SELF ASSESSMENT - Answers

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Question 1

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

It is composed of two molecules of acetylcholine, but is metabolised to the relatively inactive succinyl monocholine. The rise in intraocular pressure caused by suxamethonium alone is brief, lasting for a few minutes. The bradycardia is caused by activation of muscarinic receptors. Phase II block does exhibit the characteristics of non-depolarising block but is not reversed by anticholinesterases.

Question 2

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

There is insignificant binding to plasma proteins. Hypokalaemia may precipitate digitalis toxicity. All forms of heart block have been recorded in digitalis toxicity.

Question 3

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

Flow = [Pressure difference x Pi x (fourth power of radius)] / [8 x length x VISCOSITY]. Also don't forget that Flow = Pressure difference/RESISTANCE. Blood viscosity depends on haematocrit. If the radius of a vessel is doubled, resistance will fall to 6% of its previous value.

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

Question 4

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

Diastole is divided into active relaxation, rapid filling, slow filling and atrial systole. Active relaxation is improved by sympathetic stimulation, increased inotropic state and increased heart rate. In the early part of diastole 70% of ventricular filling occurs. Especially when the left ventricle is hypertrophied any increase in heart rate will adversely affect left ventricular filling. Ventricular filling is most commonly disturbed by hypertensive heart disease and myocardial infarction. A modulus of chamber stiffness is the slope of the (dp/dv)/P relationship for the exponential curve of diastolic pressure against volume.

REF: Priebe & Skarvan. Cardiovascular Physiology. BMJ Publishing. Chapter 2. Ventricular performance.

Question 5

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

Sevoflurane is indeed a hexafluoroisopropyl fluromethyl ether. It is related to isoflurane, enflurance and desflurane which are all also ethers. Halothane is a hydrocarbon. About 5% undergoes biotransformation in the liver. It does not possess a -CF2H group and thus produces no CO when in contact with very dry sodalime (this property is shared with halothane). Its SVP at 20 degrees C is 160 mmHg (isoflurane 238 mmHg), its BP is 56 degrees C (isoflurane 48.5, enflurane 56.5) and its blood:gas partition coefficient is 0.69 (isoflurane 1.15).

Ref: British Journal of Anaesthesia 1996; 76: 435-445

Question 6

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

Rocuronium is an aminosteroid based neuromuscular blocker. It has a monoquaternary structure similar to pancuronium and vecuronium. It is much less potent with an ED 95 of 0.3 mg/kg (vec 0.056 mg/kg). The lack of potency is thought to be an important factor in determining the speed of onset of neuromuscular block. The less potent the drug, the greater the number of molecules there are available to diffuse into the NMJ. A more rapid onset is likely to be achieved with the less potent drug due to the increased diffusion gradient (due to the number of molecules) with the higher dose of the weaker agent. Rocuronium has no active metabolites because of the lack of a methyl group at the 3 carbon position. For vecuronium the metabolite 3 disacetylvecuronium is active.

Ref: British Journal of Anaesthesia 1996; 76: 481-483

Question 7

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

Pregnancy is associated with marked haemodynamic changes. The blood volume increases substantially. The heart rate, stroke volume and cardiac output increase while systemic blood pressure and vascular resistance fall (diastolic BP > systolic producing a wide pulse pressure). Patients with mitral stenosis may deteriorate significantly during gestation due to the fixed flow obstruction. The increased heart rate and cardiac output with the decrease in colloid osmotic pressure predispose to pulmonary oedema. Aggressive diuretic therapy is contraindicated as it may decrease uterine perfusion pressure. VSD and ASD are usually well tolerated in pregnancy even among patients with large left-right shunts. However, the degree of pulmonary hypertension should guide management as marked reduction in blood pressure during or after delivery may result in reversal of the shunt. Aortic regurgitation is also well tolerated (as is mitral regurgitation) probably because the systemic vascular resistance falls. Pregnancy in patients with primary pulmonary hypertension is associated with a high mortality, probably due to right ventricular ischaemia and failure, increased arrhythmias and pulmonary embolism.

