Guidelines for Prevention of Venous Thromboembolism in Adults
Dear Colleagues,

It is our pleasure to introduce this booklet of guidelines for venous thromboembolism (VTE) prophylaxis, which is based on the most recently issued ACCP, IUA, ASRA & RCOG guidelines.

Recent evidence indicates that VTE is a major health problem. The Agency for Healthcare Research and Quality ranked 79 patients safety interventions based on the strength of the evidence supporting more widespread implementation of these procedures. The highest ranked safety practice was the appropriate use of prophylaxis to prevent VTE in patients at risk. Despite all this evidence, the risk remains underestimated and its management is suboptimal.

With your help and that of your colleagues, we will try to cover the wide variety of topics including VTE prophylaxis for different types of patients (critically ill patients, general medical, surgical, obstetric, etc...) in this booklet, with the aim to cover important issues related to our daily practice and answer outstanding questions in VTE prophylaxis.

This summarized guidelines with other tools provided for all health care professionals in our website, will help us to raise VTE awareness as well as increase prophylaxis rate, for the sake of our patients.

Finally, we are very confident that with your help, cooperation & compliance to the guidelines, you will find this project “DVT Safety Zone”
a very helpful and informative tool. We are sure that this program will be reflected on a better care for our patients.

Best regards,

Saudi Arabia VTE Advisory Group “SAVTE Group”
Guidelines Task Force
www.savte.com

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<table>
<thead>
<tr>
<th>Rationale for Thromboprophylaxis</th>
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<tbody>
<tr>
<td>High prevalence of VTE</td>
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<tr>
<td>Almost all hospitalized patients have one or more risk factors VTE</td>
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<tr>
<td>DVT is common in many hospitalized patient groups</td>
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<tr>
<td>Hospital-acquired DVT and PE are usually clinically silent</td>
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<tr>
<td>It is difficult to predict which at-risk patients will develop symptomatic thromboembolic complications</td>
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<tr>
<td>Screening at-risk patients using physical examination or noninvasive testing is neither cost-effective nor effective</td>
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<tr>
<td>Adverse consequences of unprevented VTE</td>
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<tr>
<td>Symptomatic DVT and PE</td>
</tr>
<tr>
<td>Fatal PE</td>
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<tr>
<td>Costs of investigating symptomatic patients</td>
</tr>
<tr>
<td>Risks and costs of treating unprevented VTE</td>
</tr>
<tr>
<td>Increased future risk of recurrent VTE</td>
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<tr>
<td>Chronic post-thrombotic syndrome</td>
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<tr>
<td>Efficacy and effectiveness of thromboprophylaxis</td>
</tr>
<tr>
<td>Thromboprophylaxis is highly efficacious at preventing DVT and proximal DVT</td>
</tr>
<tr>
<td>Thromboprophylaxis is highly effective at preventing symptomatic VTE and fatal PE</td>
</tr>
<tr>
<td>The prevention of DVT also prevents PE</td>
</tr>
<tr>
<td>Cost-effectiveness of thromboprophylaxis has repeatedly been demonstrated</td>
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</table>
Table 2 - Approximate Risks of DVT in Hospitalized Patients *

<table>
<thead>
<tr>
<th>Patients Group</th>
<th>DVT Prevalence, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical patients</td>
<td>10 - 20</td>
</tr>
<tr>
<td>General surgery</td>
<td>15 - 40</td>
</tr>
<tr>
<td>Major gynecologic surgery</td>
<td>15 - 40</td>
</tr>
<tr>
<td>Major urologic surgery</td>
<td>15 - 40</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>15 - 40</td>
</tr>
<tr>
<td>Stroke</td>
<td>20 - 50</td>
</tr>
<tr>
<td>Hip or knee arthroplasty, HFS</td>
<td>40 - 60</td>
</tr>
<tr>
<td>Major trauma</td>
<td>40 - 80</td>
</tr>
<tr>
<td>SCI</td>
<td>60 - 90</td>
</tr>
<tr>
<td>Critical care patients</td>
<td>10 - 80</td>
</tr>
</tbody>
</table>

* Rates based on objective diagnostic screening for asymptomatic DVT in patients not receiving thromboprophyxaxis.
1. For every general hospital, we recommend that a formal, active strategy that addresses the prevention of VTE be developed (Grade 1A).

2. We recommend that the local Thromboprophylaxis strategy be in the form of a written, institution-wide thromboprophylaxis policy (Grade 1C).

