

MCQ QUESTIONS

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Question 1

Nerve stimulators

- A. Double burst is of particular value in assessing blockade when there is no response to the train-of-four
- B. A fading pattern to the train-of-four excludes prolonged action of suxamethonium
- C. When used to locate nerves for regional blockade the positive electrode should be attached to the locating needle
- D. The post tetanic count is particularly useful for assessing the patient's suitability for extubation
- E. The ideal nerve for neuromuscular blockade assessment is generally considered to be the facial nerve

Question 2

The following potentiate the action of non-depolarising neuromuscular blockers

- A. Diethyl ether
- B. Quinidine
- C. Enflurane
- D. Lithium
- E. Dantrolene

Question 3

When looking at an ECG

- A. A bifid P wave may indicate that the patient has mitral stenosis
- B. Peaked P waves are associated with right atrial hypertrophy
- C. A short PR interval indicates that the patient has Wolff-Parkinson-White syndrome
- D. Left bundle branch block is associated with a secondary R wave in V6
- E. U waves are associated with hypothermia

Question 4

The following ECG changes are associated with the correct cause

- A. U waves - Hypothermia
- B. T wave flattening - Hypothyroidism
- C. Short QT Interval - Hypercalcaemia
- D. Biphaseic P wave in V1 - Mitral stenosis
- E. T wave inversion - Hypokalaemia

Question 5

The following ECG changes occur with hypokalaemia

- A. Tall T waves
- B. ST elevation

- C. Loss of P waves
- D. T wave inversion
- E. Prominent U waves

Question 6

The CVP trace

- A. The c wave follows the X descent
- B. The X descent occurs in (ventricular) diastole
- C. The v wave results from right atrial filling against a closed tricuspid valve
- D. Cannon waves are seen in complete heart block
- E. The a wave is of variable size in atrial fibrillation

Question 7

Anaesthesia breathing circuits

- A. The Lack circuit is a Mapleson D system
- B. The Magill attachment is more efficient for spontaneous breathing than for controlled ventilation
- C. The recommended fresh gas flow rate for controlled ventilation through a Bain circuit is 70 ml/kg body weight
- D. Minimum fresh gas flow to avoid rebreathing using a Mapleson A is equal to that patient's minute ventilation
- E. The Mapleson F system is a modification of the Mapleson E system

Question 8

The following cause a rise in the end-tidal carbon dioxide level (assuming constant ventilation)

- A. Hypothermia
- B. Malignant hyperpyrexia
- C. Pulmonary embolus
- D. Disconnection of the inner tube of a Bain circuit
- E. Failure of the endotracheal tube cuff

Question 9

The concentration of vapour in the gas mixture emerging from the outlet port of a vaporiser depends on

- A. Saturated vapour pressure of the agent
- B. Flow characteristics of the vaporiser
- C. Duration of use
- D. Surface area of the agent in contact with the gas mixture
- E. Temperature

Question 10

Anaesthesia at high altitude (using a plenum vaporiser)

- A. The concentration delivered by the vaporiser will be higher than the dialled value
- B. The concentration dialled into the vaporiser will need to be higher for the same effect
- C. The concentration dialled into the vaporiser will need to be lower for the same effect
- D. The inspired oxygen concentration may need to be increased
- E. The anaesthetic potency of 50% nitrous oxide will be reduced

Question 11

A low resistance to gas flow is a feature of the following vaporizers

- A. Oxford miniature vaporizer
- B. Epstein Macintosh Oxford vaporizer
- C. Copper Kettle Vaporizer
- D. Goldman Vaporizer
- E. Boyle's bottle

Question 12

The following are true concerning humidity and humidification of gases

- A. Relative humidity is the ratio of absolute humidity to saturated humidity at a specified temperature
- B. Operating theatre humidity should be maintained at no more than 30%
- C. Heat and moisture exchangers can achieve 40% humidity
- D. A nebuliser works on the poiseuille effect to entrain water across a pressure drop
- E. The water trap for a simple bottle humidifier must be larger than the humidifier bottle

