

## Venous Thromboembolism (VTE) Prophylaxis Guidelines in Trauma Patients

Definitions:

VTE: Venous Thromboembolism, LMWH: Low-molecular weight heparin, UFH: Unfractionated Heparin

1. All Trauma patients expected to be admitted for over 24 hours should be considered at **high risk** for deep venous thrombosis and should be considered candidates for VTE prophylaxis.

### 2. VTE Prophylaxis Modalities

- a. **Mobilization** – All patients should be mobilized as soon as safely able. Mobility alone is not adequate VTE prophylaxis in the high-risk trauma patients. We are now capable of mobilizing sicker and sicker patients early in modern ICU paradigms – this should not be construed as adequate VTE prophylaxis in lieu of pharmacologic therapy.
- b. **Low Molecular Weight Heparin** – Enoxaparin prophylaxis should be instituted in all patients unless a specific contraindication exists. Dosing regimen is as follows:
  1. BMI < 19: Consult pharmacy
  2. BMI 19-24: Enoxaparin 30 mg SQ Q12h
  3. BMI 25-29: Enoxaparin 0.5 mg/kg adjusted body weight SQ Q12h
  4. BMI > 30: Enoxaparin 0.5 mg/kg total body weight SQ Q12h
  - i. **Absolute contraindication to anticoagulation**
    1. Known allergy to the medication
    2. Heparin-induced Thrombocytopenia diagnosed within the last 85 days (for LMWH and UFH) (NEJM 355:8, 809-817)
  - ii. **Relative contraindication to anticoagulation**
    1. Traumatic Brain Injury with blood on CT for the first 48 hours only. (Contraindication may end sooner per physician discretion.)
    2. Spine surgery for the first 48 hours only. (Contraindication may end sooner per surgeon's discretion.)
    3. Solid viscus injury (grade III-V spleen or kidney injury; grade III liver injury) for the first 24 hours only. (Contraindication may end sooner per physician discretion.)
    4. Liver injury (grade IV-V) for the first 48 hours only. (Contraindication may end sooner per physician discretion.)
    5. Bleeding diathesis (until resolved)
  - iii. **Do not hold the heparin/enoxaparin dose the night prior to any surgery except in the following circumstances:**
    1. Spine surgery
    2. Neurosurgical intervention
    3. Ocular surgery
- c. **Sequential Compression Devices (SCD) (calf or foot)** – All patients should have sequential compression devices placed on their calves on admission unless a specific consideration exists.
  - i. The following will be considered contraindications to calf SCDs application
    1. Bilateral lower extremity amputees
    2. Presence of bilateral external fixators or orthopedic casts/splints.

3. Presence of bilateral lower extremity fasciotomy
4. Presence of repaired or unrepaired soft tissue injuries in the calf region that would preclude the application of calf SCDs due to pain or suboptimal healing secondary to intermittent compression.
5. Presence of abscess or cellulitis in the region of the calf SCD application.
6. Presence of a graft or flap at the calf region that has not been documented to have completely healed.
7. Documented physician discretion

N.B. Presence of a unilateral external fixator, fasciotomy, etc. will not be considered a contraindication to placement of calf SCDs in the contralateral limb.

- ii. All patients who have a contraindication to calf SCD placement and have at least one foot should have arteriovenous foot pumps placed for VTE prophylaxis
- iii. In situations where neither calf SCDs nor foot pumps may be applied physician discretion will dictate the need to place upper extremity SCDs for VTE prophylaxis.

- d. **Graded Compression Stockings (TEDs)** – May be used as alternatives to SCDs in situations of patient noncompliance.

*N.B. A previous or current diagnosis of DVT in the lower extremities is **NOT** a contraindication to ambulation or mechanical VTE prophylaxis with SCDs, foot pumps, or TEDs.*

### 3. IVC Filters

- a. **Prevention of PE in the presence of DVT or PE** – Consider the insertion of an IVC filter in the following circumstances
  - i. Absolute contraindication to anticoagulation
  - ii. Recurrent PE or DVT, or progression of DVT despite full anticoagulation
  - iii. Major bleeding complication (i.e. Significant transfusion requirement, not occult positive stool) while on full anticoagulation
  - iv. Free floating thrombus in the femoral vein, iliac vein, or inferior vena cava.
  - v. Significant hemodynamic and respiratory compromise from initial PE (i.e. a second PE would likely prove fatal)
- b. **Prevention of PE in the absence of DVT or PE** – Consider the insertion of an IVC filter in the following circumstances
  - i. Very high risk (Severe closed head injury with GCS < 8, incomplete spinal cord injury with paraplegia or quadriplegia, complex pelvic fractures with long bone fractures, multiple long bone fractures), **and**
  - ii. Have a contraindication to anticoagulation **and**
  - iii. SCDs may not be used due to lower extremity injuries (Ref 1, Sec 8.4.4)

