

Deep Venous Thrombosis

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**Cardiothoracic &
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McGovern Medical School

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Disclosures

I have nothing to disclose.



Coagulation Pathways

Virchow's Triad:

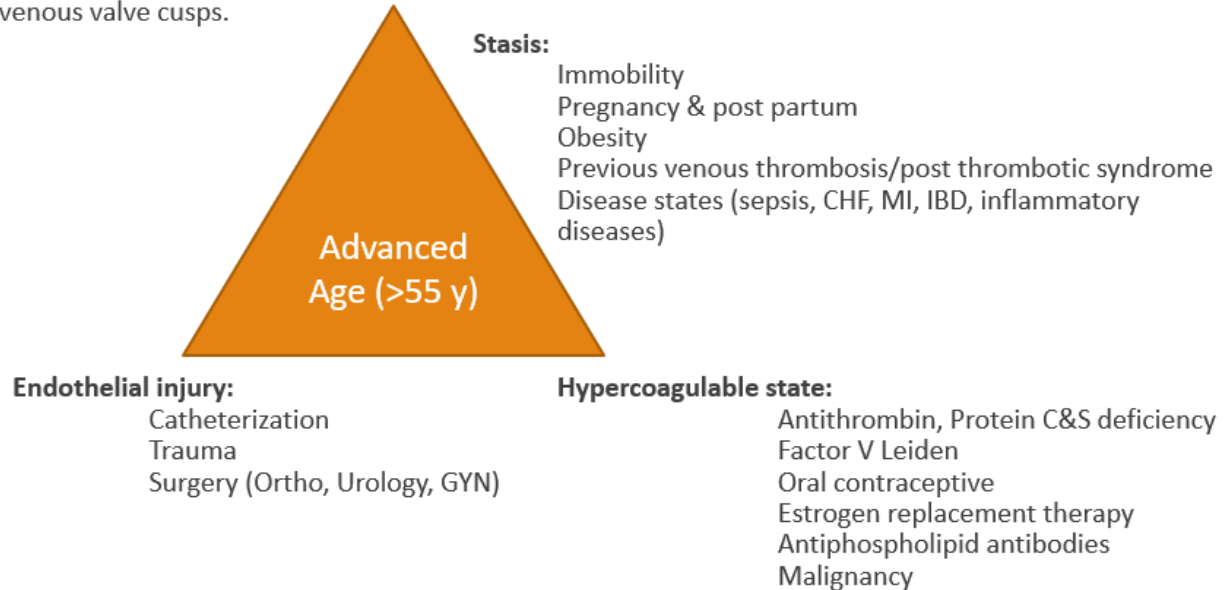
- Endothelial injury → Key to arterial thrombosis. Rupture of atherosclerotic plaque exposes lipid core to blood stream activating coagulation, platelet aggregation, then clot formation.
- Stasis
- Hypercoagulability → Stasis and changes in blood composition can incite thrombus formation in the venous system from local procoagulant events such as endothelial disruptions at venous confluences, saccules, and valve pockets.

Activation of the clotting cascade do to insult to vessels or vessel integrity disruption.



