**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 particularly as sicker patients are mobilized earlier.
   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 72 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)
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.

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 transfusion

Inability to apply sequential compression device to lower extremities

Prophylactic IVC filter insertion
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. 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).
   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 paraspinal 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:
      i. Enoxaparin is withheld at least 12 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.

   If your patient is receiving a larger dose than enoxaparin 40 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:
      i. Heparin does not need to be held prior to insertion of epidural catheter

   If your patient is receiving heparin 5000 IU SQ Q8h:
      i. Heparin is withheld for 8 hours and a PTT is drawn prior to placement of the epidural catheter.
ii. First dose of heparin after catheter insertion should be given no sooner than 2 hours after the procedure.

iii. While epidural catheter is indwelling DVT prophylaxis should be maintained with heparin 5000 IU SQ Q12h (not heparin 5000 IU SQ Q8h)

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 ≤ 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 ≤ 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 ≥ 30)
   b. Underweight (<50 kg)
   c. Significantly changing renal function
   d. Pregnancy

**References**


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