Orthopedic Surgery VTE Thromboprophylaxis: Guidelines Summary

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ABSTRACT

Venous thromboembolism (VTE) is a significant and preventable complication following orthopedic surgery, with incidences reaching up to 60% without thromboprophylaxis. This comprehensive document synthesizes recommendations from leading international guidelines to support healthcare professionals in implementing evidence-based thromboprophylaxis strategies.

All patients undergoing orthopedic surgery should undergo individualized risk assessment for both VTE and bleeding preoperatively. High-risk procedures include hip and knee arthroplasty, spine surgery, and major trauma. Key patient-related VTE risk factors include advanced age, immobility, obesity, cancer, and history of VTE. Similarly, bleeding risks should be evaluated, as complications may affect outcomes and require thromboprophylaxis strategy modification.

Pharmacologic thromboprophylaxis, including low molecular weight heparin, direct oral anticoagulants, and acetylsalicylic acid, remains the cornerstone of VTE prevention, with duration and agent tailored to procedure type and patient characteristics. Mechanical thromboprophylaxis, including intermittent pneumatic compression and graduated compression stockings, are essential adjuncts, particularly in patients with high bleeding risk or contraindications to anticoagulation. Combined pharmacologic and mechanical approaches also offer superior protection.

This Orthopedic Surgery VTE Thromboprophylaxis Guidelines Summary supports healthcare providers in optimizing thromboprophylaxis strategies and improving surgical outcomes. It also promotes a multidisciplinary, patient-centered approach involving physicians, nurses, pharmacists, and allied health professionals.

INTRODUCTION

Venous thromboembolism (VTE) after orthopedic surgery, presenting as deep vein thrombosis (DVT) and/or pulmonary embolism (PE), is a potentially preventable cause of morbidity and mortality.[1,2] The incidence of VTE after orthopedic surgery without thromboprophylaxis can be as high as 60%.[1]

Multiple guidelines exist addressing surgical thromboprophylaxis. While none of these guidelines is universally accepted and each approaches the subject in different ways, each offers useful guidance in prevention of VTE in patients undergoing orthopedic procedures. This document provides a synopsis of what we believe are the most important elements to consider from the most commonly used guidelines on thromboprophylaxis for orthopedic surgery (Table 1), citing the guidelines published most recently first.

The prevention of VTE is a serious concern and falls under purview of all healthcare providers involved in the patient's health journey, including physicians, nursing, pharmacy, respiratory, occupational, and rehabilitation therapists. We encourage a collaborative approach with clear and consistent communication between providers to reduce/prevent VTE and potentially dire consequences.

Table 1: Guidelines included in this summary

Guideline	Short form reference
European guidelines on peri-operative venous thromboembolism prophylaxis. Chapter 5: Mechanical prophylaxis (2024)[3]	European guidelines 2024
Prevention and management of venous thromboembolism. International Consensus Statement 2024[4]	International Consensus 2024
The ORNAC standards, guidelines, and position statements for perioperative registered nurses (2023)[5]	ORNAC 2023
Guideline for prevention of venous thromboembolism, AORN eGuidelines+[6]	AORN 2023
Recommendations from the ICM-VTE: General (2022)[7]	ICM-VTE General 2022
Recommendations from the ICM-VTE: Hip & Knee (2022)[8]	ICM-VTE: Hip & Knee 2022
Recommendations from ICM-VTE Trauma (2022)[9]	ICM-VTE: Trauma 2022
American Society of Hematology 2019 guidelines for management of venous thromboembolism: prevention of venous thromboembolism in surgical hospitalized patients[2]	ASH 2019
Venous thromboembolism in over 16s: reducing the risk of hospital-acquired deep vein thrombosis or pulmonary embolism (NICE 2019)[10]	NICE 2019

AORN, Association of periOperative Registered Nurses; ICM, International Consensus Meeting; NICE, National Institute for Health and Care Excellence; ORNAC, Operating Room Nurses Association of Canada; VTE, venous thromboembolism

RISK STRATIFICATION

All patients undergoing surgery should be assessed preoperatively to identify risk of VTE and bleeding complications.[1,5,6,7] The risk of VTE needs to be balanced against risk of bleeding for individual patients when considering thromboprophylaxis for surgical patients.[10]

Surgical procedures involving the upper extremities and those distal to the ankle are considered nonmajor. The risk of VTE increases from the distal leg (or ankle) up to the pelvis, with higher risk associated with more proximal surgeries.[9]

VTE assessment

There are risk assessment tools that stratify patients accordingly to their underlying risk of VTE after general surgery (eg, Caprini[11]). However, there are no validated and accepted individualized risk stratification tools specific to orthopedic surgery.[7,12] Standard accepted elements for consideration are listed in Table 2. The most critical period for VTE development occurs within the first month after orthopedic surgery, but the risk may persist for longer.[7]

The app entitled *ICM Philly* (International Consensus Meeting, Philadelphia) *VTE Guide* may be useful as a risk stratification tool for patients undergoing orthopedic surgery.

