1 - Is VTE after elective total joint arthroplasty a "never event"?

Response/Recommendation: Venous thromboembolism (VTE) after elective total joint arthroplasty (TJA) continues to occur despite various strategies in prophylaxis and should not be considered a “never event.”

Strength of Recommendation: Moderate.

Michael M. Meghpara, James J. Purtill, Richard Iorio, Thomas Jakobsen
ICM VTE Hip & Knee

1 - Is VTE after elective total joint arthroplasty a "never event"?

(Strong Consensus)
Response/Recommendation: Patients undergoing total knee arthroplasty (TKA) have a higher venous thromboembolism (VTE) risk than total hips arthroplasty (THA) patients. In addition, VTE tends to present earlier in TKA patients. There is no evidence for different risk profiles among patients undergoing THA or TKA. Also, there is also no clarity on whether it is necessary to stratify TKA differently than THA patients, or how to do it.

Strength of Recommendation: Limited.
ICM VTE Hip & Knee

2 - Is there a difference in VTE risk profile for patients undergoing total hip arthroplasty or total knee arthroplasty?

(Strong Consensus)
Response/Recommendation: Low-dose aspirin (ASA) is currently the most effective and safest method of prophylaxis against venous thromboembolism (VTE) in patients undergoing total joint arthroplasty (TJA). We recommend the use of low-dose ASA as the primary method of VTE prophylaxis in all patients undergoing TJA, including moderate-to high-risk patients.

Strength of Recommendation: Strong.

Saad Tarabichi, Matthew B. Sherman, Kerri-Anne Ciesielka, Colin M. Baker, Javad Parvizi
ICM VTE Hip & Knee

3 - What is the most optimal VTE prophylaxis following TKA/THA?

(Strong Consensus)
4 - What is the chemoprophylactic agent of choice for patients undergoing simultaneous bilateral total knee arthroplasty (SBTKA)?

**Response/Recommendation:** Patients undergoing SBTKA are at a higher risk of venous thromboembolism (VTE) compared to those undergoing unilateral total knee arthroplasty (TKA). Chemical prophylaxis should be considered for these patients.

**Strength of Recommendation:** Limited.

Graham S. Goh, Leanne Ludwick, Andrea Baldini
ICM VTE Hip & Knee

4 - What is the chemoprophylactic agent of choice for patients undergoing simultaneous bilateral total knee arthroplasty (SBTKA)?

(Strong Consensus)
5 - What is the chemoprophylactic agent of choice for patients undergoing simultaneous bilateral total hip arthroplasty (SBTHA)?

**Response/Recommendation:** Patients undergoing SBTHA are at a higher risk of venous thromboembolism (VTE) compared to those undergoing unilateral total hip arthroplasty (THA). Chemoprophylaxis should be considered for these patients, although the optimal agent remains uncertain.

**Strength of Recommendation:** Limited.

*Graham S. Goh, Leanne Ludwick, Yoshi P. Djaja*
ICM VTE Hip & Knee

5 - What is the chemoprophylactic agent of choice for patients undergoing simultaneous bilateral total hip arthroplasty (SBTHA)?

(Strong Consensus)
ICM VTE Hip & Knee

6 - Which VTE prophylactic agent used in patients undergoing TKA/THA has the highest bleeding rate?

Response/Recommendation: Patients undergoing total hip arthroplasty/total knee arthroplasty (THA/TKA) who received thromboprophylaxis are at an increased risk of bleeding. Higher bleeding rates were detected for low-molecular weight heparin (LMWH) versus aspirin (ASA) and for rivaroxaban versus LMWH and other novel oral anticoagulants (NOAC), while the lowest bleeding rates in patients receiving NOAC were observed for apixaban. Drug dosage and patient characteristics (age, renal dysfunction) may complicate the data on bleeding risk as may changes in clinical practice (particularly with the wide use of tranexamic acid (TXA) currently).

Strength of Recommendation: Limited.

