VTE Prophylaxis in Orthopedic and Non-Orthopedic Surgeries

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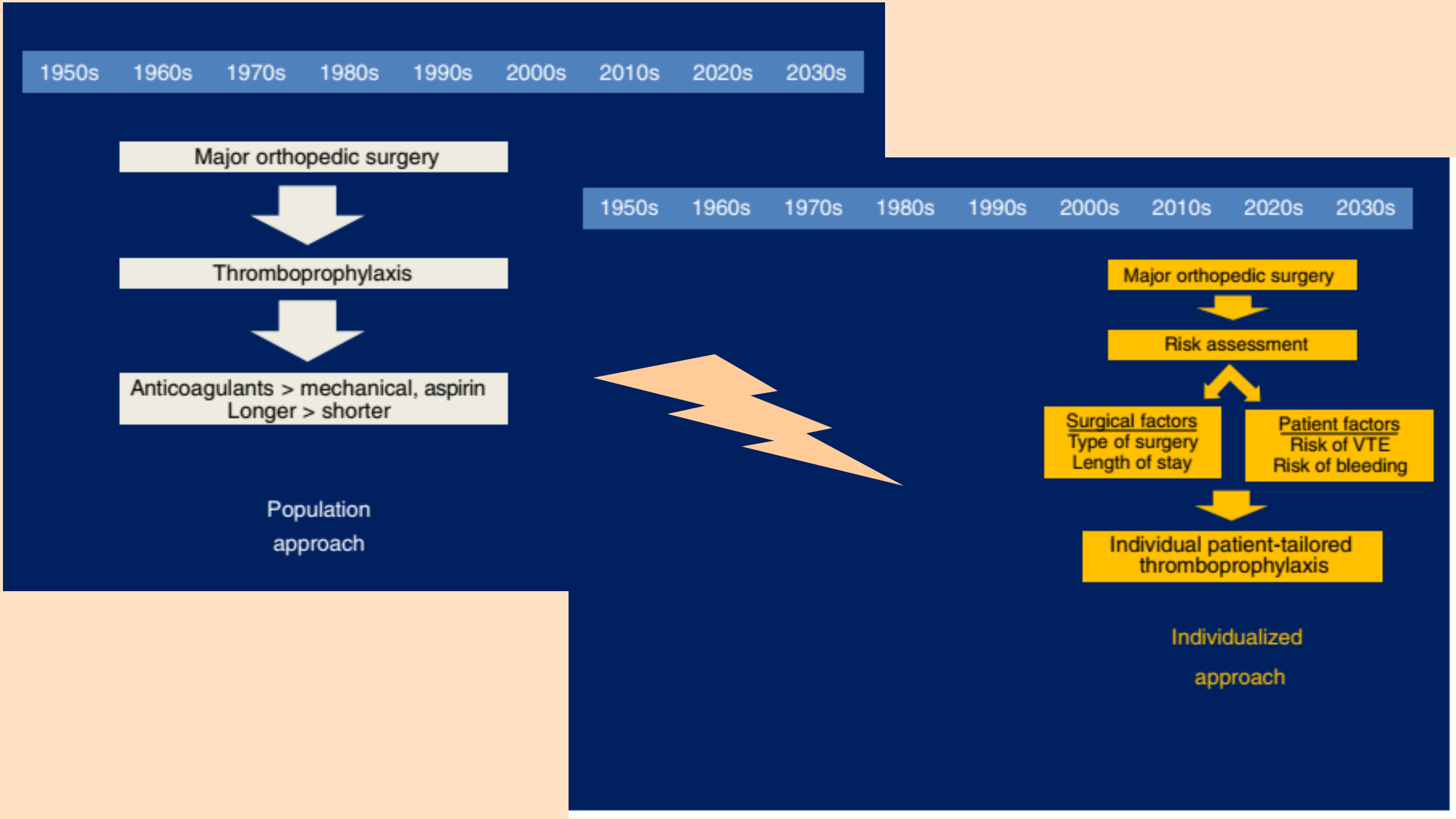
Orthopedic Surgeries


1950s 1960s 1970s 1980s 1990s 2000s 2010s 2020s 2030s
Major orthopedic surgery
Thromboprophylaxis
Anticoagulants > mechanical, aspirin
Longer > shorter
Population approach
1950s 1960s 1970s 1980s 1990s 2000s 2010s 2020s 2030s
Major orthopedic surgery
Risk assessment
Surgical factors
Type of surgery
Length of stay
Patient factors
Risk of VTE
Risk of bleeding
Individual patient-tailored thromboprophylaxis
Individualized approach

The risk of postoperative VTE in orthopedic patients

is among the highest of all surgical specialties

The risk of postoperative **VTE and bleeding** in orthopedic patients

Patient related

Procedure related

Procedure-related

- Extent and duration of surgery,
- The type of anesthesia,
- Likelihood for immobilization and casting postoperatively
- Injury and compression of the femoral vein due to flexion and adduction of the hip during hip surgery
- Use of a thigh tourniquet during knee surgery
- Performing bilateral as opposed to unilateral arthroplasty

Assessing the risk of thrombosis

At baseline, orthopedic surgeries are considered:

High risk	**Hip and knee arthroplasty** **Hip fracture surgery** **Pelvic multiple fractures** **Multiple fractures from severe trauma**	**Risk of VTE about 5%** **(without prophylaxis)**
Low risk	**Tibia, foot and ankle fractures require casting** (foot and ankle fractures, tibial osteotomy, tendon repair, hallux valgus repair) **Shoulder, elbow and hand surgery** **Arthroscopy**	**Risk of VTE <2%** **(without prophylaxis)**

Patient-related

Risk factors (causes) for the development of venous thrombosis

Inherited thrombophilia
Factor V Leiden mutation
Prothrombin G20210A mutation
Protein S deficiency
Protein C deficiency
Antithrombin deficiency

Other disorders and risk factors
Presence of a central venous catheter
Malignancy
Surgery, especially orthopedic
Trauma
Immobilization
Pregnancy
Oral contraceptives
Hormone replacement therapy
Certain cancer therapies (eg, tamoxifen, thalidomide, lenalidomide, asparaginase)
Heart failure
Congenital heart disease
Antiphospholipid syndrome
Older age (≥65 years)
Obesity
Severe liver disease
Myeloproliferative neoplasms
Polycythemia vera
Essential thrombocythemia
Paroxysmal nocturnal hemoglobinuria
Inflammatory bowel disease
Nephrotic syndrome

STATE OF THE ART ISTH 2019

rpth research & practice in thrombosis & haemostasis

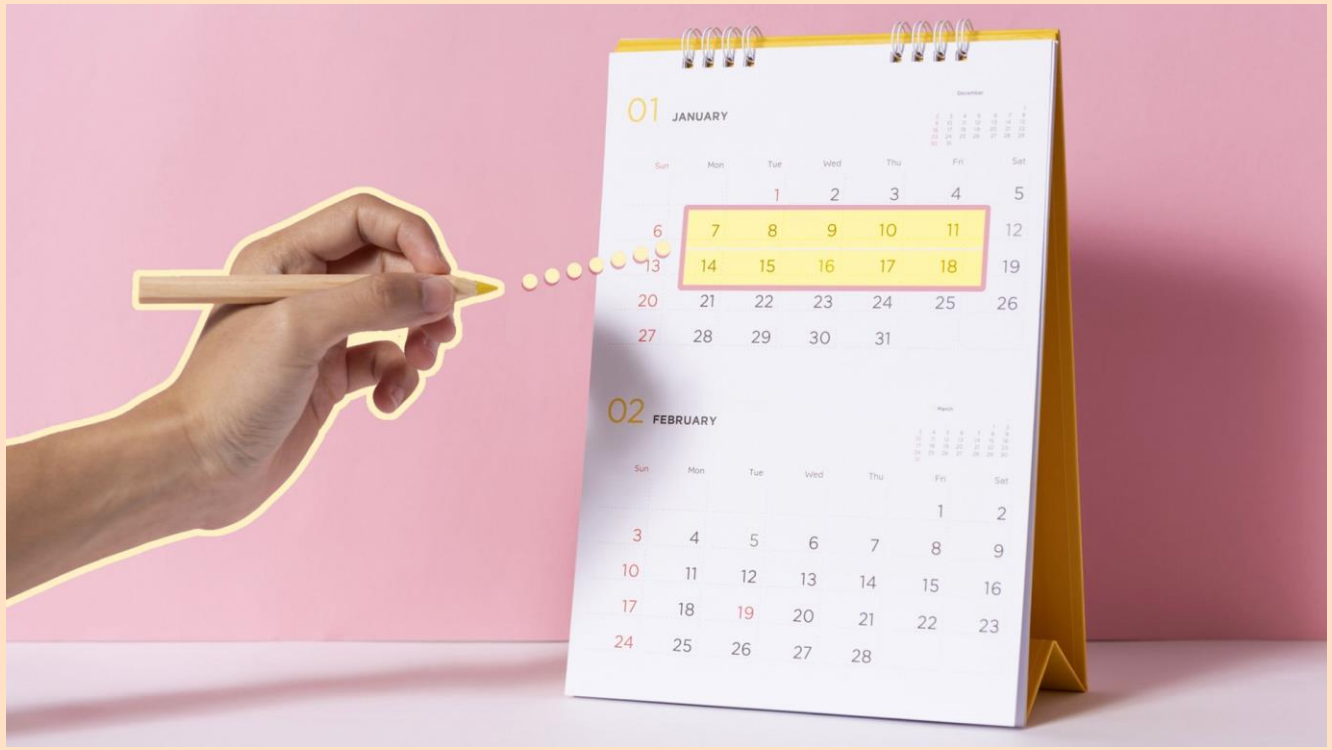
What's new in VTE risk and prevention in orthopedic surgery

