

GUIDELINES

European guidelines on peri-operative venous thromboembolism prophylaxis: first update.

Executive summary

Charles Marc Samama, Arash Afshari, Lars Grønlykke, Mikkel Herold Madsen, Sebastian Wiberg and Carolina S. Romero

European Journal of Anaesthesiology 2024, 41:561–569

1. Chapter 1 – Cardiovascular surgery (Aamer Ahmed)

1.1. In cardiac surgery: We recommend early initiation (between 6 and 24 h) postsurgery of pharmacological VTE prophylaxis in the absence of significant bleeding risk (Grade 1C). (91% Agreement)

1.2. In vascular surgery: We suggest early initiation (<24 h) of pharmacological VTE prophylaxis should be considered in patients with an increased procedural risk, such as open TAAA, AAA repair and TEVAR, and in patients with increased VTE risk factors (Grade 2C). (91% Agreement)

1.3. Therapeutic approach: We suggest LMWH should be considered as a first-line therapy over UFH in view of the increased risk of HIT in cardiac and vascular surgery (Grade 2B). (100% Agreement)

2. Chapter 2 – Oncological thoracic surgery (Yaron Shargall)

1. Lobectomy/segmentectomy:

A. In patients undergoing lobectomy or segmentectomy, the guideline panel *suggests* parenteral anticoagulation (LMWH or UFH) for VTE prevention over no prophylaxis (Conditional recommendation, low certainty in the evidence of effects $\oplus\oplus\circ\circ$). Among these anticoagulants, LMWH is preferred rather than UFH (Conditional recommendation, moderate certainty in the evidence of effects $\oplus\oplus\oplus\circ$). Using a postoperative

non-direct oral anticoagulant (DOAC) anticoagulant is suggested over a DOAC anticoagulant for thromboprophylaxis (Conditional recommendation, low certainty in the evidence of effects $\oplus\oplus\circ\circ$). Usage of DOACs in this patient population should only be in the context of a clinical trial.

B. *Mechanical prophylaxis:* In patients undergoing lobectomy or segmentectomy, the guideline panel *suggests* using combined prophylaxis over pharmacological prophylaxis alone (Conditional recommendation, very low certainty in the evidence of effects $\oplus\circ\circ\circ$). For patients undergoing lobectomy or segmentectomy who are not receiving pharmacological prophylaxis, the guideline panel *suggests* using mechanical prophylaxis [intermittent pneumatic compression (IPC) or graduated compression stockings (GCS)] over no prophylaxis (Conditional recommendation, very low certainty in the evidence of effects $\oplus\circ\circ\circ$). In patients undergoing lobectomy or segmentectomy at *moderate or high risk of thrombosis*, the guideline panel *suggests* using *extended prophylaxis* for 28 to 35 days over in-hospital prophylaxis only (Conditional recommendation, low certainty in the evidence of effects $\oplus\oplus\circ\circ$). Patients at low risk of thrombosis should receive in-hospital prophylaxis only over extended prophylaxis for 28 to 35 days (Conditional recommendation, low certainty in the evidence of effects $\oplus\oplus\circ\circ$).

C. *Preoperative vs. postoperative administration of prophylaxis:* The panel did not make a recommendation for use of immediate preoperative vs. immediate postoperative pharmacological prophylaxis in patients undergoing lobectomy or segmentectomy and identifies this as a

From the Department of Anaesthesia, Intensive Care and Peri-operative Medicine GHU AP-HP Centre-Université Paris-Cité – Cochin Hospital, Paris, France, European Society of Anaesthesiology and Intensive Care (ESAIC) (CMS), Department of Paediatric and Obstetric Anaesthesia, Rigshospitalet & Institute of Clinical Medicine, University of Copenhagen, Denmark, ESAIC (AA), Department of Cardiothoracic Anaesthesiology, Copenhagen University Hospital, Rigshospitalet (LG), Department of Paediatric and Obstetric Anaesthesia, Juliane Marie Centre (MHM), Department of Cardiothoracic Anaesthesiology, Rigshospitalet, Copenhagen, Denmark (SW), Department of Anesthesia, Critical Care and Pain Medicine, University General Hospital of Valencia (CSR) and Department of Methodology, Universidad Europea de Valencia, Spain, ESAIC (CSR)

Correspondence to Charles Marc Samama, MD, PhD, FCCP, FESAIC, Cochin University Hospital, Paris, France.
E-mail: marc.samama@aphp.fr

0265-0215 Copyright © 2024 European Society of Anaesthesiology and Intensive Care. Unauthorized reproduction of this article is prohibited.