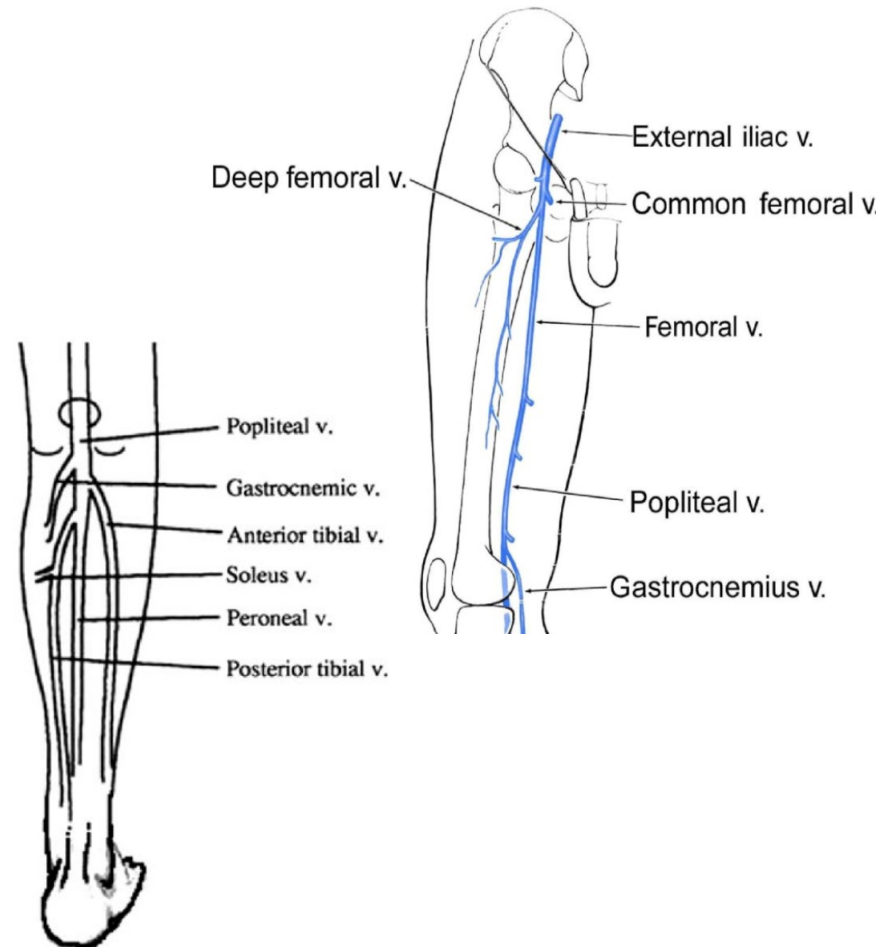
Risk Factors of Acute VTE

*Age due to adverse changes in vein wall
And thickening of venous valve cusps.



Diagnosis

- Physical Exam:
 - DVT suspected with acute unilateral leg swelling and pain.
- History:
 - Recent surgery, immobility, injury.
 - Family history of DVT, hypercoagulable disorder.
 - Pregnancy, frequent miscarriages, oral contraceptives.
 - Advanced age.



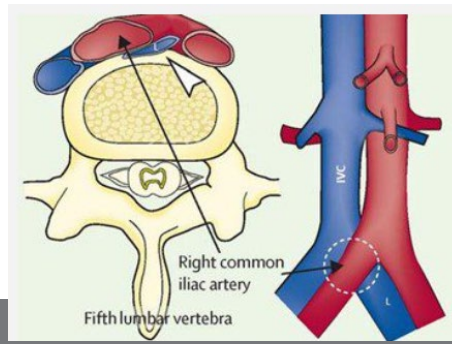
Imaging

- Venous Duplex Ultrasound:
 - Initial imaging modality of choice.
 - Evaluates femoral, deep femoral, popliteal, peroneal, soleal, gastrocnemius, posterior tibial, and anterior tibial veins.

