## ANAESTHETIC SELF-EVALUATION

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### Multiple Choice Questions

1. Hypotension may be caused by:
   a. Neostigmine
   b. Spinal anaesthesia
   c. IPPV
   d. Hypovolaemia
   e. Vecuronium.

2. The oxygen-haemoglobin dissociation curve is shifted to the right by:
   a. Alkalosis
   b. Hypothermia
   c. Nitric oxide
   d. Respiratory depression
   e. Fetal haemoglobin.

3. In the neonate:
   a. The cricoid cartilage is the narrowest part of the upper airway
   b. The spinal cord ends at L1
   c. Free drug levels may be higher due to lower plasma albumin levels
   d. Shivering is effective in increasing body temperature
   e. Greater chest wall compliance decreases the FRC.

4. The following statements regarding obesity are true:
   a. A person with a BMI of 20-25kg/m² is considered obese
   b. Oxygen consumption increases with obesity
   c. A blood pressure cuff that is too small will underestimate the blood pressure
   d. Intramuscular opioid is the analgesic method of choice in an obese patient
   e. There is a significant risk of DVT in obese surgical patients.

5. The physiological response to major surgery includes:
   a. Hyperglycaemia
   b. Decreased protein metabolism
   c. Increased sympathetic nervous system activity
   d. An increase in urine output due to a reduction in ADH secretion
   e. Increased fibrinogen levels.

6. Thiopentone:
   a. Possibly exerts some of its effects via the GABA A receptor complex
   b. Dose requirements are lower in shocked patients
   c. Reduces cerebral oxygen utilisation
   d. Is safe in porphyria because it has no effect on ALA synthase
   e. Followed by suxamethonium is absolutely contra-indicated in patients with open eye injuries.

7. Ketamine:
   a. Has active metabolites
   b. Clearance is reduced by halothane
   c. Preserves cerebrovascular responsiveness to $CO_2$
   d. Is relatively contra-indicated as the sole agent in patients with ischaemic heart disease
   e. May be added to solutions used for caudal anaesthesia to prolong analgesia.

8. With regard to volatile agents:
   a. Enflurane is the agent of choice in a patient with epilepsy
   b. Isoflurane is more extensively metabolised than halothane
   c. Ether causes sympathetic stimulation
   d. Sevoflurane's high blood-gas partition coefficient allows for faster induction of anaesthesia than with halothane
   e. Desflurane has a boiling point of 23.5°C thus cannot be used in a standard vaporiser.

9. The following drugs cause recognised interactions:
   a. Alcohol and midazolam
   b. Aminophylline and erythromycin

c. Vecuronium and gentamicin
d. Verapamil and propranolol
e. Halothane and adrenaline (epinephrine).

10. The hazards of intra-operative blood transfusions include:
    a. Coagulopathy
    b. A shift in the oxygen-haemoglobin dissociation curve
    c. Hypokalaemia
    d. Metabolic alkalosis
    e. Malaria.

11. Non-depolarising neuromuscular blockade:
    a. Can be monitored by means of double-burst stimulation
    b. Does not show post-tetanic facilitation
    c. Is achieved by competitive agonists of postsynaptic acetylcholine receptors at the neuromuscular junction
    d. Is antagonised by volatile inhalational agents
    e. Is characterised by fasciculations.

12. A pulse oximeter:
    a. Utilises the Beer-Lambert law
    b. Reliably detects $SpO_2$ of 50%
    c. Is reliable when monitoring patients extracted from house fires
    d. Is unaffected by pigmented skin
    e. Is considered an essential monitor during anaesthesia.

13. With regard to anaesthetic breathing systems:
    a. The Lack system is a co-axial form of the Mapleson D system
    b. The Mapleson A system is inefficient when used for spontaneous ventilation
    c. Mapleson's classification describes the T-piece as a Mapleson C system
    d. The Jackson-Rees modification of Ayre's T-piece has low resistance to expiration
    e. With circle systems, the lowest fresh gas flow that can safely be used is 800ml/minute.

14. The following statements about the Rotameter are true:
    a. It is a constant pressure variable orifice flow meter
    b. Viscosity is the most important determinant of flow at high flow rates
    c. Small changes in temperature cause significant inaccuracies in flow measurement
    d. Static electricity may cause inaccuracies in flow meters
    e. $CO_2$ can safely be administered via a properly calibrated air Rotameter.

15. In obstetric anaesthesia:
    a. A sensory block to T9-10 is adequate for Caesarean Section under regional blockade
    b. Sodium citrate 0.3 molar is a suitable antacid
    c. The risk of hypoxia (maternal) is higher than in non-pregnant patients
    d. The incidence of post-dural puncture headache is reduced with pencil point needles
    e. NSAIDS are useful for post-operative analgesia in healthy patients following Caesarean Section.

16. When performing regional blocks:
    a. An axillary brachial plexus block is appropriate for shoulder surgery
    b. The tourniquet can be released 10 minutes after injection of local anaesthetic for a Bier's block
    c. There is a greater risk of pneumothorax with the supraclavicular than axillary approach to a brachial plexus block
    d. A 3-in-1 block is an appropriate technique for blocking the lumbar plexus
    e. Spinal opioids can cause itching.

17. With regard to hepatitis and HIV:
    a. The risk of transmission of HBV through a needlestick injury is similar to that for HIV
    b. Immunisation against HBV is effective provided that boosters are received every 2 years
    c. HIV is killed by immersion in hypochlorite solution
    d. HIV-infected patients commonly present for abdominal surgery
    e. HIV can cause myocarditis.

18. Problems with intubation are more common in patients:
    a. With a thyromental distance of > 6.5cm
    b. Having a Caesarean Section near term
    c. With rheumatoid arthritis
    d. With acromegaly
    e. With Down's syndrome.