3. We recommend the use of strategies shown to increase thromboprophylaxis adherence, including the use of:
   • Computer decision support systems (Grade 1A)
   • Preprinted Medical order Form (Grade 1B)
   • And periodic audit and feedback (Grade 1C)

   Passive methods such as distribution of educational materials or educational meetings alone are not recommended as sole strategies to increase adherence to Thromboprophylaxis (Grade 1B).

4. We recommend that mechanical methods of prophylaxis be used primarily in patients at high risk of bleeding (Grade 1A), or possibly as an adjunct to anticoagulant-based thromboprophylaxis (Grade 2A).

5. For patients receiving mechanical methods of prophylaxis, we recommend that careful attention be directed toward ensuring the proper use of, and optimal adherence with these methods (Grade 1A).

6. We recommend against the use of aspirin alone as thromboprophylaxis against VTE for any patient group (Grade 1A).
7. For each of the antithrombotic agents, we recommend that clinicians follow manufacturer suggested dosing guidelines (Grade 1C).

8. We recommend that renal function be considered when making decisions about the use and/or the dose of LMWH, fondaparinux, and other antithrombotic drugs that are cleared by the kidneys, particularly in elderly patients, patients with diabetes mellitus, and those at high risk for bleeding (Grade 1A). Depending on the circumstances, we recommend one of the following options in this situation: avoiding the use of an anticoagulant that bioaccumulates in the presence of renal impairment, using a lower dose of the agent, or monitoring the drug level or its anticoagulant effect (Grade 1B).

9. For all patients undergoing neuraxial anesthesia or analgesia, we recommend appropriate patient selection and caution when using anticoagulant thromboprophylaxis (Grade 1A).

10. For patients receiving deep peripheral nerve blocks, we recommend that the same cautions considered for neuraxial techniques be applied when using anticoagulant thromboprophylaxis (Grade 1C).

11. For patients at both extreme body weight, dose should be adjusted according to the manufacturer’s guidelines.

12. With the exception of VTE prophylaxis during pregnancy, there is no need for laboratory monitoring for patients receiving VTE prophylaxis.
<table>
<thead>
<tr>
<th>Grade of Recommendation*</th>
<th>Benefit vs Risk and Burdens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong recommendation, high-quality evidence, <strong>Grade 1A</strong></td>
<td>Desirable effects clearly outweigh undesirable effects, or vice versa</td>
</tr>
<tr>
<td>Strong recommendation, moderate-quality evidence, <strong>Grade 1B</strong></td>
<td>Desirable effects clearly outweigh undesirable effects, or vice versa</td>
</tr>
<tr>
<td>Strong recommendation, low or very low-quality evidence, <strong>Grade 1C</strong></td>
<td>Desirable effects clearly outweigh undesirable effects, or vice versa</td>
</tr>
<tr>
<td>Weak recommendation, high-quality evidence, <strong>Grade 2A</strong></td>
<td>Desirable effects closely balanced with undesirable effects</td>
</tr>
<tr>
<td>Weak recommendation, moderate-quality evidence, <strong>Grade 2B</strong></td>
<td>Desirable effects closely balanced with undesirable effects</td>
</tr>
<tr>
<td>Weak recommendation, low or very low-quality evidence, <strong>Grade 2C</strong></td>
<td>Desirable effects closely balanced with undesirable effects</td>
</tr>
</tbody>
</table>

* We use the wording we recommend for strong (Grade 1)
### Methodologic Quality of Supporting Evidence

<table>
<thead>
<tr>
<th>Grade of Recommendation*</th>
<th>Benefit vs Risk</th>
<th>Methodologic Quality of Supporting Evidence</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong recommendation, high-quality evidence, Grade 1A</td>
<td>Desirable effects clearly outweigh undesirable effects, or vice versa</td>
<td>Consistent evidence from RCTs without important limitations or exceptionally strong evidence from observational studies</td>
<td>Recommendation can apply to most patients in most circumstances; further research is very unlikely to change our confidence in the estimate of effect</td>
</tr>
<tr>
<td>Strong recommendation, moderate-quality evidence, Grade 1B</td>
<td>Desirable effects clearly outweigh undesirable effects, or vice versa</td>
<td>Evidence from RCTs with important limitations (inconsistent results, methodologic flaws, indirect or imprecise), or very strong evidence from observational studies</td>
<td>Recommendation can apply to most patients in most circumstances; higher quality research may well have an important impact on our confidence in the estimate of effect and may change the estimate</td>
</tr>
<tr>
<td>Strong recommendation, low or very low-quality evidence, Grade 1C</td>
<td>Desirable effects clearly outweigh undesirable effects, or vice versa</td>
<td>Evidence for at least one critical outcome from observational studies, case series, or from RCTs with serious flaws or indirect evidence</td>
<td>Recommendation can apply to most patients in many circumstances; higher-quality research is likely to have an important impact on our confidence in the estimate of effect and may well change the estimate</td>
</tr>
</tbody>
</table>