**Very high risk for PE**

Severe closed head injury with GCS < 8

Incomplete spinal cord injury with paraplegia or quadriplegia

Complex pelvic fractures with long bone fractures

Multiple long bone fractures

+

**Anticoagulation contraindicated**

Intracranial hemorrhage, cranial or spinal surgery until cleared by operating surgeon

Ocular hemorrhage

Solid viscus injury

Pelvic or retroperitoneal hematoma requiring

=

**Prophylactic IVC filter**  
**insertion**

+

**Inability to apply sequential  
compression device to lower  
extremities**

**4. Special Considerations**

**a. Acute Spinal Cord Injury**

- i. All spinal cord injury patients should immediately have SCDs placed for mechanical VTE prophylaxis unless a specific contraindication exists (see above)

- ii. Initiate chemical VTE prophylaxis with enoxaparin on admission if no surgical intervention is performed, or at 48 hours post-op unless a specific contraindication exists (see dosing schema in 2b above).
- iii. IVC filters should not be used unless **both** of the above can not be used for VTE prophylaxis
- iv. If mobility is expected to remain impaired for > 2 weeks, discharge the patient with a home enoxaparin bridge to warfarin (INR goal 2-3) for at least 3 months.
- v. Treatment of DVTs in spinal cord injury patients should be individualized. In the post-operative spine patient, full anticoagulation may be started after a discussion with the operating surgeon.

**b.**

**i. VTE Prophylaxis in Traumatic Brain Injury**

- 1. All traumatic brain injury patients should immediately have SCDs placed for mechanical VTE prophylaxis unless a specific contraindication exists (see above)
- 2. Initiate chemical VTE prophylaxis with enoxaparin 30 mg SQ Q12h at 48 hours post-injury or post-op unless a specific contraindication exists (see above for contraindications and dosing regimen).
- 3. Hold the previous enoxaparin dose prior to the insertion/removal of an ICP monitor. If chemical VTE prophylaxis is with heparin SQ 5000 Q8H, do not hold the heparin for monitor insertion/removal.

**ii. VTE and PE Treatment in Traumatic Brain Injury**

- 1. If TBI is > 48 hours from surgical intervention and no intracranial monitor is in place, initiate therapeutic anticoagulation with heparin drip using the Adult Cardiology Heparin Protocol Order with goal PTT 50-70.
- 2. Once two PTT checks confirm the heparin dose to be within the therapeutic range obtain a CT scan of the head to evaluate progression of intracranial hemorrhage
- 3. If intracranial hemorrhage stability is established, may convert from heparin to enoxaparin and/or warfarin per physician discretion
- 4. If intracranial hemorrhage progresses, discontinue heparin and place IVC filter

*N.B. Presence of an ICP monitor is not a contraindication to VTE chemoprophylaxis.*

- c. Epidural catheters** – Anticoagulation with epidural or spinal catheters in place can lead to epidural or paraspinous hematomas that can result in significant morbidity. Therefore, a modified approach to VTE prophylaxis in this patient population is warranted.

*If your patient is receiving enoxaparin 40 mg SQ Q24h OR enoxaparin 30 mg SQ Q12h:*

- i. Enoxaparin is withheld at least 12 hours prior to insertion of epidural catheter
- ii. Enoxaparin 40 mg SQ Q24h may be started 4 hours after catheter insertion or removal and second dose must be at least 24 hours after the first

- iii. Enoxaparin 30 mg SQ Q12h MAY NOT BE RESTARTED AFTER EPIDURAL CATHETER INSERTION. It may be restarted at least 4 hours after catheter REMOVAL.

If your patient is receiving a **larger** dose than enoxaparin 30 mg SQ Q12h OR your patient has renal impairment:

- i. Enoxaparin is withheld at least 24 hours prior to insertion of epidural catheter
- ii. First dose of enoxaparin after catheter insertion should be administered no sooner than 8 hours after the procedure
- iii. While epidural catheter is indwelling DVT prophylaxis should be maintained with **enoxaparin 40 mg SQ Q24h** (**not** enoxaparin 30 mg Q12h)

If your patient is receiving heparin 5000 IU SQ Q12h OR heparin 5000 IU SQ Q8h:

- i. Hold heparin 6 hours prior to insertion of epidural catheter
- ii. Heparin 5000 IU SQ 12h may be started 2 hours after catheter insertion or removal
- iii. Heparin 5000 IU SQ Q8h MAY NOT BE RESTARTED AFTER EPIDURAL CATHETER INSERTION. It may be restarted at least 2 hours after catheter REMOVAL.
- iv. Confirm this plan with the consulting Acute Pain Service

If your patient is receiving a therapeutic heparin drip:

