

ANAESTHESIA COMPLICATIONS: AN OVERVIEW

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ABSTRACT

Anaesthesia means total or partial loss of sensation to touch or pain and it caused by administering anaesthetic drugs to provide surgery. The anaesthetic drug which administered for medical or surgical process may be general, regional or local and it depend upon the method of administration and the body area affected. Anaesthesia is generally safe, but complications may occur. General anaesthesia carries highest risk and local anaesthesia carries lowest risk. Any allergic reactions to the anaesthetic drugs can be life threatening and can be occur with any type of anaesthesia. Generally local anaesthetic drugs having few adverse reactions like nausea, vomiting and also be soreness at the injection site. Regional anaesthesia has high risk of complications including hypotension, back ache and head ache, inability to urine, and paralysis of the affected area. General anaesthesia affects the entire body and cause greatest number of complications such as sore throat, drowsiness, dizziness and damage to teeth; but most side effects clear up within 24 hours. General anaesthesia also carries some serious complications such as stroke, heart attack, brain damage and death. The main aim of this paper to highlight the complications of different types of anaesthesia during surgery.

Keywords: Anaesthesia, Complications, Loss of sensation

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INTRODUCTION

Anaesthesia means 'loss of sensation'. Anaesthetics are the medications that provide anaesthesia. Anaesthetics are mainly used to induce sleep, it help to prevents pain and discomfort and enables the medical procedure to be performed during tests and surgical operations. Different states of anaesthesia include amnesia, immobility in response to noxious stimulation, attenuation of autonomic responses to noxious stimulations, analgesia, and unconsciousness. There are mainly three types of anaesthesia including General anaesthesia, Local anaesthesia, and Regional anaesthesia. General anaesthetics are drugs which used to produce reversible loss of all sensation and consciousness. Local anaesthetics are drugs which cause reversible loss of the senses and pain in restricted areas of patient's body upon topical application or local injections [1]. Regional anaesthetics are the drugs which administered directly in or around the spinal cord. Blocking the nerves of the spinal cord and so it also called as spinal anaesthesia, which is commonly used in many surgical procedures and it has particular advantages that it is a very safe and simple method and that only very small dose of drug may produce profound effect.

Anaesthesiologist has improved upon techniques which help to reduce pain during surgery and at the same time increasing the safety of patient. Combined spinal-epidural, continuous epidural infusions, walking epidurals and patient controlled epidural analgesia (PCEA) are

some newer techniques which available. Anaesthesia can be maintained with oxygen, air and isoflurane. Laryngoscope and endotracheal intubation is performed after confirming adequate muscle relaxation by using neuromuscular monitoring. Oxygen saturation, end-tidal CO₂, non-invasive blood pressure and heart rate are monitored during induction and throughout the surgical procedure. The anaesthetic techniques are standardized for all patients. All patients are monitored continuously. Mainly patient's vital parameters are monitored continuously throughout the perioperative period where anaesthesia is administered. Anaesthesiologists do not receive formal training in crisis management, although they are called upon to manage life-threatening crises at a moment's notice. And the ultimate utility of this training for anaesthesiologist cannot easily determined, the course appeared to be a useful method for addressing important issues of anaesthesiologist performance [2].

TYPES OF ANAESTHESIA

There are Mainly Three Types of Anaesthesia

➤ GENERAL ANAESTHESIA

General anaesthetic agents are unique because they produce unconsciousness as a therapeutic goal. All general anaesthetics produce their central nervous system effects through a common mechanism. The main goals of general anaesthesia are amnesia, unconsciousness, and immobilization. General anaesthetic drugs include inhaled gases and intravenous agents. Physicians used general anaesthetics for inducing unconsciousness and it has been considered to be non-specific drugs with

widespread effects on the CNS. The general anaesthetics classified into three groups based on their relative potencies for different clinical endpoints. Group 1 consists of etomidate, propofol, and barbiturates, intravenous drugs that are much more potent to produce unconsciousness than immobilization. Group 2 include the gaseous anaesthetics nitrous oxide, xenon, and cyclopropane, along with ketamine; and clinically, these drugs induce significant analgesia, while their potency as hypnotics and immobilizers are relatively weak. Group 3 consists of the volatile halogenated anaesthetics: halothane, enflurane, isoflurane, sevoflurane, and desflurane; and these drugs produce amnesia, hypnosis and immobility in a predictable manner [3].

