Introduction

VTE is an important cause of morbidity and mortality in trauma and neurosurgery patients. The following recommendations were derived in order that patients admitted to the Trauma and Neurosurgery program would benefit from an evidence-based, or rational approach to venous thromboembolic prophylaxis. Evidence does not exist for all patient situations, and judgement will be needed to balance the risks of thrombosis with the risks of treatment.

2007 Guideline review: The revised guidelines were reviewed at the Trauma/Neurosurgery Knowledge Translation Committee, Trauma Care Committee and reviewed with trauma, neurosurgical and orthopedic house staff, staff intensivists, registered nurses and allied health staff involved in the care and management of patients within the Trauma and Neurosurgery program.

Definitions

VTE - venous thromboembolism
PE - pulmonary embolism

Intermittent pneumatic compression devices (IPC) - Lower leg pneumatic compression devices consist of a double-lined inflatable garment for the leg and an electrical pneumatic pump that fills the garment with compressed air. The garment is intermittently inflated and deflated with cycle times
and pressures that vary between devices. The segmental inflation promotes increased venous return.

TED anti-embolic stockings - refer to elastic stockings (ES) which are graduated compression stockings that apply pressure of 18 mmHg at the ankle, 14 mmHg at the calf, 8 mmHg at the knee, 10 mmHg at the mid-thigh, and 8 mmHg at the upper thigh.

LDUH - low dose unfractionated heparin
LMWH - low molecular weight heparin

Supporting Information for Guidelines

Persons Authorized to Implement Guidelines:

Once the appropriate prophylaxis has been determined, a physician’s order is required for pharmacological interventions and mechanical interventions for the prevention of VTE.

Nurses trained in the use of these guidelines may implement mechanical strategies (TED stockings and intermittent pneumatic compression devices) and/or pharmacological interventions with a physician’s order.

Education, training, monitoring and evaluation mechanisms:

2002 The clinical guidelines were presented at the Quality Practice Committee of the Trauma/Neurosurgery Program. Review of the guidelines were conducted with neurosurgical and orthopedic house staff, staff intensivists, registered nurses and allied health staff involved in the care and management of patients within the Trauma and Neurosurgery program.

An on-going and yearly review will be conducted to evaluate the efficacy and safety of the guidelines. Relevant new knowledge or technologies will be incorporated into the guidelines at each yearly review.

Target population:

Guidelines should be utilized for all trauma and neurosurgery patients who are admitted at St Michael’s hospital. See attached guidelines for implementation

Contraindications to implementation:

Refer to detailed guidelines and summary table (Appendix A).

Documentation requirements:

Anticoagulants ordered by a physician should follow the guidelines established by the Pharmacy and Therapeutics committee. The use of IPC’s and TED stockings are charted in the appropriate space in the nursing assessment of the ICU and floor flowsheet as well as the nursing kardex.
Guidelines

1. At admission or at the pre-operative assessment, the patient is characterized using the table (Appendix A), based first on the risk of thrombosis, then the risk of bleeding, and service (trauma or neurosurgery) and the other descriptors.

2. The corresponding preventive and monitoring recommendations are reviewed, contraindications assessed, and the appropriate strategy is implemented.

3. If contraindications do not exist, pharmacological and/or mechanical prophylaxis should start as early as possible.

4. Where pharmacological prophylaxis is contraindicated the following guidelines apply:
   a. Neurosurgery patients: where there is a concern for active bleeding or re-bleeding and pharmacologic prophylaxis may be contraindicated initiate mechanical prophylaxis. Pharmacologic prophylaxis (UFH) is to be reassessed q 24 hours and may be initiated when there are no clinical or radiological signs of active bleeding. In the highest risk categories both mechanical and pharmacologic prophylaxis might be appropriate.
   b. Trauma patients: where there is concern for ongoing bleed, where pharmacologic prophylaxis is currently contraindicated, start with mechanical prophylaxis and reassess q 24 hours for clinical signs of active bleeding. When risk of bleeding has decreased to low, use LMWH. In the highest risk categories both mechanical and pharmacologic prophylaxis might be appropriate.

5. A physician order is required for all pharmacological and mechanical interventions.

6. Nurses trained in the use of these guidelines may implement mechanical strategies (anti-embolic stockings (TED) and/or intermittent pneumatic compression devices (IPC) and/or pharmacological interventions on a physician’s order.

7. All patients who have been assessed as appropriate candidates for the use of the IPC must be evaluated for possible existing contra-indications. These may include:
   - Suspected VTE (potential risk of PE); IPC could potentially dislodge a clot
   - Pulmonary edema; IPC increases venous return when inflating
   - Open, unrepaired lower extremity fractures or fixation with external fixator
   - Lower limb compartment syndrome
   - Complex soft tissue injuries of the lower extremities
   - Severe peripheral vascular disease

Nursing Care for patients with IPC device

- IPC s should be worn continuously but may be removed for patient care needs (e.g. transport, bathing)
- Turn off the IPC when measuring wedge and cardiac output
- IPC’s may be worn without TED stockings.
- Apply the IPCs to both legs unless contraindicated.