### Implications

- Recommendation can apply to most patients in most circumstances; further research is very unlikely to change our confidence in the estimate of effect.
- Recommendation can apply to most patients in most circumstances; higher quality research may well have an important impact on our confidence in the estimate of effect and may change the estimate.
- Recommendation can apply to most patients in many circumstances; higher-quality research is likely to have an important impact on our confidence in the estimate of effect and may well change the estimate.
- The best action may differ depending on circumstances or patient or society values; further research is very unlikely to change our confidence in the estimate of effect.
- Best action may differ depending on circumstances or patient or society values; higher-quality research may well have an important impact on our confidence in the estimate of effect and may change the estimate.
- Other alternatives may be equally reasonable; higher-quality research is likely to have an important impact on our confidence in the estimate of effect and may well change the estimate.

*We use the wording we recommend for strong (Grade 1) recommendations and we suggest for weak (Grade 2) recommendations.*
### Table 4 - Risk Factors for VTE

- Surgery
- Trauma (major trauma or lower-extremity injury)
- Immobility, lower-extremity paresis
- Cancer (active or occult)
- Cancer therapy (hormonal, chemotherapy, angiogenesis inhibitors, radiotherapy)
- Venous compression (tumor, hematoma, arterial abnormality)
- Previous VTE
- Increasing age
- Pregnancy and the postpartum period
- Estrogen-containing oral contraceptives or hormone replacement therapy
- Selective estrogen receptor modulators
- Erythropoiesis-stimulation agents
- Acute medical illness
- Inflammatory bowel disease
- Nephrotic syndrome
- Myeloproliferative disorders
- Paroxysmal nocturnal hemoglobinuria
- Obesity
- Central venous catheterization
- Inherited or acquired thrombophilia
N.B.

Please refer to Page 64-65 for “VTE Risk Assessment Model (RAM) for surgical and medical patients”, in order to have a guide in stratifying your patients at risk of developing DVT or PE (i.e., very high, high, moderate, or low risk)
1. **For low-risk general surgery patients** who are < 40 years of age undergoing minor procedures and have no additional thromboembolic risk factors, we recommend against the use of specific thromboprophylaxis other than early and frequent ambulation (Grade 1A).

2. **For moderate-risk general surgery patients** who are
   - undergoing a non-major procedure and are between the ages of 40 and 60 years or have additional risk factors
   - undergoing major operations and are < 40 years of age with no additional risk factors
   We recommend thromboprophylaxis with LMWH “e.g., enoxaparin 40 mg SubCut Daily”, LDUH “e.g., 5000 IU SubCut BID”, or fondaparinux “e.g., 2.5 mg SubCut Daily” (each Grade 1A).

3. **For higher-risk general surgery patients** who are
   - undergoing non-major surgery and are > 60 years of age or have additional risk factors
   - undergoing major surgery and are > 40 years of age or have additional risk factors
   We recommend thromboprophylaxis with LMWH “e.g., enoxaparin 40 mg SubCut Daily”, LDUH “e.g., 5000 IU SubCut TID”, or fondaparinux “e.g., 2.5 mg SubCut Daily” (each Grade 1A).

4. **For high-risk general surgery patients** with multiple risk factors, we recommend that a pharmacologic method (LMWH “e.g., enoxaparin 30 mg SubCut BID”, LDUH “e.g., 5000 IU SubCut TID”, or fondaparinux “e.g., 2.5 mg SubCut Daily”) be combined with the optimal use of a mechanical method (i.e., graduated compression stockings [GCS] and/or IPC) [Grade 1C].
5. For general surgery patients with a high risk of bleeding, we recommend the optimal use of mechanical prophylaxis with properly fitted GCS or IPC (Grade 1A). When the high bleeding risk decreases, we recommend that pharmacologic thromboprophylaxis be substituted for or added to the mechanical prophylaxis (Grade 1C).

6. For selected high-risk general surgery patients, including some of those who have undergone major cancer surgery or have previously had VTE, we suggest that continuing thromboprophylaxis after hospital discharge with LMWH “e.g., Enoxaparin 40 mg SubCut Daily” for up to 28 days be considered (Grade 2A).