DOI:10.1097/EJA.0000000000002025

research priority. There was not sufficient evidence to support either way, and there was uncertainty in risk for bleeding with preoperative prophylaxis in this population, and variation between healthcare settings (e.g. in agents used for anaesthesia and hospital admission prior to the procedure).

D. Routine postoperative screening for VTE: In patients undergoing lobectomy or segmentectomy, the guideline panel *suggests against* routine screening for postoperative VTE (Conditional recommendation, very low certainty in the evidence of effects ⊕○○○).

2. Pneumonectomy and extended lung resections:

A. In patients undergoing pneumonectomy or extended lung resections, the guideline panel *suggests* using parenteral anticoagulation (LMWH or UFH) for VTE prevention over no prophylaxis (Conditional recommendation, low certainty in the evidence of effects ⊕⊕○○). Among these anticoagulants, the panel *suggests* using LMWH rather than UFH (Conditional recommendation, moderate certainty in the evidence of effects ⊕⊕⊕○). Usage of DOACs in this patient population should only be in the context of a clinical trial.

B. In patients undergoing pneumonectomy or extended resections, the guideline panel *suggests* using combined prophylaxis over pharmacological prophylaxis alone (Conditional recommendation, very low certainty in the evidence of effects ⊕○○○). In patients who are not receiving pharmacological prophylaxis, the guideline panel *suggests* using mechanical prophylaxis (IPC or GCS) over no prophylaxis (Conditional recommendation, very low certainty in the evidence of effects ⊕○○○).

C. In patients undergoing pneumonectomy or extended resections, the guideline panel *suggests* using extended prophylaxis for 28 to 35 days over in-hospital prophylaxis only (Conditional recommendation, low certainty in the evidence of effects ⊕⊕○○).

D. Preoperative vs. postoperative administration of prophylaxis – similar to lobectomy/segmentectomy.

E. Routine postoperative screening for VTE: In patients undergoing pneumonectomy or extended resections, the guideline panel *suggests routine screening for postoperative VTE* over no routine screening (Conditional recommendation, very low certainty in the evidence of effects ⊕○○○).

3. Oesophagectomy:

A. In patients undergoing oesophagectomy, the guideline panel *suggests* using parenteral anticoagulation (LMWH or UFH) for VTE prevention over no prophylaxis (Conditional recommendation, low certainty in the evidence of effects ⊕⊕○○). Among these anticoagulants, the panel *suggests* using LMWH rather than UFH

(Conditional recommendation, moderate certainty in the evidence of effects ⊕⊕⊕○).

B. In patients undergoing oesophagectomy, the guideline panel *suggests* using a non-DOAC anticoagulant over a DOAC anticoagulant for thromboprophylaxis (Conditional recommendation, low certainty in the evidence of effects ⊕⊕○○).

C. In patients undergoing oesophagectomy, the guideline panel *suggests* using combined prophylaxis over pharmacological prophylaxis alone (Conditional recommendation, very low certainty in the evidence of effects ⊕○○○).

D. In patients undergoing oesophagectomy who are not receiving pharmacological prophylaxis, the guideline panel *suggests* using mechanical prophylaxis (IPC or GCS) over no prophylaxis (Conditional recommendation, very low certainty in the evidence of effects ⊕○○○).

E. Duration of prophylaxis: In patients undergoing oesophagectomy, the guideline panel *suggests* using *extended prophylaxis for 28 to 35 days* over in-hospital prophylaxis only (Conditional recommendation, low certainty in the evidence of effects ⊕⊕○○).

F. Preoperative vs. postoperative administration of prophylaxis – similar to lobectomy/segmentectomy.

G. Routine postoperative screening for VTE: In patients undergoing oesophagectomy, the guideline panel *suggests routine screening for postoperative VTE* over no routine screening (Conditional recommendation, very low certainty in the evidence of effects ⊕○○○).

3. Chapter 3 – Day surgery and fast-track surgery (Christoffer Calov Jorgensen and Juan Llau)

3.1. Preoperative period: We recommend that all patients undergoing an ambulatory/fast-track surgical protocol should be assessed for the VTE risk of the procedure and for any personal/additional VTE risk (Grade 1B). (Agreement 96%)

3.2. Intraoperative period: all patients: We suggest assessing the benefit of specific mechanical measures [intermittent pneumatic compression (IPC) devices] (Grade 2C).

