

GUIDELINES

European guidelines on peri-operative venous thromboembolism prophylaxis: first update.

Chapter 6: Neurosurgery

Lidia Mora, John G. Gaudet, Federico Bilotta and Nicolas Bruder

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Rationale

The reported incidence of venous thromboembolic events (VTE) in neurosurgery is widely variable, due to the high heterogeneity of study designs,^{1,2} and a wide range of surgical procedures and patient risk profiles. Therefore VTE prevention should be individualised, wherever feasible, in patients scheduled for spine or intracranial surgery. Unfortunately, validated risk stratification scales are lacking, and it is not possible to provide general recommendations for this peri-operative risk specifically.³ Moreover, attempts to demonstrate the effectiveness of peri-operative VTE screening strategies in improving outcomes have mainly proved inconclusive.⁴ The risk of permanent neurological sequelae and the need for urgent decompression of a postoperative haematoma generally discourages chemoprophylaxis in the absence of major thromboembolic risk factors.

Spine surgery

Although the reported incidence rates of deep vein thrombosis (DVT) and pulmonary embolism are significantly higher in prospective than in retrospective studies, the diagnostic strategy, the type and timing of thromboprophylaxis, the spinal segment involved (cervical or lumbosacral) as well as the invasiveness (minimally invasive vs. open surgery) and the indication for surgery (degenerative vs. oncologic), all seem to affect the peri-operative thromboembolic risk.^{1,5,6} Overall, reported incidence rates range between 0 and 11%,^{1,5} but very high rates (up to 36%) are described in patients undergoing

spinal tumour/vertebral metastasis resections or following major spinal procedures such as adult deformity corrections or multiple level decompressions.⁷ Specific patient risk factors include advanced age, active cancer, disability, diabetes mellitus, history of DVT or elevated pre-operative D-dimers, and those arising from surgery include major intra-operative bleeding, long and/or extensive interventions, involving cervical or thoracic levels, spinal trauma, or spinal cancer.^{5,7,8}

Whenever possible, early mobilisation is recommended for all patients.⁹ Whereas the use of mechanical thromboprophylaxis, including graduated compression stockings (GCS) and intermittent pneumatic compression (IPC) does not increase the haemorrhagic risk,^{1,10} optimal dosing and timing (initiation and duration) of chemoprophylaxis remain difficult to establish.^{3,6,7} In the absence of robust evidence and given the implied comorbidity of haemorrhagic complications, especially in the epidural canal, there is no widely accepted consensus on the use of anticoagulants in spinal surgery. In patients at high thromboembolic risk, combined thromboprophylaxis seems beneficial, with IPC initiated pre-operatively and drug-induced preventive anticoagulation started within 24 to 48 h after surgery once correct haemostasis is achieved.^{6,7,10–12} In the absence of renal failure, low-molecular-weight heparin (LMWH) should be preferred to unfractionated heparin (UFH)¹³ as the latter appears to increase the risk of postoperative bleeding. Neither inferior vena cava filters nor acetylsalicylic acid¹⁴ appear to reduce the risk of VTE.

From the Department of Anaesthesiology, Intensive Care and Pain Clinic, Vall d'Hebron Trauma, Rehabilitation and Burns Hospital, Autonomous University of Barcelona, Barcelona, Spain (LM), CHUV, Lausanne University Hospital (JGG), 'Sapienza' University of Rome, Rome, Italy (FB) and Aix-Marseille University, APHM, Marseille, France (NB)

Correspondence to Lidia Mora, MD, Department of Anaesthesiology, Intensive Care and Pain Clinic, Vall d'Hebron Trauma, Rehabilitation and Burns Hospital, Autonomous University of Barcelona, Barcelona, Spain.
E-mail: lidiamoramiquel@gmail.com

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Intracranial surgery

The risk of VTE following intracranial surgery and non-traumatic haemorrhage is high, and has been repeatedly associated with worse long-term clinical outcomes.¹⁵ Symptomatic DVT occurs with a frequency of 1.2 to 6% and 0.5 to 1.5% for pulmonary embolism but may be higher in patients with specific risk factors such as older age, previous history of VTE, obesity, motor deficit, malignant tumour (glioblastoma) or meningioma,^{2,16} low Karnofsky performance status (KPS < 80), long duration of surgery and length of hospital stay.