Enrique Gómez-Barrena, Per Kjærsgaard Andersen
ICM VTE Hip & Knee

6 - Which VTE prophylactic agent used in patients undergoing TKA/THA has the highest bleeding rate?

(Strong Consensus)
ICM VTE Hip & Knee

7 - What is the incidence of readmission and re-operation for hematomas secondary to administration of chemoprophylaxis for VTE in patients undergoing total joint arthroplasty?

Response/Recommendation: The incidence of readmission and re-operation for hematomas secondary to chemoprophylaxis for venous thromboembolism (VTE) in patients undergoing total joint arthroplasty (TJA) is low and not definitively related to the choice of anti-coagulant. There is a trend toward increased incidence of hematomas requiring re-operation in patients on enoxaparin in comparison to warfarin or factor Xa inhibitors. Thirty-day readmission rates are higher for all chemotherapeutic agents (low-molecular-weight heparin [LMWH], direct-oral anticoagulant [DOAC], warfarin), in comparison to aspirin (ASA). However, risk stratification practices resulting in higher risk patients who have complex co-morbidities preferably receiving these more potent agents have not been eliminated as a confounding variable in existing studies.

Risk stratification can be done as per the American Academy of Orthopaedic Surgeons (AAOS) and the American College of Chest Physicians (ACCP) guidelines and by further information found in the response to question #24 of the 2021 International Consensus Meeting (ICM) on VTE - General section.

Strength of Recommendation: Limited.

Ayesha Abdeen, Maria Jurado, Jaime B. Mariño, Ernesto Guerra-Farfán
ICM VTE Hip & Knee

7 - What is the incidence of readmission and re-operation for hematomas secondary to administration of chemoprophylaxis for VTE in patients undergoing total joint arthroplasty?

(Strong Consensus)
Response/Recommendation: The use of warfarin is associated with significantly higher surgical site infection (SSI) and periprosthetic infection (PJI) rates when used for venous thromboembolism (VTE) prophylaxis, especially in patients undergoing total joint arthroplasty (TJA). Limited evidence points to lower or similar rates of SSI using aspirin (ASA) as prophylaxis compared to more potent anticoagulants.

Strength of Recommendation: Limited.
ICM VTE Hip & Knee

8 - Does the type of VTE prophylaxis influence the risk of subsequent surgical site infection (SSI) in patients undergoing orthopaedic procedures?

(Strong Consensus)
9- Does the type of VTE prophylaxis influence the risk of subsequent periprosthetic joint infection in patients undergoing joint arthroplasty?

Response/Recommendation: Yes, the type of venous thromboembolism (VTE) prophylaxis influences the risk of subsequent periprosthetic joint infection (PJI). The strongest association is observed for vitamin-K antagonists (VKA) when compared to acetylsalicylic acid (Aspirin [ASA]).

Strength of Recommendation: Moderate.
9- Does the type of VTE prophylaxis influence the risk of subsequent periprosthetic joint infection in patients undergoing joint arthroplasty?

(Strong Consensus)
ICM VTE Hip & Knee

10 - Should the method for VTE prophylaxis be altered in patients undergoing revision for infection?

Response/Recommendation: Although infection is known to increase the risk of venous thromboembolism (VTE), there is no evidence to support a change in the approach to this group of patients. In general, aspirin (ASA) is safe and effective in revision surgery. Nevertheless, more potent anticoagulation strategies should be considered in the high-risk cases after risk stratification as determined by the American Academy of Orthopaedic Surgeons (AAOS) and the American College of Chest Physicians (ACCP) guidelines and by further information found in the response to question # 24 of the 2021 International Consensus Meeting (ICM) on VTE – General section.

Strength of Recommendation: Limited.

Karan Goswami, P. Maxwell Courtney, Ran Schwarzkopf, Mohammad N. Al Mutani, Stephen Silva, Gwo-Chin Lee
ICM VTE Hip & Knee

10 - Should the method for VTE prophylaxis be altered in patients undergoing revision for infection?

