Epidural and spinal anaesthesia and the use of anticoagulants

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Neurological injuries after epidural/spinal analgesia are a serious but uncommon problem. Spinal haematoma cause a proportion of these complications, and can be minimized by avoiding central nervous blockade in high-risk patients, especially those receiving anticoagulant therapy. Early recognition of spinal haematoma by basic neurological monitoring allows early interventiron and improves outcome.

Whenever the use of epidural or spinal anaesthesia is planned there is concern about the possibility of neurological damage. If the patient is receiving anticoagulant therapy the danger of subarachnoid or epidural haematoma must be considered. The issue is complicated by the following:

- Subarachnoid/epidural haemorrhage is a rare event. Therefore large numbers of patients have to be studied in order to assess incidence and risk factors
- Subarachnoid/epidural haemorrhage can occur spontaneously in patients who have neither received a spinal/epidural block, nor have a coagulation defect.

This issue has become more pertinent recently with the increasing use of spinal/epidural block and drugs such as heparin and aspirin that affect coagulation and platelet function. Prophylaxis of venous thromboembolic complications with low molecular weight heparins (LMWHs) has become routine before and after surgery. Platelet-inhibiting drugs, such as non-steroidal anti-inflammatory drugs (NSAIDs) and dextran, may also be used. As a result, whenever spinal or epidural analgesia techniques are used, more patients are exposed to an increased risk of spinal haematomas.

ANATOMY

The epidural space surrounds the spinal cord and lies between the wall of the vertebral canal and the dural sac. It extends from the foramen magnum to the lower border of S2 and protrudes some distance into each of the 58 intervertebral foramina. Contained within the space is fat, a plexus of valveless veins, lymphatics and spinal arteries. The venous plexus is in the form of double anterior and posterior longitudinal channels linked transversely by venous rings encircling the dural sac. These veins communicate with pelvic, intracranial and paravertebral veins, as well as with the inferior vena cava (IVC). Compression or blockage of the IVC will increase the size of and flow through the veins in this plexus. The epidural space is separated from the spinal cord by the dura, the subdural space, and the subarachnoid space containing CSF. The subarachnoid space communicates with the cerebral ventricular system.

SPINAL HAEMATOMA

Subarachnoid and epidural haematoma occur as a result of spontaneous bleeding or needle-induced damage to blood vessels. Cord compression and paraplegia may result. Epidural bleeding is more common than subarachnoid, probably because of the presence of a more extensive network of blood vessels in the epidural space.

NEUROLOGICAL COMPLICATIONS AFTER CENTRAL NERVOUS BLOCKADE

Neurological complications after central nervous blockade (CNB) have been described by several authors. Kane (1981) reviewed studies over a period of 30 years and estimated a rate of 0.6/10 000 after epidural and 1.8/10 000 after spinal anaesthesia. In a study based on claims to the Patient Insurance Agency in Finland, Aromaa et al (1997) estimated a serious complication rate of 0.45/10 000 following spinal and 0.52/10 000 following epidural anaesthesia. However, these studies include neurological complications unrelated to the anaesthetic procedure. Other data come from prospective studies. Prospective and retrospective series of obstetric epidurals, encompassing 505 000 blocks, showed a complication rate of only 0.1/10 000 (Scott and Hibbard, 1990).

Illustrating the difficulty of accurate measurement of the frequency of complications, Dahlgren

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and Tornebrandt (1995), in a follow-up study of 17 733 patients after spinal and epidural anaesthesia over 3 years, described a neurological complication rate indisputably caused by epidural techniques of 1:3077 (3.25/10 000). Because the cause of the complication was in some cases unclear, they commented that the complication rate following epidurals could be as high as 1:923 (10.8/10000). However, several serious complications occurred in fully heparinized or anticoagulated patients. Full heparinization or anticoagulation, as emphasized by Bromage (1997), has always been a contraindication to CNB.

One of the difficulties in assessing the incidence of such complications is that surgical procedures, e.g. crossclamping the aorta, arterial hypotension, and positioning of the patient, may compromise the blood supply to the spinal cord and thus be responsible for some of the problems.

BLEEDING AND NEUROLOGICAL COMPLICATIONS

A proportion of neurological complications are caused by bleeding. Several large studies revealed no cases at all. Tryba (1993) reviewed more than 850 000 patients and described a rate of spinal haematoma of 1/150 000 after epidural and 1/220 000 after spinal block. Bullingham and Strunin (1995) estimated the incidence as less than 1/100 000 in normal patients.

Vandermeulen et al (1994), in a literature review extending back to 1906, found 61 published cases of epidural or subdural haematoma. Wulf (1996) estimated the incidence of epidural haematoma to be 1:190 000 epidural procedures (95% confidence interval 1:90 000–1:480 000). Horlecker and Wedel (1998) describe an increase in the reported incidence of this complication associated with use of LWMH therapy. They report 40 cases and calculate the frequency of spinal haematoma in this group to be between 1:1000 and 1:10000.