Mechanical thromboprophylaxis with or without LMWH or UFH has proved beneficial in patients undergoing intracranial surgery.^{12,13,17} IPC alone may reduce the incidence of DVT by 60%.^{10,12} Although UFH appears to be as effective as LMWH in reducing the risk of thrombosis by 50% (number needed to treat, 6 to 8), it may increase the risk of intracranial haemorrhage which occurs in 1 to 2% postoperatively.¹³ Anti-Xa assays should be used to monitor anticoagulant therapy, as supra-prophylactic levels have been associated with major bleeding in neurosurgical patients.¹⁸ The timing of chemoprophylaxis may also affect the risk of intracranial bleeding, which is the highest within 24 h after surgery. At least one-third of VTE are identified in the first week after surgery.¹⁹ Chemoprophylaxis started 24 to 48 h after intracranial surgery seems to be the best compromise to balance the haemorrhagic and thrombotic risks.

Following nontraumatic intracerebral haemorrhage, the effectiveness of IPC is comparable with other neurosurgical patients (reduction in VTE of 60%). Retrospective studies show that pharmacologic prophylaxis may be safely started within 4 days after haemorrhage to reduce the incidence of VTE without promoting haematoma expansion or rebleeding.²⁰ The prospective CLEAR III trial showed that delayed chemoprophylaxis is associated with an increased risk of VTE events in patients with intraventricular haemorrhage.²¹

Recommendations

- We recommend the peri-operative use of IPC from the beginning of surgery, in patients undergoing moderate-to-high complexity spinal procedures, craniotomy and in patients at risk of bleeding complications (**GRADE 1C**).
- In patients at high risk of thrombosis, a combination of mechanical and pharmacological prophylaxis is suggested, starting LMWH or UFH in the first 24 h postoperatively and no later than 72 h, provided that the risk of bleeding is ruled out and haemostasis is correct (**GRADE 2B**).
- After nontraumatic intracerebral haemorrhage, provided the volume of intracranial blood is not expanding and haemostasis is correct, it is suggested to start pharmacological prophylaxis 2 to 4 days after the bleeding (**GRADE 2C**).

Five supplementary tables (Appendix 1, <http://links.lww.com/EJA/A965>; Appendix 2, <http://links.lww.com/EJA/A966>; Appendix 3, <http://links.lww.com/EJA/A967>; Appendix 4, <http://links.lww.com/EJA/A968> and Appendix 5, <http://links.lww.com/EJA/A969>) providing a summary of the literature review and updates since the last edition of the ESAIC Guidelines on Thromboprophylaxis in Neurosurgery section²² are provided. These tables also show the extraction of the most relevant quality assessment data, the level of evidence (LoE), and the SIGN global checklist for the literature citations included in this chapter.

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GRAPHICAL ABSTRACT

EUROPEAN GUIDELINES ON PERIOPERATIVE VENOUS THROMBOEMBOLISM PROPHYLAXIS
FIRST UPDATE

Neurosurgery

Chapter 6

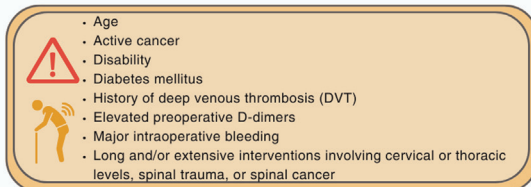


Rationale

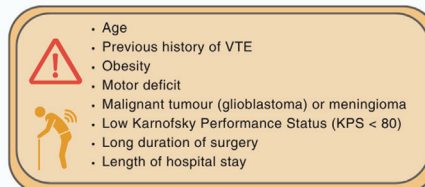
Incidence of venous thromboembolic events (VTE) in Neurosurgery is variable because of the wide range of surgical procedures and patient risk profiles
VTE prevention should be individualised in patients scheduled for spine or intracranial surgery



Spine Surgery Risk Factors



Intracranial Surgery Risk Factors



Recommendations

Perioperative use of Intermittent Pneumatic Compression (IPC) is recommended

- Moderate to high complexity spine procedures
- Craniotomy
- Patients at risk of bleeding complications
- From the beginning of surgery *Grade 1C*

Pharmacological prophylaxis is suggested

- After nontraumatic intracerebral haemorrhage provided the volume of intracranial blood is not expanding and haemostasis is correct
- Start pharmacological prophylaxis 2-4 days after the bleeding *Grade 2C*

Combination of mechanical and pharmacological prophylaxis is suggested

- In patients at high risk of thrombosis LMWH or UFH *the risk of bleeding is ruled out and haemostasis is correct*
- Start pharmacological prophylaxis in the first 24h post-operatively and no later than 72 h *Grade 2B*
- Whenever possible, early mobilization is recommended for all patients