Susan R. Kahn MD, MSc[1] | Sudeep Shivakumar MD, MPH[2]

Risk factors for VTE in patients undergoing major orthopedic surgery

Risk factor	Multivariable odds ratio
Previous VTE	3.4-26.9
Cardiovascular disease	1.4-5.1
Charlson comorbidity index ≥ 3	1.5-2.6
BMI > 25 kg/m^2	1.8
Family history of VTE	1.4
Older age (per 5 y increase vs age <40 y)	1.1
Age ≥85 y	2.1
Varicose veins	3.6
Ambulation before postoperative day 2	0.7

Highest risk occurring in the first 7 to 14 days and rates fall in the subsequent 15 to 35 days



Assess the risk of bleeding

Indication of pharmacologic VTE prophylaxis??

A full history and examination:

- Fatal bleeding
- Symptomatic bleeding in a critical area or organ
- Bleeding causing a fall in hemoglobin of ≥2 g/dl
  or
  leading to transfusion of two or more units of whole blood or red cells,
- Bleeding requiring reoperation

Individual risk factors for bleeding :

- Contraindications to pharmacologic prophylaxis (eg, active bleeding or intracranial hemorrhage),
- Patients who have underlying bleeding diathesis or thrombocytopenia (eg, platelet count <50,000/microL)
- Patients in whom the risk of bleeding is potentially catastrophic

***Epistaxis and menstrual bleeding are not contraindications to pharmacologic thromboprophylaxis

Procedural bleeding risk

High bleeding risk procedure (two-day risk of major bleed 2 to 4%)
Any major operation of duration >45 minutes
Abdominal aortic aneurysm repair
Coronary artery bypass
Endoscopically guided fine-needle aspiration
Foot/hand/shoulder surgery
Heart valve replacement
Hip replacement
Kidney biopsy
Knee replacement
Laminectomy
Neurosurgical/urologic/head and neck/abdominal/breast cancer surgery
Polypectomy, variceal treatment, biliary sphincterectomy, pneumatic dilatation
Transurethral prostate resection
Vascular and general surgery

Low bleeding risk procedure (two-day risk of major bleed 0 to 2%)
Abdominal hernia repair
Abdominal hysterectomy
Arthroscopic surgery lasting <45 minutes
Axillary node dissection
Bronchoscopy with or without biopsy
Carpal tunnel repair
Cataract and noncataract eye surgery
Central venous catheter removal
Cholecystectomy
Cutaneous and bladder/prostate/thyroid/breast/lymph node biopsies
Dilatation and curettage
Gastrointestinal endoscopy ± biopsy, enteroscopy, biliary/pancreatic stent without sphincterotomy, endosonography without fine-needle aspiration
Hemorrhoidal surgery
Hydrocele repair
Noncoronary angiography
Pacemaker and cardiac defibrillator insertion and electrophysiologic testing
Thoracentesis
Tooth extractions

Bleeding risk is higher for patients with multiple orthopedic fractures, and those with concomitant traumatic injuries.

TOTAL HIP OR KNEE ARTHROPLASTY AND HIP FRACTURE SURGERY with Low bleeding risk:

Recommendation	**Pharmacologic prophylaxis with or without intermittent pneumatic compression devices**
Initial agent of choice	**LMWH or DOACs; among the DOACs, rivaroxaban or apixaban are preferred**

- **For patients undergoing hip fracture surgery (HFS) → DOACs** have not been evaluated and **avoided** until their safety and efficacy are proven
- **Aspirin should not be used as the sole initial agent for VTE prophylaxis but switching to aspirin following a short course (eg, five days) of rivaroxaban may be suitable for selected low risk patients**

First line options

- **Low molecular weight heparin:** Highly effective and associated with a low risk of major bleeding; these features together with the extensive experience with LMW heparin have traditionally made it the agent of choice for those in whom pharmacologic prophylaxis is indicated.

- **Direct oral anticoagulants:** DOACs may also be an option in patients with a history of heparin-induced thrombocytopenia (HIT), for those unwilling to receive injections.

- **Aspirin:** Aspirin has been studied in the setting of extended prophylaxis, as a single agent or following a short course of anticoagulation. We prefer the use of aspirin be limited to the latter.

Second line options

- **Low-dose unfractionated heparin:** alternative to LMWH

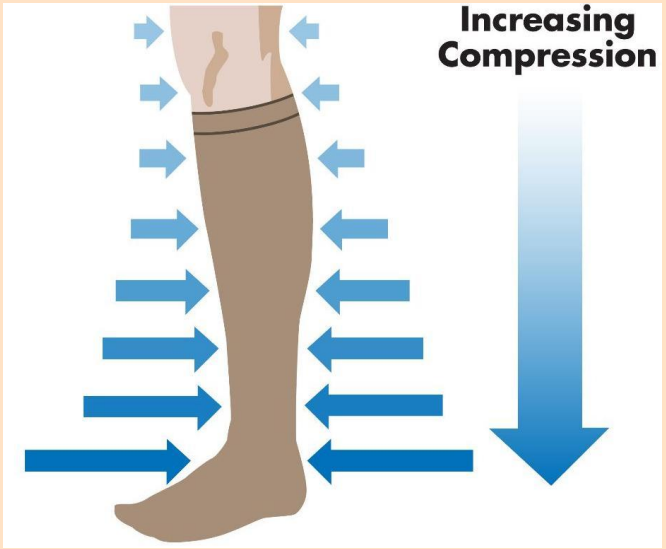
- **Fondaparinux:** Fondaparinux is an alternative to LMWH and UFH when these agents are not available or in patients with heparin-induced thrombocytopenia. It is associated with an increased risk of bleeding.

- **Warfarin:** Therapeutic anticoagulation with warfarin (usually for four weeks) is an alternative to LMW heparin or low-dose UFH (eg, patients in whom injections are not feasible or are undesirable). Dosing of warfarin should continue to target an INR of 2.5.

High bleeding risk: Mechanical methods

Intermittent pneumatic compression	Graduated compression stockings (elastic stockings)	venous foot pump

The preferred method



Less effective than LMWH or warfarin / lower bleeding risk

✓ **In case of lower efficacy, switching to or adding a pharmacologic agent, such as LMW heparin, should be done as soon as hemostasis is assessed as adequate, bleeding risk becomes acceptably low, and/or the bleeding diathesis has been reversed.**

X Their major disadvantage is poor compliance with one study reporting that properly functioning devices were used in <50 percent of cases

X Skin breakdown

Administration

Low molecular weight and unfractionated heparin

Should not be administered close to surgery (eg, within four hours preoperatively and within four hours postoperatively) due to unacceptable bleeding risk.

Administer LMWH
in 12 hours or more preoperatively and/or 12 hours or more postoperatively

Fondaparinux

Start six or more hours after skin closure consistent with major trials that demonstrated its efficacy.

