbations; patients and relatives should be warned to call for medical help if drowsiness or confusion occur.

Intermittent oxygen therapy

Oxygen is occasionally prescribed for short periods (intermittent) use for episodes of breathlessness not relieved by other treatment in patients with severe chronic obstructive pulmonary disease, interstitial lung disease, heart failure, and in palliative care.

Ambulatory oxygen

Ambulatory oxygen is prescribed for patients on long-term oxygen therapy who need to be away from home on a regular basis. Patients who are not on long-term oxygen therapy can be considered for ambulatory oxygen therapy if there is evidence of exercise-induced oxygen desaturation and of improvement in blood oxygen saturation and exercise capacity with oxygen.

Resources

- The Royal College of Emergency Medicine
- VHA Assistance for Emergency Medicine
- AED Training & Support
- Resuscitation Council (UK)
- SICS Medical
- Trauma.org
- Yudapsites

- Advance Life Support Group
- Emergency Medicine Journal
- Cardioscience
- Instant Anatomy
- Patient.co.uk
Pharmacology: Respiratory and Endocrine

Question 65 of 76

Adrenaline acts on which of the following receptors:

- a α receptors
- b β1 receptors
- c β1 and β2 receptors
- d α, β1 and β2 receptors
- e β2 receptors
Pharmacology: Respiratory and Endocrine

Question 65 of 76

- Adrenaline acts on which of the following receptors:
  a) α receptors
  b) β1 receptors
  c) β1 and β2 receptors
  d) α, β1 and β2 receptors ✓
  e) β2 receptors

Answer

Adrenaline is a catecholamine that acts on both alpha and beta receptors and increases both heart rate and contractility (beta1 effects); it can cause peripheral vasodilation (a beta2 effect) or vasoconstriction (an alpha effect).

Notes

Adrenaline is a catecholamine that acts on both alpha and beta receptors and increases both heart rate and contractility (beta1 effects); it can cause peripheral vasodilation (a beta2 effect) or vasoconstriction (an alpha effect).

Adrenaline is used in cardio pulmonary resuscitation, in the emergency management of acute allergic and anaphylactic reactions and in the management of severe group (as a nebulised solution).

Mechanism of action in anaphylaxis

As an alpha-receptor agonist, adrenaline reverses peripheral vasodilation and increased vascular permeability reducing hypotension and oedema.

As a beta-receptor agonist it dilates bronchial airways, increases the force and rate of myocardial contraction, and suppresses histamine and leukotriene release.

Adrenaline also alleviates pruritus, urticaria, and angioedema and may relieve gastrointestinal and genitourinary symptoms associated with anaphylaxis because of its relaxant effects on the smooth muscle of the stomach, intestine, uterus and urinary bladder.

Adrenaline increases glycogenolysis, reduces glucose uptake by tissues, and inhibits insulin release in the pancreas, resulting in hyperglycemia and increased blood lactic acid.

Interactions

Severe anaphylaxis in patients taking beta-blockers may not respond to adrenaline—consider bronchodilator therapy. Furthermore, adrenaline can cause severe hypertension and bradycardia in those taking non-cardioselective beta-blockers.
Pharmacology: Respiratory and Endocrine

Question 66 of 76

A 31 year old patient with a known nut allergy was eating at a Thai restaurant when he suddenly complained of lip and tongue swelling and difficulty breathing. He is brought to ED by ambulance with suspected anaphylaxis. What is the most appropriate first line treatment for this patient:

- **a** 5 mg of adrenaline intramuscularly
- **b** 0.5 mL of 1:10000 adrenaline solution intramuscularly
- **c** 500 micrograms of adrenaline intramuscularly
- **d** 0.5 mg of adrenaline intravenously if access has been achieved
- **e** 0.5 mL of 1:1000 solution adrenaline intravenously if access has been achieved

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Pharmacology: Respiratory and Endocrine

1. What is the typical dose of inhaled corticosteroids for the management of asthma?
2. Which class of medications is commonly used to treat allergic rhinitis?
3. Describe the mechanism of action of corticosteroids.
4. How are corticosteroids administered in clinical practice?
5. What are the potential side effects of corticosteroids?

