

The Importance of Deep Vein Thrombosis Prophylaxis in Patients Undergoing Surgery with Neuraxial Anaesthesia

Opidural and spinal anaesthesia (neuraxial anaesthesia)

Neuraxial anaesthesia is administered via epidural or spinal injection. These types of anaesthetics fall into two distinct categories: those of high dose that are used to produce dense neural blockade intraoperatively and those given to produce selective spinal analgesia postoperatively¹.

A recent review¹ has highlighted the benefits of neuraxial anaesthesia in how there is improved pelvic and lower extremity blood flow, diminished coagulability and reduced cardiac rate which in turn reduces thrombotic events such as pulmonary embolism and stroke, as well as cardiac events including ischemia and dysrhythmia. Other associated advantages are better graft survival after major vascular surgery and improved patient mobility¹. These benefits are largely attributable to the effects of high dose local anaesthesia which inhibit the action of the sympathetic nervous system, resulting in physiological effects such as decreased heart rate and arterial dilation.

Spinal anaesthesia is particularly suitable for older patients and those with systemic conditions including chronic respiratory disease, hepatic, renal and endocrine disorders such as diabetes (Fig 1)². Frequency of neuraxial anaesthesia has increased in recent years. Data from more than 22,000 patients on the hip and knee registry³ who underwent lower limb arthroplasty in the USA highlighted that frequency of patients receiving neuraxial anaesthesia between 1996-2001 rose from 43% to 54%.

Cost. Anaesthetic drugs and gases are costly and the latter often difficult to transport. The costs associated with spinal anaesthesia are minimal.

Patient satisfaction. If a spinal anaesthetic and the ensuing surgery are performed skilfully, the majority of patients are very happy with the technique and appreciate the rapid recovery and absence of side effects.

Respiratory disease. Spinal anaesthesia produces few adverse effects on the respiratory system as long as unduly high blocks are avoided.

Patent airway. As control of the airway is not compromised, there is a reduced risk of airway obstruction or the aspiration of gastric contents. This advantage may be lost if too much sedation is given.

Diabetic patients. There is little risk of unrecognised hypoglycaemia in an awake patient. Diabetic patients can usually return to their normal food and insulin regime soon after surgery as they experience less sedation, nausea and vomiting.

Muscle relaxation. Spinal anaesthesia provides excellent muscle relaxation for lower abdominal and lower limb surgery.

Bleeding. Blood loss during an operation is less than when the same operation is done under general anaesthesia. This is because of a fall in blood pressure and heart rate and improved venous drainage with a resultant decrease in oozing.

Splanchnic blood flow. Because it increases blood flow to the gut, spinal anaesthesia may reduce the incidence of anastomotic dehiscence.

Visceral tone. The bowel is contracted during spinal anaesthesia and sphincters are relaxed although peristalsis continues. Normal gut function rapidly returns following surgery.

Coagulation. Post-operative deep vein thromboses and pulmonary emboli are less common following spinal anaesthesia.

Figure 1. Benefits of neuraxial anaesthesia

Venous thromboembolism

Venous thromboembolism (VTE) is a complex vascular disease with a multifactorial pathogenesis that results in two major clinical manifestations⁴. The first and more common is deep vein thrombosis (DVT), which develop in the deep veins of the calf, thigh and pelvis. The second and more serious condition is pulmonary embolism (PE) which results if part of or all of the thrombus in the limb breaks off and enters the pulmonary arterial circulation occluding blood flow in the lungs. Patients undergoing surgical procedures are at risk from developing VTE; this risk is affected by the nature and length of the procedure, type of anaesthesia, dehydration and sepsis⁵. Patients at highest risk of VTE are those undergoing lower limb arthroplasty, major trauma, spinal cord injury or a person undergoing surgery who exhibits multiple risk factors⁶.

The risk of concomitant use of low molecular weight heparin (LMWH) and neuraxial anaesthesia

In 1997, the Food and Drug Administration (FDA), part of the USA's Department of Health and Human Services, released a public health advisory after 41 patients developed spinal haematoma after receiving LMWH; most of these patients had undergone lower limb arthroplasty. Spinal haematoma, where there is bleeding into the spinal canal or epidural space, is a rare and potentially catastrophic complication of neuraxial anaesthesia. When it occurs, spinal haematoma may cause a spinal cord compression, leading to neurologic ischemia and long-term or permanent paraplegia.