*** **However, many experts administer the first dose 8 to 12 hours postoperatively to mitigate the bleeding risk, a practice that is also consistent with guidelines.**

Oral agents

warfarin, aspirin, and DOACs

Begin <u>8 to 12 hours or more after surgery</u>
(provided the patient can eat)

Mechanical methods

For those in whom mechanical methods (IPC, GCS, VFP) are indicated:

Devices are typically placed on the patient just prior to the start of surgery and used continuously postoperatively until hospital discharge or ambulation

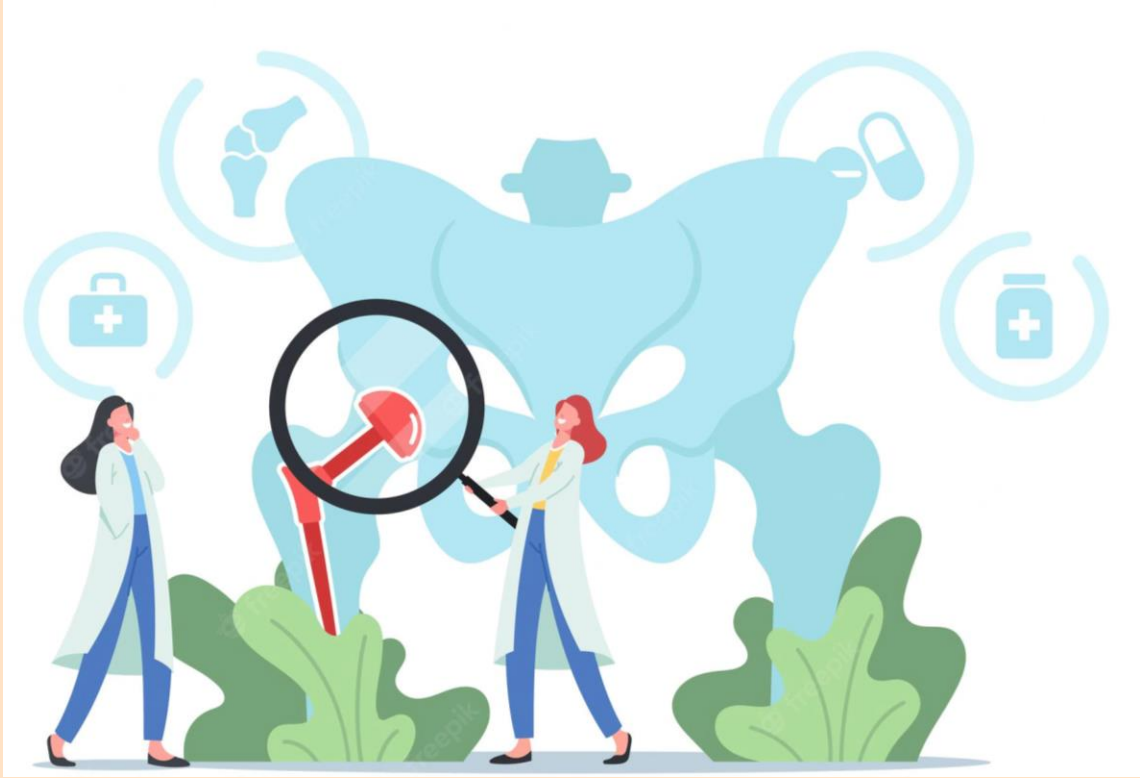
***When mechanical methods are used in patients at high risk of bleeding, **pharmacologic agents are started or added postoperatively, as soon as hemostasis is achieved and it is considered safe (eg, 12 to 72 hours)**

Duration

In patients with THA, TKA, or HFS:

Administration of pharmacologic prophylaxis for a minimum of 10 to 14 days and we suggest that it be continued for up to 35 days after surgery

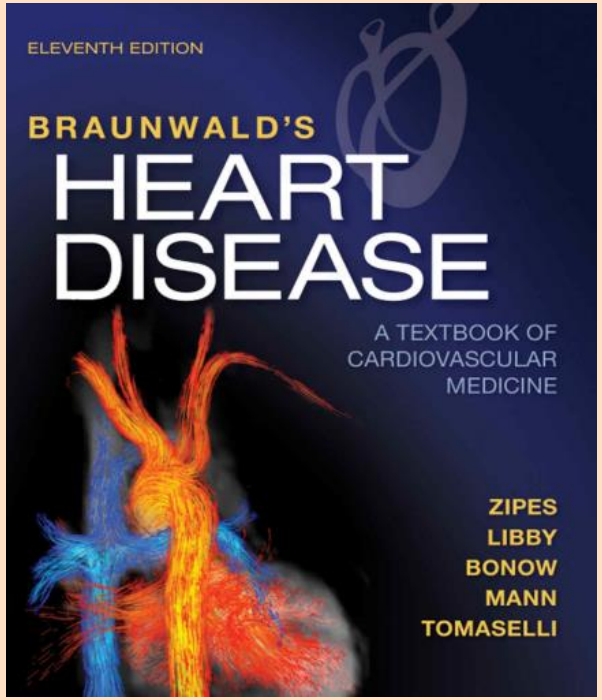
- Most clinicians prefer courses within the lower end of that range (eg, 10 to 14 days) in those undergoing TKA with longer courses in the upper end of that range (eg, 30 days) in those undergoing THA.

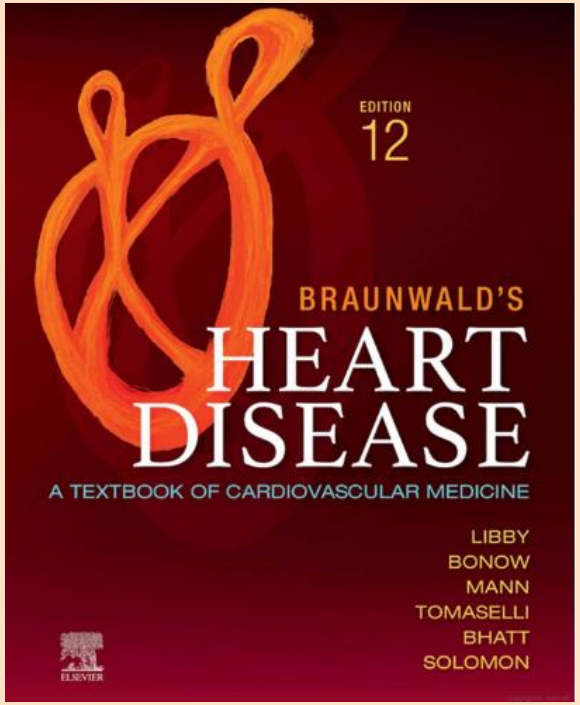


Dosing

LMWH	Enoxaparin	THA and HFS	30 mg subcutaneously every 12 hours OR 40 mg once daily	Start either ≥12 hours before or ≥12 hours after surgery
		TKA	30 mg subcutaneously every 12 hours	
	Dalteparin	THA and TKA	5000 units subcutaneously once daily	
UFH	5000 units subcutaneously twice daily (less commonly three times daily)			In obese patients some experts use 7500 units twice daily
Fondaparinux	2.5 mg subcutaneously once daily		8 to ≥12 hours after surgery	Contraindicated in patients who weigh <50 kg and avoided in those with renal insufficiency
Warfarin	Start at 5 mg orally once daily		Warfarin is started 12 to 24 hours after surgery	Some experts adjust therapeutic target INR of 1.5 to 2.5 but most experts adjusted to target an INR of 2.5 (2 to 3)
Aspirin	Typically 81 mg once daily or less commonly, 160 mg once daily			
DOACs	Rivaroxaban	10 mg once daily started 6 to ≥10 hours after surgery		
	Apixaban	2.5 mg twice daily starting ≥12 hours after surgery		
	Dabigatran	Initially 110 mg given one to four hours after surgery and thereafter 220 mg once daily		

Major orthopedic surgery	Warfarin (target INR 2 to 3) *or* Enoxaparin 30 mg SC bid *or* Enoxaparin 40 mg SC qd *or* Dalteparin 2500 or 5000 units SC qd *or* Fondaparinux 2.5 mg SC qd *or* Rivaroxaban 10 mg qd *or* Aspirin 81 mg qd *or* Dabigatran 220 mg qd *or* Apixaban 2.5 mg twice daily *or* Intermittent pneumatic compression (with or without pharmacologic prophylaxis)





Major orthopedic surgery	Warfarin (target INR 2.5) *or* Enoxaparin 30 mg SC bid *or* Enoxaparin 40 mg SC qd *or* Dalteparin 2500 or 5000 units SC qd *or* Fondaparinux 2.5 mg SC qd *or* Rivaroxaban 10 mg qd *or* Aspirin 81 mg BID *or* Rivaroxaban 10 mg qd for 5 days and then aspirin 81 mg daily thereafter Dabigatran 220 mg qd *or* Apixaban 2.5 mg twice daily

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Aspirin and the prevention of venous thromboembolism following total joint arthroplasty

commonly asked questions

I. Azboy, MD, Associate Professor of Orthopaedic Surgery,[1] R. Barrack, MD, Professor of Orthopaedic Surgery,[2]

Low dose aspirin (81 mg twice a day) was as effective as a higher dose (325 mg twice a day), with the lower dose being associated with fewer gastrointestinal side effects.

