



OBJECTIVE:

To summarize a practical approach to the prevention of venous thromboembolism (VTE) in various patient groups undergoing orthopedic surgery or with lower extremity fractures.

BACKGROUND:

Patients undergoing hip arthroplasty, knee arthroplasty, hip fracture surgery, and patients with major lower extremity injuries are at particularly high risk for VTE. In this population, routine use of thromboprophylaxis has been standard-of-care for many years. Before thromboprophylaxis was widely used, deep vein thrombosis (DVT), which was most often clinically silent, occurred in 40-60% of these patients. In addition, pulmonary embolism (PE) occurred in 5-10% of patients, and fatal embolism was one of the most common causes of death. The use of evidence-based thromboprophylaxis in these patients has been shown to reduce the risk of DVT by at least 50% and, as a result, major and fatal VTE are now uncommon. A large number of clinical trials have assessed many different thromboprophylaxis modalities in orthopedic surgery.

For patients undergoing major orthopedic surgery, the risk of symptomatic VTE continues for weeks to several months after discharge. Numerous clinical trials have demonstrated that continuing thromboprophylaxis for up to 4-6 weeks in patients with hip or knee arthroplasty or hip fracture surgery reduces symptomatic VTE compared with stopping at discharge.

There is less evidence-based literature guiding thromboprophylaxis in patients who undergo spine surgery, knee arthroscopy, lower limb amputation, and in those with other lower extremity fractures. These groups generally have lower risk of VTE than patients undergoing arthroplasty or hip fracture surgery.

This summary suggests common, effective thromboprophylaxis options. It is not designed to comprehensively discuss all possible options. In some cases, alternative options may also be considered. Given the widespread accessibility of more effective and equally or more convenient alternatives, options based on acetylsalicylic acid (ASA) alone or vitamin K antagonists have not been included.

TABLE: SUGGESTED THROMBOPROPHYLAXIS IN ORTHOPEDIC SURGERY PATIENTS

| PATIENT GROUP | THROMBOPROPHYLAXIS OPTIONS* | DURATION | |
|---|--|---|------------|
| Hip or knee arthroplasty | rivaroxaban | 10 mg PO once daily | 14-35 days |
| | apixaban | 2.5 mg PO twice daily | |
| | dabigatran | 220 mg PO once daily | |
| | enoxaparin | 30 mg SC twice daily or 40 mg SC once daily | |
| | dalteparin | 5,000 U SC once daily | |
| | tinzaparin | 4,500 U or 75 U/kg SC once daily | |
| | fondaparinux | 2.5 mg SC once daily | |
| | nadroparin | 38 U/kg SC once daily (day 1-3 post-op), followed by 57 U/kg SC once daily (day 4+ post-op) | |
| ASA | 81 mg PO once daily, beginning after receiving rivaroxaban 10 mg PO once daily for the first 5 post-op days** | | |
| Hip fracture surgery | enoxaparin | 30 or 40 mg SC once daily | 14-35 days |
| | dalteparin | 2,500 or 5000 U SC once daily | |
| | tinzaparin | 4500 U SC once daily | |
| | fondaparinux | 2.5 mg SC once daily | |
| | nadroparin | 38 U/kg SC once daily (day 1-3 post-op), followed by 57 U/kg SC once daily (day 4+ post-op) | |
| Major orthopedic trauma | LMWH [enoxaparin 30 mg SC twice daily, dalteparin 5,000 U SC once daily or tinzaparin 4,500 U SC once daily] when hemostasis is evident | Until discharge (including rehabilitation) | |
| | Mechanical method with IPC or ECS if high risk for bleeding with switch to LMWH when bleeding risk decreases. Inferior vena cava (IVC) filters are not recommended for thrombosis prophylaxis. | | |
| Spine surgery: | | | |
| a) Uncomplicated | a) Mobilization alone | Until discharge (including rehabilitation) | |
| b) Complicated (cancer, spinal cord injury with leg weakness or paralysis, prior VTE, combined anterior/posterior approach) | b) LMWH once daily starting the day after surgery | | |
| Isolated below-knee fracture | No prophylaxis if outpatient or overnight hospital stay | Until discharge (including rehabilitation) | |
| | LMWH once daily if inpatient | | |
| Knee arthroscopy: | | | |
| a) low risk | a) None | 5-30 days | |
| b) higher risk (e.g. major knee reconstruction, prior VTE, | b) LMWH once daily or direct oral anticoagulant | | |

| PATIENT GROUP | THROMBOPROPHYLAXIS OPTIONS* | DURATION |
|---|-----------------------------|--|
| cancer, other VTE risk factors) | | |
| Lower extremity amputation | LMWH once daily | Until discharge (including rehabilitation) |
| Other: bedrest, incision & drainage, etc. | LMWH once daily | Until discharge |