3.3. Intraoperative period: Low risk surgery

No patient-related risk-factors: We recommend general measures of thromboprophylaxis (e.g. optimal hydration) over mechanical or pharmacological measures (Grade 1B). (Agreement 89%)

3.4. Intraoperative period: low-risk surgery

Additional patient-related risk factors: We recommend general measures of thromboprophylaxis (e.g. optimal hydration) (Grade 1B). (Agreement 87%)

3.5. Intraoperative period: high-risk surgery

No additional patient-related risk-factors: We recommend general measures of thromboprophylaxis (e.g. optimal hydration) (Grade 1B). (Agreement 89%)

3.6. Intraoperative period: high-risk surgery

Additional patient-related risk-factors: We recommend general measures of thromboprophylaxis (e.g. optimal hydration) (Grade 1B). (Agreement 89%)

3.7. Postoperative period: low-risk general surgery

No additional patient-related risk factors: We recommend general measures of thromboprophylaxis (e.g. early mobilisation and optimal hydration) over mechanical or pharmacological measures (Grade 1B). (Agreement 91%)

3.8. Postoperative period: Low-risk general surgery

No additional patient-related risk-factors: We suggest assessing specific mechanical measures (IPCI) in patients with increased bleeding risk (Grade 2C). (Agreement 76%)

3.9. Postoperative period: Low-risk general surgery

Additional patient-related risk-factors: We recommend general measures of thromboprophylaxis (e.g. early ambulation and optimal hydration) combined with pharmacological prophylaxis with LMWH over other drugs (Grade 1B), or with specific mechanical measures (IPC) in patients with an increased bleeding risk (Grade 2C). (Agreement 80%)

3.10. Postoperative period: high-risk general surgery, including cancer surgery

We recommend general measures of thromboprophylaxis (e.g. early ambulation and optimal hydration) combined with pharmacological prophylaxis with LMWH over other drugs (Grade 1B), or with specific mechanical measures (IPC) in patients with an increased bleeding risk (Grade 2C). (Agreement 85%)

3.11. Timing:

It is not possible to recommend an optimal timing for the first dose of LMWH in ambulatory or fast-track procedures, due to the lack of studies specifically in these populations (Grade 2C). (Agreement 98%)

3.12. Timing:

In case of planned neuraxial anaesthesia or deep peripheral nerve-blocks for the procedure, we suggest to post rather than preoperative start of administration (Grade 2C). (Agreement 89%)

3.13. Duration:

We recommend a minimum of 7 days' duration of treatment over protocols lasting 3 days or single-dose protocols (Grade 1B). (Agreement 76%)

3.14. Duration:

High-risk procedures: We suggest extending the duration of thromboprophylaxis for up to 4 weeks when using ASA and in specific cases of increased VTE-risk or impaired mobilisation (Grade 2B). (Agreement 93%)

3.15. Duration:

Fast-track surgery: In elective hip and knee arthroplasty, we suggest thromboprophylaxis with LMWH or DOAC only during hospitalization as an option when LOS 5 days or less and functional discharge criteria are achieved (Grade 2B). (Agreement 76%)

4. Chapter 4 – ICU (Juan Llau)

4.1. We recommend the use of mechanical prophylaxis over no prophylaxis in surgical critically ill patients with contraindications to pharmacological thromboprophylaxis (Grade 1C). (Agreement 96%)

4.2. We suggest the use of mechanical prophylaxis over no prophylaxis in medical critically ill patients with contraindications to pharmacological thromboprophylaxis (Grade 2B). (Agreement 91%)

4.3. We recommend the use of pharmacological prophylaxis over mechanical prophylaxis in ICU patients without contraindications to pharmacological thromboprophylaxis (Grade 1C). (Agreement 96%)

4.4. We recommend pharmacological thromboprophylaxis with LMWH over pharmacological thromboprophylaxis with UFH to prevent VTE in ICU patients (Grade 1B). (Agreement 98%)

4.5. We suggest using pharmacological thromboprophylaxis with UFH or dalteparin over other LMWH in ICU patients with severe renal dysfunction (Grade 2C). (Agreement 89%)

4.6. We recommend pharmacological thromboprophylaxis with argatroban as first-line option in ICU patients with heparin-induced thrombocytopenia (Grade 1C). (Agreement 80%)

4.7. We suggest using IPC over GCS in ICU patients receiving mechanical thromboprophylaxis (Grade 2B). (Agreement 96%)

4.8. We suggest using combined mechanical and pharmacological thromboprophylaxis in selected patients at very high risk for VTE, particularly critically ill surgical patients (Grade 2B). (Agreement 98%)