Answer

1. The typical dose of inhaled corticosteroids for the management of asthma is usually around 100-400 mcg per day, divided into two or more doses.
2. Antihistamines are commonly used to treat allergic rhinitis.
3. Corticosteroids act by reducing inflammation and inhibiting the release of inflammatory mediators.
4. Corticosteroids are administered via inhaled, oral, or topical routes.
5. Potential side effects of corticosteroids include Cushing's syndrome, osteoporosis, and increased risk of infections.

Notes

FURTHER READING


Globalization

Increasingly, respiratory and endocrine medications are being used on a global scale. The increasing prevalence of asthma and allergy in developing countries underscores the need for more accessible and affordable treatments.

Reaction to cold, heat, and exercise can be problematic in asthmatic patients. The use of inhaled corticosteroids to reduce inflammation and improve clinical control is crucial.

Reference

Pharmacology: Respiratory and Endocrine

Question 67 of 76

Regarding steroids in the management of acute asthma in adults, which of the following statements is INCORRECT:

- Steroids should be given in adequate doses to all patients with an acute asthma attack.
- The earlier steroids are given in the acute attack, the better the outcome.
- Intravenous steroids are more effective at reducing relapses than oral steroids.
- Oral steroids should be continued daily for at least 5 days following the acute attack.
- At the end of the course of oral steroids, they can usually be stopped abruptly without tapering the dose.
Pharmacology: Respiratory and Endocrine

I. Introduction

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2. Endocrine System
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     - Levothyroxine

IV. Conclusion

- Recap of key points
- Future directions for research

References

1. Pathological processes in respiratory and endocrine systems
2. Clinical applications of respiratory and endocrine therapies
3. Future research opportunities in respiratory and endocrine fields
Pharmacology: Respiratory and Endocrine

Question 68 of 76

Regarding antihistamines, which of the following statements is CORRECT:

a. The newer antihistamines have more of a sedating effect than older antihistamines.
b. Antihistamines act on H2 receptors.
c. Elderly patients and children are more susceptible to side effects.
d. Cetirizine is an older antihistamine.
e. Antihistamines are used as the first line treatment in anaphylaxis.
Pharmacology: Respiratory and Endocrine

Question 8 of 76

Regarding antihistamines, which of the following statements is CORRECT?

- a) The newer antihistamines have more of a sedating effect than older antihistamines.
- b) Antihistamines act on H2 receptors.
- c) Elderly patients and children are more susceptible to side effects.
- d) Cetirizine is an older antihistamine.
- e) Antihistamines are used as the first line treatment in anaphylaxis.

Answer

Elderly patients and children are more susceptible to side effects. Antihistamines are competitive inhibitors at the H1 receptor. The newer antihistamines e.g. cetirizine cause less sedation and psychomotor impairment than the older antihistamines because they are much less lipid soluble and penetrate the blood brain barrier only to a slight extent. Antihistamines are used as a second line adjunct to adrenaline in anaphylaxis.

Notes

Antihistamines are competitive inhibitors at the H1 receptor. In contrast to H2 receptor antagonists used to decrease gastric acid secretions. They act to relieve histamine induced bronchoconstriction, block the vasodilator effect of histamine, inhibit histamine-induced increases in capillary permeability and block muscarinic secretion and sensory nerve stimulation.

Histamine (H1) receptor antagonists are well absorbed after oral administration. The effects of these agents are usually seen in 30 minutes (with maximal effects at 1 – 2 h); the duration of action is 3 – 8 hours for first generation compounds and 3 – 24 hours for second generation compounds.

H1-receptor antagonists are metabolised in the liver, many reduce microsomal enzymes and alter their own metabolism and that of other drugs.

