

Practice Management Guidelines for Venous Thromboembolism Prophylaxis

I. Purpose

To prevent pulmonary embolism (PE) and deep vein thrombosis (DVT) in trauma patients

II. Risk Factor Categories

Risk Factors	High Risk Factors	Very High Risk Factors
<ul style="list-style-type: none"> • Age > 40 years • ISS > 9 • Blood transfusions • Surgical procedure within 72 hrs • Immobilization • Malignancy • Extensive soft tissue trauma • Hormone therapy • Obesity • AIS ≥ 3 (any region) 	<ul style="list-style-type: none"> • Age > 60 years • ISS > 15 • GCS < 9 for > 4 hours • Major venous injury/repair • PMH of venous thromboembolism (VTE) • Lower extremity fracture • Multiple spinal fractures • Pregnancy 	<ul style="list-style-type: none"> • Spinal cord injury with paraplegia or quadriplegia • Complex or multiple (≥ 2) lower extremity fractures • Major pelvic fracture • Multiple (≥ 3) long bone fractures (≥ 1 in the lower extremity) • Age ≥ 75 years with any high risk factor • COVID-19 positive

III. Physical Exam Findings

- A. PE- tachycardia, tachypnea, MS changes, diaphoresis
- B. DVT- extremity pain, fever, localized edema/swelling, warmth/erythema

IV. Lab and Radiology Findings

- A. Blood gas – respiratory alkalosis, hypoxemia
- B. CXR – nonspecific, peripheral wedge defect
- C. Extremity Duplex – occlusive/non-occlusive thrombosis
- D. CT angio Chest – filling defect(s)

V. VTE Prophylaxis Protocol for Trauma Patients

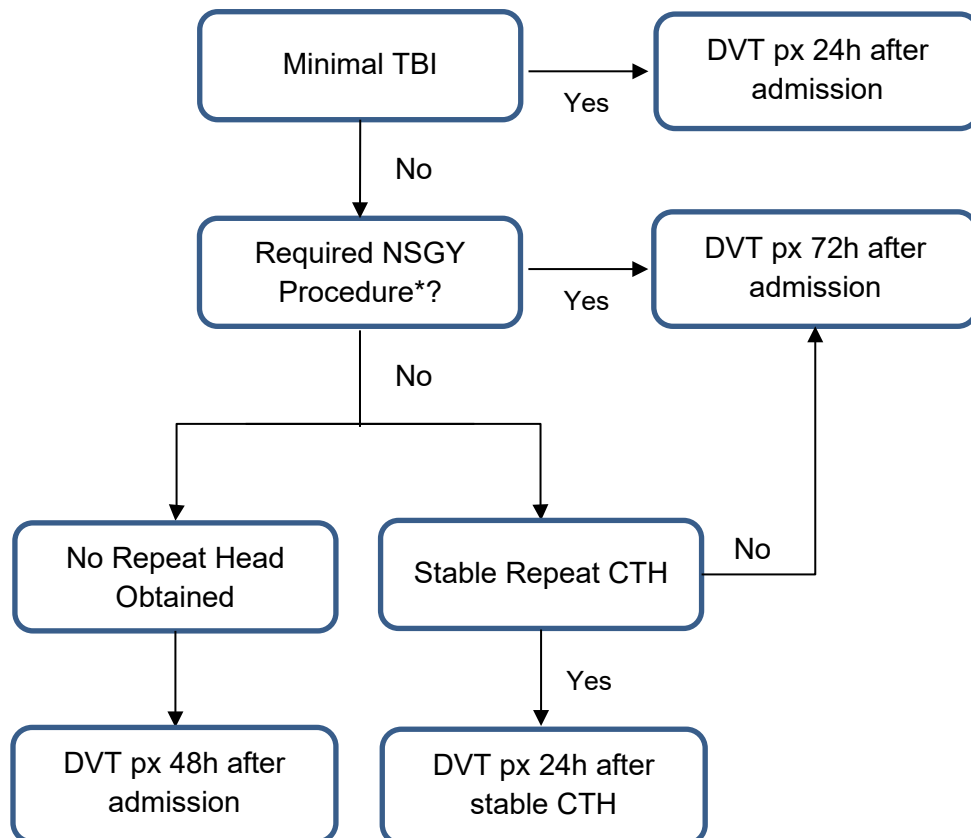
A. All trauma patients, unless otherwise specified, should receive VTE prophylaxis with weight-based enoxaparin.