4.9. We suggest the use of IPC rather than GCS in addition to pharmacological thromboprophylaxis in selected critically ill patients at very high risk (Grade 2B). (Agreement 96%)

4.10. We suggest using an intermediate dose of LMWH over a low dose in ICU patients receiving

pharmacological thromboprophylaxis following an individualized risk/benefit analysis (Grade 2B). (Agreement 85%)

4.11. We suggest not to apply routine monitoring of aFXa levels in patients admitted to the ICU receiving LMWH as thromboprophylaxis (Grade 2C). (Agreement 87%)

4.12. We suggest aFXa levels monitoring in selected cases of patients admitted to the ICU receiving LMWH as thromboprophylaxis, that is, those with renal impairment or morbidly obese patients (Grade 2C). (Agreement 87%)

4.13. We suggest using an aFXa level dose-adjustment protocol for ICU patients with renal impairment or morbid obesity receiving pharmacological thromboprophylaxis (Grade 2C). (Agreement 89%)

5. Chapter 5 – Mechanical prophylaxis (Christian Fenger-Erikssen)

5.1. We recommend an institution-wide protocol for the prevention of VTE that integrates early ambulation, pharmacological thromboprophylaxis and/or mechanical thromboprophylaxis when indicated (Grade IB). (Agreement 98%)

5.2. We recommend, for each patient prior to surgery, to assess the risk of postoperative VTE and the bleeding risk related to both the surgical procedure and patient characteristics. (Grade IB). (Agreement 96%)

5.3. In patients with low thrombosis risk; day surgery and/or immediate mobilization: We recommend general measures of thromboprophylaxis (including early ambulation and optimal hydration) over mechanical or pharmacological prophylaxis (Grade 1B).

5.4. In patients with low thrombosis risk; hospitalized patients and/or postoperative immobilization: pharmacological prophylaxis, is recommended over no prophylaxis (Grade 1C). IPC is optional (Grade 2C)

5.5. In patients with high thrombosis risk and longer anaesthesia time, we suggest prophylaxis with IPC in case of high bleeding risk or contra-indication to pharmacological prophylaxis (Grade 2C). (Agreement 95%)

5.6. In patients with high thrombosis risk and low bleeding risk: we suggest pharmacological prophylaxis + optional mechanical prophylaxis (Grade 2B). (Agreement 87%)

5.7 In patients with high thrombosis risk and high bleeding risk: we recommend IPC over no prophylaxis (Grade 1C). (Agreement 100%)

5.8 In patients with very high thrombosis risk: we suggest IPC + pharmacological prophylaxis (Grade 1C). (Agreement 100%)

6. Chapter 6 – Neurosurgery (Lidia Mora)

6.1. We recommend the peri-operative use of IPC from the beginning of surgery, in patients undergoing moderate-to-high complexity spine procedures, craniotomy and in patients at risk of bleeding complications (Grade 1C). (Agreement 95%)

6.2. In patients at high thrombotic risk, a combination of mechanical and pharmacological prophylaxis is suggested, starting LMWH or UFH in the first 24 h postoperatively and no later than 72 h, provided that the risk of bleeding is ruled out and haemostasis is correct (Grade 2B). (Agreement 100%)

6.3 After nontraumatic intracerebral haemorrhage, provided the volume of intracranial blood is not expanding and haemostasis is correct, we suggest starting pharmacological prophylaxis 2 to 4 days after the bleeding (Grade 2C). (Agreement 96%)

7. Chapter 7 – COVID 19 – Cancelled due to the absence of data and literature

8. Chapter 8 – Plastic surgery (Guido Paolini)

8.1. We recommend the 2005 Caprini Risk Assessment Model (RAM) as a reference point for DVT/PE risk stratification in plastic surgery (Grade 1C). (Agreement 89%)

8.2. Clinical Practice Statement: There is no sufficient evidence to support specific preoperative or postoperative blood parameters, including haemoglobin and haematocrit level for reducing flap thrombosis and failure in microsurgical procedures. (Agreement 93%)

8.3. We suggest that abdominal contouring surgeries (especially abdominoplasty combined with liposuction or with hernia) be considered at higher VTE/PE risk. (Grade 2B). (Agreement 100%)

8.4. Patients with hypercoagulable patterns are at an increased risk of flap failure caused by microvascular thrombosis. We suggest using prevention with selective therapeutic anticoagulation (Grade 2C). (Agreement 87%)

8.5. We suggest using a duration of anticoagulation ranging from 7 to 30 days, according to DVT/PE risk stratification, as described in 2005 Caprini RAM (Grade 2C). (Agreement 93%)