N.B.

Please refer to page 64-65 for “VTE Risk Assessment Model (RAM) for surgical and medical patients”, in order to have a better tool to assess the level of risk for your patient, which is a function of exposing (associated with clinical settings) & predisposing (associated with patient) risk factors.
1. For patients undergoing vascular surgery who do not have additional thromboembolic risk factors, we suggest that clinicians not routinely use specific thromboprophylaxis other than early and frequent ambulation (Grade 2B).

2. For patients undergoing major vascular surgery procedures who have additional thromboembolic risk factors, we recommend thromboprophylaxis with LMWH “e.g., enoxaparin 40 mg SubCut Daily”, LDUH “e.g., 5000 IU SubCut TID “, or fondaparinux “e.g., 2.5 mg SubCut Daily” (Grade 1C).
1. For low-risk gynecologic surgery patients who are undergoing minor procedures and have no additional risk factors, we recommend against the use of specific thromboprophylaxis other than early and frequent ambulation (Grade 1A).

2. For gynecology patients undergoing entirely laparoscopic procedures without additional VTE risk factors, we recommend against routine thromboprophylaxis, other than early and frequent ambulation (Grade 1B). However, in whom additional VTE risk factors are present, we recommend the use of thromboprophylaxis with one or more of LMWH “e.g., enoxaparin 40 mg SubCut Daily”, LDUH “5000 IU SubCut TID”, IPC, or GCS (Grade 1C).

3. For all patients undergoing major gynecologic surgery, we recommend that thromboprophylaxis be used routinely (Grade 1A).

4. For patients undergoing major gynecologic surgery for benign disease without additional risk factors, we recommend LMWH “e.g., enoxaparin 40 mg SubCut Daily” (Grade 1A), LDUH “e.g., 5000 IU SubCut TID” (Grade 1A), or IPC started just before surgery and used continuously while the patient is not ambulating (Grade 1B).

5. For patients undergoing extensive surgery for malignancy and for patients with additional VTE risk factors, we recommend routine thromboprophylaxis with LMWH (Grade 1A), or LDUH three times daily (Grade 1A), or IPC, started just before surgery and used continuously while the patient is not ambulating (Grade 1A). Alternative considerations include a combination of LMWH or LDUH plus mechanical prophylaxis with GCS or IPC, or fondaparinux (all Grade 1C).
7. **Duration of Prophylaxis:** For patients undergoing major gynecologic procedures, we recommend that thromboprophylaxis continue until discharge from hospital (Grade 1A). For selected high-risk gynecology patients, including some of those who have undergone major cancer surgery or have previously had VTE, we suggest that continuing thromboprophylaxis after hospital discharge with LMWH for up to 28 days be considered (Grade 2C).

N.B.

Please refer to page 64-65 for “VTE Risk Assessment Model (RAM) for surgical and medical patients”, in order to have a better tool to assess the level of risk for your patient, which is a function of exposing (associated with clinical settings) & predisposing (associated with patient) risk factors.

Please refer to medical patients section for medical setting.
1. For patients undergoing transurethral or other low-risk urologic procedures, we recommend against the use of specific thromboprophylaxis other than early and frequent ambulation (Grade 1A).

2. For all patients undergoing major, open urologic procedures, we recommend that thromboprophylaxis be used routinely (Grade 1A).

3. For patients undergoing major, open urologic procedures, we recommend routine thromboprophylaxis with LDUH “e.g., 5000 IU SubCut BID or TID” (Grade 1B), GCS and/or IPC started just before surgery and used continuously while the patient is not ambulating (Grade 1B), LMWH “e.g., enoxaparin 40 mg SubCut Daily” (Grade 1C), fondaparinux “e.g., 2.5 mg SubCut Daily” (Grade 1C), or the combination of a pharmacologic method (i.e., LMWH, LDUH, or fondaparinux) with the optimal use of a mechanical method (i.e., GCS and/or IPC) [Grade 1C].

4. For urologic surgery patients who are actively bleeding, or who are at very high risk for bleeding, we recommend the optimal use of mechanical prophylaxis with GCS and/or IPC at least until the bleeding risk decreases (Grade 1A). When the high bleeding risk decreases, we recommend that pharmacologic thromboprophylaxis be substituted for or added to the mechanical prophylaxis (Grade 1C).
Laparoscopic Surgery

1. For patients undergoing entirely laparoscopic procedures who do not have additional thromboembolic risk factors, we recommend against the routine use of thromboprophylaxis, other than early and frequent ambulation (Grade 1B).

