Important Complications of Anaesthesia

Anaesthesia

Anaesthesia is from the Greek and means ‘loss of sensation’. Anaesthesia allows invasive and painful procedures to be performed with little distress to the patient.

There are three main types of anaesthesia

- **General anaesthesia**: the patient is sedated, using either intravenous medications or gaseous substances, and occasionally muscles paralysed, requiring control of breathing by mechanical ventilation
- **Regional anaesthesia**: this can be described as central where anaesthetic drugs are administered directly in or around the spinal cord, blocking the nerves of the spinal cord (eg, epidural or spinal anaesthesia). The main benefit of this method is that ventilation is not needed (provided the block is not too high). Regional anaesthesia can also be peripheral - for example:
  - Plexus blocks - eg, brachial plexus.
  - Nerve blocks - eg, femoral.
  - Intravenous blocks whilst preventing venous flow out of the region - eg, Bier's block.
- **Local anaesthesia**: the anaesthetic is applied to one site, usually topically or subcutaneously.

Important complications of general anaesthesia

The practice of anaesthesia is fundamental to the practice of medicine. However, anaesthesia is not without its problems. It is difficult to determine exactly the incidence of deaths directly attributable to general anaesthetics, as the cause of death is often multifactorial and study methodology varies making comparisons difficult. Estimates of the number of deaths where general anaesthesia was the direct cause have been quoted in the range from 1:10,000 operations to 1:1700 (study in 1982 by the Association of Anaesthetists of Great Britain and Ireland). Nonetheless, in 1987 a confidential enquiry into perioperative deaths revealed that very few deaths were actually as a direct result of general anaesthesia - incidence of 1 in 185,086 (first Confidential Enquiry into Perioperative Deaths (CEPOD)).[1]

Figures of anaesthetic-related morbidity are more difficult to determine. Estimates suggest that up to 2% of intensive care unit admissions at any one time are related to anaesthetic problems.[1] Although general anaesthesia is not without risk, it should be remembered that it allows necessary procedures to be performed in a humane way - without which the patient might otherwise die. Along these lines, if a patient is high-risk for a general anaesthetic (eg, pre-existing comorbidities) then they should still be referred for surgery like any other patient. The decision to operate and which form of anaesthesia to use should then be decisions made by the surgeon and anaesthetist.

Important complications of general anaesthesia

- Pain.
- Nausea and vomiting - up to 30% of patients.
- Damage to teeth - 1 in 4,500 cases.
- Sore throat and laryngeal damage.
- Anaphylaxis to anaesthetic agents - figures such as 0.2% have been quoted.
- Cardiovascular collapse.
- Respiratory depression.
- Aspiration pneumonitis - up to 4.5% frequency has been reported; higher in children.
- Hypothermia.
- Hypoxic brain damage.
- Nerve injury - 0.4% in general anaesthesia and 0.1% in regional anaesthesia.
- Awareness during anaesthesia - up to 0.2% of patients; higher in obstetrics and cardiac patients.
Some specific complications of general anaesthesia

Anaphylaxis

- Anaphylaxis can occur to any anaesthetic agent and in all types of anaesthesia. The severity of the reaction may vary but features may include rash, urticaria, bronchospasm, hypotension, angio-oedema, and vomiting. It needs to be carefully looked for in the pre-operative assessment and previous general anaesthetic charts may help.
- Patients who are suspected of an allergic reaction should be referred for further investigation to try to determine the exact cause. If necessary, this may involve provocation testing or skin prick testing and patients should be referred to local immunologists. Anaphylaxis needs to be promptly recognised and managed and patients should be advised to wear a medical emergency identification bracelet or similar once they recover.

Aspiration pneumonitis

- A reduced level of consciousness can lead to an unprotected airway. If the patient vomits they can aspirate the vomitus contents into their lungs. This can set up lung inflammation with infection. The risk of aspiration pneumonitis and aspiration pneumonia is reduced by fasting for several hours prior to the procedure and cricoid cartilage pressure during induction of anaesthesia. However, the evidence for the use of cricoid pressure is not clearly documented and further investigation is required.
- Other methods of reducing aspiration pneumonitis associated with anaesthesia are the use of metoclopramide to enhance gastric emptying and ranitidine or proton pump inhibitors to increase the pH of gastric contents. The evidence for the benefit of these methods appears promising.
- Aspiration pneumonitis may also occur in spinal anaesthesia if the level of spinal block is too high, leading to paralysis or impairment of the vocal cords and respiratory impairment.

Peripheral nerve damage

- This can occur with all the types of anaesthesia and results from nerve compression. The most common cause is exaggerated positioning for prolonged periods of time. Both the anaesthetist and the surgeons should be aware of this potential complication and patients should be moved on a regular basis if possible. The severity varies and recovery may be prolonged. The most common nerves affected are the ulnar nerve and the common peroneal nerve. More rarely, the brachial plexus may be affected.
- Injury to nerves can be avoided by prevention of extreme postures for lengthy periods during surgery. If nerve damage occurs then patients should be followed up and further investigations such as electromyography may be required.

Damage to teeth

It is now common practice to check the teeth in the anaesthetist’s pre-operative assessment. Damage to teeth is actually the most common cause of claims made against anaesthetists. The tooth most commonly affected is the upper left incisor.