The recommendation is that low dose aspirin should be used for the prevention of VTE following arthroplasty.

There are equally many other studies showing the efficacy of low dose aspirin in minimising VTE, and a lower incidence of gastrointestinal bleeding than with the higher doses.[15,77,126-130] The PEP trial evaluated the efficacy of low dose aspirin (160 mg/day).[15] The relevant literature includes studies evaluating a wide range of doses of aspirin as VTE prophylaxis with doses of 75 mg,[13] 81 mg,[92] 100 mg,[17,51,98,131] 150 mg,[41,47,99] 160 mg,[15,132] 162 mg,[9,42,43] 250 mg,[133] 300 mg,[130] 325 mg,[95] 600 mg,[24] 650 mg,[9,27,42,43] 1200 mg,[82,84,115,129,130] 1300 mg,[31,33,35,93,134,135] and 3600 mg.[129,130] One unresolved issue in relation to the dose is the variation in the sensitivity to aspirin among patients.[136]

Suggested dose adjustments of low molecular weight (LMW) heparins in adults with renal insufficiency

	VTE treatment	VTE prophylaxis*
Enoxaparin	**CrCl ≥30 mL/min:** No adjustment **CrCl <30 mL/min:** Reduce to 1 mg/kg once daily	**CrCl ≥30 mL/min:** No adjustment **CrCl <30 mL/min:** Reduce to 30 mg once daily (medical or surgical patients)

Suggested doses of low molecular weight heparins in adult patients with a high body mass index (BMI)

	VTE treatment	VTE prophylaxis	Product labeling on use in patients with a high BMI
Enoxaparin*	Use standard treatment dosing (ie, 1 mg/kg every 12 hours based on TBW).¶ Once-daily dosing regimens of enoxaparin are **not** recommended.[1]	**BMI 30 to 39 kg/m^2:** Use standard prophylaxis dosing (ie, 30 mg every 12 hours or 40 mg once daily).[2] Some experts use weight-based dosing (ie, 0.5 mg/kg based on TBW once or twice daily, depending upon level of VTE risk).Δ[3,4] **BMI ≥40 kg/m^2:** Empirically increase standard prophylaxis dose by 30% (ie, from 30 mg every 12 hours to 40 mg every 12 hours).◊[2] Some experts use weight-based dosing (ie, 0.5 mg/kg based on TBW once or twice daily, depending upon level of VTE risk).Δ[3-7]	Safety and efficacy of prophylactic doses in patients with obesity (BMI >30 kg/m^2) has not been fully determined, and there is no consensus for dose adjustment. Observe carefully for signs and symptoms of VTE.[10] Marginal increase observed in mean anti-factor Xa activity using TBW and 1.5 mg/kg once-daily dosing in healthy persons with obesity (BMI 30 to 48 kg/m^2) compared with healthy persons with lower BMI.[10]

LOWER EXTREMITY INJURY REQUIRING IMMOBILIZATION

✓ Often young

✓ Fractures below the knee, tendon ruptures, cartilage injuries and surgeries of the knee and ankle

Risk of VTE →

- Degree of immobilization and casting
- Proximity to the knee (surgery closer to the knee is at higher risk)
- Type of surgery (eg, Achilles tendon rupture has a higher risk)

Most patients do not need thromboprophylaxis (other than early ambulation when feasible)

→ However, there should be a low threshold for administering pharmacologic prophylaxis high risk patients (eg, previous history of VTE, patient not fully mobile) or undergoing surgeries known to be high risk (eg, Achilles tendon rupture or tibial plateau fracture)

↓ If indicated

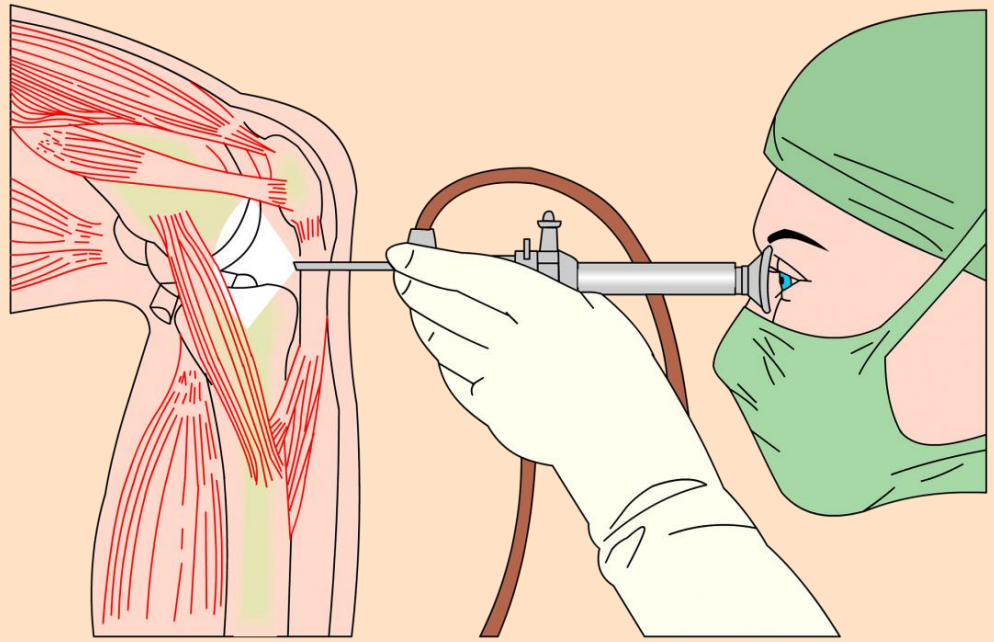
- LMW heparin is preferred
- Aspirin is frequently administered

← Duration = period of immobilization

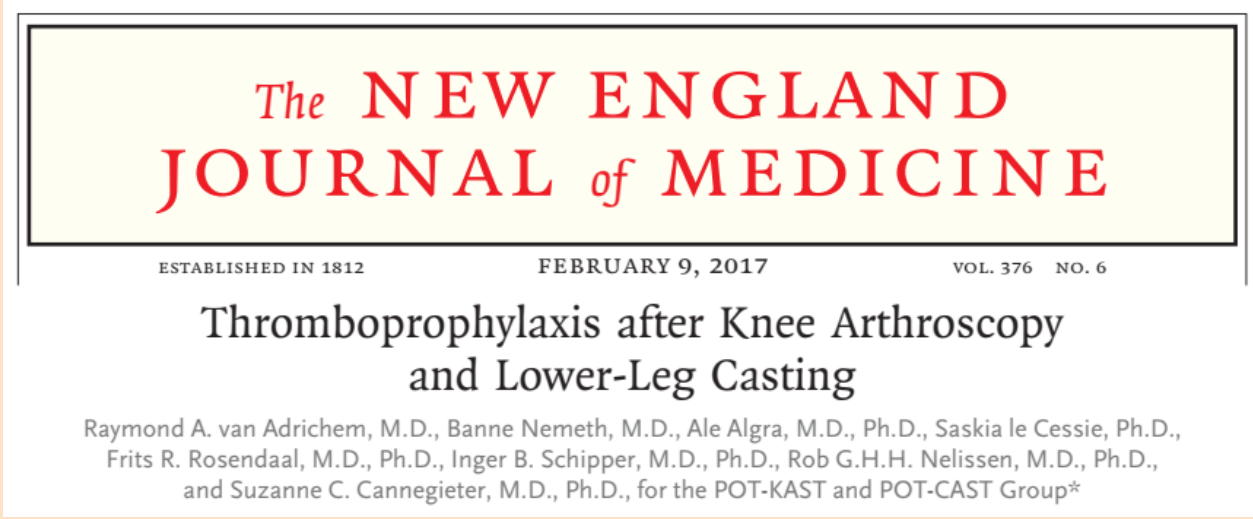
KNEE ARTHROSCOPY

Many of which are **outpatient based** and performed in **young healthy individuals**

Routine anticoagulant prophylaxis is not advised in patients undergoing arthroscopy



Best supporting this practice is one randomized trial of 1543 patients (POT-KAST) undergoing arthroscopy, which reported **the rate of VTE was unchanged among those treated with LMW heparin (for eight days) compared with those not receiving prophylactic anticoagulation.**