2. For patients undergoing laparoscopic procedures in whom additional VTE risk factors are present, we recommend the use of thromboprophylaxis with one or more of LMWH “e.g., enoxaparin 40 mg SubCut Daily”, LDUH “e.g., 5000 IU SubCut TID”, fondaparinux “e.g., 2.5 mg SubCut Daily”, IPC, or GCS (all Grade 1C).
1. For patients undergoing inpatient bariatric surgery, we recommend routine thromboprophylaxis with LMWH “e.g., enoxaparin 30 mg SubCut BID according to BMI”, LDUH “5000 IU SubCut TID”, fondaparinux, or the combination of one of these pharmacologic methods with optimally used IPC (each Grade 1C). 

2. For patients undergoing inpatient bariatric surgery, we suggest that higher doses of LMWH “e.g., enoxaparin 30 mg SubCut BID” or LDUH than usual for non-obese patients be used (Grade 2C).
Thoracic Surgery

1. For patients undergoing major thoracic surgery, we recommend routine thromboprophylaxis with LMWH “e.g., enoxaparin 40 mg SubCut Daily”, LDUH “5000 IU SubCut TID”, or fondaparinux “2.5 mg SubCut Daily” (each Grade 1C).

2. For thoracic surgery patients with a high risk of bleeding, we recommend the optimal use of mechanical prophylaxis with properly fitted GCS and/or IPC (Grade 1C).
1. For patients undergoing coronary artery bypass graft (CABG) surgery, we recommend the use of thromboprophylaxis with LMWH “e.g., enoxaparin 40 mg SubCut Daily”, LDUH “5000 IU SubCut TID”, or optimally used bilateral GCS or IPC (Grade 1C).

2. For patients undergoing CABG, we suggest the use of LMWH over LDUH (Grade 2B).

3. For patients undergoing CABG with a high risk of bleeding, we recommend the optimal use of mechanical prophylaxis with properly fitted bilateral GCS or IPC (Grade 1C).
Elective Hip Replacement

1. For patients undergoing elective total hip replacement (THR), we recommend the routine use of one of the following anticoagulant options:
   (1) LMWH (at a usual high-risk dose “e.g., enoxaparin 40 mg SubCut BID”, started 12 h before surgery or 12 to 24 h after surgery, or 4 to 6 h after surgery at half the usual high-risk dose and then increasing to the usual high-risk dose the following day); or
   (2) fondaparinux (2.5 mg started 6 to 24 h after surgery); or
   (3) adjusted-dose VKA started preoperatively or the evening of the surgical day (international normalized ratio [INR] target, 2.5; INR range, 2.0 to 3.0) (all Grade 1A).

2. For patients undergoing THR, we recommend against the use of any of the following:
   Aspirin, GCS,
   Dextran, or venous foot pump
   LDUH, (VFP)
   as the sole method of thromboprophylaxis (all Grade 1A).

3. For patients undergoing THR who have a high risk of bleeding, we recommend the optimal use of mechanical thromboprophylaxis with the VFP or IPC (Grade 1A). When the high bleeding risk decreases, we recommend that pharmacologic prophylaxis be substituted for or added to the mechanical prophylaxis (Grade 1C).
Elective Knee Replacement

1. For patients undergoing TKR, we recommend routine thromboprophylaxis using LMWH (at the usual high-risk dose – e.g., Enoxaparin 30 mg SubCut BID), fondaparinux “e.g., 2.5 mg SubCut Daily”, or adjusted dose VKA (INR target, 2.5; INR range, 2.0 to 3.0) (all Grade 1A).

2. For patients undergoing TKR, the optimal use of IPC is an alternative option to anticoagulant thromboprophylaxis (Grade 1B).

3. For patients undergoing TKR, we recommend against the use of any of the following as the only method of thromboprophylaxis: aspirin (Grade 1A), LDUH (Grade 1A), or VFP (Grade 1B).

4. For patients undergoing TKR who have a high risk of bleeding, we recommend the optimal use of mechanical thromboprophylaxis with IPC (Grade 1A) or VFP (Grade 1B). When the high bleeding risk decreases, we recommend that pharmacologic prophylaxis be substituted for or added to the mechanical prophylaxis (Grade 1C).
1. For patients undergoing knee arthroscopy who do not have additional thromboembolic risk factors, we suggest that clinicians not routinely use thromboprophylaxis other than early mobilization (Grade 2B).