Indications

- Allergic rhinitis and conjunctivitis
- Urinary tract, pruritus, insect bites and stings
- Angioedema
- Anaphylaxis (second line adjunct to adrenaline)
- Nausea/vomiting and prevention of motion sickness
- Insomnia

Chlorphenamine

All older antihistamines cause sedation but all newer bartride and promethazine may be more sedating whereas chlorphenamine modafin and cetrizine may be less so. This sedating activity is sometimes used to manage the pruritus associated with some allergies or used to manage occasional insomnia. There is little evidence that any one of the older ‘sedating’ antihistamines is superior to another and patients vary widely in their response.

Cetirizine

The newer antihistamines e.g. cetirizine cause less sedation and psychomotor impairment than the older antihistamines because they are much less lipid soluble and penetrate the blood brain barrier only to a slight extent.

Cautions

Antihistamines should usually be avoided in acute porphyria (although some antihistamines are thought to be safe).

Antihistamines should be used with caution in epilepsy, prostatic hypertrophy, urinary hypertension, hepatic impairment and susceptibility to angle-closure glaucoma.

Side effects (significantly reduced with second generation agents)

Elderly patients and children are more susceptible to side effects.

Common side effects of antihistamines may include:

- Antiholistic effects (blurred vision, dry mouth, urinary retention)
- Headache
- Gastrointestinal disturbances
- Psychomotor impairment (sedation, dizziness and loss of appetite)

Drowsiness may affect performance of skilled tasks (e.g. cycling or driving), sedating effects are enhanced by alcohol and opioid anagostics.
Pharmacology: Respiratory and Endocrine

Question 69 of 76

Salbutamol should be used with caution in patients with which of the following:

- Hypothyroidism
- Prostatic hyperplasia
- History of tendon rupture
- Susceptibility to QT-interval prolongation
- Gout

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Pharmacology: Respiratory and Endocrine

Question 4 of 7

Subbutanol should be used with caution in patients with which of the following:

- a) Hypothyroidism
- b) Prostatic hyperplasia
- c) History of tendon rupture
- d) Susceptibility to QT-interval prolongation
- e) None

Answer

Beta-2 agonists should be used with caution in people with:

- **Cardiovascular disease:** including arrhythmias and hypertension (beta-2 agonists may cause an increased risk of arrhythmias and significant changes to blood pressure and heart rate)
- **Diabetes:** (risk of hyperglycaemia and ketoadiposis, especially with intravenous use)
- **Hyperthyroidism:** (beta-2 agonists may stimulate thyroid activity)
- **Hypokalaemia:** (potentially serious hypokalaemia may result from beta-2 agonist therapy, this effect may be potentiated in severe asthmas by concurrent treatment with theophylline, corticosteroids, diuretics and/or hypokalaemia)
- **Susceptibility to QT-interval prolongation**
- **Conventional disorders**

Notes

Selective beta-2 agonists act directly on beta-2 receptors, causing smooth muscle relaxation and dilation of the airways.

Mild to moderate symptoms of asthma respond rapidly to the inhalation of a selective short-acting beta-2 agonist such as salbutamol or terbutaline sulphate. Short-acting beta-2 agonists have a rapid onset of action (15 minutes) and their effects last for up to 4 hours. Salbutamol or terbutaline sulphate can be given intravenously for severe or life-threatening acute asthma. Patients should be carefully monitored and the dose adjusted according to response and heart rate.

Short-acting beta-2 agonists are used for immediate relief of asthma symptoms, while some long-acting beta-2 agonists (e.g. salmeterol) are added to an inhaled corticosteroid in patients requiring prophylactic treatment.

