Arkansas Trauma System Evidence-Based Guidelines for Treatment of Deep Venous Thrombosis (DVT) and Pulmonary Embolism (PE)

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Introduction-

Venous thromboembolism (VTE) has two main manifestations: Deep Venous Thrombosis (DVT) and Pulmonary Embolism (PE). The first EBG document in this series dealt with prophylaxis of VTE.

DVT occurs in increased percentages of trauma patients due to the combination of increased clotting tendency and immobility. VTE prophylaxis can prevent some, but not all complications, and when the trauma patient has a DVT or PE, treatment often is much more problematic and complex than in non-traumatized patients. [1] Even after VTE prophylaxis, the incidence of DVT in lower extremities ranges from 12 to 65 percent. PE incidence also varies widely, based upon the type of trauma the patient averages 0.35%. Injury to the head, spine, and thorax being less than patients with multiple areas of injury (1% PE incidence). [2]

Diagnosis and Treatment of Deep Venous Thrombosis (DVT)

Most clinicians divide DVT into proximal (popliteal vein and above) and distal (below the popliteal vein) lower extremity thromboses, with some also dividing the leg veins into deep and superficial. Diagnosis is usually made based upon either surveillance lower extremity ultrasound with compression, or after signs and symptoms of swelling, tenderness, or pain in the legs occurs. There are occasions where potential venous clot is seen on CT scan, and then evaluation with compressive ultrasound may be indicated to confirm the diagnosis and for establishing a baseline for future comparisons. [1]

Distal DVTs are important to note and call for re-evaluation of adequacy of levels of VTE prophylaxis (if already in place) or to start VTE prophylaxis if patient conditions will allow. Full-bore treatment of distal DVT, however, is typically not indicated, as most will resolve, without treatment, with time. [3]

Proximal DVTs by comparison all are candidates for aggressive anticoagulation to prevent further propagation and development of PE, and this is now accepted as confirmed evidence from numerous trials in the latter part of the 1990s. [4] Many newer trials now confirm that the benefits of a full course of anticoagulation after a proximal DVT is diagnosed will also reduce the risk of recurrent DVT in most patients. [1, 2, 3]

Treatment with anticoagulation- For trauma patients, the decision to begin full-bore anticoagulation—as opposed to the lower dosage VTE pharmacologic prophylaxis—will often be a difficult decision due to the risk of bleeding that typically exists in a badly injured patient. Some asymptomatic patients with proximal DVTs may not need treatment if the clot is small, confined to smaller muscular branches of veins, and the D-dimer titer is low (showing low lysis of small venous clot with more tendency to stay attached to the vein). [5] Some patients who are at higher risks of rebleeding, in which anticoagulation is held, may benefit by serial ultrasound imaging of their clots, to see if the clot progresses over time.

Higher risk of clot extension higher into major veins or PE can be predicted by the several risk factors, in addition to the known risk factors associated with an increased tendency of VTE due to traumatic injury and immobility: [1]

- Progression of clot on serial ultrasound or CT scans into proximal veins
- D-dimer >500 ng/ml
- Extensive thrombosis (>5cm in length or > 7mm in diameter) involving multiple veins

Types of anticoagulants- In most non-trauma patients, there are a wide variety of medications that can be used to treat DVT, including classic anticoagulants, such as heparin, and the newer Direct-Acting Oral Anticoagulants (DOACs), which can be used both for in-patient and as outpatient care [6]. However, for those patients with acute onset of DVT shortly after trauma, anticoagulation typically is restricted to parenteral agents that can either be quickly reversed or at least monitored for level of anticoagulation. Unfractionated heparin (UFH), typically given as a bolus followed by a titrated drip, is the classic drug used in these instances, due to its ability to be measured as to the degree of anticoagulation (aPTT) and to be quickly reversed (IV Protamine) in cases of renewed hemorrhage or need for other surgical procedures. Low molecular weight (LMW) heparin and fondaparinux are also frequently used, most typically as SQ injections, but both suffer the drawbacks for trauma patients of lack of ability to monitor levels of anticoagulation and reversibility. Protamine can reverse only a small portion of LMW heparin's effect, while it cannot reverse any of fondaparinux's anticoagulation effects. Thus, while LMW heparin and fondaparinux are somewhat easier to use, the ability of classic UFH to be reversed and closely monitored has to be taken into account alongside of the patients risk of re-bleeding or need for emergent surgery, in choosing which agent to treat DVT. [4, 6] As the time extends from the acute traumatic event, and thus the risk of renewed hemorrhage or need for surgery lessens, this then opens up the options for treatment using LMW heparin, fondaparinux, and the newer DOACs for the longer term.

Duration of therapy can likewise be quite variable, but most authorities agree on at least three months of anticoagulation to prevent recurrence, extension of clot more proximally, and to help prevent PE. [1, 4, 7] Patients in whom anticoagulation is contraindicated due to risks, then should be considered for inferior vena cava (IVC) filters. These typically are placed acutely, and then removed once the risk of DVT and PE diminish over time. IVC filters have clearly been shown to reduce the incidence of PE but have not shown any effect on the death rate due to PE. [8, 9]

Diagnosis and Treatment of Pulmonary Embolism (PE)

While much less frequent than DVT in trauma patients, PE can and does occur. PE is notorious for being easily missed, but still quite deadly in effect. [10] The initial effort in a patient with suspected PE is to stabilize the patient while a diagnostic evaluation gets underway. In general, treatment for PE is divided into a pathway for unstable patients (those with a systolic BP<90 for 15+ minutes, or a drop in systolic BP >40, or requiring vasopressors to maintain adequate BP), and one for stable patients (those with a systolic BP>90 and not exhibiting typical signs of shock).

Stable PE patients- this group of patients represents the majority of PE patients but may have a broad range of clinical findings, depending upon the load of venous clot in the pulmonary arterial circuit, resistance to flow out of the right ventricle, signs of right heart failure or ischemia, etc. Depending upon the risk of anticoagulation for a trauma patient, IV bolus UFH followed by infusion of UFH is started when possible, while diagnostic tests are underway. These tests usually consist of coagulation tests (PT, PTT, platelets, and D-Dimer) and cardiac enzymes to detect injury and right heart failure (troponin, BNP). CT pulmonary angiogram is the diagnostic test of choice for most patients and gives an idea of the extent of pulmonary arterial clot and obstruction. [11] Hemodynamic support with vasopressors and fluid loading are started, along with high-flow oxygen to reverse hypoxia. [10,11]

Unstable PE patients- One of the most difficult patients to treat is the recently traumatized patient with massive PE causing instability and right heart failure. The typical treatment for this type of non-trauma patient is rapid anticoagulation combined with some type of thrombolysis, either systemic or catheter directed TPA via the pulmonary artery. However, giving thrombolytics to a patient with massive trauma is fraught with complications on both ends of the spectrum of PE versus renewed or new hemorrhage. [12] Placement of an IVC filter if anticoagulation and thrombolytic therapy cannot be given is a good choice since there may be little else that can be done under those circumstances. [9, 10, 11, 12] Catheter directed thrombectomy is another potential tool to consider, in these

circumstances, but is only available in higher level trauma centers with advance IR support.

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