2. For patients undergoing arthroscopic knee surgery who have additional thromboembolic risk factors or following a complicated procedure, we recommend thromboprophylaxis with LMWH “e.g., enoxaparin 40 mg SubCut Daily” (Grade 1B).

N.B.

Please refer to page 64-65 for “VTE Risk Assessment Model (RAM) for surgical and medical patients”, in order to have a better tool to assess the level of risk for your patient, which is a function of exposing (associated with clinical settings) & predisposing (associated with patient) risk factors.
1. For patients undergoing HFS, we recommend routine thromboprophylaxis using fondaparinux “e.g., 2.5 mg SubCut Daily” (Grade 1A), LMWH “e.g., enoxaparin 30 mg SubCut BID” (Grade 1B), adjusted dose VKA (INR target, 2.5; range, 2.0 to 3.0) [Grade 1B], or LDUH (Grade 1B).

2. For patients undergoing HFS, we recommend against the use of aspirin alone (Grade 1A).

3. For patients undergoing HFS in whom surgery is likely to be delayed, we recommend that thromboprophylaxis with LMWH or LDUH be initiated during the time between hospital admission and surgery (Grade 1C).

4. For patients undergoing HFS who have a high risk of bleeding, we recommend the optimal use of mechanical prophylaxis (Grade 1A). When the high bleeding risk decreases, we recommend that pharmacologic prophylaxis be substituted for or added to the mechanical thromboprophylaxis (Grade 1C).
Duration of Thromboprophylaxis

1. For patients undergoing THR, we recommend that thromboprophylaxis be extended beyond 10 days and up to 35 days after surgery (Grade 1A). The recommended options for extended thromboprophylaxis in THR include LMWH (Grade 1A), a VKA (Grade 1B), or fondaparinux (Grade 1C).

2. For patients undergoing TKR, we suggest that thromboprophylaxis be extended beyond 10 days and up to 35 days after surgery (Grade 2B). The recommended options for extended thromboprophylaxis in TKR include LMWH (Grade 1C), a VKA (Grade 1C), or fondaparinux (Grade 1C).

3. For patients undergoing HFS, we recommend that thromboprophylaxis be extended beyond 10 days and up to 35 days after surgery (Grade 1A). The recommended options for extended thromboprophylaxis in HFS include fondaparinux (Grade 1A), LMWH (Grade 1C), or a VKA (Grade 1C).
Elective Spine Surgery

1. For patients undergoing spine surgery who do not have additional thromboembolic risk factors, we suggest that clinicians not routinely use specific thromboprophylaxis other than early and frequent ambulation (Grade 2C).

2. For patients undergoing spine surgery who have additional thromboembolic risk factors such as advanced age, malignancy, presence of a neurologic deficit, previous VTE, or an anterior surgical approach, we recommend that one of the following thromboprophylaxis options be used: postoperative LDUH “e.g., 5000 IU SubCut BID/TID” (Grade 1B), postoperative LMWH “e.g., enoxaparin 40 mg SubCut Daily” (Grade 1B), or optimal use of perioperative IPC (Grade 1B). An alternative consideration is GCS (Grade 2B).

3. For patients undergoing spine surgery who have multiple risk factors for VTE, we suggest that a pharmacologic method (i.e., LDUH or LMWH) be combined with the optimal use of a mechanical method (i.e., GCS and/or IPC) (Grade 2C).
Isolated Lower-Extremity Injuries Distal to the Knee

1. For patients with isolated lower-extremity injuries distal to the knee, we suggest that clinicians not routinely use thromboprophylaxis (Grade 2A).
1. For all major trauma patients, we recommend routine thromboprophylaxis if possible (Grade 1A).

2. For major trauma patients, in the absence of a major contraindication, we recommend that clinicians use LMWH “e.g., enoxaparin 30 mg SubCut BID” thromboprophylaxis starting as soon as it is considered safe to do so (Grade 1A). An acceptable alternative is the combination of LMWH and the optimal use of a mechanical method of prophylaxis (Grade 1B).

3. For major trauma patients, if LMWH thromboprophylaxis is contraindicated due to active bleeding or high risk for clinically important bleeding, we recommend that mechanical prophylaxis with IPC or possibly with GCS alone be used (Grade 1B). When the high bleeding risk decreases, we recommend that pharmacologic thromboprophylaxis be substituted for or added to the mechanical prophylaxis (Grade 1C).

