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Review Article

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Complications and Dangers of Spinal Anaesthesia – An Overview

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Abstract

Spinal anaesthesia is a regional anaesthesia technique in which a local anaesthetic is injected into the subarachnoid space. This blocks the transmission of nerve signals from the lower part of the body to the brain, resulting in a loss of sensation and pain below the level of the injection. Spinal anaesthesia is a valuable tool in modern anaesthesia practice, providing effective anaesthesia and analgesia. Spinal anaesthesia is commonly used for surgeries on the lower extremities and surgeries at the level or below the umbilicus. Spinal anaesthesia is a safe and effective form of anaesthesia, but there are some complications of this procedure including Headache, being the most common, infection at the site and several systemic side effects including CVS, CNS, GIT etc.

1. Main Body

Spinal anaesthesia is a type of regional anaesthesia also known as subarachnoid block, that involves the injection of a local anaesthetic agent like lignocaine or bupivacaine into the subarachnoid space of the spinal cord [1,2]. Spinal Anaesthesia results in loss of sympathetic tone, loss of sensation, and loss of motor function in the lower part of the body, including the legs and the lower abdomen.

Spinal anaesthesia is commonly given for all procedures that are done at a level or level below the umbilicus such as region involving lower abdominal, pelvic, and lower extremities surgeries, LSCS (Lower segmental caesarean section) Orthopaedic surgeries etc [3]. It is preferred over general anaesthesia in many situations where patients with certain medical conditions make general anaesthesia riskier in that patient and in surgeries where the duration is shorter so that patients can recover more quickly from the effects of spinal anaesthesia.

The procedure of spinal anaesthesia is performed by an anaesthesiologist. The procedure involves 3 P's, which stand for "PREPARATION" "POSITION" and "PROJECTION". Preparation involves strict antiseptic precautions where the back surface is cleaned with Chlorhexidine (2% solution) or betadine (10% solution). Position of the patient can be either in Sitting (with chin touching chest) or Lateral position or in some conditions Prone position. Projection involves the structures that are pierced during spinal anaesthesia administration (from outer to inner) Skin, Subcutaneous tissue, Supraspinous ligament, Interspinous ligament, ligamentum flavum (toughest layer while passing needle), Dura matter, and Arachnoid. The site at which spinal anaesthesia is given in adults is at the level of L3-L4 and in children at the level of L4-L5 [4]. A spinal needle is used to inject a Local anaesthetic agent into the subarachnoid space. A spinal needle is of two types, either Dura cutting needle or Dura splitting needle.

After giving spinal anaesthesia block monitoring is done to check at what level the effect of the anaesthetic agent has reached. Sensory Level checking is done by using PINPRICK SENSATION, and motor level is checked by using BROMAGE SCALE that gives grading from 0 to 3, where 0 stands for the complete movement of leg and feet and 3 stands for the complete motor block. Factors affecting the height of spinal anaesthesia include Drug factor, Patient factor and procedure factor.

Drug factors include the density of the drug compared to CSF [5]. If the Density of the drug is more than CSF, it's called a Hyperbaric drug and the level of anaesthesia is lower than the administered level. Dextrose is added to make the hyperbaric solution. If the density of the drug is less than CSF, it's called a Hypobaric drug and the level of anaesthesia is higher than the administered level. Sterile water is used to make a Hypobaric solution. Less important drug factor includes Volume, Concentration, Temperature, viscosity etc.

Patient factors include the CSF volume where CSF volume is

inversely proportional to the level of anaesthesia. Age is also an important factor as CSF volume decreases and specific gravity increases in older people, thus increase in the level of anaesthesia. Other less important factor includes the height of the patient, gender of the patient etc. Procedure factors include the speed of injection, Needle type, orifice, and position of the patient.

Just like any medical procedure, spinal anaesthesia also has some side effects [6]. Spinal anaesthesia is a sympathetic block thus it affects various organ systems in the body and side effects are according to that.