19. In the neck:
    a. The thyroid cartilage is palpable at the level of C6
    b. The internal laryngeal nerve pierces the thyrohyoid membrane
    c. The vagus nerve lies outside the carotid sheath
    d. The common carotid artery bifurcates at level C6
    e. The subclavian artery passes anterior to scalenus anterior above the first rib.

20. Tension pneumothorax:
    a. May follow cannulation of the internal jugular vein
    b. Is diagnosed only on PA erect chest X-ray
    c. May cause tracheal deviation
    d. Is treated definitively by IPPV to maintain oxygenation
    e. Should be considered as a cause of cardiac arrest.

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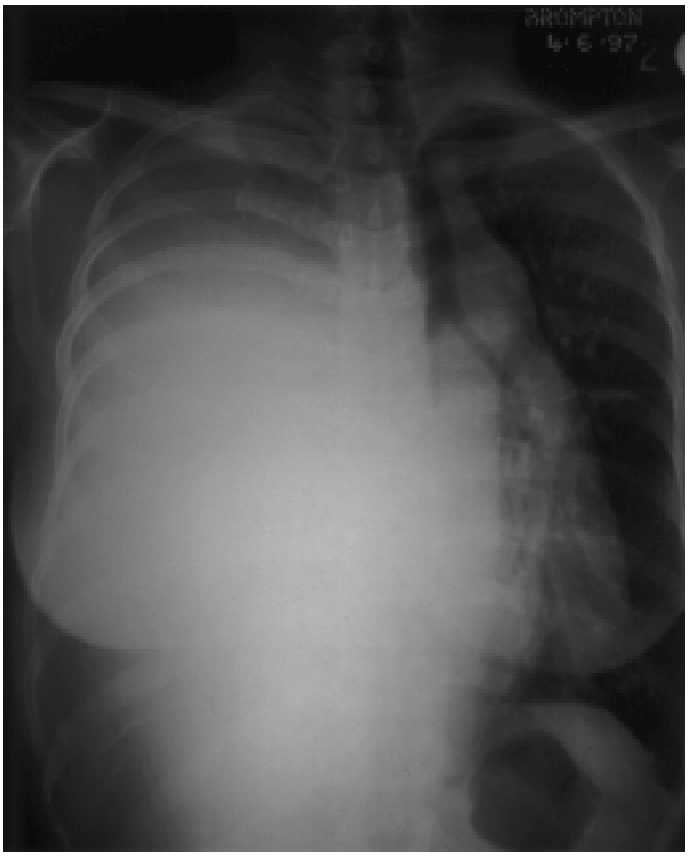
**Clinical Scenario**

You are asked to anaesthetise a 3-year-old child who requires an operation to stop bleeding 4 hours after an adenotonsillectomy. Describe your preoperative assessment, preparation, and anaesthetic technique for this case.

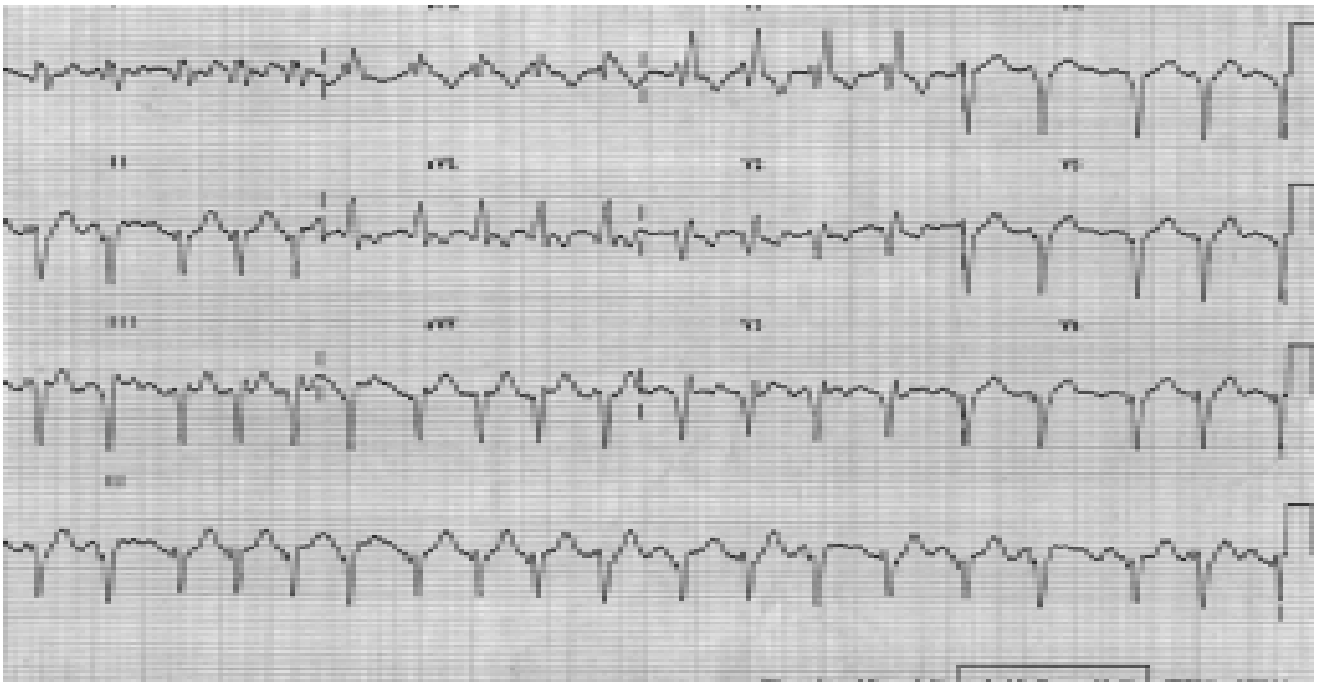
**X-Rays**

1. What abnormalities are shown on these x-rays? They are of the same patient, taken two weeks apart.
2. If anaesthesia was requested for a minor diagnostic procedure, describe how you would investigate the patient preoperatively and the anaesthetic technique you would employ.