4. In trauma patients, we recommend against routine DUS screening for asymptomatic deep vein thrombosis (DVT) (Grade 1B). We do recommend DUS screening in patients who are at high risk for VTE (e.g., in the presence of a spinal cord injury [SCI], lower extremity or pelvic fracture, or major head injury), and who have received suboptimal thromboprophylaxis or no thromboprophylaxis (Grade 1C).

5. For trauma patients, we recommend against the use of an inferior vena cava (IVC) filter as primary VTE prophylaxis (Grade 1C).

6. For major trauma patients, we recommend the continuation of thromboprophylaxis until hospital discharge (Grade 1C). For trauma patients with impaired mobility who undergo inpatient rehabilitation, we suggest continuing thromboprophylaxis with LMWH “e.g., enoxaparin 40 mg SubCut Daily” or a VKA (target INR, 2.5; range, 2.0 to 3.0) (Grade 2C).
1. For patients undergoing major neurosurgery, we recommend that thromboprophylaxis be used routinely (Grade 1A), with optional use of IPC (Grade 1A). Acceptable alternatives to IPC are post-operative LMWH “e.g., enoxaparin 40 mg SubCut Daily (Grade 2A) or LDUH “e.g., 5000 IU SubCut BID/TID (Grad 2B)

2. For patients undergoing major neurosurgery who have a particular high VTE risk, we suggest that mechanical methods (i.e., GCS and/or IPC) be combined with a pharmacologic method (i.e., post-operative LMWH or LDUH) (Grad 2B)
1. For all patients with acute SCI, we recommend that routine thromboprophylaxis be provided (Grade 1A).

2. For patients with acute SCI, we recommend thromboprophylaxis with LMWH “e.g., enoxaparin 30 mg SubCut BID”, commenced once primary haemostasis is evident (Grade 1B). Alternatives include the combined use of IPC and either LDUH “e.g., 5000 IU SubCut TID” (Grade 1B) or LWMH (Grade 1C).

3. For patients with acute SCI, we recommend the optimal use of IPC and/or GCS if anticoagulant thromboprophylaxis is contraindicated because of high bleeding risk early after injury (Grade 1A). When the high bleeding risk decreases, we recommend that pharmacologic thromboprophylaxis be substituted for or added to the mechanical prophylaxis (Grade 1C).

4. For patients with an incomplete SCI associated with evidence of a spinal hematoma on CT or MRI, we recommend the use of mechanical prophylaxis instead of anticoagulant thromboprophylaxis at least for the first few days after injury (Grade 1C).

5. Following acute SCI, we recommend against the use of LDUH alone (Grade 1A).

6. For patients with SCI, we recommend against the use of an IVC filter as primary VTE prophylaxis (Grade 1C).

7. For patients undergoing rehabilitation following acute SCI, we recommend the continuation of LMWH “e.g., enoxaparin 40 mg SubCut Daily” thromboprophylaxis or conversion to an oral VKA (INR target, 2.5; range, 2.0 to 3.0) (Grade 1C).
1. For burn patients who have additional risk factors for VTE, including one or more of the following:

   - Advanced age
   - Morbid obesity
   - Extensive or lower-extremity burns
   - Concomitant lower-extremity trauma
   - Use of a femoral venous catheter
   - And/or prolonged immobility

   We recommend routine thromboprophylaxis if possible (Grade 1A).

2. For burn patients who have additional risk factors for VTE, if there are no contraindications, we recommend the use of either LMWH “e.g., enoxaparin 40 mg SubCut Daily” or LDUH “e.g., 5000 IU SubCut TID” starting as soon as it is considered safe to do so (Grade 1C).

3. For burn patients who have a high bleeding risk, we recommend mechanical prophylaxis with GCS and/or IPC until the bleeding risk decreases (Grade 1A).
1. For acutely ill medical patients admitted to hospital with:

   • Congestive heart failure
   • Or severe respiratory disease
   • Or who are confined to bed and have one or more additional risk factors, including:
     • Active cancer
     • Previous VTE
     • Sepsis
     • Acute neurologic disease, or
     • Inflammatory bowel disease

We recommend thromboprophylaxis with LMWH “e.g., enoxaparin 40 SubCut Daily” (Grade 1A), LDUH “e.g., 5000 IU SubCut TID” (Grade 1A), or fondaparinux “e.g., 2.5 mg SubCut Daily” (Grade 1A).
1. For all patients admitted to a critical care unit, we recommend routine assessment for VTE risk and routine thromboprophylaxis in most (Grade 1A).

2. For critical care patients who are at moderate risk for VTE (e.g., medically ill or postoperative general surgery patients), we recommend using LMWH “e.g., enoxaparin 40 mg SubCut Daily” or LDUH “5000 IU SubCut TID” thromboprophylaxis (Grade 1A).