Table 2: Risk factors for VTE associated with orthopedic surgery [5,6,7,8,13]

Patient factors • Age >60 years • Reduced mobility • Obesity • Pregnancy • Dehydration	**Medications** • Oral contraceptives • Some medications used to treat cancers
Medical conditions • Previous VTE • History of congestive heart failure • Acute medical illness (e.g., myocardial infarction) • Genetic factors such as known thrombophilia • Presence of systemic infection (e.g., human immunodeficiency virus) • Sepsis • Inflammatory disease • Chronic kidney disease (CKD) • Hypoalbuminemia • Active cancers* • Presence of varicose veins and superficial venous thrombosis	**Procedure-specific factors** • Location of surgery: total hip arthroplasty (THA), total knee arthroplasty (TKA), open reduction and internal fixation of hip fractures, and major trauma carry highest DVT risk • Surgery time/length • Type of anesthesia: neuraxial < general • Extent of tissue injury or trauma • Immobility/expected post-surgical mobility

DVT, deep vein thrombosis; VTE, venous thromboembolism
*All cancers have been shown to increase VTE risk by increasing levels of leukocytes, platelets, and tissue factor-positive (TF1) microvesicles.[7]

Table 3: Risk factors for bleeding associated with orthopedic surgery [5,6,7,13,14,15,16,17]

Patient factors • Advanced age • Female gender • Obesity	**Medical conditions** • Known gastroduodenal ulcer • Low perioperative platelet count (<50 × 10^9/L) • History of previous bleeding, especially in the past 3 months • Hypertension • CKD • Preoperative hemoglobin level • Active cancer, especially gastrointestinal and genitourinary • Chronic obstructive pulmonary disease
Procedure-specific factors • Location of surgery: spine > THA >TKA • Increased surgery time/length • Increased tourniquet time • Type of anesthesia (general > spinal) • Peri- and intraoperative blood loss • Bilateral joint procedures	

CKD, chronic kidney disease; THA, total hip arthroplasty; TKA, total knee arthroplasty

Bleeding assessment

Currently there are no bleeding risk assessment tools specific to orthopedic surgery.[7,14] Bleeding events can be serious complications following orthopedic surgery; the rate of clinically significant bleeding is approximately 3%.[15] Factors that may impact bleeding risk are listed in Table 3.

THROMBOPROPHYLAXIS

Pharmacologic thromboprophylaxis

Pharmacologic thromboprophylaxis primarily encompasses acetylsalicylic acid (ASA), direct oral anticoagulants (DOACs) and low molecular weight heparin (LMWH) (see Table 4). While anticoagulants reduce the risk of thrombosis, they confer a potential for increased risk of bleeding.

Where choice is feasible, individualized goals of care and specific approaches to management should be developed in collaboration with patients and should consider their values and preferences. Some patients may prefer oral over injectable options; some may prefer once- over twice-daily dosing; some heparin-based medications can have animal origins and can be of concern to some patients because of their religious or cultural belief.[6]

Table 4: Suggested pharmacologic thromboprophylaxis in orthopedic surgery patients[1]

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	
	ASA	81 mg PO once daily or following rivaroxaban 10 mg PO once daily for 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 or 75 U/kg SC once daily	
	fondaparinux	2.5 mg SC once daily	
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 Mechanical method with IPC or GCS if high risk for bleeding with switch to LMWH when bleeding risk decreases.		Until discharge (including rehabilitation)
Isolated below-knee fracture	No prophylaxis if outpatient or overnight hospital stay LMWH once daily (see above for doses) if inpatient		Until discharge (including rehabilitation)
Spine surgery: a) Uncomplicated b) Complicated (cancer, spinal cord injury with leg weakness or paralysis, prior VTE, combined anterior/posterior approach)		a) Mobilization alone b) LMWH once daily (see above for doses) starting the day after surgery	Until discharge (including rehabilitation)
Knee arthroscopy: a) Low risk b) Higher risk (e.g., major knee reconstruction, prior VTE, cancer, other VTE risk factors)		a) None b) LMWH once daily or direct oral anticoagulant (see above for doses)	5-30 days
Lower extremity amputation		LMWH once daily (see above for doses)	Until discharge (including rehabilitation)
Other: bedrest, incision & drainage, etc.		LMWH once daily or DOAC (see above for LMWH and DOAC doses)	Until discharge