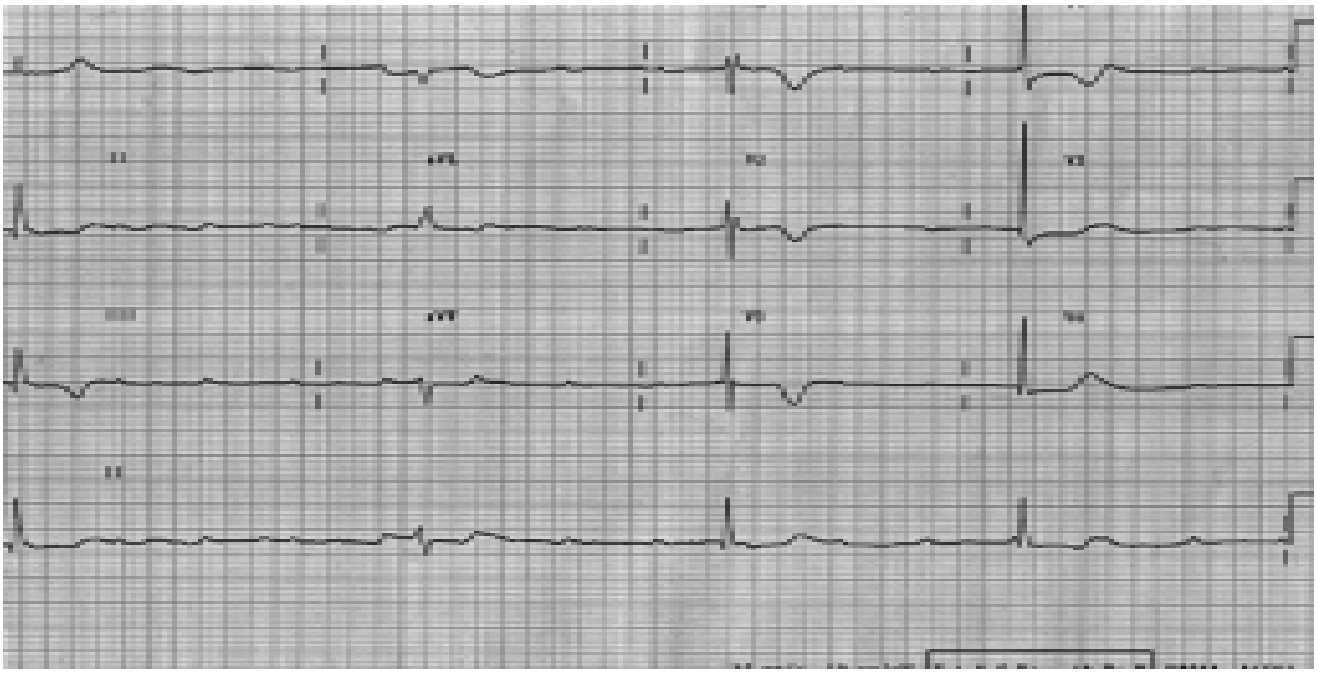


Interpret the following ECG's

**1.**



**2.**



## Answers

### Multiple Choice Questions

1. Hypotension:
   a. **T** - If used without atropine or glycopyrrolate, neostigmine may cause bradycardia that may in turn lead to hypotension.
   b. **T** - The vasodilation resulting from sympathetic blockade reduces venous return, stroke volume and cardiac output.
   c. **T** - IPPV also reduces venous return.
   d. **T** - Cardiac output drops with hypovolaemia.
   e. **F** - Vecuronium has little effect on blood pressure since there is minimal histamine release, ganglion blockade or vagal blockade.

2. The oxygen-haemoglobin dissociation curve is shifted to the right by:
   a. **F** - The curve is shifted to the left by alkalosis, hypothermia, hypocapnia and reduced 2,3-DPG levels. Acidosis, hyperthermia, hypercarbia and raised 2,3-DPG levels shift it to the right.
   b. **F**
   c. **F** - Nitric oxide has no effect on the ODC.
   d. **T** - Because of carbon dioxide retention.
   e. **F** - Fetal haemoglobin, methaemoglobin & carbon monoxide poisoning shift the curve to the left.

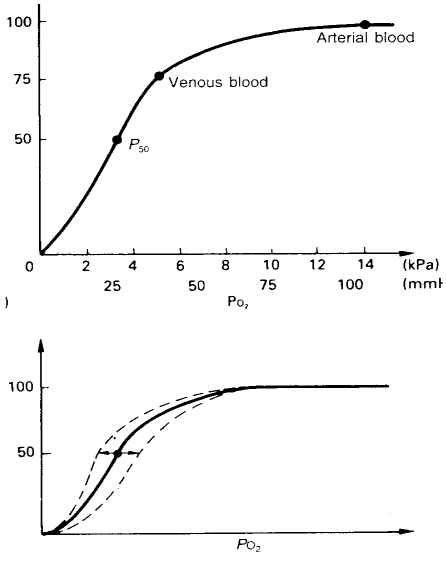



*Diagram 1: Oxyhaemoglobin dissociation curve: (a) normal; (b) shift to right or left*

3. Neonate:
   a. **T** - A small decrease in diameter (e.g. due to oedema) may cause a large increase in airway resistance. In the adult the glottis is the narrowest part of the upper airway.
   b. **F** - The spinal cord ends at L3 in the newborn. The dural sac extends as far as S3-S4, as opposed to S1 in the adult.

