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; 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 discuss comprehensively 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

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<th>Patient Group</th>
<th>Thromboprophylaxis Options*</th>
<th>Duration</th>
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| **Hip or knee arthroplasty** | rivaroxaban 10 mg PO once daily**  
apixaban 2.5 mg PO twice daily  
dabigatran 220 mg PO once daily  
dabigatran 30 mg SC twice daily or 40 mg SC once daily  
dabigatran 5,000 U SC once daily  
dabigatran 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) | 14-35 days |
| **Hip fracture surgery** | enoxaparin Pre-op: 30 mg SC once daily  
dalteparin Pre-op: 2,500 U SC once daily  
tinzaparin Pre-op: 3,500 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) | 14-35 days |
| **Major orthopedic trauma** | Low molecular weight heparin (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  
Mechanical method if high risk for bleeding with switch to LMWH when bleeding risk decreases | Until discharge (including rehabilitation) |
| **Spine surgery:**  
a) Uncomplicated  
b) Complicated (cancer, leg weakness, prior VTE, combined anterior/posterior approach) | a) Mobilization alone  
b) LMWH once daily starting the day after surgery | Until discharge (including rehabilitation) |
| **Isolated below-knee fracture** | None, if outpatient or overnight hospital stay  
LMWH once daily if inpatient | Until discharge (including rehabilitation) |
| **Knee arthroscopy:**  
a) Low risk  
b) higher risk (major knee reconstruction, prior VTE, other VTE risk factors) | a) None  
b) LMWH once daily | 5-30 days |
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<th>Lower extremity amputation</th>
<th>LMWH once daily</th>
<th>Until discharge (including rehabilitation)</th>
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<td>Other: bedrest, incision &amp; drainage, etc.</td>
<td>LMWH once daily</td>
<td>Until discharge</td>
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*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.

**For patients not at high risk of VTE, consideration can be given to 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.

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.

Patients at high risk of bleeding: For the occasional orthopedic patient with a 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.

Pre-discharge Doppler ultrasound: Screening orthopedic surgery patients for asymptomatic deep vein thrombosis is not recommended.

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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REFERENCES:


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