Question 13

During brachial plexus blockade

- A. The interscalene approach commonly leads to inadequate blockade of the ulnar nerve
- B. The axillary approach may lead to Horner's syndrome
- C. The supraclavicular approach commonly leads to inadequate blockade of the axillary nerve
- D. Bilateral interscalene blocks should be used for bilateral shoulder manipulation surgery
- E. The axillary approach commonly leads to inadequate blockade of the median nerve

Question 14

Complications of retrobulbar blockade for cataract surgery include

- A. Bradycardia
- B. Retinal detachment
- C. Brain stem anaesthesia

D. Vitreous haemorrhage

E. Optic nerve damage

Question 15

Effects of epidural blockade include

- A. A greater degree of hypotension when adrenaline (epinephrine) containing local anaesthetics are used
- B. Sympathetic blockade before sensory blockade
- C. Anterior spinal artery syndrome
- D. Reduced tidal volume with a normal block to T4
- E. Reduced peristalsis

Question 16

A successful stellate ganglion block may cause

- A. Ipsilateral miosis
- B. Contralateral nasal congestion
- C. Bilateral ptosis
- D. Ipsilateral exomphalos
- E. Horner's syndrome

Question 17

Concerning brachial plexus blockade

- A. The interscalene approach provides for anaesthesia to the ulnar border of the forearm
- B. The supraclavicular approach is not reliable to produce anaesthesia to the hand
- C. The axillary approach is least likely to cause pneumothorax
- D. Diaphragmatic paralysis is a complication
- E. Puncture of an artery may be deliberate

Question 18

Inguinal hernia field block

- A. Blocks the ilioinguinal, iliohypogastric and genitofemoral nerves
- B. May be employed for testicular surgery
- C. Prilocaine 0.5% may be used
- D. Depends on depositing local anaesthetic between internal and external oblique
- E. Quadriceps weakness is a complication

Question 19

Serum Na⁺ 120 mmol/l and K⁺ 6.4 mmol/l are consistent with

- A. Hyperaldosteronism
- B. Renal failure
- C. Hypopituitarism
- D. Adrenocortical insufficiency
- E. Cushing's disease

Question 20

The following conditions are associated with a haemoglobin concentration of 7 g/dl and a mean corpuscular volume of 70 fl

- A. Iron deficiency anaemia

- B. Acute blood loss
- C. Folate deficiency
- D. Renal failure
- E. Thalassaemia

Question 21

Obesity is associated with

- A. An increase in the incidence of airway complications
- B. Increased functional residual capacity (FRC)
- C. Increased DO_2 (Oxygen delivery)
- D. Pulmonary hypertension
- E. Quetelet index of 24.5

Question 22

Diathermy safety

- A. Ohm's law states that voltage = current x resistance
- B. Diathermy works because there is a high current density at the active electrode
- C. The heat energy produced by cautery is proportional to the current at the tip of the active electrode
- D. Bipolar diathermy requires a passive electrode ('diathermy plate')
- E. Poor contact of the passive electrode ('diathermy plate') may lead to inadvertent patient burns

Question 23

With regard to electrical safety and prevention of explosions

- A. Nitrous oxide is not flammable at atmospheric pressure

- B. Anaesthetic machines should be isolated from 'earth' to prevent completion of an electrical circuit
- C. Currents of 10 microamps may initiate ventricular fibrillation
- D. The neutral connection of a circuit is not at earth potential at the patient end of the circuit
- E. In surgical diathermy the heat released depends on the square of the potential difference between electrodes

Question 24

Ephedrine is unlikely to be effective in reversing hypotension in patients chronically receiving the following medication

- A. Reserpine
- B. Alpha-methyl dopa
- C. Phenoxybenzamine
- D. Clonidine
- E. Propranolol

Question 25

Heat loss

- A. Conduction is the largest factor in patient heat loss
 - B. Radiation accounts for about 10% of the total heat loss
 - C. Convection is due to heating of the adjacent air layer which is replaced by cooler air from the surroundings
 - D. Heat lost in breathing dry gases is approximately 15% of total heat loss in the anaesthetised subject
 - E. Burns from faulty heating equipment are more likely in the vasoconstricted patient
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Question 1