Current patient weight	Enoxaparin initial dose	Axa Monitoring Required
<50 kg	30 mg q12h	Yes
50 – 89 kg	30 mg q12h	No
90 – 129 kg	40 mg q12h	Yes
130 – 179 kg	60 mg q12h	Yes
≥ 180 kg	80 mg q12h	Yes

- B. If receiving subcutaneous heparin, patients with a BMI ≥ 40 kg/m² and who do not have an epidural catheter or paravertebral block in place, a higher dose of 7500 units q8h is recommended.
- C. VTE prophylaxis should NOT be held for patients with an elevated baseline INR due to liver dysfunction.
- D. **No doses of VTE prophylaxis will be held for operative procedures except for spine and neurosurgical operative cases or unless requested by the attending.**

VI. Exceptions to VTE Prophylaxis Protocol

A. Traumatic Brain and Spine injuries



*NSGY procedures include craniotomy, burr holes, SEPS drains, ICP monitors, and EVDs.

- a. Patients with an intraspinal hematoma should have VTE prophylaxis started within 48 hours of admission unless otherwise specified by the Ortho Spine or Neuro Spine teams.
- b. For patients requiring an operative spine intervention, VTE prophylaxis should be held the morning of surgery and may be resumed 24 hrs post-operatively unless otherwise specified by the operating team.
- c. Enoxaparin is preferred in these patient populations, as well. However, patients with one of the above conditions and an ICP monitor, extraventricular drain, or spinal drain in place should receive heparin 5000 units Q 8 hrs. After removal of the ICP monitor or drain, patients should be changed to the appropriate weight-based enoxaparin dosing.

B. Epidural or Paravertebral Block Placement

- a. Enoxaparin will not be used 12 hours prior to epidural or paravertebral block placement, while the catheter is indwelling, or for 4 hours after removal.
- b. Heparin 5000 units Q 8 hrs and SCDs may be substituted for enoxaparin during the indwelling time.

C. Renal Impairment

- a. For patients with a significant rise in SCr (> 50%) or a creatinine clearance < 30 mL/min, subcutaneous heparin 5000 units Q 8 hrs may substituted for enoxaparin.
- b. In patients on renal replacement therapy, heparin 5000 units Q 8 hrs is recommended over enoxaparin.

VII. LMWH Anti-factor Xa (Anti-xa) Level Monitoring

A. An Anti-xa level should be drawn in patients with the following characteristics:

- a. Weight <50 kg or ≥ 90 kg
- b. All patients in the very high risk factor group

B. Anti-xa level peaks should be drawn 4 hours after the administration of enoxaparin.

These labs should be ordered after the third dose of enoxaparin.

- a. To order in Epic: LMW Heparin Assay (must time correctly)
- b. Goal peak is 0.2 to 0.4 IU/mL.
 - i. If Anti-xa level is drawn appropriately and below the goal range, increase the dose to the next syringe size.
 - ii. If Anti-xa level is drawn appropriately and above goal range, decrease to the next syringe size.
 1. If already at 30 mg q12h, reduce to 30 or 40 mg q24h.
 2. If anti-xa level remains above goal range despite changing to q24h dosing, then change to subcutaneous heparin 5000 units Q 8 hrs.
- c. Once the goal range is reached, no further monitoring needed

VIII. Surveillance

- a. Routine lower extremity duplex ultrasound should be completed 72 hrs after admission and weekly thereafter in patients who are in the very high risk factor group.

IX. IVC Filter Placement

A. Refer to IVC filter protocol (see [IVC Filter Placement PMG](#))

- a. A *prophylactic* IVC filter may be considered in patients with paraplegia or quadriplegia; IVC, iliac, or femoral venous ligation/repair; severe pelvic fracture with lower extremity long bone fracture; AIS head ≥ 3 with contraindication to anticoagulation; or high risk patients with contraindication, failure, or complications of anticoagulation.
- b. Indications for a *therapeutic* IVC filter include patients with known PE or lower extremity DVT and contraindication, failure, or complication of anticoagulation, among other indications.

References:

