

The Importance of Deep Vein Thrombosis Prophylaxis in Neurosurgical Patients

Venous thromboembolism (VTE) is an important cause of mortality in patients following neurosurgery or head trauma. In a review of VTE prophylaxis in neurosurgery, Epstein (2005)¹ identified that prior VTE, the type and duration of surgery, malignancy, infection, immobility, lower extremity swelling or trauma, advanced age, heart failure, obesity and sleep apnea were all risk factors in contributing to frequency of VTE. It was also identified that the greater the number of comorbidities, the greater the likelihood of developing VTE. The incidence of deep vein thrombosis (DVT) varies depending upon the type of surgery the patient is undergoing. Without prophylaxis, rates of between 20 and 30% have been reported in mixed neurosurgical cases; for patients undergoing craniotomy for tumours or lower limb paralysis² the rates are higher at 30-50% and in those undergoing neurosurgery for serious head and spinal trauma, VTE incidence rates are in the region of 58%³.

Despite being a high risk population, a multi-modality strategy can significantly minimise both the number and extent of VTE events⁴.

Why does neurosurgery place the patient at risk of VTE development

Venous Stasis

Patients undergoing neurosurgical procedures often spend long periods of time in theatre undergoing complex surgery and experience a significant decrease in pulsatile blood flow due to a loss of normal physiological muscle contraction in the lower limbs⁵. Also many patients are immobile pre-operatively due to their underlying condition.

Alteration in fibrinolytic activity

Vessel damage and trauma during the operative procedure leads to the enhanced release of circulating procoagulants. It has been established for many years that major surgery and trauma are accompanied by a recognised reduction in the spontaneous fibrinolytic activity of the blood, a so called 'fibrinolytic shutdown'^{6,7,8,9,10}. This phenomenon is reported to commence during or soon after the surgical procedure and last for at least 3 days^{6,9}.

Those with active malignancies are at particular risk of VTE development. Patients undergoing surgery for malignancy have at least twice the risk of DVT and are at more than 3 times the risk of fatal pulmonary

embolism (PE) compared to non-cancer patients having similar procedures¹¹.

Venous Thromboembolism (VTE) Prophylaxis

During surgery and immediately post-operatively, there is a risk of intra-cranial haemorrhage in patients undergoing neurosurgery, prompting the requirement for prophylactic methods which are effective at prevention of VTE and yet do not increase the risk of bleeding. Meta-analysis has identified that all forms of bleeding following neurosurgery are twice as common in patients who receive post-operative low weight molecular heparin (LMWH) prophylaxis, compared to those who receive mechanical prophylaxis¹².

Haemorrhagic complications of pharmacological prophylaxis can prove devastating¹ and caution should be exercised with the use of pre- or early post-operative usage of LMWH in craniotomy patients¹³ and any decision to utilise pharmacological prophylaxis should be made on an individual basis¹⁴. It has been suggested that LMWH should not be commenced until after surgery once there is radiological evidence that primary haemostasis has occurred¹⁵. However for patients at very high risk, the current evidence based recommendation is to provide both pharmacological prophylaxis as well as IPC¹³. The risk of intracranial or

intraspinal haemorrhage is increased with the use of LMWH/ LDUH (low dose unfractionated heparin) but this risk is outweighed by the risk of VTE if heparin is not used¹⁶.

Mechanical and biochemical effects of FLOWTRON® DVT Prophylaxis Systems

Prevention of venous stasis

Use of *FLOWTRON* DVT Prophylaxis Systems prevents venous stasis by active augmentation of blood flow^{17,18,19,20,21,22,23,24}. This reduces stasis, flushes valve pockets where thrombi originate, decreases venous hypertension and decreases interstitial oedema²⁴.

Increases fibrinolytic activity

Use of *FLOWTRON* DVT Prophylaxis Systems results in an increase in the fibrinolytic activity of the blood^{25,26}, suppression of procoagulant factors²⁵ 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 using *FLOWTRON* Systems have established high levels of efficacy combined with excellent patient compliance and freedom from adverse affects^{5, 27, 28, 29, 30}. In addition,

when *FLOWTRON* Systems were used as the method of prophylaxis compared to LMWH, the operative field was easier to work in and drier^{28,30,31}.

Two recent randomised clinical studies^{32,33} have compared LMWH with *FLOWTRON* DVT Prophylaxis Systems in patients with head and spinal trauma. Both studies identified that use of *FLOWTRON* Systems was as effective as use of LMWH in preventing DVT and PE. There was significantly lower cost and no side effects associated with the use of IPC.

Duration of Prophylaxis

IPC should be commenced pre-operatively if the patient is immobile and then continued intraoperatively, as DVT often develops as a result of the surgical procedure. Evidence based guidelines and consensus papers^{13,14} highlight the requirement for prophylaxis to continue until the patient is fully ambulatory and in some high risk specialities, this should continue for several weeks after hospital discharge. .

Conclusion

Given the relative safety of many elective intracranial procedures, death from PE and morbidity from DVT should be a major concern¹⁵. *FLOWTRON* Systems provide safe and cost-effective DVT prophylaxis.

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