Central Neural Blockade for Lower Limb Surgery – Perioperative Management

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INTRODUCTION

Regional anaesthesia in the form of central neural blockade has been widely offered as the sole anaesthesia or in combination with a general anaesthesia for the orthopaedic patients who present for lower limb surgery.

Regional anaesthesia (RA) is associated with fewer perioperative complications then general anaesthesia when properly performed. Many studies that have been completed and the meta-analysis that have been done show an advantage of regional over general anaesthesia in limiting cardiovascular, thromboembolic, pulmonary, and gastrointestinal complications[1]. RA is shown to reduce blood loss in comparison to similar cohorts of patients undergoing the major orthopaedic surgery without RA. Furthermore, convalescence and hospital stay may be decreased. Post-op short-term mortality (<3 months) is decreased though the longer-term mortality advantage is not apparent.

Perhaps the largest benefit of regional anaesthesia and analgesia is its role in providing adequate pain relief for rehabilitation. Pain control is the key to the postoperative recovery of patients undergoing orthopaedic surgery. Optimizing postoperative analgesia improves the patient's ability to participate in rehabilitation sessions. Continuous passive motions are tolerated by a larger percentage of patients treated with regional analgesia than narcotic based analgesia following knee surgery[2].

Types of Regional Anaesthetic Technique for lower limb surgery

Central neural blockade (CNB) can be administered in many different forms: a single dose spinal anaesthetic, epidural, combined spinal epidural, epidural with catheter and a continuous spinal anaesthesia with microcatheter. A small volume of local anaesthetic (LA) is used for spinal anaesthetic technique and a relatively larger volume of LA is used for the epidural anaesthetic technique. Narcotics or other adjuvant such as clonidine could sometimes be added to the LA to reduce the dosage of LA used, therefore reducing the toxic side effects of LA and excessive motor paralysis.

CNB is most commonly performed as single injection technique, however, the major hip and knee replacement surgery warrants the placement of catheter into the epidural/spinal space for postoperative pain control. Placement of catheter also allows the possibility of extending the block during surgery when needed. It provides an easy technique to reach an adequate level and duration of anaesthesia with small intermittent doses of local anaesthetic, which also minimizes the risk of possible cardiovascular and respiratory disturbance[3].

Possible complications of Central Neural Blockade

Complications of CNB could be classified as immediate, intermediate and late. Immediate complication such as hypotension can be treated with fluid loading and use of sympatomimetic drugs. Shivering can happen soon after onset of neural block and can be treated with warming or small dose of pethidine[4], tramadol or clonidine.

The surgeons who follow up patients in the ward will however observe the intermediate and late complications of CNB. These include: backache, postdural puncture headache, transient neurologic symptoms, anterior spinal artery syndrome, spinal haematoma and infective complications such as meningitis and epidural abscess. Adequate preoperative preparation and postoperative vigilance with high index of suspicion to look out for the early signs of complications is essential.

Many of the orthopaedic patients are elderly with diminished organ reserve and on multiple medications for their chronic illnesses. A proper history taking and physical examination with appropriate laboratory investigations will identify the risk and help the anaesthetist in the anaesthetic plan.

Special attentions should be given to patient's medications that affect blood coagulation function when a CNB is planned.

Low molecular weight heparin (LMWH) has a higher and more predictable bioavailability, longer biological half-life (4 – 7hr) and reduced influence on platelets when compared with the unfractionated heparin (UH). A more predictable anticoagulant effect to fixed dose is obtained with LMWH than with UH, which is why LMWH can be administered safely once daily without laboratory monitoring. The aPTT is not generally elevated with LMWH therapy[5].

United States Food and Drug Administration (FDA) issued an "alert" warning in Nov 1997 when it noted 30 unsolicited safety reports associating epidural or spinal haematomas with concurrent use of **enoxaparin** (LMWH), following spinal/epidural anaesthesia or spinal puncture. There were a number of cases of neurological injury and approximately 75% of the patients were elderly women undergoing orthopaedic surgery[6]. It was thus recommended there should be a lapse of 12 hours between the last dose of

LMWH and CNB. Removal of an indwelling catheter should be done at least 10 – 12 but preferably 24 hours after the last LMWH dose.

Unfractionated heparin (UH) is used for perioperative thromboprophylaxis for orthopaedic, general, gynaecologic, and urologic surgery, and for therapeutic anticoaguagulation during vascular and cardiac surgery.

The response to subcutaneous heparin is unpredictable with therapeutic heparin blood concentrations recorded for up to 4 hours following 5000 units of subcutaneous. Risks and benefits of CNB on these patients need to be assessed individually. Initiation of the CNB should be delayed 4 – 6 hours from the last dose of UH. If CNB needs to be performed sooner, the aPTT should be measured. If the patient has been on UH for some time, thrombocytopenia should be excluded[7].