8.6.1.a. We suggest the use of low-molecular-weight heparin (LMWH) in the postoperative period once daily (Grade 2B). (Agreement 98%)

8.6.1.b. Clinical Practice Statement: Weight-based LMWH (Enoxaparin 0.5 mg 50 IU⁻¹ kg⁻¹) for thromboembolic prophylaxis in the postoperative period for plastic surgery patients deserves further research, which should incorporate both a multicentre and randomised design. (Agreement 91%)

8.6.2. Simple Statement: There is no evidence to support the use of DOACs over LMWH because we do not know if DOACs are noninferior to LMWH for thromboembolic prophylaxis in plastic surgery patients. (Agreement 93%)

8.6.3. We suggest that in surgery with an indication for VTE prophylaxis, a higher prophylactic dose of LMWH (3000 to 4000 anti-Xa IU every 12 h subcutaneously) should be considered for morbidly obese patients with a BMI more than 40 kg m^{-2} undergoing plastic surgery (Grade 2C). (Agreement 91%)

8.6.4. Clinical Practice Statement: The use of IPC might play a role in VTE risk reduction in plastic surgery patients, either combination with chemoprophylaxis, or alone in patients where LMWH is contraindicated, but further evidence is needed. (Agreement 91%)

9. Chapter 9 – Surgery during pregnancy and the immediate postpartum period (Anne-Sophie Ducloy)

9.1. To decrease maternal mortality due to VTE, we recommend to educate all patients on the symptoms and signs of VTE and to perform a personalised evaluation of VTE risk factors in all pregnant women, updated before any surgery (Grade 1C). We recommend an update in the postpartum period regardless of the mode of delivery (Grade 1C). (Agreement 96%)

9.2. When thromboprophylaxis is necessary, we suggest adjusting LMWH dosing to weight in women presenting with a BMI greater than 40 kg m^{-2} (Grade 2C). (Agreement 96%)

9.3. In women with a personal history of VTE for surgery during pregnancy and postpartum, we recommend thromboprophylaxis with either a low dose or an intermediate dose of LMWH (Grade 2B). (Agreement 88%)

9.4. Compression stockings can be used during and after any surgery in pregnant or postpartum women, at least until ambulation. Although there is no evidence that compression stockings prevent peri-operative VTE, their use for surgery during pregnancy and the postpartum period might increase patient's comfort and limit pregnancy-induced vasoplegia. (Agreement 91%)

10. Chapter 10 – Surgery in the obese patient (Juan Arcelus)

A. Bariatric surgery

10.1. We recommend VTE prophylaxis with LMWH, UFH or fondaparinux over no prophylaxis in patients with high VTE risk and low risk for bleeding (Grade 1B). (Agreement 98%)

10.2. We suggest VTE prophylaxis with LMWH over UFH or DOAC (rivaroxaban or apixaban) (Grade 2C). (Agreement 93%)

10.3. We suggest prophylaxis with higher doses of LMWH, UFH or fondaparinux over standard doses, particularly in patients with BMI greater than 40 or weight greater than 150 kg (Grade 2B). We suggest against routine monitoring of anti-Xa levels in patients receiving LMWH, UFH or fondaparinux (Grade 2C). (Agreement 89%)

10.4. We suggest mechanical methods of prophylaxis over no prophylaxis in patients with high VTE risk and high risk of bleeding (Grade 2C). (Agreement 98%)

10.5. We suggest combined prophylaxis with LMWH and mechanical methods (intermittent pneumatic compression) over mechanical methods alone (Grade 2A). (Agreement 93%)

10.6. We recommend extending pharmacological prophylaxis with LMWH, UFH or fondaparinux for at least 10 days over prophylaxis limited to hospital stay in patients with high VTE risk (Grade 1C). (Agreement 98%)

B. Nonbariatric surgery

10.7. We suggest higher doses of LMWH in obese patients ($\text{BMI} > 40 \text{ kg m}^{-2}$ at high risk of VTE and low risk for bleeding undergoing non-bariatric major surgery (Grade 2C). (Agreement 96%)

11. Chapter 11 – Trauma (Catherine Heim)

11.1. We suggest that dose adjustment is associated with reduced VTE in severe trauma patients but there is inconclusive evidence to support one method over another, that is, weight adjusted *vs.* anti-Xa levels and further research is required (Grade 2B). (Agreement 80%)

11.2. We do not recommend the use of TEG/ROTEM to stratify VTE risk for adjusting prophylaxis (Grade 1C). (Agreement 98%)

11.3. We suggest DOAC as an alternative to LMWH in protecting against VTE (Grade 2C). (Agreement 98%)

11.4. We recommend that LMWH be used rather than UFH as thromboprophylaxis after severe trauma (Grade 1C). (Agreement 96%)

11.5. We recommend thromboprophylaxis to be initiated early ($< 24 \text{ h}$) after severe trauma without TBI and absence of active haemorrhage (Grade 1C). (Agreement 98%)

11.6. Statement: for nonoperative management (NOM) of blunt solid organ injuries, VTE rates decrease consistently with early thromboprophylaxis but based on conflicting results concerning delayed bleeding risk, some high-risk patients might benefit from a 48 h delay.

