MULTIPLE CHOICE ANSWERS

1. TTTFT

Beta-blockers depress contractility and slow the heart. They were traditionally avoided in all forms of heart failure, but now, under the guidance of a cardiologist they may be useful in the treatment of some cases of heart failure. They may also precipitate asthma and should therefore be avoided in patients with a history of asthma or chronic obstructive pulmonary disease. Beta-blockers are avoided in patients with second or third degree heart block. Other side effects include fatigue, extremity coldness and glucose intolerance. Beta-blockers are a treatment for angina.

2. TFFFT

Normal ranges of physiological values in a 3 year old child include:

- Systolic blood pressure 80 - 100 mmHg
- Pulse rate 95 - 140
- Respiratory rate 25 - 30

Using the formula: Weight (in kg) = (Age +4) x 2

- Weight (approximately)14 kg

The tidal volume is 5 - 7 ml per kg for all ages, and the circulating blood volume is 75 - 80 ml per kg, which gives the following values:

- Tidal volume 70 - 98 ml
- Circulating blood volume 1050ml

3. FTFFT

The larynx of a child is situated at a higher level. The infant larynx is level with the third cervical vertebra compared to C6 in an adult. The epiglottis is U shaped and relatively long and the cricoid cartilage forms the narrowest part of the larynx prior to puberty. An inappropriately large tube may pass easily through the cords, and cause trauma at the level of the cricoid cartilage. The mucosa of a child is susceptible to oedema and this may result in airway obstruction after extubation. Children are prone to laryngospasm.

4. FTFFT

Inhalational agents that have a high degree of solubility in blood are absorbed in greater quantities during anaesthesia, and on termination of anaesthesia they are relatively slow at passing into the lung. A quantity of agent dissolved in a volume of blood will have a relatively low 'partial pressure' (when compared with agents with low solubility), and it is the 'partial pressure' that causes the agent to come out of solution in the lungs. The recovery from anaesthesia with an agent that is highly soluble in blood will therefore be slow.

In a high cardiac output state, the inhaled vapour is removed from the lungs and distributed around the body, preventing a sufficient 'partial pressure' from quickly building up. The 'partial pressure' build up in the lungs reflects the 'partial pressure' elsewhere in the body, including the brain. Induction is therefore slow.

Increasing oxygen does not affect the level of anaesthesia (unless there is a significant decrease in nitrous oxide). While trichloroethylene, methoxyflurane and ether produce good analgesia, other volatiles have little or no analgesic effects, and other analgesics are required to produce balanced anaesthesia during painful procedures. Anaesthetic effect is related to the partial pressure of the agent in the brain. At equilibrium (where the same partial pressure exists in blood and alveolar gas) the partial pressure in the brain bears a constant relationship to the partial pressure / concentration of the agent in the alveoli. The MAC or Minimum Alveolar Concentration is the concentration in the alveoli, at atmospheric pressure, that prevents movement in 50% of patients when exposed to a noxious stimulus such as skin incision. It is inversely proportional to the solubility of the drug in oil and is a measure of drug potency.

5. TTTFT

Stomach emptying can be slowed by many factors including trauma, anxiety, shock, hypothermia, intestinal obstruction, fatty foods, peritonitis, hypokalaemia, opioids, hyperglycaemia, anticholinergics, uraemia. Emptying may be slowed in late pregnancy

6. FTFTF

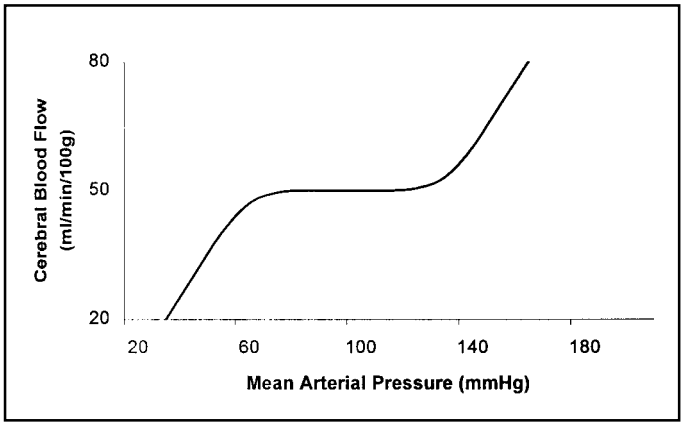
Cerebral blood flow (CBF) is related to the cerebral perfusion pressure.