1. Rogers FB, Cipolle MD, Velmahos G, Rozycki G, Luchette FA. Practice management guidelines for the prevention of venous thromboembolism in trauma patients: the EAST practice management guideline workgroup. *J Trauma*. 2002;53:142-164.
2. Whiting PS, White-Dzuro GA, Greenberg SE, et al. Risk factors for deep venous thrombosis following orthopedic trauma surgery: an analysis of 56,000 patients. *Arch Trauma Res*. 2016;5(1):e32915.
3. Geerts WH, Jay RM, Code KI, et al. A comparison of low-dose heparin with low-molecular-weight-heparin as prophylaxis against venous thromboembolism after major trauma. *N Engl J Med*. 1996;335:701-707.
4. Phelan HA, Wolf SE, Norwood SH, et al. A randomized, double-blinded, placebo-controlled pilot trial of anticoagulation in low-risk traumatic brain injury: the Delayed Versus Early Enoxaparin Prophylaxis I (DEEP I) study. *J Trauma and Acute Care Surg*. 2012;73:1434-1441.
5. Koehler DM, Shipman J, Davidson MA, Guillaumondegui O. Is early venous thromboembolism prophylaxis safe in trauma patients with intracranial hemorrhage. *J Trauma*. 2011;70:324-329.
6. Christie S, Thibault-Halman G, Casha S. Acute pharmacological DVT prophylaxis after spinal cord injury. *Journal of Neurotrauma*. 2011;28:1509-1514.
7. Clark NP. Low-molecular-weight heparin use in the obese, elderly, and in renal insufficiency. *Thrombosis Research*. 2008;123:S58-S61.
8. Scholten DJ, Hoedema RM, Scholten SE. A comparison of two different prophylactic dose regimens of low-molecular weight heparin in bariatric surgery. *Obesity Surgery*. 2002;12:19-24.
9. Constantini TW, Min E, Box K, et al. Dose adjusting enoxaparin is necessary to achieve adequate venous thromboembolism prophylaxis in trauma patients. *J Trauma Acute Care Surg*. 2013;74(1):128-135.
10. Chapman SA, Irwin ED, Reicks P, Beilman GJ. Non-weight based enoxaparin dosing subtherapeutic in trauma patients. *Journal of Surgical Research*. 2016;201:181-187.
11. Hegsted D, Gritsiouk Y, Schlesinger P, Gardiner S, Gubler KD. Utility of the risk assessment profile for risk stratification of venous thrombotic events for trauma patients. *The American Journal of Surgery*. 2013;205(5):517-520.
12. Droege ME, Mueller EW, Besl KM, et al. Effect of a dalteparin prophylaxis protocol using anti-factor Xa concentrations on venous thromboembolism in high-risk trauma patients. *J Trauma Acute Care Surg*. 2014;76:450-456.
13. Walker C, Sandmann E, Horyna T, Gales M. Increased enoxaparin dosing for venous thromboembolism prophylaxis in general trauma patients. *Annals of Pharmacother*. 2017;51:323-331.
14. Nunez J, Becher R, Rebo G, et al. Prospective evaluation of weight-based prophylactic enoxaparin dosing in critically ill trauma patients: adequacy of anti-xa levels is improved. *The American Surgeon*. 2015;81:605-609.
15. Bickford A, Majercik S, Bledsoe J, et al. Weight-based enoxaparin dosing for venous thromboembolism prophylaxis in the obese trauma patient. *The American Journal of Surgery*. 2013;206:847-852.
16. Wang TF, Milligan PE, Wong CA, Deal EN, Thoenke MS, Gage BF: Efficacy and safety of high-dose thromboprophylaxis in morbidly obese inpatients. *Thrombosis and haemostasis*. 2014; 111(1):88-93.

17. Bethea A, Samanta D, Deshaies, et al. Determination of Optimal Weight-Based Enoxaparin Dosing and Associated Clinical Factors for Achieving Therapeutic Anti-Xa Assays for Deep Venous Thrombosis Prophylaxis. *J Am Coll Surg*. 2019;229(3):295-304.
18. Ha NB, Regal RE. Anticoagulation in Patients with Cirrhosis: Caught Between a Rock-Liver and a Hard Place. *Ann Pharmacother*. 2016;50(5):402-409.
19. Chang R, Scerbo MH, Schmitt KM, et al. Early chemoprophylaxis is associated with decreased venous thromboembolism risk without concomitant increase in intraspinal hematoma expansion after traumatic spinal cord injury. *J trauma Acute Care Surg*. 2017;83(6):1088-1094.
20. Malas MB, Naazie IN, Elsayed N, Mathlouthi A, Marmor R, Clary B. Thromboembolism risk of COVID-19 is high and associated with a higher risk of mortality: A systematic review and meta-analysis-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>). Published online 2020. doi:10.1016/j.eclinm.2020.100639
21. Kaufman E, Ong AW, Cipolle MD, et. al. The impact of COVID-19 infection on outcomes after injury in a state trauma system. *J Trauma Acute Care Surg*. 2021; 91(3):559-565.
22. Rojas L, Aizman A, Ernst D, et al. Anti-Xa activity after enoxaparin prophylaxis in hospitalized patients weighing less than fifty-five kilograms. *Thromb Res*. 2013;132(6):761-764.
23. Ley EJ, Brown CV, Moore EE, et al. Updated guidelines to reduce venous thromboembolism in trauma patients: A Western Trauma Association critical decisions algorithm. *J Trauma Acute Care Surg*. 2020;89(5):971-981.

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