Cautions

Beta-2 agonists should be used with caution in people with:

- **Cardiovascular disease:** including arrhythmias and hypertension (beta-2 agonists may cause an increased risk of arrhythmias and significant changes to blood pressure and heart rate)
- **Diabetes:** (risk of hyperglycaemia and ketoadiposis, especially with intravenous use)
- **Hyperthyroidism:** (beta-2 agonists may stimulate thyroid activity)
- **Hypokalaemia:** (potentially serious hypokalaemia may result from beta-2 agonist therapy, this effect may be potentiated in severe asthmas by concurrent treatment with theophylline, corticosteroids, diuretics and/or hypokalaemia)
- **Susceptibility to QT-interval prolongation**
- **Conventional disorders**

Interactions

Hypokalaemia may be potentiated by concurrent treatment with theophylline and its derivatives, corticosteroids, and diuretics. This in turn may predispose to toxicity in patients taking digoxin.

Side effects

Side effects are usually dose-related and include:

- **Fibre tremor** — occurs particularly in the hands and is usually seen in the first few days of treatment.
- **Pulmonary and tachycardia**
- **Headache**
- **Seizure**
- **Anxiety**
- **Hypokalaemia**
- **Cardiac arrhythmia and paradoxical bronchosspasm (rare)**
- **Acute angle-closure glaucoma**
- **QT-interval prolongation**
Pharmacology: Respiratory and Endocrine

Question 70 of 76

Which of the following is NOT a common side effect of antihistamines:

- a. Blurred vision
- b. Dry mouth
- c. Gastrointestinal disturbance
- d. Urinary retention
- e. Tremor

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Question Navigator

1. Answered
2. Answered
3. Answered
4. Answered
5. Answered
6. Answered
7. Answered
8. Answered
9. Answered
10. Answered
11. Answered
12. Answered

Something wrong?
Pharmacology: Respiratory and Endocrine

Which of the following is NOT a common side effect of antihistamines:

- a) Blurred vision
- b) Dry mouth
- c) Gastrointestinal disturbance
- d) Urinary retention
- e) Tremor

Answer

Common side effects of antihistamines may include:

- Anticholinergic effects (blurred vision, dry mouth, urinary retention)
- Headache
- Gastrointestinal disturbance
- Psychomotor impairment (sedation, dizziness and loss of appetite)

These side effects are significantly reduced with second-generation agents.

Notes

Antihistamines are competitive inhibitors at the H1 receptor (in contrast to H2 receptor antagonists used to decrease gastric acid secretion). They act to raise histamine-induced bronchoconstriction, block the vasodilator effect of histamine, inhibit histamine-induced increases in capillary permeability and block muscarinic receptor and sensory nerve stimulation.

Histamine (H1) receptor antagonists are well absorbed after oral administration. The effects of these agents usually occur in 30 minutes (with maximal effects at 1 – 2h); the duration of action is 3 – 8 hours for first-generation compounds and 3 – 24 hours for second-generation compounds.

H2-receptor antagonists are metabolized in the liver; many induce microsomal enzymes and alter their own metabolism and that of other drugs.

Indications

- Allergic rhinitis and conjunctivitis
- Urinary incontinence, pruritus, insect bites and stings
- Angina
- Anaphylaxis (second-line treatment to adrenaline)
- Nausea/vomiting and prevention of motion sickness
- Insomnia

Chlorpheniramine

All older antihistamines cause sedation but chlorpheniramine (promethazine) may be more sedating whereas chlorpheniramine maleate and cyclizine may be less so. This sedating activity is sometimes used to manage the pruritus associated with some allergies or used to manage occasional insomnia. There is little evidence that any one of the older, ‘sedating’ antihistamines is superior to another and patients vary widely in their responses.

Cetirizine

The newer antihistamines e.g. cetirizine cause less sedation and psychomotor impairment than the older antihistamines because they are much less lipid soluble and penetrate the blood-brain barrier only to a slight extent.

Cautions

Antihistamines should be used in acute porphyria (although some antihistamines are thought to be safe).

Antihistamines should be used with caution in epilepsy, prostatic hypertrophy, urinary hypertension, hepatic impairment and susceptibility to angle-closure glaucoma.