The disposable sleeves are available in small, medium and large; knee and thigh length.

Discontinuing IPC device

The IPC should be worn until:
A pharmacological mode of prophylaxis has been started; overlap of the two therapies is acceptable
The patient is fully ambulatory.
References

Advisory Committee. Management of warfarin therapy during invasive procedures and surgery. BCHealth Services 2004; 1-5.


Geerts et al. Prevention of venous thromboembolism, The Seven ACCP Conference on Antithrombotic and thrombolytic therapy. CHEST 2004;126;338S-400S


Rogers et al. A practice management guidelines for the management of venous thromboembolism in trauma patients. EAST Practice Parameter Workgroup for DVT Prophylaxis.


Siddiqui, A., Buchman, T., Hotchkiss, R. Pulmonary embolism as a consequence of applying sequential compression device on legs in a patients asymptomatic of deep vein...


Trauma delay in initiation of prophylaxis is associated with three fold greater risk of VTE. Presented in part at the Annual Meeting of the American Association for the Surgery of Trauma 2006; 2-22.


**Appendix Document**

Appendix A – see the following page
# Low Thrombosis Risk

**Neurosurgery:**
- Minor surgery in patients <40 years with no additional risk factors.
  - e.g. V-P shunt, simple cervical or lumbar spine surgery, SDH, minor/moderate head injury, vertebral body fracture without spinal cord injury

**Trauma:**
- Minor surgery in patients with no additional risk factors.
  - e.g. isolated facial fractures

**Prophylaxis**
- Mechanical: early ambulation
- Monitoring: daily reassessment for new risk factors

# Moderate and High Thrombosis Risk

**Neurosurgery:**
- Minor surgery in patients with additional risk factors.
- Major surgery in patients age 40-60 years with no risk factors
- Surgery in patients age > 60 years with additional risk factors.
  - e.g. complete spinal cord injury, severe closed head injury, spinal cord injury, craniotomy for tumour, craniotomy or coiling for ruptured aneurysm, major spine surgery, TBI without frank blood (most contusions), DAI, minor traumatic SAH

**Neurosurgery Prophylaxis:**
- Mechanical: IPC’s until pharmacologic prophylaxis initiated
- Pharmacologic: Heparin 5000 units sc q 12 h 24 hours post operative if no clinical or radiological signs of active bleeding
- Monitoring: daily reassessment for new risk factors

In neurosurgery patients where there is a concern for active bleeding or re-bleeding and pharmacologic prophylaxis may be contraindicated initiate mechanical prophylaxis. Pharmacologic prophylaxis is to be reassessed q 24 hours and may be initiated when there are no clinical or radiological signs of active bleeding. In the highest risk categories both mechanical and pharmacologic prophylaxis might be appropriate.
  - e.g. Intracranial hemorrhage, SDH, SAH when aneurysm not clipped; AVM, large contusion, intraspinal hemorrhage, incomplete spinal cord injury

**Trauma:**
- Multi-system injuries or major thoraco-abdominal injury
- Prior VTE, cancer, prolonged surgery, reduced pre/postoperative mobility, lower extremity paralysis, lower limb or pelvic fractures
  - e.g. isolated pneumothorax, laparotomy or thoracotomy only lower extremity or pelvic fractures, prolonged immobility

**Trauma Prophylaxis:**
- Mechanical: IPC’s until pharmacologic prophylaxis initiated
- Pharmacologic: Dalteparin (Fragmin) 5000 units sc OD at 48 hours post operative if no clinical signs of active bleeding
- Monitoring: daily reassessment for new risk factors

In trauma patients where there is concern for ongoing bleed, where pharmacologic prophylaxis is currently contraindicated, start with mechanical prophylaxis and reassess q 24 hours for clinical signs of active bleeding. When risk of bleeding has decreased to low: Dalteparin (Fragmin) 5000 units OD. In the highest risk categories both mechanical and pharmacologic prophylaxis might be appropriate.
  - e.g. spinal cord injury with spinal hematoma, uncorrected coagulopathy, pelvic # with significant retroperitoneal bleed, non-operative management of solid organ injury (x 48-72 hours), damage control surgery

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*age > 40, prior VTE, cancer, reduced pre/postoperative mobility, lower extremity paralysis, lower limb fractures
IPC=Intermittent Pneumatic Compression Devices
If IPC device not available use TEP’s until IPC available
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