RISK FACTORS

Vandermeulen et al (1994) found 42 patients of 61 with spinal/epidural haematoma received anticoagulant drugs (mostly heparin) or had a clotting disorder. Insertion and removal of epidural catheters was shown to have a strong association with spinal haematoma. Other factors include alcohol abuse, chronic renal insufficiency, thrombocytopenia and use of platelet-unfriendly drugs, e.g. aspirin. Bloody taps were noted in 10–40% of cases. Multiple and difficult punctures were reported in 27–36%. Old age, abnormal anatomy of the back (causing difficult and multiple attempts), the presence of anatomical (spina bifida occulta) or vascular abnormalities, arteriosclerotic vessels and diabetic angiopathy were also considered to be possible predisposing risk factors.

Spinal stenosis has been particularly singled out as a risk factor. This may be because of the extra technical difficulties encountered when attempting to site an epidural catheter, causing multiple attempts and repeated punctures (Renck, 1995). In the elderly, the reduced compliance of the epidural space indicates lower volumes and slower injections into the epidural space. However, since these epidural pressure increases are very transient, it is probably more important to avoid prolonged hypotension and especially repeated and traumatic punctures or catheter siting attempts.

TABLE 1.
Haematological parameters allowing central nervous blockade

International normalized ratio <1.5
Activated partial thromboplastin time upper limit of normal
Platelets >80000
Bleeding time <8 minutes

From Vandermeulen et al (1994)

PREOPERATIVE ANTICOAGULANTS

The use of CNB techniques is contraindicated in patients treated with full-dose heparin, warfarin or any thrombolytic drugs. Values allowing CNB institution were summarized by Vandermeulen et al (1994) (*Table 1*). These can only be rough guidelines, as an overall evaluation of the patient's risk factors, and the strength of indication for using a CNB in that patient, must be considered.

LOW-DOSE ANTICOAGULANTS FOR THROMBOPROPHYLAXIS

The position of low-dose anticoagulants is less clear. Although there are individual case reports of spinal haematomas after low-dose heparin a meta-analysis of 9013 patients receiving a combination of LMWH prophylaxis and spinal/epidural anaesthesia did not identify any spinal haematomas at all (Bergqvist et al, 1992). A German consensus conference in 1989 considered CNB acceptable after low-dose anticoagulants. However, other authorities are concerned about CNB in the presence of low-dose heparin techniques.

Horlecker and Wedel (1998) make several recommendations including use of the smallest effective dose of LMWH, delaying the dose of LMWH for at least 12 hours after the CNB and careful postoperative neurological assessment. They point out a possible increased risk of haematomas in elderly small female patients as well as an association of haematomas with combinations of LMWH and antiplatelet drugs.

Bullingham and Strunin (1995) suggest waiting until after insertion of the block before starting low-dose antithromboembolic prophylaxis. In the event that low-dose heparin has already been started, the block should be delayed by 4–6 hours after low-dose unfractionated heparin (LDUH), and about 10–12 hours after LMWH. Removal of an epidural catheter in patients on LDUH should be delayed until 4 hours after administration, or 10–12 hours after LMWH has been administered.

INTRAOPERATIVE HEPARIN USE

When heparin administration is planned intraoperatively, e.g. for open heart surgery or abdominal aneurysmectomy, a CNB is considered acceptable. However, in these circumstances Vandermeulen et al (1994) make the following recommendations/comments:

- Carefully select patients, excluding those with a history of bleeding diathesis and those on anticoagulant therapy
- Consider carefully before anticoagulating patients after a bloody tap. Some, but not all authors consider anticoagulation is contraindicated in these circumstances
- Wait 1–2 hours between block and heparin administration
- Monitor coagulation variables and correct if necessary
- Do not remove epidural catheter until at least 4 hours after heparin, 10–12 hours after LMWH, or 48 hours after thrombolytic agent
- Monitor spinal cord compression symptoms/signs for at least 24 hours.

NSAIDS

Reports of CNB bleeding after NSAID administration are rare. Dahlgren and Tornebrandt (1995) reported one case and Horlecker et al (1995) considered that NSAIDs used alone are not a significant risk factor in the development of spinal haematoma.

Aspirin therapy results in prolonged inhibition of platelet aggregation and should ideally be stopped 7–10 days before the block. This is often not practical and may even be contraindicated in patients who are taking aspirin for medical reasons, such as carotid stenosis, coronary artery insufficiency, after myocardial infarction or coronary artery surgery. Many individuals use over-the-counter aspirin for various ailments and indications. They are often not considered as drugs and not always revealed during history taking.

A bleeding time of less than 10 minutes indicates absence of an aspirin effect on platelets, but this test is difficult, and in inexperienced hands controversial. Some authorities suggest that aspirin and other NSAIDs should be avoided during ongoing epidural catheter analgesia, although it is noteworthy that many obstetric patients in the CLASP study (Collaborative Low-dose Aspirin Study, 1994) received aspirin and epidural analgesia without complication.