11.7. In nonoperated patients with TBI and no progression of intracranial haemorrhage on the CT scan 24 h after the injury, we suggest early prophylaxis with LMWH within 48 h after injury (Grade 2C). (Agreement 98%)

11.8. In patients having urgent neurosurgical interventions after TBI or in those at high risk of intracranial bleeding, we suggest delaying pharmacological prophylaxis on a case-by-case basis balancing the risk of haemorrhage and the risk of VTE (Grade 2C). (Agreement 98%)

11.9. For trauma patients with TBI and contraindication to pharmacological prophylaxis, we recommend IPC (Grade 1C). We suggest adding LMWH when the risk of bleeding decreases (Grade 2C). (Agreement 98%)

11.10. In patients with spinal cord injury, we suggest starting pharmacological prophylaxis within 48 h following trauma or surgery (Grade 2B). (Agreement 98%)

11.11. We suggest a total duration of pharmacological prophylaxis of 3 to 6 months after spinal cord injury with neurological deficit (Grade 2C). (Agreement 96%)

11.12. We suggest associating pharmacological and IPC in patients with spinal cord injury and a motor deficit (Grade 2C). (Agreement 95%)

11.13. In trauma patients, we recommend against the routine use of IVC filters for the primary prevention of VTE (Grade 1C). (Agreement 98%)

12. Chapter 12 – Urology (Kari Tikkinen)

12.1. In all patients undergoing ambulatory day surgery (e.g. circumcision, vasectomy, hydrocelectomy and ureteroscopy), the Panel recommends against use of pharmacological prophylaxis (Grade 1B), and against use of mechanical prophylaxis (Grade 1B). (Agreement 93%)

12.2. In all patients undergoing open radical cystectomy, or open radical prostatectomy with extended lymphadenectomy, the Panel recommends use of pharmacological prophylaxis (Grade 1A or Grade 1B, depending on risk stratum), and suggests use of mechanical prophylaxis (Grade 2C). (Agreement 91%)

12.3. In patients undergoing most other urological procedures, the risk prediction varies by surgical procedure and patient factors and a more detailed approach is preferred. (Agreement 93%)

13. Chapter 13 – Nonambulatory orthopaedic surgery (Jean-Yves Jenny and John Eikelboom)

Foreword 1: The term ‘Nonambulatory orthopaedic surgery’ refers to patients remaining at hospital for at least one night postsurgery, without defining the total length of

stay. Furthermore, this term does not define the type of postoperative rehabilitation, which may or may not include a fast-track procedure. The risk of VTE increases with the length of stay, whereas fast-track procedures are presumed to reduce this risk. It is therefore not possible to define unique recommendations.

Foreword 2: The term ‘pharmacological VTE prophylaxis’ includes (by alphabetic order) aspirin, coumarin, DOACs, LMWH and UFH in case of renal failure. The term ‘mechanical prophylaxis’ included (by alphabetical order) fast-track procedures, graduate compression stockings and intermittent pneumatic compression.

Foreword 3: There is no generally accepted classification for low or high VTE risk of surgery and low or high risk of bleeding. These points should be assessed with a surgery-specific and patient-specific policy.

13.1 Preoperative period: We suggest routine patient-specific over population-based preoperative evaluation of the risk of VTE and bleeding according to the type of procedure and the planned postoperative course (fast-track or standard postoperative procedure) (Grade 2B). (Agreement 98%)

13.2 Postoperative period: We recommend routine fast-track procedures including early ambulation and joint mobilisation over timing of procedures based on convenience (Grade 1B). (Agreement 96%)

13.3 Postoperative period:

Low VTE risk surgery: no patient-related risk factor: We suggest no pharmacological VTE prophylaxis for procedures with low VTE risk for a patient without high personal risk of VTE (Grade 2B). (Agreement 96%)

13.4 Postoperative period:

Additional patient-related risk factor for VTE and *no* high risk of bleeding: We suggest pharmacological VTE prophylaxis with either LMWH or DOACs over no VTE prophylaxis for procedures with low VTE risk for a patient with high personal risk of VTE (Grade 2B).