ASA, acetylsalicylic acid; DOAC, direct oral anticoagulation; GCS, graduated compression stockings; IPC, intermittent pneumatic compression; LMWH, low molecular weight heparin; PO, by mouth; SC, subcutaneous; VTE, venous thromboembolism

*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.

Mechanical thromboprophylaxis

Mechanical thromboprophylaxis used alone has no impact on the hemostatic system and therefore does not increase the risk of bleeding.[15,16] Intermittent pneumatic compression (IPC) delivers compression to the lower extremities by simulating the skeletal muscle pump. This improves venous return and, by avoiding venous stasis, reduces the risk of thrombus formation.

Patients at high risk of VTE require adequate pharmacologic thromboprophylaxis. Patients at low risk of VTE and those at high risk for bleeding may be more effectively managed by application of mechanical prophylaxis. The concurrent use of IPC and prophylactic anticoagulation is more effective than the mechanical or pharmacologic approaches alone, providing additional VTE risk reduction by up to 60%.[19,21] See Table 5 for recommendations from ORNAC and AORN on the safe and effective use of mechanical devices.

Foot impulse technology (FIT, also called foot-sole pump) simulates active weight-bearing in the bed-ridden patient through sudden and intermittent increases in venous flow. Combined use of FIT plus pharmacologic thromboprophylaxis is reported to significantly lower the risk of DVT in comparison to the administration of pharmacologic thromboprophylaxis alone after orthopedic procedures.[7]

Graduated compression stockings (GCS) increase blood flow velocity, minimize venous distension, and reduce the likelihood of vessel wall damage by limiting micro-tears from venous dilation. Improper application of stockings may cause complications such as venous stasis, ischemia, discomfort and edema, and the costs related to the use of stockings should also be considered.[3] There are few robust studies on the use of GCS in orthopedic surgeries. As other methods are more effective, use of GCS alone is not recommended.[3,4]

Table 5: Recommendations on the safe and effective use of mechanical thromboprophylaxis; ORNAC 2023[5], AORN 2023[6]

• Contraindications related to use of mechanical thromboprophylaxis include: - any leg condition (e.g., dermatitis, recent skin graft, gangrene, skin breakdown, ulceration, injury) that pneumatic compression may exacerbate - skin injury - known allergy or sensitivity to the sleeve or tubing material - vascular disease - diabetic neuropathy - cardiac failure or pulmonary edema from congestive heart failure - any factor that prevents correct fitting of sleeves (e.g., exceeding the size limit, severe leg edema, deformity) - pre-existing DVT - compartment syndrome
• Components of mechanical thromboprophylaxis (e.g., IPC device sleeves, tubing) used on the sterile field should be sterile.
• GSC need to be fitted and sized appropriately to the patient and applied prior to the start of the surgical procedure. Proper fit and use is required to ensure efficacy.
• IPC devices must be fitted and sized appropriately and used according to manufacturers direction. Use, decontamination, and maintenance of IPC devices must follow manufactures directions to ensure patient safety.
• IPC devices should be applied and activated before induction of anesthesia. Induction of anesthesia causes venous dilation and reduced venous return.
• IPC devises should be monitored during use for proper function. Monitoring during use can quickly identify and rectify any interruptions during use.
• Perform interventions for safe and effective use of IPC devices - Verify that material is wrinkle-free when applied to the skin - Verify that tubing on external surface of the sleeve faces away from patient's skin and away from locations that may create a pressure injury during IPC application and after patient positioning - The IPC device should remain on and functioning for a minimum of 18 hours daily during the intraoperative and immediate postoperative period unless removal is necessitated by patient care needs
• Documentation of mechanical interventions should be included in the patient's health care records and include type of device or device control number, time of initiation, time of discontinuation.