General anaesthetics can be used in a general anaesthetic procedure without the aid of any other drug; And these drugs by themselves can achieve all the essential goals of general anaesthesia, therefore can be used as a sole drug for surgical anaesthesia. As general anaesthesia carries highest risk, monitoring the stages and depth of anaesthesia is important. Modern general anaesthesia techniques use combination of an analgesic, a hypnotic and a muscle relaxant. Depending upon the general anaesthetic procedure and on the patient, the concentration of each drug has to be titrated independently and, several functional variables such as muscle relaxation, suppression of responses, hypnosis have to be monitored independently to ensure the therapeutic goals of the general anaesthetic procedure are being achieved [4].

➤ REGIONAL ANAESTHESIA

Regional anaesthesia allows surgical procedures to be done on a region of the

body without patient being unconscious. Mainly 2 types of regional anaesthesia include: 1) peripheral nerve blocks, which block sensations of pain from the area of the body supplied by the nerve and is injected near a specific nerve or bundle of nerve. This type is most commonly used for surgery on the arms and hands, the legs and feet, the groin, or the face. 2) Epidural and spinal anaesthetics, helps to block sensations of pain from an entire region of the body, such as lower abdomen, the hips, or the legs; and it is injected near the spinal cord and major nerves [5].

Regional anaesthesia offers benefit to the patient that they are staying awake. And for anaesthetist, regional anaesthesia offers some advantages like cardiovascular and respiratory stability, rapid postoperative recovery, and preservation of protective airway reflexes. Regional anaesthesia techniques has some drawbacks such as pain at puncture site, fear of needles, and recall of the procedures; and these factors stress the importance of sedation and that offers analgesia, anxiolysis, and amnesia. Sedation is a part of management of patient who receiving a regional block and awake during surgery; and the main aim include patient comfort, freedom from specific discomfort and amnesia for both block and surgical operation, to meet the patient's preference and safety. And sedation has been shown to increase patient satisfaction during regional anaesthesia and this sedative effect can be enhanced by the addition of adrenaline. The pharmacodynamics and pharmacokinetic properties of sedatives are shows that sedation is safe and effective. And if sedatives are contraindicated, hypnosis may be useful in suitable patients by an experienced specialist. New models

of administration are on development and it improved the quality of sedation [6].

➤ LOCAL ANAESTHESIA

Local anaesthetics provide a reversible loss of sensation in a specific region. Local anaesthetics reduce pain, and are safer than general or systemic anaesthetics; therefore, they are used whenever possible. In addition, they are relatively easy to administer and are readily available. The mechanism of local anaesthetics involves the inhibition of polarization of the nerve membrane by interfering with both Na⁺ and k⁺ currents. The action potential is not propagated because the threshold level is never attained [7].

Local anaesthesia is used during minor surgical procedure in a small site to prevent pain without changing the patient's awareness. This anaesthetic is usually applied topically or subcutaneously. Local anaesthesia helps to reduce post-operative pain and it also facilitates mobilization of the patient and helps to decrease post-operative complications. Many studies have indicated that the use of local anaesthetics provide cytotoxicity and can induce apoptosis. The types of local anaesthetics and the induction rates of apoptosis remain unclear. And there are some study results shows that, not only the lipophilicity but also another factors are correlated with the toxicity of local anaesthetics [8].

COMPLICATIONS RELATED TO ANAESTHESIA

- SPECIFIC COMPLICATIONS OF GENERAL ANAESTHESIA

Anaphylaxis

Anaphylaxis can be occurs due to any anaesthetic agent and in all types of anaesthesia. The severity of the reaction

may very depend upon the types of anaesthesia but the features may include rash, urticarial, bronchospasm, hypotension, angio-oedema, and vomiting. It may prevent by careful pre-operative assessment and by using general anaesthetic charts. Patients who are suspected of an allergic reaction should be referred for further investigations such as provocation testing or skin prick testing to determine the exact cause of allergic reaction^[9]. If necessary, the patients should be referred to local immunologists. Anaphylaxis needs to be recognised and managed immediately.