Aspirin and other NSAIDs impair platelet aggregation by inhibiting the formation of platelet thromboxane after binding irreversibly with the enzyme cyclo-oxygenase. Aspirin inhibits the cyclo-oxygenase activity throughout the life span of the platelets (10days) whereas other NSAIDs are competitive, reversible and partial inhibitor of the enzymes. Platelet function returns to normal within 72 hours of the last non-aspirin NSAID dose[8].

The clinical dilemma posed by aspirin ingestion is whether this effect on platelets translates into a significant risk of increased bleeding in the spinal canal.

In a large, blinded, randomized study comparing aspirin 60mg daily versus placebo, 2793 women (1422 aspirin allocated vs. 1361 placebo-allocated) underwent epidural analgesia. There were no cases of spinal haematoma and hemorrhage only occurred on 3 occasions (1 in aspirin group, 2 in placebo) and was limited to bloodstain fluid in the catheter. The overall risk of epidural haematoma following regional anaesthesia in patients on aspirin is unknown; it must be considered extremely rare. There is no good evidence that regional anaesthesia should be denied to patients currently receiving aspirin or NSAIDs, provided no other risk factors are present[9-13, 17].

Dipyridamole is a weak platelet inhibitor. There are insufficient data to assign risk of spinal hematoma associated with this agent. Most authorities, however, do not consider use of dipyridamole by itself to be a contraindication to neuraxial anaesthesia[11, 15].

Thienopyridines such as **ticlopidine** and **clopidogrel** selectively inhibit adenosine diphosphate-induced platelet aggregation without affecting the cyclo-oxygenase pathway. Platelet activity remains impaired for up to 7 days after the last dose. However, the risk of spinal hematoma associated with the use of these agents is not known. It may be advisable to avoid neuraxial anaesthesia and analgesia in patients receiving these agents[11, 13].

Glycoprotein IIb and IIIa Receptor Antagonists (**e.g.** abciximab) are strong inhibitors of platelet function. These are commonly used drugs in cardiac cauterization. There have been no reports of neuraxial anaesthesia associated spinal hematomas linked to these agents. However, it may be advisable to avoid neuraxial blocks in patients receiving these agents[11, 13].

Oral Anticoagulants. Warfarin are commonly indicated for patients with prosthetic heart valves and for the prevention of thromboembolic events in disorders such as atria fibrillation, rheumatic heart disease, venous thromboembolism, and dilated cardiomyopathy. It should be discontinued 3 to 5 days before surgery to allow the INR level to return to baseline. The INR should be checked before the operation[9,11,12].

Thrombolytic drugs such as streptokinase, urokinase and tissue plasminigen activator (TPA) are used in the treatment of myocardial infarct, stroke and vascular thrombosis. Neuraxial anaesthesia should not be considered in patients receiving thrombolytics.

A thorough history to determine if any bleeding problems are present in the patient or family is essential. Questions should be directed to prolonged bleeding or rebleeding following tooth extraction, recurrent epistaxis or excessive bleeding in connection with previous surgery or menstruation. Particular attention should be paid to medications (western or herbal) taken within the last ten days. Herbal medications with anti-platelet activity such as ginger, ginko biloba and garlic can induce coagulation disturbance and may cause increased peri-operative bleeding[18]. The patient should be examined for signs of bruising or bleeding from mucous membranes and venipuncture sites.

Laboratory investigations

Bleeding time: a meta-analysis of bleeding time concluded that it is not a specific in vivo indicator of platelet function. There is no evidence that the bleeding time can predict the risk of haemorrhage, and that the degree of bleeding from the skin may not accurately reflect the risk of bleeding elsewhere in the body.

Platelet counts: RA is contraindicated in the presence of marked thrombocytopaenia. The lower limit of platelet counts for RA in the presence of normal clotting test is unknown and controversial. Platelet counts anywhere between 60,000 and 100,000/mm3 have been suggested.

PT/PTT: Prothrombin time (PT) is a test of intrinsic pathway and normal range is <3 s of control. Activated partial thromboplastin time (aPTT) 6 s longer than control is probably abnormal though the normal range varies between laboratories.

Postoperative management

Duration and intensity of motor paralysis after central neural blockade depends on the type and dosage of local anaesthetic agents used. A single dose 2% lignocaine will give 1 – 2 hours of paralysis, whereas bupivacaine and ropivacaine provide 2 – 4 hours of pain relief and paralysis. A 4 - 6 hour requisite to rest in bed after single dose CNB is to prevent falls due to weakness of lower limb muscles. Prolongation of block beyond the time period should lead to further investigation.