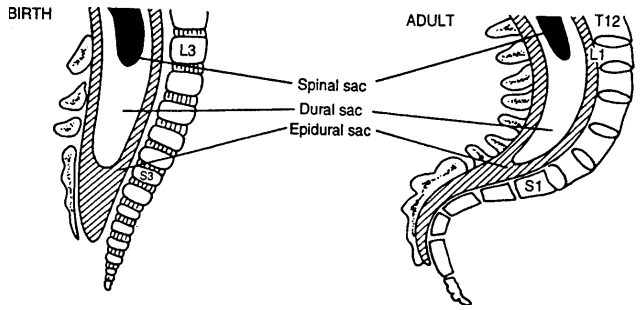



*Diagram 2: Age-related differences in the anatomy of the spinal cord and dural sac. The spinal cord (solid black) extends as far as L3 in the newborn and assumes the adult position of L1 at about 1 year of age. The dural sac extends as far as S3-S4 in the newborn and also achieves the adult postion of S1 at about 1 year of age.*

   c. **T** - Albumin levels in the child are low until about 1 year of age.
   d. **F** - The neonate depends on non-shivering thermogenesis, i.e. metabolism of brown fat. The latter is laid down from 22 weeks' gestation in the mediastinum, axillae, base of the neck and between the scapulae. Shivering does not occur until 3 months of age.
   e. **T** - Increased chest wall compliance allows it to be pulled inwards by the lung, decreasing the FRC, which may be less than the closing capacity. This, accompanied by an increase in $O_2$ consumption, predisposes the neonate to rapid desaturation.

4. Obesity:
   a. **F** - BMI (Body mass index) = body weight (in kg) / height squared ($m^2$)

| **BMI ($kg/m^2$)** | |
|---|---|
| <25 | normal |
| 25-30 | overweight |
| 30-35 | obese |
| >35 | morbidly obese |

Mortality & morbidity rise sharply when the BMI exceeds $30kg/m^2$.

Ref: Adams JP, Murphy PG. Obesity in anaesthesia and intensive care. British Journal of Anaesthesia 2000; 85: 91-108

   b. **T** - $O_2$ consumption & $CO_2$ production are increased due to the metabolic activity of adipose tissue & the increased workload on supportive tissues. FRC decreases because of reduced chest wall & lung compliance while closing capacity increases, adding to V/Q mismatch that is worsened in the supine position. This leads to impaired gas exchange & hypoxia. Possible sequelae include pulmonary vasoconstriction, pulmonary hypertension, right ventricular hypertrophy & failure. All these factors, coupled with the increased incidence of difficult intubation, predispose the obese patient to the risk of hypoxia on induction, during maintenance & after anaesthesia.
   c. **F** - Too small a cuff tends to over-estimate the blood pressure. It may occasionally be necessary to opt for invasive arterial pressure monitoring in these patients.

Ref: Hutton P, Prys-Roberts C (Ed.). Monitoring in Anaesthesia and Intensive Care. 1994. WB Saunders Company Ltd

   d. **F** - Intramuscular injections may be unpredictable & less effective than intravenous injections in these patients. PCA, if available, is a good option. If intravenous opioids are used small, titrated doses may be given but good nursing observation is required. Regional blocks supplemented by oral NSAIDS or paracetamol are very useful, but may be more difficult to perform.
   e. **T** -The incidence is high due to prolonged immobility with venous stasis, raised haematocrit, cardiac failure, reduced fibrinolysis following surgery, and pressure of the increased weight of the abdomen on deep veins. DVT prophylaxis is essential.

5. Physiological response to surgery: Surgery is a form of trauma that causes a stress response characterised by neuro-endocrine and inflammatory changes that are aimed at ensuring survival and promoting wound healing. It consists of a catabolic phase that lasts 5 (or more) days during which fuel production and delivery is increased, sodium and water are retained, and potassium is lost. This is followed by an anabolic phase in which a positive nitrogen balance allows for replacement of lost muscle, and fat stores are replenished. Anaesthetic agents and techniques may modify this stress response.
   a. **T** - Gluconeogenesis and glycogenolysis are increased by cortisol and catecholamines; insulin resistance also occurs.
   b. **F** - Protein catabolism is enhanced by cortisol.
   c. **T** - The sympathetic system, activated by

*Table 1. Principal hormonal response to surgery*

| **Endocrine gland** | **Hormones** | **Change in secretion** |
|---|---|---|
| Anterior pituitary | ACTH | Increases |
| | Growth hormone | Increases |
| | TSH | May increase or decrease |
| | FSH and LH | May increase or decrease |
| Posterior pituitary | ADH | Increases |
| Adrenal cortex | Cortisol | Increases |
| | Aldosterone | Increases |
| Pancreas | Insulin | Often decreases |
| | Glucagon | Usually small increases |
| Thyroid | Thyroxine, tri-iodothyronine | Decrease |

the hypothalamus, causes increased adrenal catecholamine secretion and noradrenaline release from adrenergic neurons.

d. **F** - ADH secretion is increased.
e. **T** - Fibrinogen is an acute phase protein.