Side effects (significantly reduced with second-generation agents)

Elderly patients and children are more susceptible to side effects.

Common side effects of antihistamines may include:

- Anticholinergic effects (blurred vision, dry mouth, urinary retention)
- Headache
- Gastrointestinal disturbance
- Psychomotor impairment (sedation, dizziness and loss of appetite)

Drowsiness may affect performance of skilled tasks (e.g. cycling or driving); sedating effects are enhanced by alcohol and opioid analgesics.
Pharmacology: Respiratory and Endocrine

Question 71 of 76

Regarding the management of acute asthma in adults, which of the following statements is INCORRECT:

- a) Intravenous aminophylline is not likely to result in any additional bronchodilation compared to standard care.
- b) Parenteral hydrocortisone or intramuscular methylprednisolone are alternatives in patients who are unable to take oral prednisolone.
- c) Intravenous magnesium sulphate should be considered for patients with acute severe asthma who have not had a good initial response to inhaled bronchodilator therapy.
- d) High-dose inhaled short-acting beta2-agonists are the first line treatment for acute asthma.
- e) Nebulised magnesium sulphate should be considered for patients with acute severe asthma who have not had a good initial response to inhaled bronchodilator therapy.
Pharmacology: Respiratory and Endocrine

Acute Respiratory Gas Exchange

Acute respiratory gas exchange is the exchange of respiratory gases across the lungs. It involves the diffusion of oxygen and carbon dioxide across the alveolar membrane. The alveolar membrane is thin and permeable, allowing gases to diffuse across it. The exchange of gases is facilitated by the alveolar ventilation and the blood flow to the lungs.

Nerves

The respiratory system is innervated by both autonomic and somatic nerves. The autonomic nervous system controls the smooth muscles of the trachea, bronchi, and bronchioles, as well as the blood vessels supplying the lungs. The somatic nervous system controls the muscles of respiration, such as the diaphragm and intercostal muscles.

Classification of Asthma in Adults

Types of Asthma

1. **Allergic Asthma**: Characterized by an allergic reaction to specific allergens, such as pollen, dust, or animal dander. It is mediated by IgE antibodies and involves the release of histamine and other inflammatory mediators.
2. **Non-Allergic Asthma**: Also known as extrinsic asthma, it is not linked to a specific allergen. It is often associated with exercise or physical activity.
3. **Occupational Asthma**: Caused by exposure to specific substances in the workplace. It may involve both allergic and non-allergic mechanisms.
4. **Aspirin-Induced Asthma**: A subtype of occupational asthma caused by exposure to aspirin or other non-steroidal anti-inflammatory drugs.
5. **Exercise-Induced Asthma**: A form of asthma that is triggered by physical activity.
6. **Chronic Obstructive Pulmonary Disease (COPD)**: A condition characterized by airflow obstruction due to chronic inflammation and hypersecretion in the lungs. It includes chronic bronchitis and emphysema.

**Common Symptoms**

- Shortness of breath
- Wheezing
- Coughing
- Chest tightness
- Fatigue
- Exertional dyspnea

**Diagnosis**

Diagnosis of asthma is typically based on a combination of symptoms, a physical examination, and pulmonary function tests. A bronchodilator challenge test may be performed to determine if the symptoms are reversible.

**Treatment**

Treatment options for asthma include medications such as inhaled corticosteroids, long-acting beta-agonists, and leukotriene modifiers. Proper inhaler technique is crucial to ensure effective medication delivery. Asthma education and management planning are also important components of treatment.
Pharmacology: Respiratory and Endocrine

Question 72 of 76

Prednisolone would be most useful for which of the following conditions:

a. Topical use in eczema
b. Cerebral oedema secondary to malignancy
c. Mineralocorticoid replacement in Addison's disease
d. Long-term suppression in polymyalgia rheumatica
e. Emergency management of anaphylaxis

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Pharmacology: Respiratory and Endocrine

Question Navigator:
1. Tropicamide use in asthma
2. Cortisol adverse effects in infants
3. Intercolony replacement in honeybee colonies
4. Long-term suppression in hematopoietic malignancies
5. Emergency management of anaphylaxis

Answer:

Tropicamide is used in asthma to control symptoms and prevent asthma attacks. It is a non-steroidal anti-inflammatory drug that works by reducing the inflammation in the airways.