* Recommendations assume the patient has body weight 40-100 kg and creatinine clearance ≥ 30 mL/min. Patients outside these parameters may require dosage modification or an alternative prophylaxis method.

** Rivaroxaban 10 mg orally per day until post-operative day 5, followed by ASA 81 mg daily for an additional 9 days following total knee arthroplasty or for 30 days after total hip arthroplasty; not evaluated in patients undergoing bilateral arthroplasty and limited evaluation in patients with prior VTE and cancer (see **Use of ASA for extended thromboprophylaxis** below).

LMWH = low molecular weight heparin; IPC = intermittent pneumatic compression; ECS = elastic compression stockings

ADDITIONAL SUGGESTIONS:

Start of thromboprophylaxis: For most elective orthopedic surgery patients in whom thromboprophylaxis is recommended, anticoagulant prophylaxis should start approximately 12 hours after surgery (usually the morning after surgery). For hip fracture patients in whom surgery may be delayed, commencing the thromboprophylaxis shortly after admission is suggested. In these cases, thromboprophylaxis should not be given within 12 hours of surgery (particularly if neuraxial anesthesia will be used).

Patients at high risk of bleeding: For patients with high risk of bleeding, we suggest the use of mechanical thromboprophylaxis such as intermittent pneumatic compression devices until it is safe to convert to anticoagulant thromboprophylaxis.

Duration of thromboprophylaxis: Although the optimal duration of thromboprophylaxis is not known for any orthopedic surgery group, extended prophylaxis for 14-35 days is recommended for patients undergoing hip and knee arthroplasty or hip fracture surgery. Therefore, for most of these patients, this implies a period of post-discharge prophylaxis. Within this duration range, we suggest longer duration for patients who are at greater than usual risk for VTE, including those with bilateral arthroplasty, previous VTE, or substantially impaired mobility at discharge. Most orthopedic surgery patients who go to rehabilitation should continue thromboprophylaxis at least until they are discharged from rehabilitation.

Use of ASA for extended thromboprophylaxis: A large randomized controlled trial demonstrated non-inferiority with the use of ASA 81 mg PO once daily vs rivaroxaban 10 mg PO once daily for extended thromboprophylaxis in patients undergoing elective unilateral hip or knee arthroplasty. All patients received rivaroxaban 10 mg PO once daily up to and including post-op day 5 before being randomized to continue with rivaroxaban or switch to ASA. Patients with metastatic cancer were

excluded and less than 3% of the study population had a history of VTE or cancer, which limits applicability to these important subgroups. The risk of major bleeding and all bleeding was similar between ASA and rivaroxaban, suggesting no safety benefit to ASA. Based on patient-preference, it is reasonable to consider the use of ASA for extended thromboprophylaxis in this population.

Pre-discharge Doppler ultrasound: Screening orthopedic surgery patients for asymptomatic DVT is not recommended as studies have not demonstrated a benefit to this strategy. These studies found major bleeding events in the patients treated for asymptomatic DVT.

Pediatrics: Evidence is lacking as to whether thromboprophylaxis is needed in neonates and children who have orthopedic surgery. However, there may be high-risk cohorts in whom thromboprophylaxis may be considered. Consultation with a pediatrician or hematologist with expertise in pediatric thrombosis is recommended.

OTHER RELEVANT THROMBOSIS CANADA CLINICAL GUIDES:

- Acetylsalicylic Acid (ASA)
- Apixaban (Eliquis[®])
- Dabigatran (Pradaxa[®])
- Rivaroxaban (Xarelto[®])
- Unfractionated Heparin, Low Molecular Weight Heparin, and Fondaparinux

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