DVT, deep vein thrombosis; GCS, graduated compression stockings; IPC, intermittent pneumatic compression, VTE, venous thromboembolism

GENERAL RECOMMENDATIONS FOR ORTHOPEDIC SURGERY

The European guidelines 2024[3] (Table 5) and the ICM-VTE General guidelines (Table 6)[7] provide general recommendations for surgery, rather than guidance for specific types of surgery. Most guidelines recommend early ambulation post-surgery to reduce the risk of VTE.[3,7,8]

Table 6: European guidelines 2024 recommendations for surgery[3]

Patient population	Recommendation	Level of evidence
Institution-wide protocol for the prevention of VTE	Early ambulation, pharmacologic thromboprophylaxis and/or mechanical thromboprophylaxis when indicated	Grade 1B
All patients before surgery	Assessment of the risk of postoperative VTE and the bleeding related to both the surgical procedure and the patient's characteristics	Grade 1B
Patients with a low thrombosis risk, such as day surgery and/or immediate mobilisation	General measures of thromboprophylaxis (including early ambulation and optimal hydration) over mechanical or pharmacologic prophylaxis	Grade 1B
Patients with low thrombosis risk such as hospitalised patients and/or postoperative immobilisation	Pharmacologic thromboprophylaxis over no prophylaxis Additional IPC is optional	Grade 1C Grade 2C
Hospitalised patients with a high thrombosis risk	Suggest mechanical thromboprophylaxis with IPC if high bleeding risk or contra-indication to pharmacologic thromboprophylaxis	Grade 2C
Patients with high thrombosis risk and low bleeding risk	Suggest pharmacologic thromboprophylaxis plus optional IPC or GCS	Grade 2B
Patients with high thrombosis risk and high bleeding risk	IPC over no thromboprophylaxis	Grade 1C
Patients with very high thrombosis risk	Suggest IPC in combination with pharmacologic thromboprophylaxis	Grade 1C

GCS, graduated compression stockings; IPC, intermittent pneumatic compression, VTE, venous thromboembolism

Table 7: ICM-VTE General (2022) recommendations for orthopedic procedures in special populations[7]

Patient population	Recommendation	Strength of recommendation, strength of consensus*
Patients undergoing orthopedic procedures	IPC provides protection against VTE development following orthopedic surgery. Utilizing these devices has been shown to be an effective thromboprophylactic measure. GCS may provide some protection against VTE.	Strong, strong
Patients with chronic kidney disease	Pharmacologic thromboprophylaxis may require dose adjustment to prevent major bleeding or other complications based on each agent's biochemical properties. In unstable advanced renal disease, unfractionated heparin (UFH) or mechanical thromboprophylaxis alone may be preferred.	Limited, strong
Patients with chronic liver disease (CLD)	CLD alone should not be considered a reason to withhold or alter thromboprophylaxis. The decision to possibly modify VTE prophylaxis should be multidisciplinary and individualized based on risk factors for both VTE and bleeding.	Consensus, strong
Patient undergoing orthopedic procedure with diagnosed acute atrial fibrillation (AF)	There is no evidence to indicate that the perioperative VTE prophylaxis of these patients should be altered. Patients with AF and at high risk of embolic events should receive anticoagulation therapy.	Moderate, strong
Patients with bleeding disorders such as hemophilia or Von Willebrand disease	Mechanical thromboprophylaxis is most appropriate for patients with bleeding disorders undergoing orthopedic surgery. However, the addition of mild pharmacologic thromboprophylaxis should be considered for select patient groups that may express a higher prothrombotic phenotype, and in those using replacement factor concentrates, bypassing agents or monoclonal antibodies that may increase the risk of thrombosis.	Limited, strong
Patients with clotting disorders such as thrombophilia	For major surgery a combination of mechanical and pharmacologic thromboprophylaxis is recommended for up to 35 days after the procedure to address the variability of VTE risk, which is difficult to estimate in frequency and magnitude. For less invasive musculoskeletal procedures, thromboprophylaxis should be tailored according to the prothrombotic risk of each procedure, with emphasis on those of lower extremities.	Limited, strong
Patients on strict bed rest pre- or postoperatively	Any combination of pharmacologic and/or mechanical (i.e., intermittent compression devices) thromboprophylaxis may be considered in patients who will be on prolonged and strict bed rest.	Limited, strong

GCS, graduated compression stockings; IPC, intermittent pneumatic compression; VTE, venous thromboembolism
*Based on vote of ICM-VTE General delegates