ASPIRIN/NSAIDS, DEXTRAN AND LMWH IN COMBINATION

These drugs when used in combination may increase the bleeding risk. Although low-dose aspirin and low-dose LMWH may be allowed when aspirin has been given for a medical indication, the combination of LMWH, aspirin, and other more potent NSAIDs (for postoperative analgesia), as well as dextran infusion for volume therapy, may increase the bleeding risk to unacceptable levels and should not be used in combination with catheter techniques for CNBs.

OUTCOME

Outcome after spinal or epidural bleeding is poor. In the series of 55 patients reviewed by Vandermeulen et al (1994), five died, 29 had poor neurological recovery, 11 partial recovery and only six good recovery. The time taken to make a clinical diagnosis, do a scan (by magnetic resonance imaging; MRI) and perform decompressive laminectomy is a key factor in recovery. A target treatment time of less than 8–12 hours is necessary if permanent paraplegia is to be avoided.

Wulf (1996) documented that 80% recovered good spinal function if decompressive laminectomy was performed less than 8 hours after symptoms of intraspinal haematoma had started. Decompression performed later than 24 hours after symptom debut generally left patients with permanently poor spinal cord function.

MONITORING AND DIAGNOSIS

Leg weakness and sensory loss, urinary retention, back pain and paraplegia are the most common symptoms and signs of developing spinal cord ischaemia and spinal cord compression. Unfortunately, the postoperative ward environment and the presence of continuous CNB with local anaesthetics make recognition of these signs and symptoms very difficult. One daily visit by the pain team is not enough. Nurse training is vital so that the sensory level and the degree of motor blockade is monitored regularly and documented at least twice per nursing shift.

Where suspicion exists, an MRI (by far the most sensitive), a computed tomography (CT) scan or myelogram should be arranged urgently. *Table 2* summarizes Breivik's (1995) recommendations to avoid neurological damage.

CONCLUSIONS

Given current information it is possible to identify contributory factors in the development of spinal haematoma. Although controversy and uncertainty exists, the following recommendations have been made by several authorities, including Vandermeulen et al (1994) and Breivik (1998), and should be considered when CNB is planned:

- Patients should be specifically questioned at the preoperative visit. Those with a history or family history of coagulopathy should not have CNB
- Anticoagulant or thrombolytic drugs are a contraindication to CNB
- Elderly patients and those suffering from alcohol abuse, chronic renal insufficiency, spinal stenosis, diabetic angiopathy and abnormal spinal anatomy may be more likely to develop spinal haematomas. Bloody taps and multiple and difficult punctures are also associated with this complication
- Patients on aspirin may have CNB by a skilled anaesthetist/operator followed by neurological monitoring
- Perioperative thromboprophylaxis by LDUH or LMWH should be given after CNB
- Where LMWH has been given, CNB should be delayed if possible for 10 hours. After LDUH wait 4–6 hours
- The combination of LMWH and aspirin plus NSAIDs or dextran increases the risk of intraspinal bleeding
- Intraoperative heparin can be given to patients with CNB providing 1–2 hours has elapsed since the block, there has been no bloody tap, coagulation variables are monitored and corrected if excessively prolonged and monitoring for spinal cord compression is instituted
- Catheter removal should be delayed by 4 hours after LDUH and 10 hours after LMWH. Removal should preferably be in the morning to allow early symptoms of intraspinal bleeding to be observed
- Following CNB or removal of an epidural catheter, a simple system of ward-based neurological monitoring should be instituted
- Teaching programmes for medical staff and nurses should focus on early symptoms of spinal cord compression, i.e. increasing leg weakness, loss of leg and perineal sensation, bladder control and backache
- Hospitals should be prepared to verify the diagnosis of spinal haematoma by MRI or myelography. A CT scan without contrast may be useless
- Urgent neurosurgical decompressive therapy should be arranged within 8 hours whenever a spinal haematoma is diagnosed. HM

TABLE 2.
Recommendations for safe spinal and epidural analgesia

Discontinue spinal anaesthetics if paraesthesia is elicited
If the patient has coagulation disorders avoid CNB and follow guidelines
Educate trainees in safe practice
Educate nurses to monitor for early signs of cord compression
Institute 4-hourly monitoring of patients with continuous epidurals
Avoid motor block and/or deep sedation to allow neurological assessment
Arrange urgent magnetic resonance imaging if haematoma suspected

CNB = central nervous blockade. From Breivik (1995)

KEY POINTS

- Epidural/spinal anaesthesia is contraindicated in patients with coagulopathies or who are on anticoagulants or thrombolytics.
- Certain risk factors increase the likelihood of a spinal haematoma occurring after central nervous blockade.
- Symptoms of spinal cord compression are increasing leg weakness, loss of leg and perineal sensation and bladder control, as well as backache.
- Anaesthetists should take a leading role in the education of staff responsible for patients who have had epidural/spinal anaesthesia.

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