CPP = MAP - (ICP + CVP)

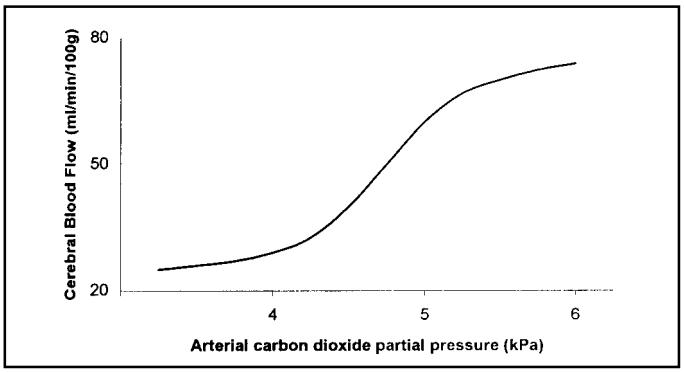
- ICP = Intracranial Pressure
- CVP = Cerebral Venous Pressure
- CPP = Cerebral Perfusion Pressure
- MAP = Mean Arterial Pressure

An increase in intracranial pressure therefore results in a reduction in cerebral blood flow. In a person with normal intracranial haemodynamics however, the blood flow is kept constant over a wide range of blood pressures due to "autoregulation". Loss of such autoregulation is common following head injury.

Cerebral Autoregulation



Cerebral Response to Blood Gases



CBF is increased by:
- Ketamine
- All volatile anaesthetics (Isoflurane has the least effect)

CBF is decreased by:
- Thiopentone
- Methohexitone
- Etomidate
- Propofol

ICP rises with an increase in intracranial contents. Increased CBF secondary to vasodilatation, leads to an increase in the volume of intracranial blood and may produce a rise in ICP. Anaesthetic agents that cause a marked increase in cerebral blood flow should be avoided in patients with raised ICP.

High CO_2 levels increase cerebral blood flow by vasodilatation, as do arterial oxygen partial pressures below 8kPa (60mmHg).

The veins draining the head have no valves preventing back flow of blood. A head down position therefore causes an increase in intracranial venous pressure. This effect causes little more than discomfort in patients with no intracranial pathology. However even a modest rise in ICP in patients with intracranial pathology may result in reduced CBF. A similar rise in cerebral venous pressure may result from tight neck collars or neck haematomas.

7. TTTTT

Sympathetic stimulation leads to a collection of effects called the "fright and flight" response. This includes a number of changes that include tachycardia, increased myocardial contractility and vasoconstriction in arterioles in the skin and gut. In contrast, vessels supplying blood to skeletal muscles dilate. The blood pressure rises in response to an increase in cardiac output and an increase in systemic vascular resistance.

Sympathetic stimulation can be produced by both the sympathetic nervous system and by circulating hormones from the adrenal medulla (adrenaline and noradrenaline). The sympathetic nervous system leaves the central nervous system from thoracic and lumbar spinal levels (T_1 - L_2, called the thoraco-lumbar outflow). When these nerves are blocked by spinal or epidural anaesthesia, the resulting vasodilatation can lead to a drop in blood pressure. If the sympathetic nerves that supply the heart (T_1 - T_4) are blocked, both heart rate and myocardial contractility will fall, and profound hypotension can result.

The parasympathetic nervous system produces opposite effects to the sympathetic nervous system, and acts to balance the sympathetic effects.

8. TTTFF

Factors affecting the height of a spinal anaesthetic block include:
- Local anaesthetic dose (i.e. volume multiplied by concentration) with respect to the size of the patient
- Local anaesthetic density (baricity)
- Patient posture
- Patient factors

Volume has a relatively minor effect on spread if dose is kept constant. The level chosen for spinal injection has little effect on the height of block achieved as the injection for spinal anaesthesia can only be carried out at L_2/L_3, L_3/L_4 or L_4/L_5. The spinal cord is present at and above L_1 and spinal cord damage may result from injections at or above this level, and the fused sacrum prevents injection below L_5. Needle size and the direction of the bevel have little effect on the level of block.

Many patient factors can affect the eventual height of block:
- Age - older patients require smaller doses
- Height - taller patients require a larger doses
- Weight - obese patients require smaller doses
- Pregnancy - patients require smaller doses
- Kyphosis / Scoliosis may affect the spread of local anaesthetic

Factors affecting duration of a spinal anaesthetic include:
- Dose of anaesthetic given
- Local anaesthetic agent chosen
- Addition of adrenaline

9. TTFTF

Cardiac tamponade results from a build up of blood or other fluid in the pericardium. If this interferes with normal filling of the heart ventricles, symptoms may include tachycardia, hypotension, a high jugular venous pulsation that rises on inspiration and muffled heart sounds. The volume of the pulse falls in inspiration - "pulsus paradoxus". If cardiac tamponade is recognised as the cause of shock it should be treated by immediate drainage.

10. FFFTT

All solutions of suxamethonium are destroyed by alkali, and should never be mixed with thiopentone. A small proportion of people take a long time to metabolise suxamethonium. Multiple doses also sometimes cause prolonged paralysis and in both these situations, patients may require ventilation for a few hours before muscle function returns. Suxamethonium frequently causes bradycardia, especially with a second dose in children. Some patients release high levels of potassium following suxamethonium (in particular, patients a few days following burns or spinal cord injuries, or severe muscle trauma), and this may result in serious life threatening arrhythmias or a cardiac arrest.