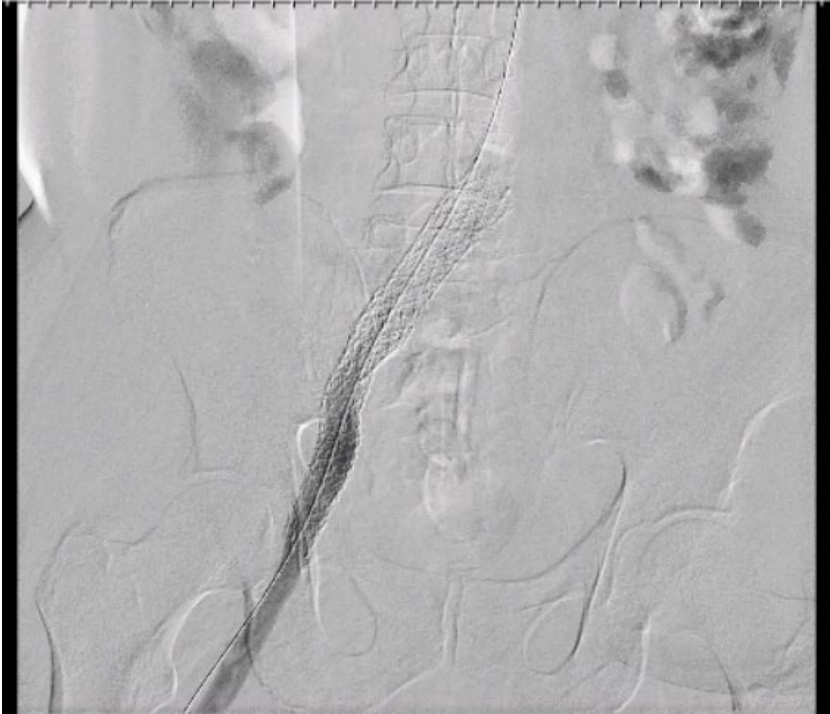
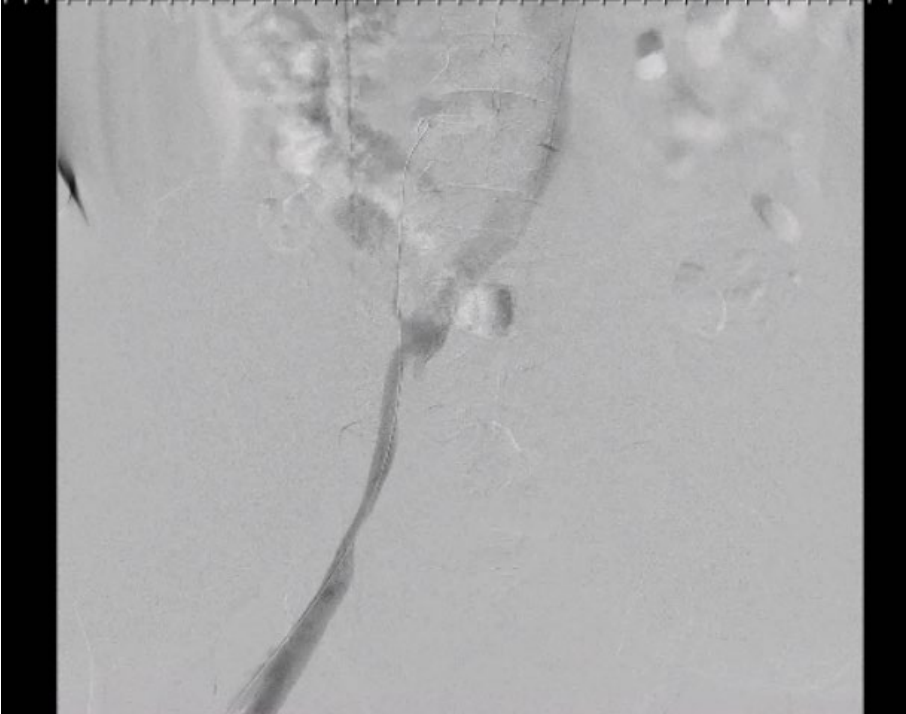


Imaging

- Ultrasound of Pelvic Veins:
 - Evaluates iliac veins. Requires patients to fast.
 - Consider when thrombus on lower extremity ultrasounds extends to the proximal femoral vein.
 - Consider for evaluation of May Turner Syndrome.
- CT Venogram:
 - Consider for evaluation for pelvic veins and IVC for thrombus or stenosis.
 - Consider for evaluation of May Turner Syndrome: Compression of left common iliac vein by the right common iliac artery. Causes stenosis and forces blood flow through pelvic collaterals. Treatment with left common iliac vein stent.