(Strong Consensus)
Response/Recommendation: Following explantation or reimplantation of components as part of a two-stage procedure or definitive resection arthroplasty for a hip or knee periprosthetic joint infection (PJI), patients should be stratified based on the risk of venous thromboembolism (VTE) events versus risk of post-operative complications associated with anticoagulation. Anticoagulation can be selected from established guidelines for primary total hip arthroplasty (THA) and total knee arthroplasty (TKA).

Strength of Recommendation: Moderate.
ICM VTE Hip & Knee

11 - What is the optimal choice for VTE prophylaxis following two-stage or resection arthroplasty for treatment of knee and hip periprosthetic joint infection?

(Strong Consensus)
ICM VTE Hip & Knee

12 - Should the use of lower extremity tourniquet be avoided in patients at a high risk of VTE?

Response/Recommendation: Lower extremity tourniquets may be associated with an increased risk of venous thromboembolism (VTE) post-operatively and should be used with caution in patients at a high risk of VTE.

Strength of Recommendation: Moderate.

Charles P. Hannon, Nicolaas C. Budhiparama, Matthew P. Abdel
ICM VTE Hip & Knee
12 - Should the use of lower extremity tourniquet be avoided in patients at a high risk of VTE?

(Strong Consensus)
13 - Considering the trend to ambulatory hip and knee arthroplasty, is there a role for the use of pneumatic compression devices?

Response/Recommendation: Pneumatic compression devices have been demonstrated to be effective prophylaxis against venous thromboembolism (VTE) following hip/knee arthroplasty when used concurrently with chemoprophylaxis. However, their use in present-day ambulatory hip/knee arthroplasty is not clearly supported in current literature.

Strength of Recommendation: Limited.

Muhammad S. Amin, Mohsin Javid, Plamen Kinov, William A. Jiranek
ICM VTE Hip & Knee

13 - Considering the trend to ambulatory hip and knee arthroplasty, is there a role for the use of pneumatic compression devices?

(Strong Consensus)
ICM VTE Hip & Knee

14 - Should mechanical compressive devices be used routinely in patients undergoing total hip arthroplasty or total knee arthroplasty?

Response/Recommendation: Mechanical compressive devices can be used routinely in patients undergoing total hip arthroplasty (THA) or total knee arthroplasty (TKA) as venous thromboembolism (VTE) prophylaxis.

Strength of Recommendation: High.

Zhongming Chen, Daniel J. Berry, Mojieb M. Manzary, Michael A. Mont
14 - Should mechanical compressive devices be used routinely in patients undergoing total hip arthroplasty or total knee arthroplasty?

(Strong Consensus)
15 - Should pneumatic compression devices (PCD) routinely be co-administered to patients receiving aspirin for VTE prophylaxis?

Response/Recommendation: It appears that coadministration of aspirin (ASA) with pneumatic compression devices (PCD) may be more effective than ASA alone in prevention of venous thromboembolism (VTE) following total joint arthroplasty (TJA).

Strength of Recommendation: Moderate.

Ariel E. Saldaña, Ronald J. Pérez
ICM VTE Hip & Knee

15 - Should pneumatic compression devices (PCD) routinely be co-administered to patients receiving aspirin for VTE prophylaxis?

(Strong Consensus)
Response/Recommendation: There is no conclusive evidence that continuous passive machine (CPM) reduces the risk of venous thromboembolism (VTE) following knee surgery. Three moderate quality studies demonstrate no difference in the risk of VTE in knee surgery with the use of continuous passive motion, with five low quality studies showing a potential reduced risk of VTE.

Strength of Recommendation: Limited.

Charlotte Brookes, Caroline B. Hing, William Roberts, Nelson E. Socorro, Andres Silberman
ICM VTE Hip & Knee

16 - Does the use of Continuous Passive Machine (CPM) reduce the risk of VTE following knee surgery?

(Strong Consensus)
17 - Does the "enhanced recovery" concept, which includes early ambulation, reduce the risk of VTE in patients undergoing primary total hip or knee arthroplasty?