Ref: Desborough JP. The stress response to trauma and surgery. British Journal of Anaesthesia 2000; 85: 109-117

6. Thiopentone:
   a. **T** - Although the mode of action is unclear, GABA A receptors do have a role in the action of barbiturates, benzodiazepines, propofol and etomidate on the CNS. Barbiturates bind to distinct sites on the GABA A receptor and facilitate their response to GABA. GABA receptor activation increases chloride conductance, hyperpolarizes post-synaptic membranes and thereby reduces neuronal excitability.
   b. **T** - It should be used with caution in patients who are likely to be sensitive to its hypotensive effects (e.g. hypovolaemia, myocardial disease, valve stenosis), and patients with reduced protein binding resulting in raised free drug levels (e.g. hepatic or renal disease, burns, the elderly, advanced malignancies)
   c. **T** - It also reduces cerebral blood flow and intracranial pressure. It can reduce cerebral $O_2$ consumption by up to 50%. The remaining $O_2$ is consumed during processes that are necessary to maintain the integrity of neuronal cells.
   d. **F** - Barbiturates induce ALA synthetase. Other drugs considered to be unsafe include etomidate, halothane, antihistamines, steroids, some NSAIDS, lignocaine, theophylline and pentazosine.

Ref: British National Formulary Sept 2000

   e. **F** - Thiopentone reduces intraocular pressure, while suxamethonium increases it slightly. The risk of aspiration and coughing should be balanced against the risk of raising intra-ocular pressure by using suxamethonium.

7. Ketamine:
   a. **T** - It is metabolised in the liver to several active metabolites. Norketamine has 20-30% of the activity of ketamine. The relative potencies of other metabolites have not yet been determined.
   b. **T** - Mean total clearance depends on hepatic blood flow. Halothane reduces hepatic flow.
   c. **T**
   d. **T** - It increases heart rate and blood pressure, thus increases myocardial oxygen demand.
   e. **T** - In children it has been used in a dose of 0.5mg/kg with a local anaesthetic.

Ref: Cook et al. Comparison of the effect of adrenaline, clonidine and ketamine on the duration of caudal analgesia produced by bupivacaine in children. British Journal of Anaesthesia 1995;75: 698-701

8. Volatile agents:
   a. **F** - Epileptiform EEG changes may occur particularly with hypocapnia, and may persist for several weeks. Seizures have been reported after enflurane anaesthesia therefore it is best avoided in epileptic patients.
   b. **F**- The extent of metabolism of volatile agents is as follows: halothane 20%, enflurane 2%, isoflurane 0.2%, desflurane 0.02%, sevoflurane 3-5%.
   c. **T** - There is little myocardial depression and blood pressure is maintained. Dysrhythmias are rare so the use of adrenaline is relatively safe. Ether also causes some bronchodilatation.
   d. **F** - Sevoflurane has a low blood-gas partition co-efficient (0.69 vs. 2.4 for halothane) making induction and recovery smooth and extremely rapid. The blood-gas partition co-efficients of the inhalational agents at 37ºC are: $N_2O$ 0.47, enflurane 1.9, isoflurane 1.4, desflurane 0.42, and ether 12.
   e. **T** - Since its boiling point is close to room temperature, standard vaporisers are unsuitable. The Desflurane vaporiser is electrically powered, heating it to 39ºC.

Fresh gas does not enter the vaporisation chamber. Instead, vapour (0-18%) is added to the fresh gas flow at the vaporiser outlet.

9. Drug interactions:
   a. **T** - Enhanced sedative effect
   b. **T** - Antibiotics that increase the plasma theophylline levels by inhibiting hepatic metabolism are erythromycin, clarithromycin, ciprofloxacin, and norfloxacin. Rifampicin decreases the levels.
   c. **T** - The effect of non-depolarising neuromuscular blocking drugs is enhanced by the following antimicrobials: aminoglycosides, clindamycin, colistin and piperacillin.
   d. **T** - There is a risk of severe hypotension, cardiac failure or asystole.
   e. **T** - Arrhythmias may occur if adrenaline or isoprenaline are used with halothane.

10. Blood transfusions:
   a. **T**
   b. **T**
   c. **F**
   d. **F**
   e. **T**

Infections that may be transmitted by blood transfusion are:

- Viral - Hepatitis B & C, HIV, HTLV-1, CMV, EBV
- Bacterial - contaminants during collection and storage (e.g. Pseudomonas, coliforms), syphilis, brucellosis, yaws
- Parasitic - malaria, trypanosomiasis, leishmaniasis.

The risk of transfusion-related infections can be reduced by screening donors and blood products, by using autologous blood, and by decreasing the amount of blood transfused. This can be achieved using the following strategies: accepting lower haemoglobin levels in healthy patients, pre-operative haemodilution, minimising intra-operative blood loss, and intra- and postoperative blood salvage. In addition, large blood transfusions may cause the following adverse effects:

- Coagulopathy due to reduced platelets, fibrinogen and factors V and VIII. Platelet and FFP administration should be guided by the platelet count, fibrinogen level and INR.
- Impaired oxygen delivery to tissues because of the left shift of the ODC in stored blood (up to 24 hours).
- Hyperkalaemia - rarely a problem except in patients with pre-existing hyperkalaemia, acidosis, hypothermia or in children. Potassium rapidly re-enters red blood cells after infusion and warming.
- Hypocalcaemia - following rapid transfusion.
- Acid-base imbalance - transfused blood has a low pH and may initially cause a metabolic acidosis. Alkalosis may follow the metabolism of citrate to bicarbonate. Citrate intoxication may result from rapid transfusion. A warm, well-oxygenated adult can metabolise the citrate content of one unit of CPD blood in 5 minutes. Rapid infusion may exceed the metabolic rate, causing tremors, arrhythmias, acidosis and hypocalcaemia.
- Hypothermia - therefore blood should be warmed. Rapid transfusion of cold blood may cause cardiac arrest.

A massive blood transfusion is defined as the replacement of the total blood volume with transfused blood within 24 hours, or the transfusion of more than 5 units of blood within 1 hour.

11. Neuromuscular blockade:
   a. **T** - *see below*
   b. **F** - *see below*
   c. **F** - competitive antagonists
   d. **F** - volatile agents potentiate neuromuscular blockade
   e. **F** - fasciculations are characteristic of depolarising neuromuscular blocking drugs.