A. false B. false C. false D. false E. false

The pattern of peripheral nerve stimulation used for assessment of neuromuscular blockade most commonly is the train-of-four. This shows characteristic fade when recovery from non-depolarising neuromuscular blockade is occurring. However in prolonged blockade with suxamethonium there is a conversion to the non-depolarising pattern with fade appearing. This is called dual block and occurs if the prolonged block is due to either repeated doses of suxamethonium or impaired metabolism (suxamethonium apnoea). The train-of-four is of no value when there is no response to the first twitch, and in this case post-tetanic count is used. During recovery it is difficult to assess the ratio between the first (t1) and fourth twitch (t4) and this should be 100:70 for successful extubation. This comparison is easier using the double burst pattern. Stimulators used for regional blockade should be used with the locating needle attached to the negative electrode as this ensures depolarisation of the nerve at a lower applied current.

Question 2

A. true B. true C. true D. true E. false

All the volatile agents enhance the action of neuromuscular blockers by reducing the tone of skeletal muscle, an action mediated by an effect at the post junctional membrane. Quinidine is a membrane stabiliser and an isomer of quinine. Dantrolene disrupts excitation-contraction coupling and so does not directly potentiate the action of NMBs.

Question 3

A. true B. false C. false D. true E. false

Bifid P waves are associated with left atrial hypertrophy and may indicate the presence of mitral stenosis. Tall peaked P waves (>3mm) are associated with raised right atrial pressure and hypertrophy. The presence of a short PR interval suggests pre-excitation. If there is a delta wave present then this is known as the Wolff-Parkinson-White syndrome. The absence of a delta wave suggests that it is the Lown-Ganong-Levine syndrome. In left bundle branch block the left ventricle depolarises late and so there is a slurred or secondary R wave in V6 and S wave in V1 (M shaped complex in V6). U waves are associated with hypokalaemia and occur after the T wave. J waves are associated with hypothermia and are a characteristic deflection at the end of the QRS complex.

Ref: *Yentis, Hirsch and Smith. Anaesthesia A to Z. Butterworth*

Question 4

A. false B. true C. true D. true E. true

Hypothermia is associated with J waves which are positive deflections at the end of the QRS complex. Hypokalaemia is associated with U waves as well as T wave flattening, inversion, and prolongation of the PR and QT intervals. U waves may also be a normal finding and be associated with both hypercalcaemia and hyperthyroidism. A short QT interval is a recognised sign of hypercalcaemia. Biphasic P waves in V1 represent left atrial enlargement and are associated with P mitrale where the P wave

is bifid in lead II. Hypothyroidism is associated with low voltage complexes, bradycardia and T wave flattening or inversion.

Question 5

A. false B. false C. false D. true E. true

Hypokalaemia causes P-R prolongation, ST depression, T wave inversion and prominent U waves.

Ref: *Ganong WF. Review of Medical Physiology. Lange.*

Question 6

A. false B. false C. true D. true E. false

The CVP trace consists of three main waves and two descents, (in chronological order):

The a wave - right atrial (RA) contraction. Absent in atrial fibrillation; enlarged with tricuspid stenosis, RV hypertrophy, pulmonary stenosis or pulmonary hypertension; cannon waves (giant A waves) occur if the RA contracts against a closed tricuspid valve (e.g. in complete heart block)

The c wave - bulging of the tricuspid valve at the onset of ventricular systole

The X descent - atrial relaxation during ventricular systole

The v wave - RA filling with a closed tricuspid valve

The Y descent - opening of the tricuspid valve with blood flow into the right ventricle.

Question 7

A. false B. true C. true D. false E. true

The Mapleson classification of breathing systems has six classifications A-F. The Lack circuit and the Magill attachment are examples of Mapleson A systems. They are very efficient for spontaneous breathing (requiring a fresh gas flow (FGF) equal to alveolar ventilation - less than minute ventilation (MV)). They are much less efficient for controlled ventilation (FGF = 3 x MV). The Mapleson D (including the coaxial Bain circuit) is most efficient for controlled ventilation. The Bain circuit requires a FGF of 70 ml/kg to maintain normocarbida. The Mapleson F (Jackson-Rees) is a modification of the Ayre's T-piece (Mapleson E) designed to minimise resistance to gas flow and ideal for paediatric use.