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Thromboprophylaxis after Knee Arthroscopy and Lower-Leg Casting

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THROMBOPROPHYLAXIS AFTER ORTHOPEDIC SURGERY

Thrombosis Canada

Thrombose Canada

Suggested Thromboprophylaxis in Orthopedic Surgery Patients

Patient Group	Prophylaxis Options*		Duration
Hip or knee arthroplasty	Rivaroxaban	10 mg by mouth (PO) daily	14-35 days
	Apixaban	2.5 mg PO twice daily	
	Enoxaparin	30 mg subcutaneously (SC) twice daily or 40 mg SC daily	
	Dalteparin	5,000 U SC daily	
	Tinzaparin	4,500 U SC daily or 75 U/kg daily	
Hip fracture	Enoxaparin	Pre-op: 30 mg SC daily Post-op: 40 mg SC daily	14-35 days
	Dalteparin	Pre-op: 2,500 U SC daily Post-op: 5,000 U SC daily	
	Tinzaparin	Pre-op: 3,500 U SC daily Post-op: 4,500 U SC daily	

Isolated below-knee fracture	None, if outpatient or overnight hospital stay LMWH once daily if inpatient	Until discharge (including rehabilitation)
Knee arthroscopy:		5-30 days
a) low risk	a) None	
b) higher risk (major knee reconstruction, prior VTE)	b) LMWH once daily	
Lower extremity amputation	LMWH once daily	Until discharge (including rehabilitation)

Non-Orthopedic Surgeries

Nonorthopedic surgeries include:

- Surgery of the skin and soft tissues of the trunk or extremities
- Surgery involving the chest, abdomen, or pelvic organs
- Surgery of the head (including brain) and neck

ASSESS RISK FOR THROMBOSIS

- ✓ Should be assessed prior to surgery
- ✓ Patient is stratified into very low, low, moderate, or high risk

➢ Procedure-related

- The extent and duration of surgery
- Intraoperative positioning
- The type of anesthesia
- Postoperative mobility

Highest risk

- Abdominal and thoracic cavity surgery
- Prolonged surgery (> 45 minutes or ≥2 hours)
- Emergency rather than elective surgery
- Postoperative immobilization for ≥4 days
- Critically ill patients who are confined to bed (eg, extensive burns, multiple trauma, brain/spine injury)

Lowest risk

- Minor surgery
- Ambulatory procedures

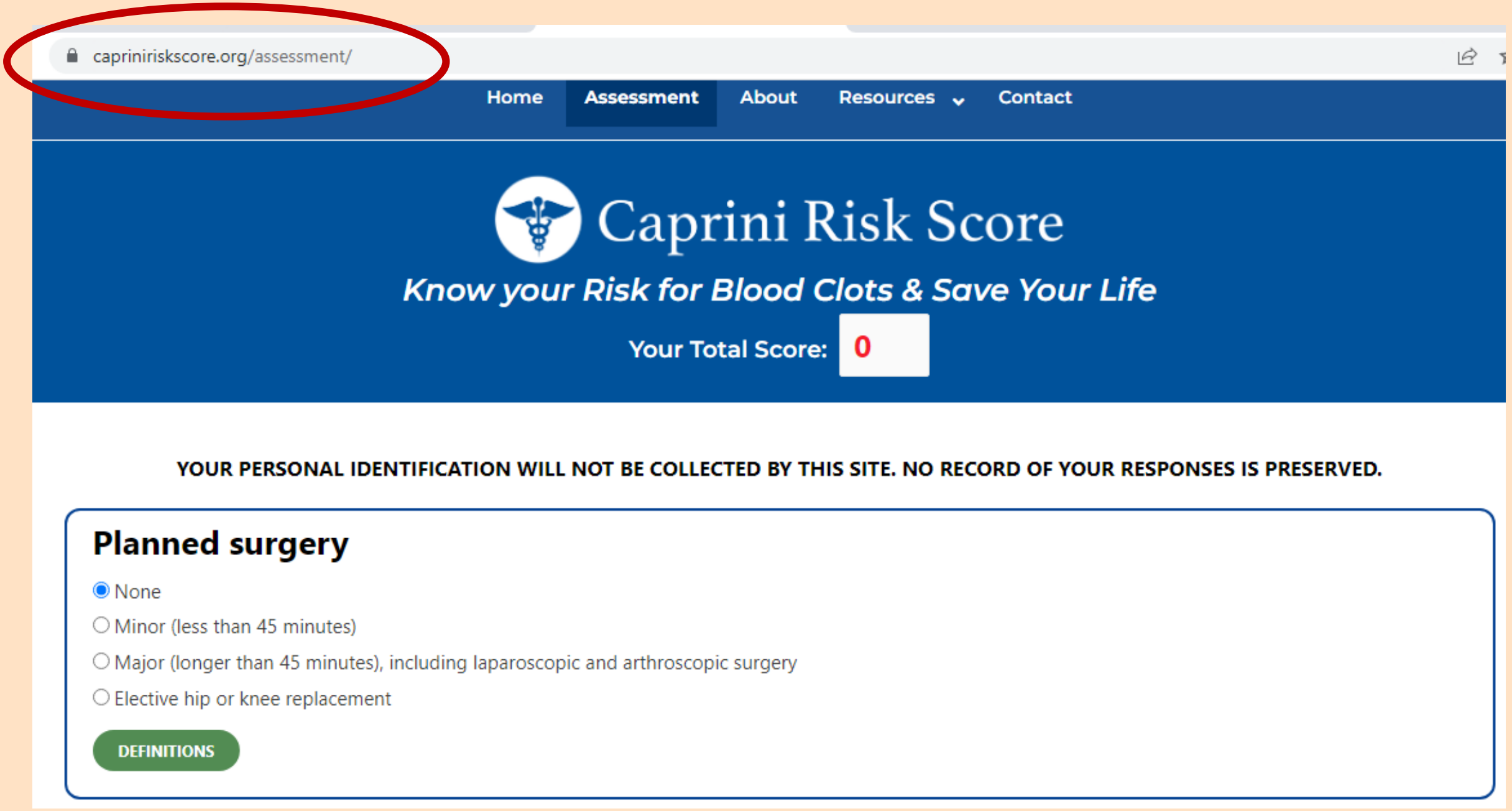
(elective hernia repair, thyroid surgery, minor skin excision, carotid endarterectomy)

➢ Patient-related

Modified Caprini risk assessment model for VTE in general surgical patients

Risk score			
1 point	**2 points**	**3 points**	**5 points**
Age 41 to 60 years	Age 61 to 74 years	Age ≥75 years	Stroke (<1 month)
Minor surgery	Arthroscopic surgery	History of VTE	Elective arthroplasty
BMI >25 kg/m^2	Major open surgery (>45 minutes)	Family history of VTE	Hip, pelvis, or leg fracture
Swollen legs	Laparoscopic surgery (>45 minutes)	Factor V Leiden	Acute spinal cord injury (<1 month)
Varicose veins	Malignancy	Prothrombin 20210A	
Pregnancy or postpartum	Confined to bed (>72 hours)	Lupus anticoagulant	
History of unexplained or recurrent spontaneous abortion	Immobilizing plaster cast	Anticardiolipin antibodies	
Oral contraceptives or hormone replacement	Central venous access	Elevated serum homocysteine	
Sepsis (<1 month)		Heparin-induced thrombocytopenia	
Serious lung disease, including pneumonia (<1 month)		Other congenital or acquired thrombophilia	
Abnormal pulmonary function			
Acute myocardial infarction			
Congestive heart failure (<1 month)			
History of inflammatory bowel disease			
Medical patient at bed rest			

Interpretation		
Surgical risk category*	**Score**	**Estimated VTE risk in the absence of pharmacologic or mechanical prophylaxis (percent)**
Very low (see text for definition)	0	<0.5
Low	1 to 2	1.5
Moderate	3 to 4	3.0
High	≥5	6.0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Know your Risk for Blood Clots & Save Your Life
Your Total Score: 0
YOUR PERSONAL IDENTIFICATION WILL NOT BE COLLECTED BY THIS SITE. NO RECORD OF YOUR RESPONSES IS PRESERVED.
Planned surgery
None
Minor (less than 45 minutes)
Major (longer than 45 minutes), including laparoscopic and arthroscopic surgery
Elective hip or knee replacement
DEFINITIONS

Google Play Games Apps Kids

MDCalc Medical Calculator

MD Aware, LLC
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Caprini Score for Venous Thromboembolism (2005)

Stratifies risk of VTE in surgical patients.