Aspiration pneumonitis

If unconsciousness level of patient is increased, it may leads to unprotected airways. If the patient vomits, they may aspirate the vomitus contents into their lungs, leads to lung inflammation along with infection. Fasting for several hours prior to the procedure and cricoid cartilage pressure of anaesthesia is the technique used to reduce the risk of aspiration pneumonitis and aspiration pneumonia. Some other techniques also used to reducing aspiration pneumonitis, which include the use of metoclopramide to enhance gastric emptying and increasing the pH of gastric contents by using proton pump inhibitors such as ranitidine^[10].

Peripheral nerve damage

This can occur as the result from nerve compression due to anaesthesia. This may occur with all types of anaesthesia. The most common cause of it is exaggerated positioning for prolonged period of time. Both the anaesthetist and surgeon should be aware of this complication and the patients should be moved on a regular basis, if possible. The severity of this may

varies and recovery may be prolonged. The ulnar nerve and the common peroneal nerve are most commonly affected and rarely, the brachial plexus may be affected. Injury to nerve can be avoided by preventing extreme postures for lengthy periods during surgery. If nerve damage occurs, then patients should be followed up and further investigations such as electromyography are required^[11].

Damage to teeth

Damage to teeth is most common cause of claims made against anaesthetists, so now it is a common practice to check the teeth in the anaesthesiologist's pre-operative assessment. The tooth most commonly affected is upper left incisor^[12].

Embolism

Embolism due to anaesthesia is potentially fatal but is rare. Air embolism is occurs commonly during neurosurgical procedures or pelvic operations. In pre-operative period, prophylaxis of thromboembolism is starts with thromboembolic deterrents and low molecular weight heparin^[13].

- SPECIFIC COMPLICATIONS TO REGIONAL ANAESTHESIA

Post dural puncture headache

The post dural puncture headache (PDPH) is one of the most common complications of neuraxial block. The reason for PDPH include any breach in dura mater, which may follow a spinal anaesthetic, an epidural "wet tap", diagnosis lumbar puncture, or migration of epidural catheter. PDPH is persistent leakage of cerebrospinal fluid (CSF) through the dural defect as faster than that of CSF production. The transdural leak leads to decreased CSF volume and pressure. The basic clinical diagnosis is usually presents 48-72hrs after the

procedure, typically bilateral, fronto-occipital extending up to neck and shoulders. Pain is usually associated with nuchal stiffness and backache. Severe complication of PDPH is subdural hematoma but is rare. The risk factors include young age, female sex, pregnancy and prior history of PDPH^[14].

The treatment of PDPH could be conservative or invasive. The conservative measures include bed rest, hydration, analgesics, abdominal binders and caffeine, and will help to decrease downward traction, increase CSF production, constrict the intracranial vessels and provide the symptomatic relief. The invasive treatment is epidural blood patch, which is considered as the most effective treatment for complete resolution of most of the symptoms. Aseptically withdrawn autologous blood is injected in the same space or one space below until the patient experiences lumbar discomfort or until 20ml has entered in epidural space. Use of smaller and non-cutting needle may help to decrease the incidence of PDPH.

Cardiac Arrest

Different studies over two decades in many countries states that the incidence of cardiac arrest during regional anaesthesia during perioperative period is about 1.5-6.4/10000 cases. Neuraxial block contributes to cardiac arrest involve a circulatory aetiology. Initially, cardiac arrest was contribute by sedation during spinal anaesthesia, and another causes include, decrease in preload associated with neuraxial block resulting in a shift in cardiac autonomic balance towards the parasympathetic system leading to bradycardia. Three mechanisms have been proposed mainly, including activation of the

low-pressure baroreceptors in the right atrium, the receptors within the myocardial pacemaker cells, and mechanoreceptors in the ventricle. In addition, bradycardia may developed due to high sympathetic level may directly favour vagal tone; sedation, hypoxemia, hypercarbia, and chronic medications such as [beta]-adrenergic antagonists.

Intravascular fluid administration, administration of mixed [alpha]-and [beta]-agonists, and vagolytic therapy have advised to decrease the frequency and improve the survival associated with cardiac arrest during neuraxial block^[15].

Transient Neurological Symptoms

Transient neurological symptoms (TNS) can be defined as the development of severe radicular back pain with no sensory or motor deficit and no signs of bowel and bladder dysfunction. The symptoms resolved within one week after resolution of an uneventful, lidocaine spinal anaesthetic.