Question 8

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

Clinical signs of pulmonary hypertension are raised JVP with prominent a waves and large v waves (especially with coexistent tricuspid regurgitation), left parasternal heave, sometimes a palpable pulmonary second sound, and on auscltation, loud P2 sometimes with an ejection click (P2 is closer to A2, not further apart), pansystolic murmur of tricuspid incompetence, right ventricular fourth heart sound and early diastolic murmur of functional pulmonary regurgitation (the Graham-Steele murmur). Atrial fibrillation may occur.

Question 9

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

Respiratory failure is defined as PaO2 <8kPa. Type I is characterised by ventilation perfusion mismatch and patients have a PaCO2 <6.5kPa while type II is characterised by alveolar hypoventilation and patients have a PaCO2 >6.5 kPa. Often both coexist. Hypoxia results in confusion, cyanosis and eventually coma. Hypercapnoea produces papilloedema, miosis, hypertension, flapping tremor, hyporeflexia, muscle twitching, sweating, headache, bounding pulse, retinal vein distension and eventually coma with extensor plantars. Lactic acidosis is a common finding due to anaerobic metabolism within tissues. Treatment should be directed at the precipitant as well as supportive therapy. 100% oxygen is unsafe in patients with COAD. Artificial ventilation or doxapram are the mainstay. Diptheria produces neuromuscular paralysis and can precipitate respiratory failure. Other causes of neuromuscular respiratory failure include: myasthenia gravis, motor neurone disease, polymyositis, muscle dystrophies (e.g. myotonic), polio, multiple sclerosis, stroke, encephalitis, etc.

Question 10

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

The pupil is dilated in IIIrd nerve palsy (compressive lesion), Holmes-Adie syndrome (myotonic pupil - often unilateral and poorly responsive to light; associated with reduced or absent ankle and knee reflexes), midbrain lesions, congenital syphilis, anticholinergic treatment (atropine), cocaine intoxication.

Causes of Horner's syndrome include Pancoast's tumour (apical lung carcinoma involving sympathetic chain), iatrogenic (sympathectomy), syringomyelia, lateral medullary syndrome, Shy Drager syndrome (causes Parkinsonism with postural hypotension and atonic bladder).

Other causes of small pupil include myotonic dystrophy, pontine lesions, acute iritis, opiates and organophosphates. The Argyll-Robertson pupil is seen in neurosyphilis - the pupil is unreactive to light but reacts to accomodation (a similar phenomenon may be seen in DM).

Question 11

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

A protein meal stimulates both insulin and glucagon secretion; the glucagon prevents the hypoglycaemia that would result from the increased insulin levels if there were no carbohydrate with the protein. Somatostatin infusion inhibits both insulin and glucagon secretion and produces hypoglycaemia, suggesting that glucagon is essential for the liver to release glucose. In addition, cortisol and growth hormone are required for normal glucose efflux from the liver. ILGF-I and ILGF-II are peptides that appear to function primarily as growth factors rather than influencing glucose uptake by tissues. ILGF-I is synthesised by the liver in response to growth hormone (not insulin). Beta-oxidation of free fatty acids to form acetyl CoA and ketone bodies provides the energy required for gluconeogenesis in starvation. This is inhibited by insulin.

Question 12

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

In a pure paracetamol overdose patients are normally fully conscious on admission. A decreased level of consciousness suggests another substance has been taken. A paracetamol level above 200 mg/L at 4 hours suggests treatment is indicated. Alcoholics and those taking enzyme-inducing drugs should be treated at half this level. Even after an overdose that causes severe hepatic damage long term sequelae don't develop, and normal therapeutic doses of paracetamol can be taken.

Question 13

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

Albumin , with a molecular weight of 65,000 Da and a plasma half life of 20 days is synthesised in the liver. Approximately 60% of albumin in the extracellular compartment is in the interstitial compartment though the concentration in the plasma compartment is very much higher. Albumin levels vary by as much as 5-10g/litre in the recumbent patient due to fluid redistribution. Analbuminaemia is a rare condition in which despite the complete lack of albumin there is only minimal ankle oedema following prolonged standing

Ref: Zilva JF, Pannall PR & Mayne PD. Clinical chemistry in diagnosis and treatment.