Ref: *See Update No 7.*

Question 8

A. false B. true C. false D. true E. false

A rise in end tidal carbon dioxide may be due to:

Inspired carbon dioxide

Rebreathing in the circuit (e.g. disconnection of the inner tube in a Bain circuit or increased dead space)

Increased production of carbon dioxide (e.g. malignant hyperpyrexia)

Inadequate ventilation

Leaks, reduced metabolic rate (due to hypothermia) and impaired

cardiac output (pulmonary embolus) all cause reduced end tidal carbon dioxide.

Question 9

A. true B. true C. true D. true E. true

All of these factors will determine the concentration of vapour in the gas mixture.

The more volatile the agent, the higher the SVP and hence the higher the concentration emerging from the vaporiser assuming the same splitting ratio. The temperature determines the SVP of the agent. Duration of use may alter the SVP via its effect on temperature. The surface area of the vaporiser must be sufficient to ensure full saturation of the mixture passing through the vaporising chamber. The flow characteristics are important to ensure complete mixing and hence full saturation once again. The splitting ration is also important as if the gas exiting the vaporising chamber is fully saturated it will determine the total amount of agent added to the final gas mixture.

Modern vaporisers are temperature compensated. The splitting ratio amount of gas passing through the bypass chamber is altered to reflect the change in SVP with temperature and thus ensure constant output of vapour at the required level.

Question 10

A. true B. false C. false D. true E. true

The amount of oxygen, nitrous oxide and anaesthetic agent required by the body for oxygenation and anaesthesia is related to the partial pressure of these in the trachea. For convenience the more easily measured concentration or fraction is used, and the barometric pressure is assumed to be constant. At high altitude the barometric pressure is reduced. The partial pressure of anaesthetic agent that is delivered by the vaporiser is constant at differing barometric pressures, so the concentration dialled into the apparatus will have the same clinical effect as the SVP is unchanged if the temperature is the same. However the fraction (%) actually delivered will be higher than the dialled value as the absolute pressure in the environment is lower. Furthermore to get the same partial pressure of oxygen at lower barometric pressure requires a higher inspired fraction, and the same inspired fraction of nitrous oxide will provide a lower partial pressure and so a reduced effect.

This can be confusing and it is advisable to read the reference.

Question 11

A. true B. true C. false D. true E. false

Low resistance is a feature of the OMV, EMO and Goldman vaporizers.

The OMV is a small non-temperature compensated vaporizer used with portable anaesthetic equipment. It has a antifreeze filled sealed compartment that acts as a heat sink and so minimise temperature changes. The scale can be change for the use of the vaporizer with different volatile agents.

The EMO is used for ether. It is still used throughout the world and has a large water filled heat sink.

The Goldman vaporizer is a small cheap and simple device used for halothane. It is not temperature compensated and output depends somewhat on the gas flow through the vaporizer.

Both the Copper Kettle and Boyles bottle vaporizers are examples of plenum vaporizer with a high internal resistance to gas flow.

Ref: See Update No 14

Question 12

A. true B. false C. true D. false E. true

Absolute humidity is defined as the mass of water in a volume of air. Relative humidity is defined as in the question is usually presented as a %. Humidification devices can be defined as active or passive; vapour or droplet producing; hot or cold and finally functioning in a breathing system or in the atmosphere. Theatre humidity should be around 60% as a compromise between discomfort (if too high) and the increased risk of explosion due to static electricity (if too low). Heat and moisture exchangers can achieve 70% humidification. A nebuliser works on the venturi or bernouille effect. For a bottle humidifier the water trap should be at least the same size as the humidifier bottle.

Question 13

A. true B. false C. false D. false E. false

The brachial plexus can be approached from above or below during regional anaesthesia for surgery on the upper arm. The interscalene approach gives excellent anaesthesia to the shoulder and upper arm, but commonly leads to inadequate blockade of the ulnar nerve. Potential side-effects of this block are Horner's syndrome, phrenic nerve block, recurrent laryngeal nerve block and inadvertent extradural or intrathecal injection. Bilateral interscalene blocks should not be performed. The supraclavicular approach commonly leads to inadequate blockade of the median nerve. Horner's syndrome and pneumothorax are amongst the adverse events that can occur with this approach. The axillary approach commonly leads to inadequate blockade of the axillary nerve, and supplemental sub-cutaneous local anaesthetic will be required if the upper/outer aspect of the arm is involved in surgery, or if a tourniquet is to be used. Horner's syndrome does not occur with the axillary approach.