Neuromuscular blockade (NMB) can be monitored by assessment of a muscle's mechanical response to peripheral nerve stimulation. When a supramaximal stimulus (20-60mA) is applied to a peripheral nerve, avoiding direct stimulation of the muscle, the response obtained allows differentiation between depolarising and non-depolarising blockade.

Train of four (TOF) involves four 0.2msec stimuli at 2 Hz while double burst stimulation (DBS) consists of two 50Hz tetanic stimuli of 40msec separated by a 750msec interval. Non-depolarising block is characterised by fade on testing with TOF or DBS (mechanical twitch in response to first stimulus is greater than that due to subsequent stimuli). Non-depolarising block is also characterised by post-tetanic facilitation (following a tetanic stimulus of 50Hz for 5 seconds a subsequent TOF response is increased).

Ref: Hutton P and Prys-Roberts (Ed.) Monitoring in Anaesthesia and Intensive Care. 1994. WB Saunders Company Ltd.

12. Pulse oximetry:
    a. **T**
    b. **F**
    c. **F**
    d. **T**
    e. **T**

The pulse oximeter is a non-invasive device used to determine arterial oxygen saturation. The probe consists of two light-emitting diodes emitting red (660nm) and infrared (940nm) light on one side, and a photodetector on the other. Oxy- and deoxyhaemoglobin absorb light at different wavelengths. Comparison of the absorbance at the two different wavelengths enables the oximeter to calculate oxygen saturation. The pulsatile nature of arterial blood flow allows the oximeter to differentiate it from venous blood.

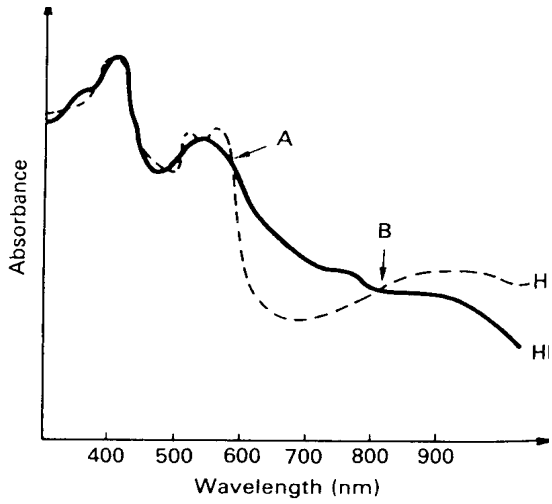



*Diagram 3: Absorbance of light by oxygenated (Hb0) and deoxygenated (Hb) haemoglobin. A and B are isobestic points.*

It is accurate in the 70-100% range. Machine calibration is done on healthy volunteers so that below 70%, saturation readings are, by necessity, extrapolated. Inaccuracies result from carbon monoxide (gives falsely high values), methaemoglobinaemia (reads 85% regardless of true saturation), coloured nail varnish, IV dyes (e.g. methylene blue), vasoconstriction, excessive movement, venous pulsation, and interference from external fluorescent light.

The Beer-Lambert law forms the basis of spectrophotometric techniques such as oximetry. It is a combination of two laws that describe the absorption of monochromatic light by a transparent substance through which it passes.

- Beer's law: intensity of transmitted light decreases exponentially as the concentration of the substance increases.
- Lambert's law: intensity of transmitted light decreases exponentially as distance travelled through the substance increases.

13. Breathing systems:
    a. **F** - Lack = co-axial A; Bain = co-axial D.
    b. **F** - It requires a FGF equal to minute ventilation. It is inefficient for controlled ventilation when FGF = 2,5-3 times the minute volume.
    c. **F** - Mapleson E.
    d. **T** - This is a reason for its popularity in paediatric anaesthesia.
    e. **F** - The minimum flow rate that can be used is a flow rate of 100% oxygen that matches the total $O_2$ consumption of the patient (as low as 200-300ml $O_2$/min, depending on metabolic demands). This is only achievable after an initial period of high flow that adequately denitrogenates the patient and delivers volatile anaesthetic at a high enough rate during the initial period of high uptake.

14. The rotameter:
    a. **T**
    b. **F**
    c. **F**
    d. **T**
    e. **F**

The Rotameter is a constant pressure, variable orifice flowmeter. Inflow occurs via a needle valve into a tapered glass tube, which widens toward the top. When gas flows, a light metal bobbin floats on the gas jet, the height of the bobbin in the calibrated tube indicating the flow rate. At low flow rates, flow is a function of gas viscosity since the relatively longer and narrower annulus behaves like a tube allowing laminar flow. The Hagen-Poiseuille equation can be applied to calculate flow through a tube:

$$Q = \frac{\pi P r^4}{8 \eta l}$$

where Q = flow through a tube
P = pressure across the tube
r = radius
l = length
$\eta$ = viscosity of the gas.

At high flow rates where the short wide annulus acts like an orifice, flow is turbulent. Here gas density is an important determinant of flow.

Each rotameter is accurately calibrated at specific pressure and temperature for its particular gas. Temperature changes encountered in clinical practice, however, have insignificant effects on accuracy of flow measurement.

Inaccuracies may result when the bobbin sticks against the tube because of tilting, static or dirt. Ensuring that the tube is vertical, clean & treated with an antistatic (a thin gold coating or an antistatic spray) will prevent errors in measurement.