Question 14

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

High pressures commonly employed in anaesthetic practice can be measured using a Bourdon gauge. In this gauge, the gas at high pressure causes a tube to uncoil and in doing so moves a pointer over a scale on a dial. Bourdon gauges have the advantage over manometers that there is no liquid to spill, and they are sometimes called anaeroid gauges from the Greek 'a-neros' (without liquid). Another form of anaeroid gauge is based on a bellows or capsule which expands or contracts depending on the pressure across it. The strain gauge pressure transducer involves movement of a diaphragm with changes in pressure. This movement of the diaphragm alters the tension in the resistance wire thus changing its resistance. The change of current flow through the resistor can then be amplified and displayed as a measure of pressure on a scale. The Rayleigh refractometer and Raman spectrophotometer are techniques used for anaesthetic gas analysis.

Ref: P D Davis, G D Parbrook, G N C Kenny. Basic Physics and Measurement in Anaesthesia, 4th ed. Butterworth-Heinemann, 1995.

Question 15

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

The Bain circuit is the coaxial version of the Mapleson D system. Fresh gas flow (FGF) is supplied through a narrow inner tube. The patient's expired gases pass through the outer tube and are vented to atmosphere. This sytem is inefficient during spontaneous breathing but efficient during controlled ventilation. A FGF rate of between two to three times minute volume (200-250 ml/kg/min) may be required during spontaneous ventilation to prevent rebreathing. FGF of between 70 and 80 ml/kg/min is required during controlled ventilation to prevent rebreathing.

The Lack circuit is the coaxial version of the Mapleson A system. The outer tube supplies inspired gas from the reservoir bag and the patient exhales through the inner tube. This system is inefficient during controlled ventilation but efficient during spontaneous breathing. During controlled ventilation, the FGF rate must be at least three times alveolar minute volume to prevent rebreathing. If the system is functioning correctly and no leaks are present, a FGF rate equal to the patient's alveolar minute ventilation is sufficient to prevent rebreathing. In practice, a higher FGF rate (equal to the minute volume) is selected to compensate for leaks. Unlike the Bain circuit, the Lack circuit does not permit the use of ventilators to provide controlled ventilation.

Ref: A R Aitkenhead, G Smith. Textbook of Anaesthesia,

Question 16

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

The most common adverse drug reactions are gastrointestinal (nausea) and dermatological (rashes). Approximately 3% of hospital admissions are directly related to adverse drug interactions.

Question 17

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

Dopamine is a precursor of adrenaline. Dobutamine is a synthetic compound. The synthetic pathway is as follows:

Tyrosine-DOPA-Dopamine-Noradrenaline-Adrenaline

Question 18

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

Warfarin interferes with the activation of vitamin K, and thereby prevents the hepatic synthesis of the vitamin K dependent clotting factors II, VII, IX and X. It has serious teratogenic effects, one third of infants being still born, or born with severe abnormalities. It is 97% bound to albumin, and there is therefore negligible urinary excretion. Metabolites are conjugated with glucuronic acid and excreted in the bile and urine.

Question 19

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

For beta-blocker overdose, try atropine, glucagon infusion and temporary pacing. Tricyclic overdose may require iv neostigmine to counteract the anticholinergic effects and a beta blocker for treatment of SVTs. Phenytoin is useful for convulsions and VT in TCA poisoning. Other antidotes include desferrioxamine for iron, calcium EDTA and/or dimecaprol for lead poisoning, dimecaprol for heavy metal poisoning, ethanol for ethylene glycol, dicobalt edetate for cyanide, digoxin-specific antibody for digoxin, naloxone for opiates, N-acetylcysteine for paracetamol, Fuller's earth for paraquat, vitamin K for warfarin.

Question 20

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

Ondansetron (5HT3 antagonist) reduces nausea and vomiting by central activity. Opioids and metoclopramide have both central and local actions on gut motility. Neostigmine causes a rise in acetylcholine levels and will increase segmental contractions within the bowel.