Question 14

A. true B. true C. true D. true E. true

Complications of retrobulbar block may be systemic or local. Retrobulbar blockade requires the injection of local anaesthetic into the muscle cone behind the eye. The most common complication is retrobulbar haemorrhage due to puncturing the vessels within the retrobulbar space. The increased pressure in the globe can cause central artery occlusion. Other complications include bradycardia secondary to the oculocardiac reflex, posterior globe puncture with resultant retinal detachment and vitreous haemorrhage, penetration of the optic nerve, brain stem anaesthesia from local entering breeched dura around the optic nerve and subarachnoid blockade or inadvertant intraocular or intravascular injection; hence the preference of most anaesthetists for peribulbar blocks.

Question 15

A. true B. false C. true D. false E. false

More hypotension occurs when adrenaline containing local anaesthetics are used for epidural blockade. This may be due to the beta 2 effects of the absorbed adrenaline causing vasodilation in peripheral beds. It is countered by the chronotropic and inotropic effects on beta 1 receptors. However the more prolonged hypotension seen is probably due to the achievement of a more profound degree of sympathetic blockade. Sympathetic blockade occurs after sensory blockade. Small unmyelinated sensory fibres with no barrier to local anaesthetic diffusion are blocked before the larger autonomic B fibres. Anterior spinal artery syndrome is due to severe hypotension secondary to epidural blockade and not due to the technique itself. This leads to infarction of the spinal cord and results in a lower motor neurone paralysis at the level of the lesion and spastic paraplegia with decreased pain and temperature sensation below the level. Epidural blockade may cause lower intercostal muscle and abdominal muscle weakness resulting in impaired coughing and exhalation. However with a T4 block diaphragmatic innervation (C3-C5) is maintained and tidal volume and inspiratory pressure are maintained. Bowel contraction results from blockade of the sympathetic outflow and unopposed parasympathetic activity. Sphincters relax and peristalsis increases.

Question 16

A. true B. false C. false D. false E. true

Horners syndrome is the triad of enophthalmos, ptosis and miosis. Nasal congestion and anhidrosis are common but ipsilateral. Remember that exomphalos is a neonatal condition!

Question 17

A. false B. false C. true D. true E. true

There are 3 common approaches to blocking the brachial plexus. The interscalene approach is ideal for shoulder and upper arm operations. It however frequently spares the C8 and T1 fibres which innervate the ulnar border of the forearm. Injection of local anaesthetic by this approach may produce cervical plexus block which may cause diaphragmatic paralysis. The phrenic nerve may also be blocked because of diffusion or inappropriate injection to the anterior side of the anterior scalene. The supraclavicular approach attempts to block the plexus at the first rib and is most reliable at producing anaesthesia of all four terminal nerves of the forearm and hand. It does however carry the greatest risk of pneumothorax. The axillary approach is simplest and has the least chance of pneumothorax. If paraesthesia cannot be elicited during this approach then one alternative is to deliberately puncture the axillary artery and advance the needle through the opposite wall where half the anaesthetic solution is deposited. The remainder is injected once the needle has been pulled back through the "anterior" wall of the artery.

Question 18

A. true B. false C. true D. true E. true

Local anaesthetic is deposited between the internal and external oblique muscle layers. If the internal oblique is penetrated, local

anaesthetic may track back to the lumbar plexus and affect the femoral nerve, producing quadriceps weakness. Prilocaine may be used because of the larger amount of solution which may safely be injected, but most would use bupivacaine. The testicle is innervated by T10 and so this block is quite ineffective for testicular surgery.

Question 19

A. false B. true C. false D. true E. false

Aldosterone causes sodium retention and potassium loss. In chronic renal failure hyponatraemia or hypernatraemia can occur. In acute renal failure fluid retention can lead to hyponatraemia. Hyperkalaemia can also occur and is an indication for dialysis. Hypopituitarism leads to a reduced secretion from the anterior pituitary gland and hence ACTH insufficiency and reduced cortisol. Mineralocorticoid production remains largely intact as this is predominantly stimulated by angiotensin II. Destruction of the entire adrenal cortex reduces glucocorticoids, mineralocorticoids and sex steroids. As such hyponatraemia, hyperkalaemia and a raised urea result. Cushings results in excess cortisol which has some mineralocorticoid activity. This can lead to loss of potassium.