Notes:

- It is important to note that a combination of medications is often used to control asthma symptoms. The effectiveness of tropicamide may vary from person to person.

Side effects:

Common side effects of tropicamide include:
- Dryness of the mouth
- Blurred vision
- Increased sweating
- Increased urination
- Headache
- Fatigue

If you experience any of these side effects, please consult your healthcare provider.

Pharmacology: Respiratory and Endocrine

Resources:
- www.fecmes.com
- www.pharmacologytoday.com
- www.medicaljournalsarchive.com

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Pharmacology: Respiratory and Endocrine

Question 73 of 76

Which of the following clinical features is a cardinal sign of near-fatal asthma:

- [ ] a. Altered conscious level
- [ ] b. Silent chest
- [ ] c. PEFR < 33% of best or predicted
- [ ] d. PaCO2 > 6.0 kPa
- [ ] e. PaO2 < 8.0 kPa

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Pharmacology: Respiratory and Endocrine

Glucagon may be used as an antidote for overdose with which of the following:

a. Calcium channel blockers
b. Beta blockers
c. SSRIs
d. Theophylline
e. Digoxin

< Previous  Next >  See Answer  Something wrong?
Glucagon may be used as an antidote for overdose with which of the following:

- a) Calcium-channel blockers
- b) Beta blockers
- c) 5HTH
- d) Theophylline
- e) Digoxin

**Answer**

Glucagon is mainly used as a treatment for hypoglycaemia but may also be used as an antidote in beta-blocker overdose and in anaphylaxis in patients on beta-blockers that fail to respond to adrenaline.

**Notes**

**Management of hypoglycaemia in adults**

- In adults who are conscious, cooperative and can swallow:
  - Give 15 – 20 g quick acting carbohydrate of the patient’s choice where possible e.g. 90 – 120 ml of Lysine or 5 – 7 Dextrose tablets
  - Repeat capillary blood glucose 10 – 15 minutes later
  - If blood glucose is still < 4.0 mmol/L, repeat step 1 (no more than 3 treatments total)
  - If blood glucose remains < 4.0 mmol/L after 45 minutes or 3 cycles, consider:
    - 1 mg glucagon IM
    - IV 10% glucose infusion at 100ml/hr
- In adults who are conscious but uncooperative:
  - Give either 1.5 – 2 tablets Glucopril/Dextropep (may repeat up to 3 times)
  - If this is ineffective give glucagon 1 mg IM (may only give once)
  - If blood glucose level remains less than 4.0 mmol/L after 45 minutes or 3 cycles, consider IV 10% glucose infusion at 100ml/hr
- In adults who are unconscious:
  - Give either:
    - 1 mg glucagon intramuscularly (if not effective after 10 – 15 minutes, IV glucose should be given)
    - 75 – 80 ml of 20% glucose intravenously over 10 – 15 minutes
    - 150 – 160 ml of 10% glucose intravenously over 10 – 15 minutes

Once blood glucose is > 4.0 mmol/L and the patient recovered, give a long acting carbohydrate of the patient’s choice where possible e.g. two biscuits, one slice of bread. Note that patients given glucagon require a larger portion of long acting carbohydrate to replenish glycogen stores (double the suggested amount).

If the hypoglycaemia was due to sulfonylurea or long acting insulin then be aware that the risk of hypoglycaemia may persist for up to 24 – 36 hours following the last dose, especially if there is concurrent renal impairment.