Some patients require urinary catherization due to bladder dysfunction after CNB. Patients should be advised that difficulties in passing urine might arise postoperatively and excessive strain should be avoided.

Post-dural puncture headache (PDPH) manifests itself from several hours to 48 hours after. It has an overall

incidence of as high as 7%. The mechanism of PDPH is commonly thought to be persistent leakage of cerebrospinal fluid (CSF) through the dural defect at a faster rate than that of CSF production. Headache can be mild to severe lasting several days, usually resolves within 10 days. It is bifrontal and occipital in location and often involves the neck and shoulders. Nuchal stiffness and pain, as well as backache are frequently present. It usually is described as dull or throbbing. The most characteristic aspect of PDPH is that pain is postural in nature. Patients often experience complete resolution of symptoms when supine. Associated symptoms include malaise, photophobia, nausea, vomiting, cranial nerve palsies, and ocular, vestibular and auditory dysfunction. Fever and localizing neurologic signs and symptoms are not part of PDPH.

Conservative measures for treating PDPH include bed-rest, hydration, abdominal binders, analgesics, and caffeine. Mild headache can be relieved with oral analgesic, bed rest and assurance. Epidural blood patch can be offered to patients with severe headache or those with symptoms persist beyond some arbitrary limit[14].

Transient neurological symptoms (TNS) can develop after an uncomplicated spinal anaesthetic and patients can make complete recovery. A clear interval, normally 2 to 5 hours after mobilization, without any signs or symptoms of neurological deficits, exists before pain starts. A dull or throbbing back pain and/or dysthesia in the buttocks, thighs, or lower limbs develops within 24 hours after full recovery from the anesthetic. Pain is usually transient and resolves within1 – 4 days. The etiology of TNS following single-injection spinal anaesthesia has not yet been elucidated although choice of local anaesthetic (lignocaine, mepivacaine), the addition of phenylephrine to the LA solution, the lithotomy position, manipulations during surgery and early mobilization are considered as possible causative factors. When this occurs, make sure that there is no weakness or sensory loss to exclude epidural haematoma or abscess, then treatment should be started with NSAID, narcotics, warm heat or trigger point injection[16].

Postoperative severe neurologic complications

Lack of recovery from spinal or epidural blockade in the expected time interval may indicate spinal cord compression, ischaemia or other forms of injury. Understanding and awareness of the following severe neurological complications is important

Anterior spinal artery syndrome occurs when the blood supply to the anterior column of the spinal cord is compromised due to risk factors of hypotension or arterioseclerosis. Clinical presentations include sudden onset of flaccid paralysis with only a minor sensory involvement.

Spinal hematoma is a rare and potentially devastating complication of CNB. Bleeding can happen with any neuraxial blockade technique. An expanding hematoma in the closed space of the spinal canal can cause compression of spinal cord and result in neurological ischaemia and paraplegia. Risk factors for spinal haematoma after neuraxial blockade include coagulation disturbance, anatomic abnormalities of the spinal cord or vertebral column, vascular malformations, impaired homeostasis, difficult needle placement and indwelling neuraxial catheters. Pre-operative identification of patients with bleeding tendency was discussed earlier on.

Signs and symptoms of spinal hematoma very depending on the level at which they occur, but they include new onset numbness, weakness, bowel and bladder dysfunction, and, rarely as severe radicular neck pain[15].

Postoperative careful and frequent neurologic testing is important. Neurological recovery is unlikely if cord compression is not relieved for more than 8 – 12 hr. A two hourly neurological assessment for 12-24 hours is recommended in the high-risk patients. With a continuous technique, the infusate should contain low concentrations of local anaesthetics or opiods alone to allow accurate assessment of neurologic status. Since early intervention is the key to success in managing these potentially devastating complications, prompt diagnosis (MRI or CT) and early surgical management might be indicated when spinal hematoma is suspected.

Meningitis and epidural abscess are serious complications after neuraxial blocks. These, however, are rare. Symptoms of epidural abscess usually begin several days after neural block but they can occur months later. Symptoms include backache, fever, malaise, elevated white leukocyte count, signs of cord compression, elevated cerebrospinal fluid protein and leukocytes and elevation of nonspecific serum markers of inflammation such as C-reactive protein and ESR. Rapid diagnosis and prompt appropriate treatment is paramount[11].

CNB is frequently administered as a sole or combined anaesthetic to the orthopaedic patients with lower limb surgery. Understanding of the complications will help the surgeons in the preoperative and postoperative management of the patients.

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