Response/Recommendation: The “enhanced recovery” concept including early mobilization is likely to reduce the risk of venous thromboembolism (VTE) in patients undergoing primary total hip arthroplasty (THA) or total knee arthroplasty (TKA). However, the literature lacks studies with a high level of evidence considering this topic.

Strength of Recommendation: Limited.

William G. Fishley, Mihovil Plečko, Rasmus T. Mikkelsen, Ivan Bohaček, Per Kjærsgaard Andersen, Óliver Marín-Peña, Mike Reed
ICM VTE Hip & Knee

17 - Does the "enhanced recovery" concept, which includes early ambulation, reduce the risk of VTE in patients undergoing primary total hip or knee arthroplasty?

(Strong Consensus)
18 - Do patients undergoing elective pelvic and/or femoral osteotomy require routine VTE prophylaxis?

Response/Recommendation: Given the low rate of venous thromboembolism (VTE) in patients undergoing elective pelvic and/or femoral osteotomy, as well as the absence of robust data in current literature, this workgroup recommends that aspirin (ASA) and/or mechanical prophylaxis should be used as VTE prophylaxis in this patient population. Only patients at a high risk of VTE should be given more potent or additional chemoprophylaxis.

Strength of Recommendation: Limited.

Oğuzhan Korkmaz, Yutaka Inaba, Taro Tezuka, Ibrahim Azboy
ICM VTE Hip & Knee

18 - Do patients undergoing elective pelvic and/or femoral osteotomy require routine VTE prophylaxis?

(Strong Consensus)
ICM VTE Hip & Knee

19 - What are the indications for Doppler ultrasound of the lower extremity to confirm or rule out DVT?

**Response/Recommendation:** In the absence of any specific guidance from the literature we would propose that in any patient who is within 6 weeks following a lower limb surgery that a Doppler scan should be requested when:

a. There is lower limb swelling that does not respond to elevation or after a night’s rest in bed.

b. The lower extremity swelling worsens after a night spent recumbent.

c. There is a high index of suspicion for deep venous thrombosis (DVT) in patients with active cancer and/or history of prior venous thromboembolism (VTE).

**Strength of Recommendation:** Limited.

*Geno J. Merli, Michael Tanzer, Nicola Gallagher, David E. Beverland*
ICM VTE Hip & Knee

19 - What are the indications for Doppler ultrasound of the lower extremity to confirm or rule out DVT?

(Strong Consensus)
Response/Recommendation: Based on current literature and recommendations from official bodies, patients with an isolated distal deep venous thrombosis (DVT) (in whom a proximal component was not detected at the initial scan) can be managed without anticoagulation but need to have a follow up ultrasound (US) of the proximal veins after 1 week to rule out DVT extension. It is reasonable to treat the patient empirically with anticoagulation, especially in situations where a follow-up ultrasound may not be possible.

Strength of Recommendation: Consensus.
ICM VTE Hip & Knee

20 - Should the presence of a distal DVT in an extremity mandate repeat imaging of proximal veins?

(Strong Consensus)
ICM VTE Hip & Knee

21 - Do patients undergoing UKA, including patellofemoral joint arthroplasty, have a different VTE risk profile compared to TKA?

Response/Recommendation: The incidence of symptomatic venous thromboembolism (VTE) is low in both uni-compartmental knee arthroplasty (UKA) and total knee arthroplasty (TKA) patients, deep venous thrombosis (DVT) and pulmonary embolism (PE) occur in up to 1.6% and 0.13% of UKA patients. Most studies had a trend of decreased VTE risk following UKA compared to TKA but were underpowered, only registry studies were sufficiently powered and showed a VTE risk ratio (RR) of 0.39 (0.27 - 0.57). There is a paucity of data on patellofemoral joint arthroplasty (PFJA) and VTE risk.

Strength of Recommendation: Moderate.

Tad Gerlinger, Ivan Bohaček, David G. Campbel
ICM VTE Hip & Knee

21 - Do patients undergoing UKA, including patellofemoral joint arthroplasty, have a different VTE risk profile compared to TKA?

(Strong Consensus)