When to Use | Pearls/Pitfalls | Why Use

Age (Years)	≤40	0
	41-60	+1
	61-74	+2
	≥75	+3
Sex	Male	Female
Type of surgery (Minor surgery does not refer to type of surgery but rather length of anesthesia <45 minutes.)	None	0
	Minor	+1

General/abdominal pelvic (low to high Caprini score) → 05 – 1.6 %

Higher among those undergoing surgery for malignancy: 3.7%

(Broad range of surgeries from laparoscopic appendectomy to open pelvic surgery for cancer)

Noncardiac vascular surgery (low to high Caprini score) → Up to 10 %

Peripheral artery surgery (1.8 to 9 percent), venous ablation procedures (<1 percent), and lower extremity amputation (2 to 15 percent, higher for above knee compared with below-knee.

Plastic and reconstructive (low to high Caprini score) → 0.5 to 1.8 %

However, the estimated baseline VTE risk ranges from low (eg, outpatient cosmetic procedures) to high (eg, reconstructive surgeries).

Cardiac surgery (moderate to high Caprini score)

Noncardiac thoracic surgery (moderate to high Caprini score) → Up to 7.4 %

Highest in pneumonectomy and esophagectomy

Neurosurgery (moderate to high Caprini score) → 16 -29 %

Highest in those undergoing craniotomy and limited spine surgeries for benign conditions and cervical spine surgery are associated with less risk

Major trauma (moderate to high Caprini score) → Up to 58 percent

Seriously ill patients with multiple other injuries (eg, traumatic brain and spinal injury)

Assess the risk of bleeding

Indication of pharmacologic VTE prophylaxis??

A full history and examination:

- Fatal bleeding
- Symptomatic bleeding in a critical area or organ
- Bleeding causing a fall in hemoglobin of ≥2 g/dl
  or
  leading to transfusion of two or more units of whole blood or red cells,
- Bleeding requiring reoperation

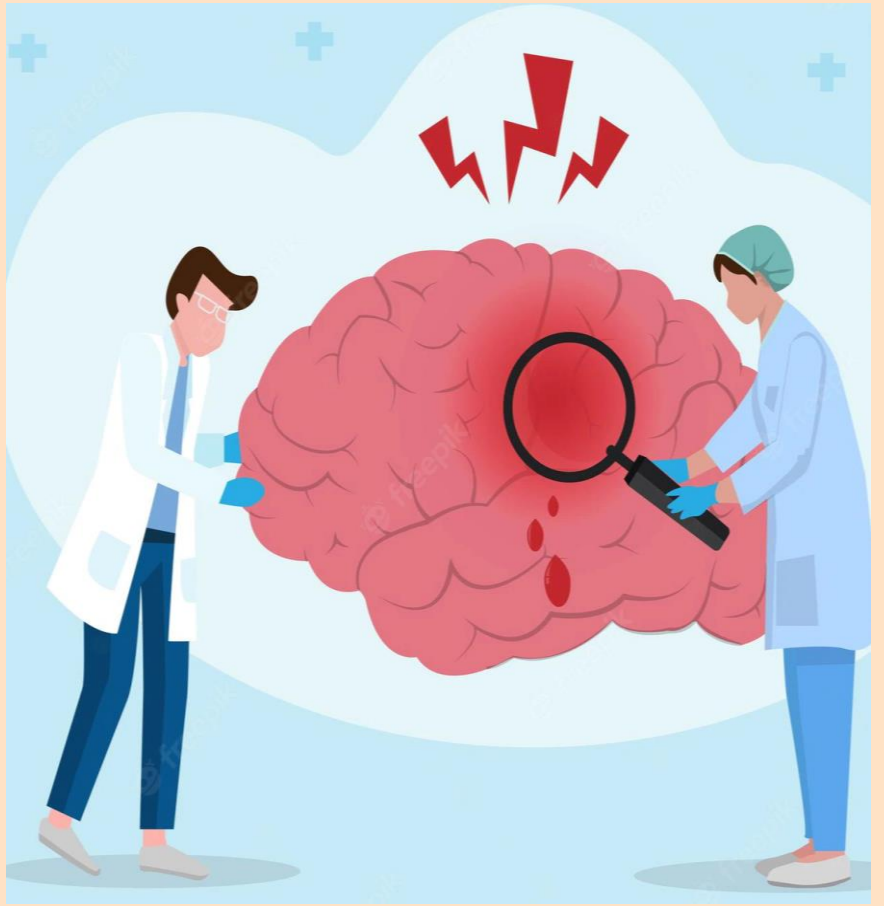
Individual risk factors for bleeding :

- Active bleeding as an indication for surgery (eg, gastrointestinal bleeding, trauma, ruptured aneurysm),
- Patients with intracranial hemorrhage,
- Patients who develop a moderate or severe coagulopathy (eg, patients with liver disease),
- Patients with an underlying bleeding disorder or thrombocytopenia (eg, platelet count <50,000/microL plus additional risk factors for bleeding).

***Epistaxis and menstrual bleeding are not contraindications to pharmacologic thromboprophylaxis

Bleeding Risk Categories

Low bleeding risk	• General, • Abdominal-pelvic, • Bariatric, • Vascular, • Uncomplicated thoracic	< 2 %
High bleeding risk **	• Cardiac • Major trauma, especially involving the brain and spine	> 3 %



** Patients in this category also include:

Those in whom the consequences of bleeding are considered potentially devastating;

Example: Patients undergoing neurosurgical procedures where thromboprophylaxis may result in spinal or intracranial hemorrhage, and patients undergoing plastic/reconstructive surgery where thromboprophylaxis may result in failed reconstruction.

SELECTING THROMBOPROPHYLAXIS

Very low thrombosis risk: Early ambulation (Risk of VTE is < 0.5 %)

Healthy young patients undergoing minor outpatient procedure:
LASIK surgery, cataract removal, skin biopsy, benign breast biopsy, diagnostic endoscopy, nasal polyp removal, dilatation and curettage, colposcopy, fluid removal from joint effusion

Recommendation: Early and frequent ambulation

*** **Mechanical methods** may be employed in the unusual circumstance where unexpected issues occur during the procedure (eg, bleeding, more extensive surgery, which intrinsically change the risk category) or the patient has a complication and requires admission

Low VTE risk: Mechanical methods (Risk of VTE is : 1.5 %)

- General or abdominal/pelvic surgery with a Caprini score of 1 to 2
- Patients undergoing plastic/reconstructive surgery with a Caprini score of 3 to 4

Examples

- Minor elective abdominal-pelvic surgery (eg, appendectomy, laparoscopic cholecystectomy)
- Minor thoracic surgery (eg, diagnostic thoracoscopy, video-assisted biopsy)
- Minor vascular procedures (eg, vein ablation)
- Elective spine surgery (eg, spinal fusion)

Recommendation:

Mechanical methods of VTE prophylaxis **rather than** pharmacologic prophylaxis or no prophylaxis

****Switching to pharmacologic methods may be appropriate in this with individual risk factors for VTE (eg, history of recurrent VTE or cancer)**

Moderate or high VTE risk (Risk of VTE is in moderate risk: 3% and high risk > 6%)

- General or abdominal/pelvic surgery with a Caprini score of 3 to 4
- Patients undergoing plastic/reconstructive surgery with a Caprini score of 5 to 6

Examples

Moderate risk:

- Major gynecologic and urologic surgery
- Major cardiac or thoracic surgery
- Bariatric surgery
- Neurosurgical procedures
- Nonextensive trauma not involving the brain or spine

- General or abdominal/pelvic surgery with a Caprini score > 5
- Plastic/reconstructive surgery with a Caprini score of 7 to 8

Examples

High risk:

- Extensive thoracic or abdominal-pelvic surgery (eg, distal colorectal surgery)
- Major trauma (particularly if involving the brain or spinal cord)
- Acute spinal cord injury
- Cancer surgery

With low bleeding risk

Recommendation: Pharmacologic prophylaxis, rather than mechanical methods

***For selected patients in whom the risk of VTE is considered to be particularly high, addition of mechanical to pharmacologic methods (eg, multiple risk factors, surgery for cancer) is suggested.

1. LMWH is generally the preferred
2. Renal insufficiency (creatinine clearance <20 to 30 mL/min) or for those in whom cost is an issue, UFH is appropriate
3. UFH or LMW heparin is contraindicated (eg, heparin-induced thrombocytopenia [HIT]) or unavailable, fondaparinux or mechanical methods are preferred

Oral agents (warfarin, aspirin, direct oral anticoagulants) ???