In response, at a specially convened conference in April 2002, the American Society of Regional Anaesthesia and Pain Medicine (ASRA) developed guidelines on the use of neuraxial anaesthesia and anticoagulants⁷. These guidelines identified risk factors for development of spinal haematoma, which included traumatic needle/catheter placement, sustained anticoagulation in an indwelling neuraxial catheter and catheter removal during therapeutic levels of anticoagulation. Generally, a patient's coagulation status should be optimised at the time of spinal or epidural needle/catheter placement and the level of anticoagulation should be

monitored during epidural catheterisation⁸. This effectively means that if LMWH is the sole method of VTE prophylaxis utilised, the patient is not protected against development of VTE during and immediately post-operatively.

Patients admitted for lower limb arthroplasty have the highest incidence of VTE amongst any surgical patient group⁹ and VTE is the most commonly seen post-operative complication following joint replacement in the lower extremity^{10,11}. Without prophylaxis, patients undergoing hip and knee arthroplasty have been found to have a DVT prevalence of up to 70%^{6,10,12,13,14}.

Immobility is a major risk factor for VTE development, therefore to be fully effective prophylaxis should be commenced when the patient becomes immobile pre-operatively and then continued intra-operatively and postoperatively until the patient is fully ambulatory. Recent international guidelines suggest that VTE prophylaxis should be continued in those patients at highest risk for at least 10 days post hospital discharge and up to 4-6 weeks post-operatively⁶.

It has been established for many years that major surgery is accompanied by a recognised reduction in the spontaneous fibrinolytic activity of the blood; a so called 'fibrinolytic shutdown'^{15,16,17,18,19}. This phenomenon is reported to commence during or soon after the surgical procedure and last for at least 3 days^{15,18} which underlines the great importance of using effective prophylaxis peri-operatively and immediately post-operatively.

Mechanical and biochemical effects of FLOWTRON® DVT Prophylaxis Systems

Prevention of venous stasis

The *FLOWTRON* DVT Prophylaxis System prevents venous stasis by active augmentation of blood flow^{20,21,22,23,24,25,26}. This reduces stasis, flushes valve pockets where thrombi originate, decreases venous hypertension and decreases interstitial oedema²⁷.

Increases fibrinolytic activity

Use of *FLOWTRON* DVT Prophylaxis Systems results in an increase in the fibrinolytic activity of the blood^{28,29}, suppression of procoagulant factors^{28,29} and may assist in the reversal or prevention of fibrinolytic shutdown.

Clinical studies using the FLOWTRON DVT Prophylaxis Systems

Clinical studies undertaken in surgical patients utilising FLOWTRON DVT Prophylaxis Systems have established high levels of efficacy combined with excellent patient compliance and freedom from adverse affects^{10,30,31,32,33,34}.

An additional benefit is that when FLOWTRON DVT Systems were used as the method of prophylaxis compared to LMWH, the operative field was drier and easier to work in^{30,33,35}.

Comparative studies^{36,37} have identified that use of the FLOWTRON DVT Prophylaxis System was as effective as use of LMWH in preventing DVT and PE. There was significantly lower cost and no side effects associated with use of the FLOWTRON Systems.

Conclusion

Neuraxial anaesthesia is an increasingly common method of anaesthesia, particularly suited to elderly patients, those with significant comorbidities and patients undergoing lower limb surgery, all of whom are at increased risk of VTE.

The concomitant use of LMWH and neuraxial anesthesia is contraindicated due to a small risk of spinal haematoma development. Recent guidelines⁷ highlight that the patient's coagulation status should be optimised during spinal needle / epidural catheter placement and that indwelling epidural catheters should not be removed whilst the patient is anticoagulated.

For patients at high risk of VTE who are receiving neuraxial anaesthesia, use of FLOWTRON DVT Prophylaxis Systems will provide a safe and effective method of VTE prophylaxis whilst minimising the risk of potentially harmful side effects.

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