TRAUMA, HIP FRACTURE

Risk

Patients requiring hip fracture surgery have the highest rates of DVT (46-60%) and fatal PE (2.5-7.5%). The VTE risk period continues for two to three months post-fracture surgery despite common use of thromboprophylaxis with a 90-day risk of overall death of 13%. The risk of dying post hip fracture is greater than post elective hip replacement, the majority due to vascular events even though most patients receive thromboprophylaxis.[4]

Due to the high risk of VTE, patients with hip fracture should be started on thromboprophylaxis as soon as possible after diagnosis, using the same regimens as those recommended for post elective THA.[4]

Table 8: International Consensus 2024 Recommendations for hip fracture[4]

Patient population	Recommendation	Strength of recommendation, strength of consensus*
Patients undergoing hip fracture surgery	LMWH (initiated and dosed according to the manufacturer's recommendations) or fondaparinux	High, strong
	Adjusted dose VKA (INR range 2-3) or low dose UFH (5000 units SC q12h or q8h)	High, moderate
	Rivaroxaban may be considered	Moderate, moderate
	IPC or FIT combined with GCS should be used when there are contraindications for pharmacologic prophylaxis	Low, weak
	If surgery is likely to be delayed, prophylaxis should be initiated with LMWH or IPC or FIT plus GSC as close to the fracture as possible	Low, strong
	Prophylaxis should be provided for 4-5 weeks after surgery	High, strong
	In view of the relatively small reduction in DVT by ASA and the increased risk of post-thrombotic syndrome in patients with asymptomatic DVT, ASA should not be the first choice for VTE prevention if more effective methods are available until more data is available	Moderate, moderate

ASA, acetylsalicylic acid; DVT, deep vein thrombosis; FIT, foot impulse technology; GCS, graduated compression stockings; INR, international normalized ratio; IPC, intermittent pneumatic compression; LMWH, low molecular weight heparin; SC, subcutaneous; UFH, unfractionated heparin; VKA, vitamin K antagonist; VTE, venous thromboembolism

Table 9: ICM-VTE Trauma (2022)[9]

Patient population	Recommendation	Strength of recommendation, strength of consensus*
Patients undergoing internal fixation of a hip fracture	Mechanical and pharmacologic thromboprophylaxis are advised following an individualized risk assessment. In the setting of surgical delays, preoperative pharmacologic thromboprophylaxis should be considered. Pharmacologic thromboprophylaxis should continue throughout the persistent postoperative prothrombotic state, commencing 12 hours post wound closure, and continuing for at least 28 days.	Moderate, strong
Patients with hip fracture undergoing arthroplasty (hemiarthroplasty or total hip arthroplasty)	See recommendations in Table 13, Arthroplasty section	
Patients with fragility fracture of the pelvis or lower extremity	Pharmacologic thromboprophylaxis is recommended as long as the risk of VTE outweighs the risk of bleeding given other medical comorbidities. The use of IPC devices should be considered for those who cannot receive pharmacologic thromboprophylaxis.	Low, strong
Patients undergoing osteotomy around the knee	Routine use of mechanical and/or pharmacologic thromboprophylaxis is recommended.	Moderate, strong
Patients with isolated patellar fracture who may or may not require surgery	Routine thromboprophylaxis is not indicated but should be considered for patients with risk factors for VTE	Limited, strong

ASA, acetylsalicylic acid; VTE, venous thromboembolism
*Based on vote of ICM-VTE General delegates

Table 10: ASH 2019 Recommendations for major trauma and hip fracture[2]

Patient population	Recommendation	Strength of recommendation, strength of consensus*
Patients experiencing major trauma, at low to moderate risk for bleeding	Pharmacologic thromboprophylaxis over no pharmacologic thromboprophylaxis	Conditional, very low
Patients experiencing major trauma, at high risk for bleeding	ASH guideline panel suggests against pharmacologic thromboprophylaxis	Conditional, very low
Patients experiencing major trauma in whom pharmacologic thromboprophylaxis is used	ASH guideline panel suggests using LMWH or UFH	Conditional, low
Patients undergoing hip fracture surgery	ASH guideline panel suggests using pharmacologic thromboprophylaxis over no pharmacologic thromboprophylaxis	Conditional, very low
	ASH guideline panel suggests using LMWH or UFH	Conditional, very low