They are unstudied and are not typically administered in nonorthopedic surgical patients

With high bleeding risk

- Contraindications to pharmacologic prophylaxis (eg, active bleeding, intracranial hemorrhage)
- High risk of bleeding
- Consequences of bleeding are thought to be potentially catastrophic (eg, neurosurgical procedures)

→ **Mechanical methods**

****Switching to or adding a pharmacologic agent**, such as LMW heparin, should be done as soon as the bleeding risk becomes acceptably low (eg, 48 to 72 hours following neurosurgery)**

Bariatric surgery

High risk for VTE given the risk factors:

Obesity, obstructive sleep apnea/hypoventilation syndrome

The current American Society of Bariatric and Metabolic Surgeons (ASMBS) guidelines

→ **Mechanical prophylaxis and Ambulate early**

***Additionally, the surgeon may routinely utilize chemical prophylaxis consisting of either low-molecular-weight heparin or unfractionated heparin

- **Hypercoagulable disorders**
- **History of previous VTE**
- **BMI > 60 kg/m2**

→ **May be considered for extended administration of VTE prophylaxis.**

Patients with brain tumor surgery

Patients with primary or metastatic brain tumors have a latent hypercoagulable state particularly in the postoperative period

Risk factors for VTE in brain tumor patients
age ≥60 years,
Obesity
Glioblastoma histology,
Large tumor size
Subtotal resection
Chemotherapy
Neurosurgery within the past two months
Presence of leg paresis
Use of steroids
A or AB blood type

Recommendation:

Pneumatic compression stockings
+
LMWH or subcutaneous UFH
(started preoperatively and resumed 24 to 48 hours after surgery)

These measures are generally continued until the patient resumes ambulation

Timing of initiation

Low bleeding risk →

- Mechanical methods just before surgery
- Pharmacologic agents within 2 to 12 hours preoperatively

***Exception: Fondaparinux, which is typically started six to eight hours after skin closure

High bleeding risk
(potential catastrophic effect of bleeding) →

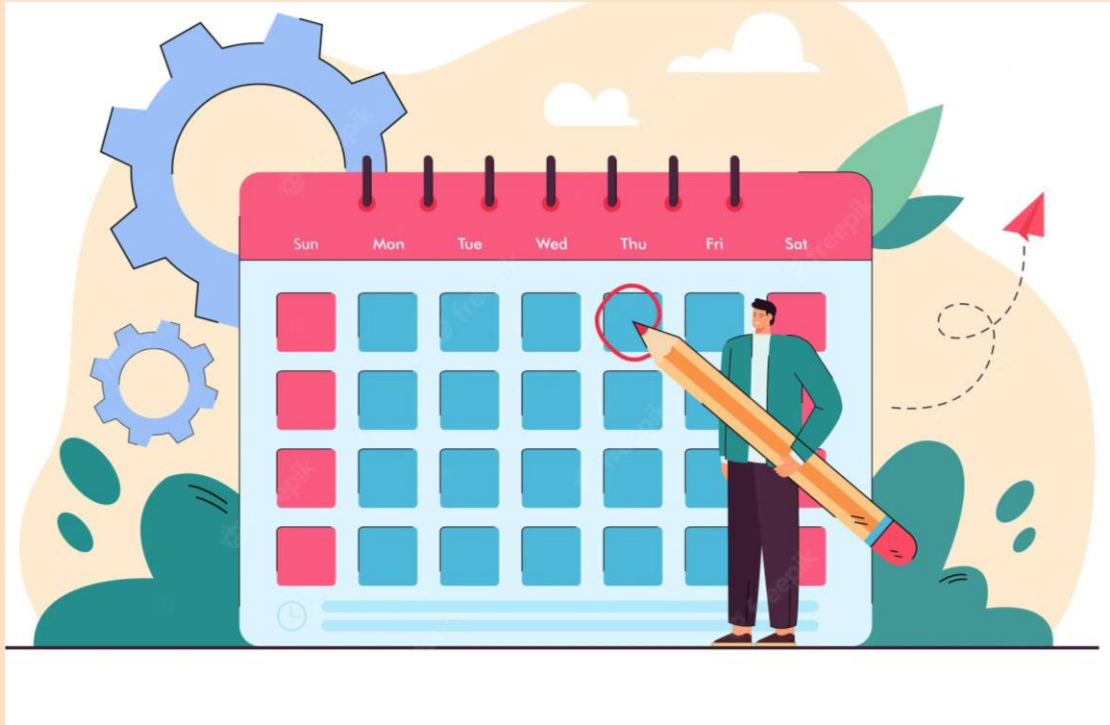
- Mechanical methods just before surgery
- Pharmacologic agents started or added postoperatively, as soon as hemostasis is achieved and it is considered safe (eg, 2 to 72 hours)

Duration

Once patients become fully ambulatory, pharmacologic and mechanical methods of prophylaxis are generally stopped (typically up to 10 days)

Extended pharmacologic VTE prophylaxis??

Not routinely recommended except for those who undergo major abdominal and/or pelvic surgery for cancer for a period of three to four week with LMWH



Risk of spinal or epidural hematoma in patients receiving neuraxial anesthesia or undergoing spinal puncture??

Increased risk in:

- **Indwelling epidural catheters**
- **Drugs that impair hemostasis (eg, anti-platelet agents)**
- **Traumatic or repeated epidural or spinal puncture**
- **History of spinal surgery**

American Society of Regional Anesthesia (ASRA) suggest:

Not administering preoperative pharmacologic agents
and
waiting at least 6 to 8 hours after catheter removal before administering prophylactic anticoagulant.

Pharmacologic dosing

Low molecular weight heparin

None of LMWH agents have superiority over the others to prevent VTE

Enoxaparin

Patients without cancer:

40 mg subcutaneously once daily started 2 hours before abdominal surgery
or about 12 hours before other surgery and 40 mg once daily thereafter

Patients with cancer:

40 mg 10 to 12 hours before surgery and 40 mg once daily thereafter

Dalteparin

Including patients with cancer:
5000 units subcutaneously started about 12 hours (or evening) before surgery and 5000 units once daily thereafter

- In patients with a BMI ≥40 kg/m , some experts empirically increase the standard LMWH dose by approximately 30 percent.

- LMWH better be avoided in patients with severe renal insufficiency (eg, creatinine clearance 20 to 30 mL/min and end stage renal failure requiring dialysis).

For those who develop severe renal insufficiency during hospitalization, it is prudent that the LMW heparin agent be discontinued and replaced with UFH.

Suggested dose adjustments of low molecular weight (LMW) heparins in adults with renal insufficiency

	VTE treatment	VTE prophylaxis*
Enoxaparin	**CrCl ≥30 mL/min:** No adjustment **CrCl <30 mL/min:** Reduce to 1 mg/kg once daily	**CrCl ≥30 mL/min:** No adjustment **CrCl <30 mL/min:** Reduce to 30 mg once daily (medical or surgical patients)
Dalteparin	**CrCl ≥30 mL/min:** No adjustment **CrCl <30 mL/min:** Use an anticoagulant with less dependence on renal clearance ¶	**CrCl ≥30 mL/min:** No adjustment

Suggested doses of low molecular weight heparins in adult patients with a high body mass index (BMI)

	VTE treatment	VTE prophylaxis
Enoxaparin*	Use standard treatment dosing (ie, 1 mg/kg every 12 hours based on TBW).¶ Once-daily dosing regimens of enoxaparin are **not** recommended.[1]	**BMI 30 to 39 kg/m^2:** Use standard prophylaxis dosing (ie, 30 mg every 12 hours or 40 mg once daily).[2] Some experts use weight-based dosing (ie, 0.5 mg/kg based on TBW once or twice daily, depending upon level of VTE risk).Δ[3,4] **BMI ≥40 kg/m^2:** Empirically increase standard prophylaxis dose by 30% (ie, from 30 mg every 12 hours to 40 mg every 12 hours).◊[2] Some experts use weight-based dosing (ie, 0.5 mg/kg based on TBW once or twice daily, depending upon level of VTE risk).Δ[3-7] **High VTE-risk bariatric surgery with BMI ≤50 kg/m^2:** 40 mg every 12 hours.§[8,9] **High VTE-risk bariatric surgery with BMI >50 kg/m^2:** 60 mg every 12 hours.§[9]

Low-dose unfractionated heparin

Alternative to LMW heparin, when, for example, cost or renal insufficiency (creatinine clearance <20 to 30 mL/min) is an issue.