We are unable to propose a recommendation in favour or against the use of aspirin. (Agreement 91%)

13.5 Postoperative period:

Additional patient-related risk factor for VTE *with* high risk of bleeding: We suggest mechanical prophylaxis over no VTE prophylaxis for procedures with low VTE risk for a patient with high personal risk of VTE (Grade 2C). (Agreement 98%)

13.6 Postoperative period:

High VTE risk surgery and *no* high risk of bleeding:

We suggest VTE prophylaxis with either LMWH or DOACs over no VTE prophylaxis for procedures with

high VTE risk without high risk of bleeding (Grade 2B). We are unable to propose a recommendation in favour or against the use of aspirin. (Agreement 91%)

13.7 Postoperative period:

High VTE risk surgery *and* high risk of bleeding: We suggest mechanical VTE prophylaxis over pharmacological prophylaxis for procedures with high VTE risk with high risk of bleeding (Grade 2C). (Agreement 96%)

13.8 Postoperative period – specific procedures:

We recommend pharmacological VTE prophylaxis over no prophylaxis after THA, TKA and hip fractures (Grade 1A). (Agreement 98%)

13.9 Postoperative period – specific procedures:

We recommend pharmacological VTE prophylaxis with either LMWH or DOACs over no prophylaxis after fast-track THA, TKA or hip fracture (Grade 1B). (Agreement 98%)

13.10 Postoperative period – specific procedures:

We recommend pharmacological VTE prophylaxis with aspirin over no prophylaxis after fast-track THA and TKA (Grade 1C). (Agreement 89%)

13.11 Postoperative period – specific procedures:

We recommend pharmacological VTE prophylaxis with either LMWH or DOACs over no prophylaxis after THA, TKA and hip fractures (Grade 1A). (Agreement 100%)

13.12 Postoperative period – specific procedures:

We recommend pharmacological VTE prophylaxis with LMWH (Grade 1B), DOACs (Grade 1B) or aspirin (Grade 1C) over no prophylaxis after fast-track THA or TKA. (Agreement 91%)

Acknowledgements relating to this article

Assistance with the article: none.

Financial support and sponsorship: the work was funded by ESAIC, EACTAIC, EACTS, ISTH, EURAPS and EKS.

Conflict of interest: CMS, other support: Norgine pharma (adviser); CRG, other support: attendance to scientific congress OCTAPHARMA sponsorship.

Presentation: none.

This article was reviewed by ESAIC members and approved by ESAIC Board.

This manuscript was handled by Charles Marc Samama.

GRAPHICAL ABSTRACT

EUROPEAN GUIDELINES ON PERIOPERATIVE VENOUS THROMBOEMBOLISM PROPHYLAXIS

FIRST UPDATE

Recommendations 1A and 1B

DAY AND FAST-TRACK SURGERY

PREOPERATIVE PERIOD

All patients should be assessed for the VTE risk of the procedure and for any personal/ additional VTE risk (Grade 1B).

INTRAOPERATIVE PERIOD

	low risk surgery	high risk surgery
no additional patient-related risk-factors	general measures of thromboprophylaxis (e.g. optimal hydration) over mechanical or pharmacological measures. (Grade 1B)	
additional patient-related risk-factors		

POSTOPERATIVE PERIOD

	Low-risk general surgery
no additional patient-related risk-factors	general measures of thromboprophylaxis (e.g. early mobilization and optimal hydration) over mechanical or pharmacological measures (Grade 1B)
additional patient-related risk-factors	general measures of thromboprophylaxis combined with pharmacological prophylaxis with LMWH over other drugs (Grade 1B)
A minimum of 7 days treatment over protocols lasting 3 days or single-dose protocols (Grade 1B)	

SURGERY IN THE OBESE PATIENT

	Bariatric surgery
Patients with high VTE risk and low risk for bleeding	VTE prophylaxis with LMWH, UFH or fondaparinux over no prophylaxis (Grade 1B)

MECHANICAL PROPHYLAXIS

PREOPERATIVE PERIOD

prior to surgery, assess the risk of postoperative VTE and the risk of bleeding related to the surgical procedure and patient characteristics. (Grade 1B)

POSTOPERATIVE PERIOD

institution-wide protocol that integrates

- early ambulation
- pharmacological thromboprophylaxis and/or mechanical thromboprophylaxis when indicated (Grade 1B).

