VENOUS THROMBOEMBOLIC DISEASE

Please note for all the recommendations listed below-- the risk of new or recurrent Venous Thromboembolism (VTE) versus the risk of perioperative bleeding while on anticoagulation should always be discussed with the surgeon.

Preoperative evaluation:

For patients at risk for DVT or PE:

Evaluate for signs and symptoms in patients at risk (e.g. patients with previous VTE, malignancy, hereditary thrombophilias, pregnancy). If a patient is on hormone replacement therapy or oral contraceptives, this should be stopped if possible (see "**Perioperative Medication Management"**). There is no data to support screening imaging studies prior to surgery.

For patients with recent DVT or PE[1,2, 3]:

Time of VTE prior to surgery	Risk of recurrent VTE after stopping anticoagulation	Management	
		Preop	Postop
Within 1 month	Approaching 50% if stopped prior to 1 month.	***Avoid surgery if possible.*** Consider IVC filter. Bridge with IV heparin.	Bridge with IV heparin.
1-3 months prior	The risk decreases sharply after 1 month. At 1 month about 8%. At 3 months about 4%.	Avoid surgery if possible. Consider bridging with IV heparin. If hospitalized, give prophylaxis-dosed subcutaneous unfractionated heparin or LMWH if not giving therapeutic dose anticoagulation.	Bridge with IV heparin.
>3 months prior	3 months of anticoagulation is a reasonable amount of time prior to surgery	No bridging unless severe hypercoagulable state present. If hospitalized, give prophylaxis-dosed subcutaneous unfractionated heparin or LMWH.	Prophylaxis-dosed subcutaneous unfractionated heparin or LMWH until on therapeutic anticoagulation (if this is being continued for an extended duration)

Considerations:

- IV heparin: If used preop, stop heparin infusion 4-6 hours prior to surgery. Check with surgeon for when bleeding risk is acceptable postop and consider giving without bolus when reinitiating postoperatively.
- IVC filters exist only to prevent PE. Anticoagulation is still indicated once surgical bleeding risk is low enough.
- Possible indications for IVC filters:
  1. Acute proximal DVT with an absolute contraindication to therapeutic anticoagulation due to bleeding.[6]
  2. Acute VTE within 2 weeks of surgery AND high risk of bleeding while on IV heparin.[1,4]
  3. Large PE and poor baseline cardiopulmonary reserve such that another embolic event would be poorly tolerated (even if able to be anticoagulated).[5]
- A *potentially retrievable* IVC filter may be considered when the contraindication to anticoagulation is likely to be temporary, e.g. <2 wks. However, the likelihood that a filter will be able to be removed decreases with time. Studies suggest that retrieval should occur by 3 months[7,8], although there have been reports of retreival up to around 1 year after placement depending on type of retreivable filter[8]. A time course for possible retrieval should always be discussed with the proceduralist.

Postoperative management:

Recommended VTE prophylaxis[9]

Risk Category*	Type of Surgery	Recommended Prophylaxis[10]	
		1st line	2nd line
Low Risk	Minor surgery in mobile patients (e.g. gyne laparoscopic procedures, transurethral surgeries, outpatient spine procedures in low risk patients)	Early ambulation	None
Moderate Risk	General surgery Open gynecologic Open urologic surgery	LDUH (heparin 5000 units SQ Q12H or Q8H) +/- IPC/GCS.	LMWH (e.g. enoxaparin 40 mg SQ daily) +/- IPC/GCS.
		For higher risk patients (e.g. prior VTE, extensive surgery for malignancy): Use LDUH Q8H dosing. Consider extending prophylaxis for up to 28 days.	
	Bariatric surgery	LMWH (e.g. enoxaparin 40 SQ Q12H) +/- IPC/GCS	Heparin 5000 units SQ Q8H +/- IPC/GCS. Consider higher doses e.g. 7500 units SQ Q8H.
	Intracranial neurosurgical procedure	IPC	Heparin 5000 units SQ Q8H or Q12H, or LMWH (e.g. enoxaparin 40 SQ daily)
	Elective spine surgery with additional VTE risk factors (advanced age, malignancy, neurologic deficit, previous VTE, anterior surgical approach)	Heparin 5000 SQ Q8H +/- IPC/GCS	LMWH (enoxaparin 40 SQ daily) +/- IPC/GCS
High Risk	Hip or knee arthroplasty	LMWH (e.g. enoxaparin 30 mg SQ Q12H) started either 12 hrs preop or 12-24 hours post op +/- IPC/VFP. Cont for a total of 10-35 days.	Warfarin (INR 2-3) started either night before or evening of surgery +/- IPC/VFP. Cont for a total of 10-35 days.
	Hip fracture surgery	LMWH (enoxaparin 30 SQ Q12H) +/- GCS/IPC. Cont for a total of 10-35 days.	Warfarin (INR 2-3) initiated either night before or evening of surgery. Cont for a total of 10-35 days.
	Spinal cord injury	LMWH (enoxaparin 30 SQ Q12H) +/- GCS/IPC. Initiate when bleeding risk acceptable. Continue LMWH or convert to warfarin if going to inpatient rehab.	LDUH (Heparin 5000 units SQ Q8H or Q12H) + IPC/GCS
	Trauma	LMWH (enoxaparin 30 mg SQ Q12H) as soon as bleeding risk is low enough. For major trauma in immobile pts going to inpatient rehab, can continue LMWH/warfarin.	IPC/GCS

IPC=intermittent pneumatic compression, LDUH=low dose unfractionated heparin, LMWH=low molecular weight heparin, GCS=graded compression stockings, VFP= venous foot pump
*assumes patients with average risk of venous thromboembolism at baseline, not those with hypercoagulable states, and average risk of bleeding, not those with bleeding diatheses.