5000 units every 12 hours starting ≥ 2 hours before surgery

The frequency may be increased to 3 times daily in high risk patients for VTE like cancer

Obese patients??

Empirically treat with UFH 5000 to 7500 units twice daily (or 3 times per day)

***The dose of UFH does not need to be adjusted for patients with renal insufficiency

The platelet count should be monitored regularly (eg, day 5, 7, and 9) in all patients receiving LMWH or UFH to detect the development of heparin-induced thrombocytopenia.

Fondaparinux

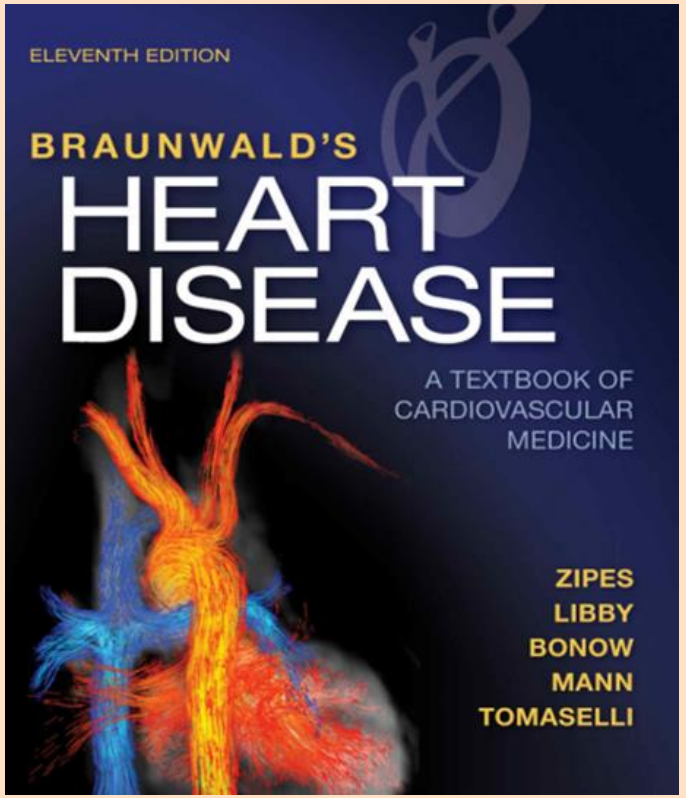
Alternative to LMW heparin and UFH in patients with contraindications to heparin (eg, HIT)

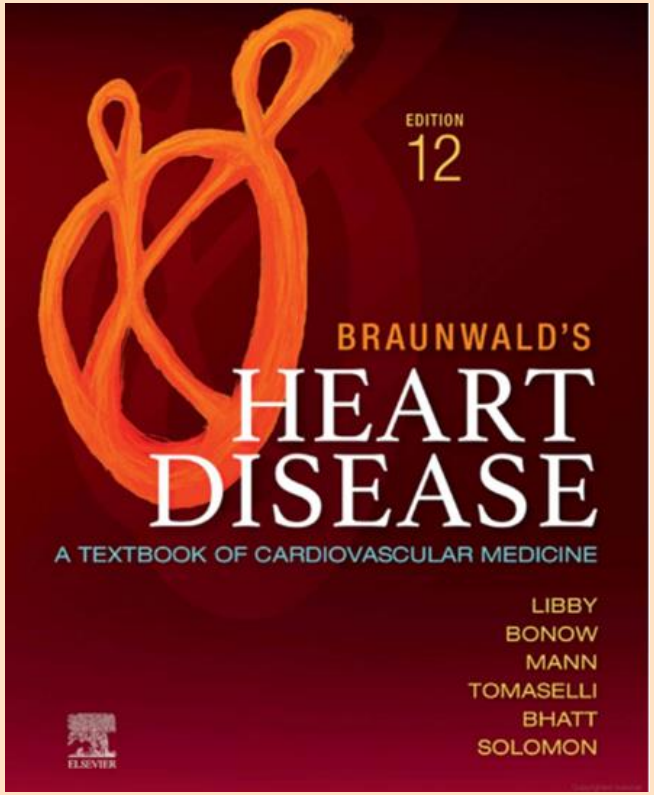
Fondaparinux is typically given as 2.5 mg once daily, starting at least 6 to 8 hours postoperatively (after skin closure)

METHODS NOT RECOMMENDED

- **Screening with ultrasonography for DVT**
- **Prophylactic vena cava filters:** should generally be avoided as prophylaxis against postoperative VTE

General surgery	Unfractionated heparin 5000 units SC bid or tid *or* Enoxaparin 40 mg SC qd *or* Dalteparin 2500 or 5000 units SC qd





General surgery	Unfractionated heparin 5000 units SC bid or tid *or* Enoxaparin 40 mg SC qd *or* Dalteparin 2500 or 5000 units SC qd

THROMBOPROPHYLAXIS AFTER NON-ORTHOPEDIC SURGERY

Thrombosis Canada

Thrombose Canada

Table: Suggested Thromboprophylaxis in Non-Orthopedic Surgery Patients

Patient Group	Prophylaxis options*	Duration
General and abdominal-pelvic surgery at very low risk for VTE (< 0.5%, Caprini score: 0)	No specific pharmacologic or mechanical prophylaxis other than early ambulation	n/a
General and abdominal-pelvic surgery at very low risk for VTE (1.5%, Caprini score: 1-2)	IPC/ECS (preferably IPC)	n/a
General and abdominal-pelvic surgery at moderate risk for VTE (3%, Caprini score: 3-4) *and* not at high risk for bleeding	LMWH or UFH IPC/ECS (preferably IPC)	7-10 days or until discharge

General and abdominal-pelvic surgery at moderate risk for VTE (3%, Caprini score: 3-4) *and* high risk for bleeding	IPC/ECS (preferably IPC)	7-10 days or until discharge
General and abdominal-pelvic surgery at high risk for VTE (6%, Caprini score: > 4) *and* not at high risk for bleeding	LMWH or UFH IPC/ECS (preferably IPC) should be added to pharmacologic prophylaxis	7-10 days or until discharge
General and abdominal-pelvic surgery at high risk for VTE (6%, Caprini score: >4) *and* high risk for bleeding	IPC/ECS (preferably IPC) Initiate LMWH or UFH when bleeding risk diminishes	7-10 days or until discharge
General and abdominal-pelvic *cancer* surgery at high risk for VTE (6%, Caprini score: > 4) *and* not at high risk for bleeding	LMWH	30 days

Patient Group	Prophylaxis options*	Duration
Cardiac surgery	IPC/ECS (preferably IPC) Add LMWH or UFH if hospitalization is prolonged.	7-10 days or until discharge
Thoracic surgery at moderate risk for VTE (3%, Caprini score: 3-4) *and* not at high risk for bleeding	LMWH or UFH or IPC/ES (preferably IPC)	7-10 days or until discharge
Thoracic surgery at high risk for VTE (6%, Caprini score: > 4) *and* not at high risk for bleeding	LMWH or UFH IPC/ECS (preferably IPC) should be added to pharmacologic prophylaxis	7-10 days or until discharge

Thoracic surgery at moderate or high risk for VTE *and* high risk for bleeding	IPC/ECS (preferably IPC) Initiate LMWH or UFH when bleeding risk diminishes	7-10 days or until discharge
Craniotomy	IPC/ECS (preferably IPC)	7-10 days or until discharge
Craniotomy at very high risk for VTE (e.g. cancer resection)	IPC/ECS (preferably IPC) Initiate LMWH or UFH when bleeding risk diminishes	7-10 days or until discharge
Spinal surgery	IPC/ECS (preferably IPC)	7-10 days or until discharge

Spinal surgery at very high risk for VTE (e.g. cancer resection)	IPC/ECS (preferably IPC) Initiate LMWH or UFH when bleeding risk diminishes	7-10 days or until discharge
Trauma surgery	LMWH or UFH or IPC/ECS (preferably IPC)	7-10 days or until discharge
Trauma surgery at very high risk for VTE (e.g. spinal cord injury, traumatic brain injury)	LMWH or UFH IPC/ECS (preferably IPC) should be added to pharmacologic prophylaxis (if not contraindicated by lower extremity trauma)	7-10 days or until discharge
Trauma surgery at high risk for bleeding	IPC/ECS (preferably IPC) Initiate LMWH or UFH when bleeding risk diminishes	7-10 days or until discharge

Thank You for Your Attention