**Glucagon**

Glucagon, a polypeptide hormone produced by the alpha cells of the islets of Langerhans, increases plasma glucose by mobilising glycogen stored in the liver. Glycogen promotes glycogenolysis and glucogenogenesis.

Glucagon may take up to 15 minutes to have an effect and will be less effective in alcoholics, prolonged starvation and severe liver disease when glycogen stores are depleted. In this situation or if prolonged treatment is required, IV glucose is better. Glucagon may also be less effective in patients prescribed sulfonylurea therapy.

Glucagon may also be used as an antidote in beta-blocker overdose and in anaphylaxis in patients on beta-blockers that fail to respond to adrenaline.

Glucagon is contraindicated in phaeochromocytoma.

**Adverse effects include:**

- Nausea and vomiting
- Hypoglycaemia
- Hypokalaemia
- Hypotension

**Resources**

- The Royal College of Emergency Medicine
- Web Association for Emergency Medicine
- Advanced Trauma Life Support
- Resuscitation Council UK
- TraumaAccreditation
- Traumaburg
- Robkappa
Pharmacology: Respiratory and Endocrine

Question 75 of 76

Which of the following is NOT a typical side effect of salbutamol:

- a. QT-interval prolongation
- b. Headache
- c. Hyperkalaemia
- d. Arrhythmias
- e. Tremor particularly affecting the hands

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Pharmacology: Respiratory and Endocrine

Question 75 of 106

Which of the following is NOT a typical side effect of salbutamol:

a) QT interval prolongation
b) Headache
c) Hypokalaemia

d) Arrhythmias
e) Tremer particularly affecting the hands

Answer

Side effects are usually dose-related and include:

- Fine tremer — occurs particularly in the hands and is usually worse in the first few days of treatment.
- Palpitations and tachycardia
- Headache
- Seizure
- Anxiety
- Hypokalaemia
- Cardiac arrhythmia and paradoxical bronchoconstriction (rare)
- Acute angle-closure glaucoma
- QT interval prolongation

Notes

Selective beta-2 agonists act directly on beta-2 receptors, causing smooth muscle relaxation and dilation of the airways.

Mild to moderate symptoms of asthma respond rapidly to the inhalation of a selective short-acting beta2 agonist such as salbutamol or terbutaline sulphate. Short-acting beta-2 agonists have a rapid onset of action (15 minutes) and their effects last for up to 4 hours. Salbutamol or terbutaline sulphate can be given intravenously for severe or life-threatening acute asthma; patients should be carefully monitored and the dose adjusted according to response and heart rate.

Short acting beta-2 agonists are used for immediate relief of asthma symptoms, while some long-acting (IQ agonists e.g. salmeterol) are added to an inhaled corticosteroid in patients requiring prophylactic treatment.

Cautions

Beta-2 agonists should be used with caution in people with:

- Cardiovascular disease, including arrhythmias and hypertension (beta-2 agonists may cause an increased risk of arrhythmias and significant changes to blood pressure and heart rate)
- Diabetes (risk of hyperglycaemia and ketoadis, especially with intravenous use)
- Hyperthyroidism (beta-2 agonists may stimulate thyroid activity)
- Hypokalaemia (potentially serious hypokalaemia may result from beta-2 agonist therapy; this effect may be potentiated in severe asthma by concomitant treatment with theophylline, corticosteroids, diuretics and by hypoxia)
- Susceptibility to QT interval prolongation
- Convulsive disorders

Interactions

Hypokalaemia may be potentiated by concomitant treatment with theophylline and its derivatives, corticosteroids, and diuretics. This in turn may predispose to toxicity in patients taking diuretics.