Notes on prophylaxis:

- In the table above, the suitable types of pharmacologic prophylaxis for each type of surgery are outlined by 2008 American College of Chest Physicians (ACCP) guidelines, while the specific dosing recommendations are from the UWMC anticoagulation website. Regardless,

be aware that decisions regarding timing and method of prophylaxis are usually at the discretion of the surgeon with consideration to the risk of surgical bleeding.

- The American Academy of Orthopedic Surgeons[11] guidelines allow for the use of aspirin 325 mg bid as prophylaxis. However, the ACCP guidelines do not recommend this.[9]
- If pharmacologic prophylaxis is indicated but not possible due to bleeding risk, then GCS/IPC is recommended. When the bleeding risk has subsided, pharmacologic prophylaxis should be added.
- For patients with high VTE risk, there may be benefit to using pharmacologic and mechanical prophylaxis together.
- The use of neuraxial anesthesia may complicate use of LMWH and warfarin[10]. Generally use LDUH instead.
- Dose adjustment of LMWH is often needed in very obese patients (as in the bariatric population above) and those with very low body weight- check with your clinical pharmacist.
- Chronic kidney disease: LMWH may need dose adjustment or additional monitoring with factor Xa levels—discuss with clinical pharmacist. Consider using LDUH if acceptable.
- Oral direct thrombin inhibitors which do not require frequent monitoring are currently in phase III clinical trials. One study recently demonstrated that dabigatran was as effective as enoxaparin in VTE prevention and had similar bleeding rates following total hip arthroplasty.[14]
- Vascular surgery: Unless other risk factors present, no pharmacologic prophylaxis recommended. Most patients receive either heparin or antiplatelet agents.
- Burns: If additional risk factors (advanced age, morbid obesity, extensive or lower-extremity burns, lower extremity trauma, femoral venous catheter, prolonged immobility) then use LMWH or LDUH when surgically acceptable. Most burns patients are treated at Harborview.
- Fondaparinux is an equally weighted option in multiple categories in the current Chest guidelines; however its cost in our opinion does not currently justify its use over that of LDUH or LMWH.

Suspected postop DVT/PE:

Use the following tests along with clinical probability to make the diagnosis

- Chest CT-A (also known as CT PE protocol). Keep in mind that an 18 gauge antecubital IV, power PICC, or power port is usually necessary to deliver an adequately timed contrast bolus for the study to be properly interpreted.
- V/Q scan if contraindication to CT. However the V/Q may be difficult to interpret in patients with underlying lung disease.
- Lower extremity duplex if suspected DVT, or if suspected PE and unable to perform Chest CT-A or V/Q scan. Please note that a single negative lower extremity duplex does not rule out PE.
- Do not check D-dimer: not useful in patients with moderate to high pre-test probability of DVT or PE.

Newly diagnosed postop DVT/PE

Immediate management: Must discuss surgical bleeding risk with surgery team.

Bleeding risk	Management of DVT/PE
Anticoagulation unacceptable	IVC filter until able to anticoagulate. Consider potentially retrievable IVC filter
Anticoagulation acceptable, but high risk	IV heparin. Consider using “no-bolus” protocol.
Anticoagulation acceptable, low risk	IV heparin or LMWH. Begin warfarin.

Pulmonary

Considerations:

- IV heparin and LMWH have been found to be equal in efficacy for VTE. A systematic review found a mortality benefit to LMWH in patients with DVT.[12] However, IV heparin is advantageous postoperatively because of its short half life and is reversible.
- Thrombolytics indicated only for massive PE (SBP <90). Contraindications include intracranial neoplasm, hx of intracranial hemorrhage/hemorrhagic stroke, internal bleeding within 6 months.
- Upper extremity and catheter-associated DVT: Current recommendations favor treating as you would a lower extremity DVT, although definitive data is lacking. Either LMWH or IV heparin are appropriate initial management strategies.[6]

Subacute and long term management:

- For acute VTE, administer IV heparin/LMWH for at least 5 days total and until the INR is ≥ 2.0 for at least 24 hours. (i.e. usually need to give additional heparin after the first INR is in target range)
- Consider LWMH alone if VTE in association with malignancy[13]. However, cost is a concern.
- Duration of therapy for VTE is 3 months if there was a reversible, transient risk factor (e.g. recent surgery, immobilization).[6]
- Duration of therapy is at least 3 months for unprovoked VTE. After 3 months, risk-benefit of further anticoagulation should be assessed. If proximal DVT with no bleeding and good monitoring while on anticoagulation, long-term therapy is recommended. For 2nd unprovoked VTE, long-term therapy is also recommended.[6]

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