ASH, American Society of Hematology; LMWH, low molecular weight heparin; UFH, unfractionated heparin

Table 11: NICE 2019 recommendations for fragility fractures of the pelvis, hip, and proximal femur[10]

Patient population	Recommendation
Patients with fragility fractures of the pelvis, hip, and proximal femur	Offer thromboprophylaxis for a month if the risk of VTE outweighs the risk of bleeding. Choose either: • LMWH, starting 6 to 12 hours after surgery • Fondaparinux sodium, starting 6 hours after surgery, providing there is low risk of bleeding
	Consider preoperative thromboprophylaxis if surgery is delayed beyond the day after admission. Give the last dose no less than 12 hours before surgery for LMWH or 24 hours before surgery for fondaparinux sodium.
	Consider IPC at the time of admission if pharmacologic thromboprophylaxis is contraindicated. Continue until the person no longer has significantly reduced mobility relative to their normal or anticipated mobility.

IPC, intermittent pneumatic compression; LMWH, low molecular weight heparin; VTE, venous thromboembolism

ARTHROPLASTY

In general, patients undergoing TKA have a higher VTE risk than those requiring THA. Further, VTE tends to present earlier in patients requiring TKA.[8]

The risk of clinical DVT and PE can continue for up to three months after hospitalization. Mortality studies have shown a reduced survival for two to three months following elective surgery, with the highest death rate early after operation. There is a high incidence of proximal DVT (18-36%) in patients having THA compared to those having TKA, where the thrombosis generally occurs more distally.[4]

Table 12: International Consensus 2024 Recommendations for elective knee arthroplasty[4]

Patient population	Recommendation	Level of evidence, recommendation strength
Patients undergoing elective knee arthroplasty	LMWH initiated and dosed according to the manufacturer's recommendations Rivaroxaban Apixaban Fondaparinux	High, strong
	VKAs (although less effective)	High, weak
	ASA may be considered for extended prophylaxis	High for reduction in mortality and PE, but low for DVT prevention and by inference reduction in PTS Weak recommendation
	IPC is an alternative option	Moderate, moderate
	LMWH combined with IPC is more effective than LMWH thromboprophylactic modality used alone and should be considered	High, strong

ASA, acetylsalicylic acid; DVT, deep vein thrombosis; IPC, intermittent pneumatic compression; LMWH, low molecular weight heparin; PE, pulmonary embolism; PTS, post-thrombotic syndrome; VKAs, vitamin K antagonists; VTE, venous thromboembolism

Table 13: ICM-VTE Hip & Knee (2022) Recommendations[8]

Patient population	Recommendation	Strength of recommendation, strength of consensus*
Patients undergoing elective total joint arthroplasty (TJA)	Low-dose ASA (81 mg daily) is currently the most effective and safest method of prophylaxis against VTE. Recommend use of low-dose ASA as the primary method of thromboprophylaxis in all patients undergoing TJA, including moderate- to high-risk patients. Coadministration of ASA with IPC may be more effective than ASA alone in prevention of VTE following TJA.	Strong, strong
Patients undergoing simultaneous bilateral TKA	These patients are at higher risk of VTE compared to those undergoing unilateral TKA. Pharmacologic thromboprophylaxis should be considered.	Limited, strong
Patients undergoing simultaneous bilateral THA	These patients are at higher risk of VTE compared to those undergoing unilateral THA. Pharmacologic thromboprophylaxis should be considered, although the optimal agent remains uncertain.	Limited, strong
Patients undergoing ambulatory hip and knee arthroplasty	IPC has been demonstrated to be effective against VTE following THA/TKA when used concurrently with pharmacologic thromboprophylaxis. However, their use in present-day ambulatory THA/TKA is not clearly supported in current literature.	Limited, strong
Patients undergoing TKA or THA	Mechanical compressive devices can be used routinely in patients undergoing THA or TKA as thromboprophylaxis.	High, strong

ASA, acetylsalicylic acid, IPC, intermittent pneumatic compression; THA, total hip arthroplasty; TKA, total knee arthroplasty; VTE, venous thromboembolism
*Based on vote of ICM-VTE Hip & Knee delegates

Table 14: ASH 2019 Recommendations orthopedic surgery[2]