15. Obstetric anaesthesia:
    a. **F** - A sensory block from T4-6 to S5 is required for adequate analgesia during Caesarean Section. Testing the sacral dermatomes is especially important with an epidural, as these nerve roots are not always blocked. This almost never happens with a spinal anaesthetic.
    b. **T** - Sodium citrate is non-particulate. Particulate antacids, if aspirated, may cause pneumonitis. In addition, they do not mix effectively with gastric contents.
    c. **T** - Factors contributing to the greater risk of hypoxaemia are the reduced FRC and increased oxygen consumption in pregnancy, and the higher incidence of difficult intubation in this group of patients.
    d. **T** - The incidence of post-dural puncture headache (PDPH) is increased when large gauge spinal needles are used, especially if the longitudinal dural fibres are cut transversely by the needle bevel (as with a Quincke point). Pencil point needles split the fibres longitudinally, reducing the risk of a CSF leak. The incidence of PDPH is <1% with 25-29G pencil point needles (e.g. Whitacre or Sprotte).
    e. **T**

16. Regional anaesthesia:
    a. **F**
    b. **F** - While intravenous regional anaesthesia is relatively simple, the technique may be extremely hazardous if caution is not exercised. Measures to ensure safety include: siting a second intravenous cannula in a limb other than the operation site; use of an anaesthetic agent considered to be safe for IVRA (e.g. prilocaine, up to 5mg/kg without adrenaline; bupivacaine is contra-indicated for this purpose); use of a double cuffed tourniquet which has been checked for integrity; injecting the drug slowly so as to avoid exceeding the pressure in the tourniquet; not releasing the tourniquet before at least 20 minutes have elapsed since time of injection.
    c. **T** - Complications of brachial plexus blocks *see table below*
    d. **T** - Regional anaesthesia for the lower limb:
    The lumbar plexus originates from the primary ventral rami of L1-4 ± a contribution from T12. It lies between the quadratus lumborum and psoas muscles. It may be blocked by either an approach from the groin (3-in-1 block) or a posterior approach (lumbar plexus block).
    e. **T** - Neuraxial opioids:
    Opioids were first used clinically by the epidural and intrathecal routes in 1979.Their advantage over local anaesthetic given by these routes is that

they produce analgesia without affecting sensory, motor and autonomic function. They bind to opioid receptors in the spinal cord and periaqueductal grey matter of the midbrain, and produce analgesia by inhibiting pain pathways in the dorsal horn of the spinal cord and by stimulating descending inhibitory neuronal pathways. (Gate theory of pain, Melzack & Wall). They are used mainly in combination with local anaesthetics for both intraoperative postoperative analgesia. The combination may result in better analgesia of longer duration than local anaesthetics alone, and because a lower dose of local anaesthetic is used, there may be less motor block and hypotension. The required dose, onset and duration of action, and side effects of spinally administered opioids will depend on their lipid-solubility, molecular weight and shape, degree of ionisation, and the epidural blood flow. These factors affect dural and spinal cord permeability and the systemic absorption of the drugs via epidural veins. Unfortunately, complications of spinally administered opioids include respiratory depression, nausea and vomiting, pruritis (itching) and urinary retention. Pruritis is common after epidural (8.5%) and intrathecal (46%) opioids and may be treated with systemic antihistamines or naloxone.

Ref: Ballantyne et al. Pain 1988;33:149-160

17. Hepatitis and HIV:
    a. **F** - The risk of transmission of HIV is 0.3-0.5% whereas that for HBV is 30%
    b. **F** - Boosters are required every 5 years
    c. **T** - HBV and HIV are killed by autoclaving, ionising radiation, hypochlorite, formaldehyde, and gluteraldehyde
    d. **T** - Abdominal symptoms occur in 20-30% of HIV patients, and the diagnosis of acute abdomen may be difficult. Conditions that may present include GI perforation or obstruction, cholecystitis, acute appendicitis (twice as common), anorectal disease and haemorrhage
    e. **T** - HIV may cause a lymphocytic myocarditis. In advanced AIDS it may be caused by Cryptococcus, toxoplasmosis, Coxackie B, CMV, Nocardia, Aspergillus, and lymphoma.

18. Difficult intubation:
    a. **F**
    b. **T**
    c. **T**
    d. **T**
    e. **T**

Failure to intubate is relatively uncommon but an accurate preoperative assessment of the likely difficulty is obviously very important. Tests that may be used preoperatively include:

1. The Mallampati test: Class 1 = easy, class 4 = difficult. It will predict only 50% of difficult intubations.
2. Thyromental distance >6.5cm = easy (Patil)

***Table - Complications of brachial plexus block***

| | **Interscalene** | **Supraclavicular** | **Axillary** |
|---|---|---|---|
| Phrenic nerve block | + | + | - |
| Recurrent laryngeal nerve block | + | + | - |
| Horner's syndrome | + | + | - |
| Extradural/intrathecal injection | + | - | - |
| Intravascular injection | Vertebral artery | Subclavian vessels | Axillary vessels |
| Pneumothorax | - | ++ | - |
| Nerve damage | + | + | + |

3. Wilson et al devised a more complex scoring system based on body weight, extent of head, neck & jaw movement, and presence of receding mandible and prominent teeth.

19. Neck anatomy:
    a. **F** - The cricoid cartilage is palpable at C6 and the thyroid cartilage at C4-5
    b. **T**
    c. **F**
    d. **F** - It bifurcates at the level of C3
    e. **F** - The artery passes posterior to the scalenus anterior muscle.