Embolism

Embolism is rare during an anaesthetic but is potentially fatal. Air embolism occurs more commonly during neurosurgical procedures or pelvic operations. Prophylaxis of thromboembolism is common and begins pre-operatively with thromboembolic deterrents (TEDS) and low molecular weight heparin (LMWH).
Central regional anaesthesia was first used at the end of the 18th century. It provided a method of blocking afferent and efferent nerves by injecting anaesthetic agents in either the epidural space around the spinal cord (epidural anaesthesia) or directly in the cerebrospinal fluid surrounding the spinal cord (ie in the subarachnoid space called spinal anaesthesia). All nerves are blocked including motor nerves, sensory nerves and nerves of the autonomic system. Epidural anaesthesia takes slightly longer than spinal anaesthesia to take effect and provides predominantly analgesic properties. With both, the need for muscle paralysis and ventilation is not usually required but there is a risk that a high block will impair respiration, meaning that ventilation will be necessary. Results from a review of 114 studies and a Cochrane systematic review have shown that regional anaesthesia is associated with reduced mortality and reduction in serious complications in comparison with general anaesthesia.\[8, 9\]

**Important complications of regional anaesthesia**

- Pain - 25% of patients still experience pain despite spinal anaesthesia.
- Post-dural headache from cerebrospinal fluid (CSF) leak.
- Hypotension and bradycardia through blockade of the sympathetic nervous system.
- Limb damage from sensory and motor block.
- Epidural or intrathecal bleed.
- Respiratory failure if block is ‘too high’.
- Direct nerve damage.
- Hypothermia.
- Damage to the spinal cord - may be transient or permanent.
- Spinal infection.
- Aseptic meningitis.
- Haematoma of the spinal cord - enhanced by use of LMWH pre-operatively.
- Anaphylaxis.
- Urinary retention.
- Spinal cord infarction.
- Anaesthetic intoxication.\[10\]

**Some specific complications of regional anaesthesia**

**Post-dural puncture headache**

- Post-dural puncture headache is very common after spinal anaesthesia and especially in young adults and obstetrics. The headache results from CSF leak from the puncture site. It is enhanced by use of larger-gauge needles and reduced by pencil-tipped needles. Presenting symptoms may include headache, photophobia, vomiting and dizziness.\[11\]
- Post-dural puncture headache is usually treated with analgesia, bed rest and adequate hydration. The evidence does not suggest that bed rest prevents or changes the outcome.\[12, 15\] Occasionally epidural blood patch is used where 15 ml of the patient’s blood are injected at the site of the meningeal tear.\[11\] Caffeine is also used and acts as a stimulant of the CNS and has shown benefit.\[14\] Other medications with benefit include gabapentin, theophylline and hydrocortisone.\[14\] Subcutaneous sumatriptan, adrenocorticotropic hormone (ACTH) and epidural saline have not shown consistent benefits.\[12, 14\]

**Total spinal block**

Total spinal block can occur with the injection of large amounts of anaesthetic agents into the spinal cord. It is detected by a high sensory level and rapid muscle paralysis. The block moves up the spinal cord so that respiratory embarrassment may occur, as can unconsciousness. In these situations the patient needs prompt assessment and may need to be intubated and ventilated until the spinal block wears off.

**Hyptension**

- Up to half of patients receiving spinal anaesthesia will develop transient hypotension as sympathetic nerves are blocked. This usually responds to prompt fluid replacement, usually starting with crystalloids followed by colloids. Occasionally hypotension can be severe and may require vasopressors along with fluids.\[10, 15\]
Care must be taken in patients with a cardiac history, as they may develop myocardial ischaemia with minor drops in blood pressure.\textsuperscript{[16]} It is suggested that heart rate variability prior to spinal anaesthesia represents autonomic dysfunction and may help determine patients who are more likely to develop hypotension.\textsuperscript{[17]}

Cases of bradycardia with asystole leading to cardiac arrest have also occurred and it appears the underlying aetiology is complicated and not just related to autonomic dysfunction.

**Neurological deficits**

- Cauda equina syndrome may occur and can be transient or permanent. This is a common reason for patients to refuse spinal anaesthesia. There may also be traumatic injury to the spinal cord.\textsuperscript{[10, 18]}
- Adhesive arachnoiditis is a longer-term sequela of spinal anaesthesia, occurring weeks and even months later.\textsuperscript{[18]} It is characterised by proliferation of the meninges and vasoconstriction of spinal cord blood vessels. This results in gradual sensory and motor deficits from ischaemia and infarction of the spinal cord.\textsuperscript{[19]}

**Important complications of local anaesthesia**

- Pain.
- Bleeding and haematoma formation.
- Nerve injury due to direct injury.
- Infection.
- Ischaemic necrosis.

All forms of anaesthetics are invasive to a patient and therefore consent should be obtained as for other procedures. Ideally patients should be given a leaflet regarding anaesthesia and then counselled regarding the intended benefits and the risks of anaesthesia. In a general practice setting it will be the responsibility of the clinician who administers the local anaesthesia to ensure good, non-coercive consent is obtained.

**Further reading & references**

15. Complications of Regional Anaesthesia.; Anaesthesia UK, 2005

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