The cardio-vascular system shows a decrease in the heart rate (bradycardia), a fall in blood pressure (Hypotension) and peripheral pooling of blood in extremities [7]. Management of this includes before administration of Spinal anaesthesia, and preloading the patient with fluid most commonly with Crystalloid. Drugs like Atropine, Epinephrine, and epinephrine can be used to prevent these side effects.

The respiratory system shows no side effects if the level of anaesthesia is low but a high level of anaesthesia (above T4) led to paralysis of intercostal muscle leading to dyspnoea [8]. Reassurance is given to the patient if this occurs and oxygen supplements are given to maintain oxygen saturation level.

The central Nervous system shows Headache which is also the most common side effect of spinal anaesthesia, which usually occurs after the procedure. The headache may range from mild to severe, lasting many days. POST-DURAL PUNCTURE HEADACHE (PDPH) is a condition where there is a headache due to increasing CSF leakage, leading to the loss of cushioning effect of CSF [9]. PDPH is a dull, boring type of headache that is common in younger females and involves mostly the occipital region followed by the temporal region. PDPH is more commonly associated with Dura Cutting needle (e.g., Quincke or Babcock) as they are thicker, and creates a big rent in the dura mater that leads to CSF leakage. PDPH usually occurs after 24 to 48 hours of administration of spinal anaesthesia. PDPH is aggravated by factors like Standing, walking, coughing, strenuous exercise etc. and is relieved by taking some rest. PDPH is sometimes associated with Nausea, vomiting, photophobia, and 6th cranial nerve palsy but is never associated with Fever and Neck rigidity (the classic triad of meningitis).

Treatment for PDPH includes adequate rest and reassurance. Symptomatic treatment includes a drug combination of Paracetamol and caffeine that led to vasoconstriction and increase CSF production. Plenty of fluid through IV can be given that increase the plasma level and thus Increase CSF production, as CSF is produced from Ultrafiltration of Plasma. If any of these measures fail to cure the headache Epidural Blood Patch is used where the patient's blood (10-15ml) is injected into the epidural space, after it clots it acts as glue-like material and prevents leakage of CSF. However, since we are injecting blood in epidural space, the utmost care and aseptic measure should be taken to prevent any infection [10]. Other CNS effects include motor blockage which is 2 segments below sensory blockage and autonomic block which is 2 segments higher than sensory block. The gastrointestinal system shows sphincter relaxation leading to defecation and also an increase in reverse peristalsis.

The genitourinary system shows urinary retention due to paralyses of detrusor muscles, hence catheterising the patient before spinal anaesthesia with Foley's catheter. Other side effects include Infection at the site of administration leading to Meningitis, most commonly due to bacteria STREOTOCOCCUS VIRIDANS present on the skin.

The anterior spinal syndrome is a rare neurological disorder caused by damage to the anterior spinal artery that supplies blood to the spinal cord while administering Spinal anaesthesia [11]. Symptoms include sudden onset of severe back pain, weakness or paralysis in the legs, and loss of sensation below the level of the injury. The effects of anterior spinal syndrome may be permanent, and the goal of treatment may be to manage symptoms and improve quality of life.

Cauda equina syndrome is a rare but serious complication that can occur when administering spinal anaesthesia [12]. Cauda equina syndrome is caused by damage or injury to nerves of the spinal cord, which can result in severe lower back pain, weakness or numbness in the legs. The patient should also be closely monitored for any signs or symptoms of cauda equina syndrome during and after the procedure, and prompt treatment should be provided if it is suspected.

In Summary, Spinal anaesthesia is a type of regional anaesthesia that involves the injection of a local anaesthetic into the cerebrospinal fluid surrounding the spinal cord. Spinal anaesthesia is generally considered safe, but it carries some risks. Complications can include hypotension, headache, back pain, nerve damage, respiratory depression and infections. Close monitoring and appropriate management can help minimize the risk of complications. Overall, spinal anaesthesia is a valuable tool in modern anaesthesia practice, providing effective anaesthesia and analgesia with a lower risk of complications than general anaesthesia in certain situations.

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