20. Tension pneumothorax:
    a. **T** - but it is less likely than with the subclavian approach
    b. **F** - It is a clinical diagnosis. It is a medical emergency, and treatment (i.e. needle decompression in 2nd intercostal space, mid-clavicular line) is required before a chest X-ray is taken
    c. **T** - away from the side of the pneumothorax
    d. **F** - IPPV will increase tension. The large bore needle (as above) is left in place until an intercostal drain has been inserted

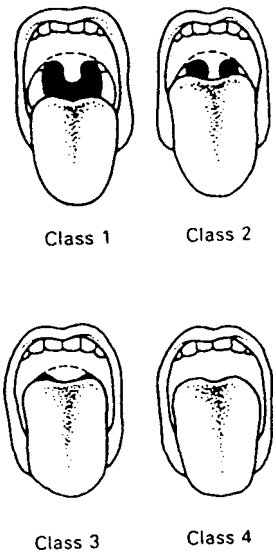



*Diagram 8: Modified Mallampati classification of pharyngeal appearance.*

    e. **T** - It must be considered as one of the causes of pulseless electrical activity (or EMD = electromechanical dissociation). The causes to be excluded are
        - Hypoxia
        - Hypovolaemia
        - Hypothermia
        - Hyper- or hypokalaemia or metabolic disorders
        - Tension pneumothorax
        - Tamponade
        - Toxic or therapeutic disturbances
        - Thromboembolic/mechanical obstruction.

**Clinical Scenario - answer**

**Problems:** Hypovolaemia, full stomach as a result of swallowed blood, and difficulties with intubation due to presence of blood and oedema in the upper airway.

**Assessment and resuscitation:** assess airway, breathing and circulation, and resuscitate as necessary. Signs of blood loss include slow capillary refill, pallor, and a rapid, low volume pulse. Restlessness, confusion and a low blood pressure are late signs. It is easy to underestimate blood loss because large amounts may have been swallowed. Blood should be cross-matched and a full blood count and coagulation screen performed. Fluid replacement should be undertaken with crystalloid, colloid or blood, depending on how much blood has been lost. Hypovolaemia should be corrected before induction of anaesthesia because of the risk of cardiovascular collapse. The anaesthetic chart from the previous procedure should provide the rest of the information necessary to complete the anaesthetic assessment; difficulty with intubation and the size of the ET tube should be noted.

**Preparation of the operating theatre.** Two suction devices capable of removing blood clots (one may block when it is most needed), spare laryngoscopes (bulbs may become covered in blood) and tracheal tubes in a range of sizes (post operative oedema may reduce the size of the airway).

**Anaesthetic technique.** The commonest technique used is probably a rapid sequence induction using an intravenous induction agent and suxamethonium with pre-oxygenation and cricoid pressure. This technique may not be appropriate if proper pre-oxygenation is impossible (brisk bleeding or uncooperative patient)

or if difficulty was experienced in intubating the patient for the original procedure (the presence of blood and oedema will certainly make it more difficult now!)

An alternative technique is a gaseous induction with the patient in the lateral position.

Because of the potential hypovolaemia, maintenance of anaesthesia is probably best achieved with a low concentration of volatile anaesthetic, muscle relaxation and IPPV.

Further fluids and blood should be transfused as necessary. An orogastric tube should be used to empty the stomach before extubation, and extubation should be performed in the lateral position with the child fully awake.

**C. Answer to chest Xray**

1. The first x-ray shows widespread opacification of the right hemithorax due to a pleural effusion. The mediastinum is shifted to the left. The second x-ray, taken after aspiration of the effusion, shows a large mediastinal mass and some residual pleural fluid. In this case it was an aggressive lymphoma.
2. These patients commonly present for minor procedures to establish a tissue diagnosis (e.g. lymph node biopsy). Tumours in this region may compress the tracheobronchial tree, the main pulmonary artery, the atria, or the superior vena cava, and can cause life-threatening complications during anaesthesia.

Large pleural effusions should be drained prior to anaesthesia. Symptoms of shortness of breath, an inability to lie flat or stridor indicate large airway compression. Induction of anaesthesia may be associated with complete airway obstruction. This is particularly associated with the loss of spontaneous ventilation. Intubation may be difficult because of compression and distortion of the trachea. Distended veins in the upper half of the body, oedema of the head and neck, collateral vessels in the chest wall and cyanosis are signs of superior vena caval obstruction. Respiratory symptoms may be due to engorged veins in the airway and mucosal oedema. A decreased level of consciousness may be due to cerebral oedema (venous hypertension). These patients often have an airway that is difficult to manage and intraoperative bleeding can be a major problem. A CT scan of the chest should be performed. This will demonstrate any compression of vital structures. Additionally, flow/volume loops and echocardiography may be useful.

Because of the potential complications of general anaesthesia, these patients should always have procedures performed under local anaesthesia if possible. If this is not possible and the patient is symptomatic or if compression is demonstrated on the CT scan, consideration should be given to using radiotherapy or chemotherapy to shrink the tumour before a tissue diagnosis is obtained. If general anaesthesia is unavoidable, the following strategies should be considered.

**Tracheobronchial compression:**

- Awake intubation.
- Maintenance of spontaneous ventilation.
- Extreme caution with muscle relaxants.
- Ability to change the patient's position (obstruction may be less in the prone or lateral positions).
- Availability of a rigid bronchoscope to bypass the obstruction.
- ? Availability of cardiopulmonary bypass if the airway is lost completely.

**Compression of the pulmonary artery and heart:**

- Be able to change patient position.
- Maintain preload.
- Avoid negative inotropes. Ketamine may be a suitable agent.
- Have cardiopulmonary bypass available.

**SVC obstruction:**

- Head-up position to reduce swelling.
- IV lines in lower extremity.
- Treat the airway with caution (oedema, and potential for bleeding from minor trauma).
- Cross-match blood for even minor procedures,

Ref: Miller RD. Anaesthesia. 5th Ed. 2000. Churchill-Livingstone)

**D. Answer to ECG:**

1. Atrial fibrillation / flutter
   RBBB
   Left axis deviation (possibly L anterior hemiblock)
2. Complete heart block with ventricular escape.