Patient population	Recommendation	Level of evidence, recommendation certainty
Patients undergoing TKA or THA	ASH guideline panel *suggests* using ASA or anticoagulants	Conditional, very low
	ASH guideline panel *suggests* using any of the DOACs approved for use	Conditional, low
Patients undergoing THA or TKA in which anticoagulants are used	ASH guideline panel *suggests* using DOACs over LMWH	Conditional, moderate
Patients undergoing THA or TKA, if a DOAC is not used	ASH guideline panel *suggests* using LMWH rather than warfarin	Conditional, very low
	ASH guideline panel *suggests* using LMWH rather than UFH	Conditional, moderate

ASA, acetylsalicylic acid; ASH, American Society of Hematology; DOAC, direct oral anticoagulant; LMWH, low molecular weight heparin; THA, total hip arthroplasty; TKA, total knee arthroplasty; UFH, unfractionated heparin

Table 15: NICE 2019 recommendations for hip, knee, foot, and ankle orthopedic surgery[10]

Patient population	Recommendation
Patients undergoing surgery for elective THA or TKA	Offer thromboprophylaxis if the risk of VTE outweighs the risk of bleeding. Choose any of: • LMWH for 10 days followed by ASA (75 mg or 150 mg) for a further 28 days • LMWH for 28 days combined with GSC (until discharge) • Rivaroxaban
	Consider apixaban or dabigatran if none of the options above can be used
	Consider GCS until discharge
Patients undergoing non-arthroplasty orthopedic knee surgery	Be aware that thromboprophylaxis is generally not needed where: • total anaesthesia time is < 90 minutes and • the person is at low risk of VTE
	Consider LMWH 6 to 12 hours after surgery for 14 days if: • total anesthesia time is > 90 minutes or • the risk of VTE outweighs the risk of bleeding
	Consider thromboprophylaxis for people undergoing other knee surgery (for example, osteotomy or fracture surgery) whose risk of VTE outweighs their risk of bleeding
Patients undergoing foot or ankle surgery	Consider pharmacologic thromboprophylaxis for people undergoing foot or ankle surgery: • that requires immobilisation (e.g., arthrodesis or arthroplasty); consider stopping prophylaxis if immobilisation continues beyond 42 days • when total anesthesia time is > 90 minutes or • the risk of VTE outweighs the risk of bleeding

ASA, acetylsalicylic acid; GCS, graduated compression stockings; LMWH, low molecular weight heparin; IPC, intermittent pneumatic compression; THA, total hip arthroplasty; TKA, total knee arthroplasty; VTE, venous thromboembolism

PRACTICAL APPROACH

The Operating Room Nurses Association of Canada (ORNAC 2023)[5] and the Association of periOperative Registered Nurses (AORN 2023)[6] guidelines provide useful guidance for the application of recommendations, and reinforce that the prevention of VTE is considered an international patient safety issue in which nursing plays a pivotal role. VTE prophylaxis should be included in the transition of care communication between healthcare providers through all phases of the surgical journey. Continuing education about the risks and prevention of VTE should be available to perioperative personnel. Patient and caregiver education supports reduction in complications, and adherence to thromboprophylaxis as prescribed.

FUTURE DIRECTIONS

There is a clear need for validated VTE and bleeding risk scores for orthopedic surgery. Mitigation of VTE risk is a key factor in all the guidelines included in this document. Major bleeding events are serious complications that are often examined as secondary outcomes in clinical trials with cohorts that are too small to allow adequate statistical power for examining this issue.[7] This needs to be a focus of future trials.

There is also a need for more high-quality clinical trials assessing the use of mechanical thromboprophylaxis over no mechanical prophylaxis.[2] There are a limited number of published guidelines that reference the different modes of mechanical thromboprophylaxis in surgical patients.[22]

In summary, VTE remains a significant yet preventable complication following orthopedic surgery. The guidelines reviewed in this document emphasize the importance of individualized risk assessment, balancing the benefits of thromboprophylaxis with the potential for bleeding complications. Pharmacologic options, including DOACs and LMWHs, remain the mainstay of prophylaxis, while mechanical interventions such as IPC and GCS serve as valuable adjuncts, particularly for high-risk patients or those with contraindications to anticoagulation. A multidisciplinary approach, incorporating early mobilization, standardized institutional protocols, and ongoing education for healthcare providers, is essential to optimizing patient outcomes. Future research should focus on refining risk stratification tools and evaluating the long-term effectiveness of various thromboprophylaxis strategies to further reduce the burden of VTE in orthopedic surgery.

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