Question 20

A. true B. false C. false D. false E. true

These indices indicate a microcytic anaemia (normal MCV = 85 fl). The most common cause is iron deficiency. The red cells will also be hypochromic (MCH less than 27 pg). In thalassaemia there is a deficiency in the synthesis of the globin chains of haemoglobin. In addition the accumulation of abnormal chains within the red cell leads to its early destruction. This causes an anaemia with reduced MCV and MCH. The reticulocyte count is also raised. The anaemia of renal failure is normocytic and normochromic, in common with anaemias of chronic disease. In renal failure it is due to reduced erythropoietin production and in severe uraemia, > 30 mmol/l, a shortened red cell life and marrow toxicity. Folate and vitamin B12 deficiency cause macrocytic (high MCV) megaloblastic anaemia. Acute blood loss will cause an anaemia with a normal MCV and normal shaped existing red cells.

Question 21

A. true B. false C. true D. true E. false

The Quetelet index (or body mass index) is weight (kg) divided by the square of height (in m²). The upper limit of normal is 24.9. Overweight is 25-29.9, obese is 30-34.9, and morbid obesity over 35. Hypertension, ischaemic heart disease and increased oxygen consumption are characteristics, as are airway obstruction, right heart strain and, eventually, pulmonary hypertension and right-sided failure. The FRC is reduced with a tendency to V/Q mismatch and hypoxaemia. Hiatus hernia with reflux, and diabetes are other considerations.

Ref: Shenkman et al. Perioperative management of the obese patient. British Journal of Anaesthesia 1993;70:349.

Question 22

A. true B. true C. false D. false E. true

Diathermy relies on generation of heat energy from electrical energy. Ohm's law states that voltage = current x resistance ($V=IR$). The heat energy produced = (current)² x resistance ($E=I^2R$). At the active electrode there is a high current density due to the small area of the electrode. This leads to the heat energy and cautery. The passive electrode ('diathermy plate') used with unipolar diathermy has a large area and so the current density (and hence the heat produced) is small. However if the contact is poor then either there is a reduced area of contact (with a higher current density) or increased resistance. As $E=I^2R$ both these faults lead to an increased risk of burning. Bipolar diathermy does not have a passive electrode, and the current passes from an active electrode to a return electrode; these are the two blades of the diathermy forceps.

Question 23

A. true B. false C. false D. true E. false

Nitrous oxide is not flammable. An anaesthetic machine should be connected to a conducting floor of an operating theatre to prevent the production of static electrical sparks. A current of approximately 100 microamps is needed to produce a microshock to the heart, capable of producing ventricular fibrillation. Since all connections have some finite resistance the neutral connection is not exactly at earth potential at the patient end of the circuit. The heat released in surgical diathermy depends on the resistance and to the square of the current flowing.

Question 24

A. true B. true C. true D. false E. true

Indirectly acting sympathomimetics like ephedrine are unlikely to increase blood pressure in patients taking drugs which alter neuronal storage, uptake, metabolism or release of neurotransmitters. Reserpine depletes neuronal granules of noradrenaline. Alpha-methyl dopa acts as a false transmitter. Phenoxybenzamine and propranolol block peripheral receptors and industrial doses of directly acting sympathomimetics may be required to overcome their blockade. Clonidine works on central adrenergic receptors and the peripheral effect of indirectly acting sympathomimetics is not decreased, in fact smaller doses may be required due to receptor up regulation.

Question 25

A. false B. false C. true D. true E. true

Patient heat loss is mainly due to radiation (40-50%) and, to a lesser extent, convection (defined as in the question) and evaporation. About 15% of heat loss in the anaesthetised patient is via the respiratory tract. The main part of this is due to the latent heat needed to vaporise water to humidify the gas within the trachea. This can be minimised by humidification. Warming equipment such as electric blankets and water-filled mattresses have caused thermal burns in anaesthetised patients. The risk of burns is greater if there is poor blood supply as blood can help conduct the heat away from the site of potential injury.