The aetiology of TNS is not well defined; however, up to 30% of patients with TNS report severe pain, but there is no evidence that this pain is associated with any neurological pathology. The symptoms of TNS disappeared spontaneously by the fifth postoperative day. The use of lidocaine for spinal anaesthesia increased the risk of TNS development.

As compared to lidocaine, spinal anaesthesia with bupivacaine, prilocaine, or procaine have less chances for developing TNS. Freedman's study identified some other risk factors include out- patient status, obesity, and lithotomy position^[16].

Spinal or Epidural Hematoma

Epidural or Spinal Hematoma is a disastrous complications of central neuraxial blocks but is rare. The incidence of hematomas has

been estimated is about 1:150,000 for epidural blocks and 1:220,000 for spinal anaesthetics. Spinal hematoma is particularly catastrophic as it may go unnoticed until there is permanent neurologic compromise.

The reasons for increased incidence of spinal haematoma include female gender, increased age, traumatic needle/ catheter placement, indwelling epidural catheter placement during, immediate preoperative, intra-operative, and post-operative low molecular weight heparin administration.

The patient usually feels the symptoms of sudden new onset sharp back and leg pain with numbness, weakness, bladder dysfunction, and bowel dysfunction. When spinal haematoma is suspected, immediately neurologic imaging (MRI and CT scan) and neurologic consultation should be taken. Good neurological recovery has been seen in patients who have undergone surgical decompression within 8-12hrs^[17].

• SPECIFIC COMPLICATIONS OF LOCAL ANAESTHESIA

Pain at Injection

Pain during administration of local anaesthetic solution can be caused by many reasons, mainly due to two factors; related to solution and related to practitioner. Factors depending on solution are mainly pH, and temperature. Solution having low pH may irritate the tissue, and in warm temperature of solution feels more comfortable than cold. So the cartridge can be warmed in practitioner's hand or in warm water before injection are useful to reduce pain.

The practitioner related factors relate to technique used during administration. Fast injection and high injection pressure cause rapid swelling of tissue and pain; so this can

be avoided by slower injection. Aggressive insertion of the needle may tear soft tissues, blood vessels, nerves, or periosteum and cause more pain. And inadequate injection site can lead to intramuscular or intraneural injection. When the needle penetrates a nerve, the patient may feel a sudden electric shock in the distal area of nerve. Pain after intramuscular injection is mainly due to fibrosis or inflammation inside the muscle^[18].

Haematoma

Haematoma is caused by penetrating the vessel with needle or by an intravascular injection, which causes trauma to the affected blood vessels and this trauma causes bleeding into tissues and formation of a haematoma. Many areas intraoral are highly vascular and target nerves are followed by large vessels. Blood pressure in an artery that has been damaged, which provides large haematoma. Different parts of maxillary artery can be affected in the IAN-block, the second division block, posterior superior alveolar nerve block and infraorbital anaesthesia. Ocular paralysis and temporary blindness can be caused by penetration of anaesthetics to the orbital area.

It is important to use adequate techniques, anatomical landmarks and to avoid relocating needle to different sides inside the tissue. Haematoma formation can be avoided by careful aspiration before injecting anaesthetic and by gentle removal of needle. Haematomas can be large and can appear rapidly in the infraorbital space. It is important to inform the patient and re-evaluate the possibilities of continuing the treatment^[19].

Trismus

Intramuscular injections of anaesthesia can cause haematoma formation inside the muscle and fibrosis, which leads to trismus. Trismus can also cause by multiple injection to same area, by a large haematoma or infection close to the area. Needle fracture in the muscle inserting to styloid process may cause a painful and severe trismus, which is usually disappears within a few days without any further treatment.

In severe cases, treatment such as heat therapy, analgesics, soft diet, muscle relaxant or physiotherapy should be considered. Trismus can also be caused by infection, so always need antibiotics or even a surgical intervention to heal. The painful trismus can be avoided by following methods like careful insertion of needle and bone contact before injection, and awareness of anatomical landmarks and muscles also useful ^[20].

CONCLUSION

Anaesthesia has some complications and risk while administering during a surgical procedure. There is some specific complications depends upon the type of anaesthesia used and also depend upon the patient's health, and the medicine administered. Anaesthesiologists are responsible to provide techniques to reduce complication during anaesthesia. The proper knowledge about the suspected complications of anaesthesia helps to produce proper clinical decision making and risk management.

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