- i. The heparin drip should be held for 2 hours and a PTT drawn prior to epidural catheter insertion.
- ii. A heparin drip may be used with an epidural catheter but a **communication** must be held and maintained with the Acute Pain Service inserting and managing the catheter.

d. **Lumbar drains** – Same algorithm as epidural catheters above.

e. **Renal failure**

- i. If CrCl is 30-50 use Enoxaparin 40mg SQ daily or contact pharmacist for dose adjustment.
- ii. If CrCl is <30 use heparin 5000 IU SQ Q8H

f. **Surveillance Duplex Scanning**

- i. The routine use of venous duplex scanning to screen for DVTs in the *asymptomatic* trauma patient is **not** recommended.

g. **Pregnancy**

- i. Use enoxaparin or heparin for VTE prophylaxis until 36 weeks (see dosing schema in 2b)
- ii. After 36 weeks may use heparin only

## 5. Orthopedic Trauma

a. **DVT Prophylaxis in Orthopedic trauma resulting in immobility or suboptimal mobility for  $\leq 2$  weeks**

- i. Arrange for home VTE prophylaxis in the following situations for a total of 2 weeks
  - 1. If the patient is immobile at discharge but is expected to remain immobile for  $\leq 2$  weeks
  - 2. Lower extremity orthopedic surgery above the knee (eg. Acetabulum, femur, etc.)

- ii. Pharmacologic agents should be chosen from the following in order of preference:
  1. Enoxaparin 30 mg SQ Q12h
  2. Fondaparinux (Arixtra) 2.5 mg SQ once daily
  3. Warfarin PO anticoagulation with PCP monitoring of INR. Goal INR of 1.5-2 or 1.5x baseline (whichever is higher).
  4. Rivaroxiban (Xarelto) 10 mg PO once daily (assistance program available)
  5. Apixaban 2.5 mg PO twice daily
  6. Aspirin 325 mg PO daily

**b. DVT Prophylaxis in Orthopedic Trauma Resulting in Immobility for > 2 weeks.**

- i. Arrange for home VTE prophylaxis for a total of 3 months with the following agents in order of preference
  1. Warfarin PO anticoagulation with PCP monitoring of INR. Goal INR of 1.5-2. Bridge with prophylactic dose enoxaparin or heparin
  2. Rivaroxiban (Xarelto) 10 mg PO once daily

**6. Anti-Xa level monitoring** – Should be considered in the following situations

- a. Morbid obesity (BMI  $\geq$  30)
- b. Underweight (<50 kg)
- c. Significantly changing renal function
- d. Pregnancy

## References

1. Kahn SR, Shrier I, Kearon C. Physical Activity in Patients with Deep Venous Thrombosis: a systematic review. *Thromb Res*; 2008; 122(6): 763-73
2. Gordon et al. Antithrombotic therapy and Prevention of Thrombosis, 9<sup>th</sup> ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. *CHEST* 2012; 141(2)(Suppl):7S-47S
3. Rogers et al. Practice Management Guidelines for the Prevention of Venous Thromboembolism in Trauma Patients: The EAST Practice Management Guidelines Work Group. *J Trauma* 2002; 53;142-164
4. Louis SG, Sato M, Geraci T, et al. Correlation of Missed Doses of Enoxaparin with Increased Incidence of Deep Vein Thrombosis in Trauma and General Surgery Patients. *JAMA Surg*. 2014;149(4):365-370
5. Arepally G, Ortel T. Heparin-Induced Thrombocytopenia. *N Engl J Med* 2006; 355:809-17
6. Dhall S, et al. Deep Venous Thrombosis and Thromboembolism in Patients with Cervical Spinal Cord Injuries. *Neurosurgery* 72:244-254, 2013
7. Iorio A, Agnelli G. Low-Molecular-Weight and Unfractionated Heparin for Prevention of Venous Thromboembolism in Neurosurgery. *Arch Intern Med*; 2000;160:2327-2332
8. WVUH Internal Data. Enoxaparin Medication Use Evaluation. Park SJ and Petros KO (2010).
9. Bickford et al. Weight-based Enoxaparin Dosing for Venous Thromboembolism Prophylaxis in the Obese Trauma Patient. *American Journal of Surgery* (2013) 206: 847-852.
10. Douketis et al. Perioperative Bridging Anticoagulation in Patients with Atrial Fibrillation. *NEJM* (2015) epub ahead of print. Accessed 07/02/2015
11. Horlocker TT, Wedel DJ, Rowlingson JC, et al. Regional anesthesia in the patient receiving antithrombotic or thrombolytic therapy: American Society of Regional Anesthesia and Pain Medicine Evidence-Based Guidelines (Third Edition). *Reg Anesth Pain Med*. 2010 Jan-Feb;35(1):64-101.