low thrombosis risk day surgery	→	general measures over mechanical or pharmacological prophylaxis (Grade 1B)
immediate mobilization		

UROLOGY

	Ambulatory day surgery
The Panel recommends against the use of pharmacological prophylaxis (Grade 1B) and against the use of mechanical prophylaxis (Grade 1B)	
Open radical cystectomy, or open radical prostatectomy with extended lymphadenectomy	
The Panel recommends the use of pharmacological prophylaxis (Grade 1A or Grade 1B, depending on the risk stratum)	

INTENSIVE CARE UNIT

- pharmacological thromboprophylaxis with LMWH over pharmacological thromboprophylaxis with UFH (Grade 1B)

NON-AMBULATORY ORTHOPAEDIC SURGERY

Routine fast-track procedures, including early ambulation and joint mobilization over timing of procedures based on convenience (Grade 1B)

pharmacological VTE prophylaxis over no prophylaxis after THA, TKA and hip fractures (Grade 1A)

↳ with either LMWH or DOACs over no prophylaxis (Grade 1A)

pharmacological VTE prophylaxis with either LMWH or DOACs over no prophylaxis after fast-track THA, TKA or hip fracture (Grade 1B)

pharmacological VTE prophylaxis with LMWH (Grade 1B), DOACs (Grade 1B) or aspirin (Grade 1C) over no prophylaxis after fast-track THA or TKA.

EUROPEAN GUIDELINES ON PERIOPERATIVE VENOUS THROMBOEMBOLISM PROPHYLAXIS

FIRST UPDATE

Highlights



CARDIAC AND VASCULAR SURGERY

We recommend early initiation (between 6h-24h) post-surgery of pharmacological VTE prophylaxis in the absence of significant bleeding risk **Grade 1C**



ONCOLOGICAL THORACIC SURGERY

In patients undergoing Esophagectomy and Pneumonectomy: extended prophylaxis for 28-35 days over in-hospital prophylaxis only. **Conditional recommendation low certainty** ⊕⊖○○



DAY SURGERY AND FAST-TRACK SURGERY

In elective hip and knee arthroplasty we suggest thromboprophylaxis with LMWH or DOAC only during hospitalization when LOS ≤ 5 days and functional discharge criteria are achieved **Grade 2B**



INTENSIVE CARE

We suggest using combined mechanical and pharmacological thromboprophylaxis in patients at very high risk for VTE **Grade 2B**



MECHANICAL PROPHYLAXIS

In patients with low thrombosis risk; Day surgery and/or immediate mobilization: We recommend general measures of thromboprophylaxis (including early ambulation and optimal hydration) over mechanical or pharmacological prophylaxis **Grade 1B**



NEUROSURGERY

In patients at high thrombotic risk, a combination of mechanical and pharmacological prophylaxis is suggested, starting LMWH or UFH in the first 24 hours post-operatively and no later than 72 h, provided that the risk of bleeding is ruled out and haemostasis is correct **Grade 2B**



PLASTIC SURGERY

We suggest that abdominal contouring surgeries (especially abdominoplasty combined with liposuction or with hernia) be considered at higher VTE/PE risk **Grade 2B**



SURGERY DURING PREGNANCY AND THE IMMEDIATE POST-PARTUM PERIOD

We recommend personalized evaluation of risk factors in each patient, updated before any surgery **Grade 1C**



SURGERY IN THE OBESE PATIENT

We suggest prophylaxis with higher doses of LMWH, UFH or fondaparinux over standard doses, particularly in patients with BMI > 40 or weight > 150 kg **Grade 2B**

We suggest against routine monitoring of anti-Xa levels in patients receiving LMWH, UFH or fondaparinux **Grade 2C**

We suggest combined prophylaxis with LMWH and mechanical methods (intermittent pneumatic compression) over mechanical methods alone **Grade 2A**



TRAUMA

We recommend thromboprophylaxis to be initiated early (<24 hours) after severe trauma without TBI and absence of active hemorrhage **Grade 1C**



UROLOGY

In all patients undergoing open radical cystectomy, or open radical prostatectomy with extended lymphadenectomy, the Panel recommends use of pharmacological prophylaxis **Grade 1A/Grade 1B** and suggests use of mechanical prophylaxis **Grade 2C**



NON AMBULATORY ORTHOPEDIC SURGERY

We recommend pharmacological VTE prophylaxis with either LMWH (**Grade 1A**), fondaparinux (**Grade 1B**), DOACs (**Grade 1B**) or aspirin (**Grade 1C**) over no prophylaxis after THA or TKA.