Side effects

Side effects are usually dose-related and include:

- Fine tremer — occurs particularly in the hands and is usually worse in the first few days of treatment.
- Palpitations and tachycardia
- Headache
- Seizure
- Anxiety
- Hypokalaemia
- Cardiac arrhythmia and paradoxical bronchoconstriction (rare)
- Acute angle-closure glaucoma
- QT interval prolongation
Pharmacology: Respiratory and Endocrine

Question 76 of 76

What is the mechanism of action of theophylline:

- a. Beta-2 agonist
- b. Muscarinic antagonist
- c. Phosphodiesterase inhibitor
- d. Acetylcholinesterase inhibitor
- e. Dopamine antagonist

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Pharmacology: Respiratory and Endocrine

Question 76

What is the mechanism of action of theophylline?

- Beta 2 agonist
- Histamine antagonist
- Phosphodiesterase inhibitor
- Atrial natriuretic factor
- Depressant agent

Answer

Theophylline may have an additive bronchodilating effect when used in conjunction with small doses of beta 2 agonists. Theophylline is a xanthine that inhibits phosphodiesterase resulting in increased tissue concentrations of cyclic adenosine monophosphate (cAMP).

Notes

Theophylline may have a bronchodilating effect when used in conjunction with small doses of beta 2 agonists. Theophylline is a xanthine that inhibits phosphodiesterase resulting in increased tissue concentrations of cyclic adenosine monophosphate (cAMP).

Theophylline is metabolized in the liver, and thus can cause hepatic toxicity. The plasma theophylline concentration is increased in heart failure, hepatic impairment, in oral infections in fever and in the elderly. Akin to theophylline dose may need to be lowered to account for accumulation. The plasma theophylline concentration is decreased in smokers, and by alcohol consumption.

Indications

It is used as a bronchodilator in asthma and stable COPD. It is not generally effective in exacerbations of chronic obstructive pulmonary disease, but is used rarely for severe or life-threatening acute asthma given its receptor and adenosine actions. A level of theophylline with theophylline serum, which is 20 times more soluble than theophylline alone.

Contraindications

Theophylline should not be used in people with:

- Cardiac arrhythmias or other cardiac disease
- Hepatic impairment
- Epilepsy
- Hyperthyroidism
- Peptic ulcer
- Risk of hypokalaemia

Interactions

Hypokalaemia may be potentiated by concurrent therapy with beta 2-agonists, cardiotonic agents, and diuretics. Excretion of theophylline may be potentiated by concurrent therapy with theophylline.

There is an increased risk of convulsions when theophylline is given with opiates.

<table>
<thead>
<tr>
<th>Examples of enzyme-inhibiting drugs (lower plasma theophylline level)</th>
<th>Examples of enzyme-inducing drugs (lower plasma theophylline level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theophylline</td>
<td>Theophylline</td>
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<tr>
<td>Chlorothiazide</td>
<td>Phenobarbital</td>
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<td>Flurazepam</td>
<td>Cardiac glycosides</td>
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<td>Levothyroxine</td>
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<tr>
<td>Metoclopramide</td>
<td>Bismuth</td>
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<tr>
<td>Cimetidine</td>
<td>At i ston's level</td>
</tr>
</tbody>
</table>

Side effects

Side effects include:

- Tachycardia, palpitations, and tachyarrhythmias
- Cholinergic effects: sweating, headache, insomnia, and nervousness
- Gastrointestinal irritation, nausea, vomiting, and diarrhea
- Hypokalaemia

Hypokalaemia may result in serious arrhythmias. Theophylline may potentiate the effects of theophylline and its derivatives, cardiotonic agents, and diuretics, and (hypokalaemia).

Monitoring requirements

In most individuals, plasma theophylline concentrations of 10–20 mg/L (0.5–1.5 micromole/L) is required for satisfactory bronchodilatation, although a lower plasma theophylline concentration of 5–15 mg/L may be effective. An adverse effect can occur within the range 30–200 mg/L and the frequency and severity increase as concentrations above 20 mg/L.

Plasma theophylline concentration is measured 5 days after starting oral treatment and at least 3 days after any dose adjustment.

Dosage

Theophylline is given in capsules which may be given once and twice daily. A single peak effect is desired and theophylline is administered in the morning. Severe hypokalaemia may develop rapidly.