May Turner Syndrome

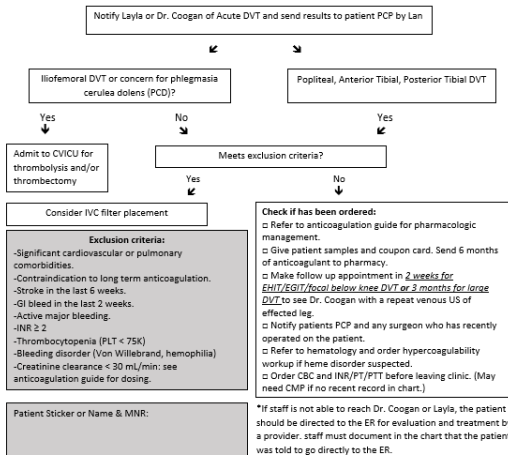


Treatment Algorithm

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Outpatient DVT Treatment Plan



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Outpatient Anticoagulation Guide

Warfarin (Coumadin)

- Warfarin 2-5 mg PO QD for typical patients.
- Warfarin 7.5 mg PO QD for morbid obesity (BMI>40) and <55 years old.
- Warfarin 2.5 mg PO QD >60 years old, malnourished, <45 kg, decompensated heart failure, liver disease, elevated baseline INR (>1.3).
- Must bridge with Lovenox therapeutic dosing until INR at goal of 2-3.
- Check INR 2-3 days after starting Warfarin and adjust warfarin dose as needed. Discontinue Lovenox once INR at goal.

Apixaban (Eliquis)

- Eliquis 10mg PO BID x7 days, then 5mg PO BID for 6 months.
- No dosing change for patients with renal dysfunction.

Rivaroxaban (Xarelto)

- Xarelto 15mg PO BID x21 days, then 20mg daily with food for 6 months.
- Do NOT use if CrCl < 15.

Enoxaparin (Lovenox)

- Lovenox 1mg/kg/dose SC q12h for 6 months.
- Renal dosing: CrCl <30 then 1mg/kg/dose QD for 6 months.
- Preferred regimen for cancer associated thrombosis, coordinate care with oncologist.

Aspirin

- Aspirin 81 md daily x14 days
- Patient with EHT, EGIT, or any focal below knee DVT

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Hypercoagulability Workup Guide

Only test before anticoagulation stated or after completed

Indications:

- Frequent miscarriages
- Recurrent DVT
- Family member with history of DVT
- Age <40 years old
- ? Idiopathic DVT
 - Not on hormone replacement, OCP, testosterone
 - No long bone fx/trauma
 - No inflammatory disorders (IBD, UC)
 - No active cancer
 - Consider May Turner syndrome if DVT is to LLE

Hypercoagulability Work Up Labs:

- Antiphospholipid antibody
- Protein S antigen
- Antithrombin activity and antigen
- Prothrombin 20210G>A mutation
- Homocysteine, serum
- PT and PTT
- CBC with diff
- CMP
- Protein C antigen, total
- Factor V Leiden mutation
- ANA with reflux



Nonoperative Treatment

- Graduated pressure support stockings including the foot, ankle, and knee (30-40 mmHg if patient is able to tolerate).
- Insure patient doesn't meet exclusion criteria for full dose anticoagulation.
 - Significant cardiovascular or pulmonary comorbidities.
 - -Contraindication to long term anticoagulation.
 - -Stroke in the last 6 weeks.
 - -GI bleed in the last 2 weeks.
 - -Active major bleeding.
 - -INR ≥ 2
 - -Thrombocytopenia (PLT < 75K)
 - -Bleeding disorder (Von Willebrand, hemophilia)



Nonoperative Treatment: 3-6 months

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Operative Treatment: Goal is to prevent post thrombotic syndrome and phlegmasia cerulea dolens.

- Patients with iliofemoral DVT (IFDVT) due to high clot burden.
 - 50% have asymptomatic PE and 25% become symptomatic once inflammatory process extends to the pleura.
 - IVC filter placement is indicated with presence of free floating thrombus in the IVC.
- Endovascular Thrombolysis and Mechanical Thrombectomy:
 - Combining chemical infusion and mechanical removal results in more efficient thrombus removal in a shorter time.
 - Endovascular thrombolysis alone is associated with prolonged infusion time and longer ICU stay, high drug cost, and higher risk of hemorrhagic complications.
- Open Surgical Treatment: Indicated if endovascular thrombolysis or pharmacomechanical thrombectomy fail or are contraindicated (long term anticoagulation).



Hypercoagulability Workup and Hematology Referral

- Indications: Frequent miscarriages, recurrent DVT, Family member with history of DVT, age <40 years old, and if possibly idiopathic DVT
- Hereditary thrombophilia refers to 5 genetic conditions including Factor V Leiden, Prothrombin G20210A (prothrombin gene mutation), Protein S deficiency, Protein C deficiency, and Antithrombin deficiency.
- Hypercoagulability Work Up Labs: completed before anticoagulation initiated
 - Antiphospholipid antibody
 - Protein S antigen
 - Antithrombin activity and antigen
 - Prothrombin 20210G>A mutation
 - Homocysteine, serum
 - PT and PTT
 - CBC with diff
 - CMP
 - Protein C antigen, total
 - Factor V Leiden mutation
 - ANA with reflex



Recanalization

- Process of reestablishing venous lumen following most DVTs. Occurs by intrinsic and extrinsic fibrinolysis, peripheral fragmentation, neovascularization, and retraction.
- Recanalization occurs within the first 6-12 weeks after acute event.
- Reduces thrombus load by 50%-60% within 6-9 months.
- Greater recanalization if DVT caused by transient risk factor (surgery/trauma) and malignancy.

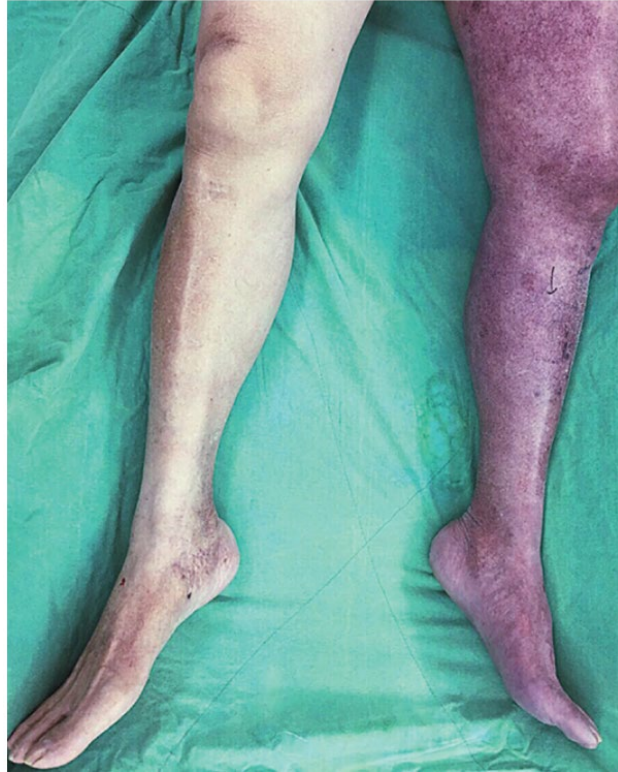


Complications

- Pulmonary Embolism (PE)
 - Most important acute complication of DVT.
 - 30-50% of patients with proximal DVT will have a PE if not recognized and treated and 10% of those are fatal.
 - Recurrence of VTE while on anticoagulation is 5% or less.
- Phlegmasia Cerulea Dolens (PCD): manifestation of severe outflow disruption. Includes venous collaterals thrombose and flow to subdermal and dermal plexus is severely reduced or absent. This leads to massive limb swelling, sever pain, nonblanching dusky blue skin.
 - Can progress to venous gangrene and limb loss
- Post Thrombotic Syndrome (PTS): results from ambulatory venous hypertension.
 - Pain, edema, hyperpigmentation, skin changes, and ulceration
 - Risk factors: previous ipsilateral DVT, iliofemoral DVT, obesity, advanced age, and female gender
 - Rapid recanalization preserves valve function



Phlegmasia Cerulea Dolens



Villalta Score for Severity of Post Thrombotic Syndrome

Clinical Descriptor	Absent (0)	Mild (1) (RT, LT)	Moderate (2) (RT, LT)	Severe (3) (RT, LT)
Pain	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
Cramps	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
Heaviness	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
Burning/prickling	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
Itching	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
Edema	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
Hyperpigmentation	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
Redness	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
Dilation of veins/venules	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
Pain on calf compression	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
Venous Ulceration	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>

Total Criteria Point Count: Right _____ Left _____






Thank You!



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