3. For critical care patients who are at higher risk (e.g., following major trauma or orthopedic surgery), we recommend LMWH “e.g., enoxaparin 30 mg SubCut BID” thromboprophylaxis (Grade 1A).

4. For medical & critical care patients who are at high risk for bleeding, we recommend the optimal use of mechanical thromboprophylaxis with GCS and/or IPC at least until the bleeding risk decreases (Grade 1A). When the high bleeding risk decreases, we recommend that pharmacologic thromboprophylaxis be substituted for or added to the mechanical thromboprophylaxis (Grade 1C).
Cancer Patients

1. For cancer patients undergoing surgical procedures, we recommend routine thromboprophylaxis that is appropriate for the type of surgery (Grade 1A). Refer to the recommendations in the relevant surgical subsections.

2. For cancer patients who are bedridden with an acute medical illness, we recommend routine thromboprophylaxis as for other high risk medical patients (Grade 1A). Refer to the recommendations in medical patients Section.

3. For cancer patients with indwelling central venous catheters, we recommend that clinicians not use either prophylactic doses of LMWH “e.g., enoxaparin 40 mg SubCut Daily” (Grade 1B), or minidose warfarin (Grade 1B) to try to prevent catheter-related thrombosis.
Long-Distance Travel

1. For travelers who are taking flights > 8 h, we recommend the following general measures: avoidance of constrictive clothing around the lower extremities or waist, maintenance of adequate hydration, and frequent calf muscle contraction (Grade 1C).

2. For long-distance travelers with additional risk factors for VTE, we recommend the general measures listed above. If active thromboprophylaxis is considered because of a perceived high risk of VTE, we suggest the use of properly fitted, below-knee GCS, providing 15 to 30 mm Hg of pressure at the ankle (Grade 2C), or a single prophylactic dose of LMWH “e.g., enoxaparin 40 mg SubCut Daily” injected prior to departure (Grade 2C).

3. For long-distance travelers, we recommend against the use of aspirin for VTE prevention (Grade 1B).
1. For acute stroke patients with restricted mobility, we recommend prophylactic low-dose SubCut heparin “e.g., 5000 IU SubCut TID” or low-molecular-weight heparins “e.g., enoxaparin 40 mg SubCut Daily” (Grade 1A).

2. For patients who have contraindications to anticoagulants, we recommend intermittent pneumatic compression (IPC) devices or elastic stockings (Grade 1B).

3. IPC for Deep Vein Thrombosis/Pulmonary Embolism Prophylaxis in Patients with Intracerebral Hematoma

3.1. In patients with an acute intracerebral hematoma (ICH), we recommend the initial use of IPC devices (Grade 1B).

3.2. In stable patients, we suggest low-dose SubCut heparin as soon as the second day after the onset of the hemorrhage (Grade 2C). (Underlying values and preferences: Given the uncertainty about the risk of heparin in this setting, this recommendation places a relatively high value on reducing the consequences of Thromboembolism and a relatively lower value on minimizing the risk of cerebral rebleeding.)
1. We recommend that clinicians use UFH “e.g., 5000 IU SubCut BID/TID” (Grade 1B) or low molecular-weight heparin “e.g., enoxaparin 40 mg SubCut Daily” (Grade 1B) over no anticoagulant therapy during the acute phase, even in the presence of hemorrhagic infarction. In these patients, we recommend continued use of vitamin K antagonist therapy for up to 12 months (target INR, 2.5; range, 2.0 –3.0) [Grade 1B].
• The anti-Xa level is not predictive of the risk of bleeding. We recommend against the routine use of monitoring of the anti-Xa level (Grade 1A).

• Antiplatelet or oral anticoagulant medications administered in combination with LMWH increase the risk of spinal hematoma. Education of the entire patient care team is necessary to avoid potentiation of the anticoagulant effects. We recommend against concomitant administration of medications affecting hemostasis, such as antiplatelet drugs, standard heparin, or dextran, regardless of LMWH dosing regimen (Grade 1A).

• The presence of blood during needle and catheter placement does not necessitate postponement of surgery. We suggest that initiation of LMWH therapy in this setting should be delayed for 24 hrs postoperatively and that this consideration be discussed with the surgeon (Grade 2C).

**Preoperative LMWH**

• Patients on preoperative LMWH thromboprophylaxis can be assumed to have altered coagulation. In these patients, we recommend that needle placement should occur at least 10 to 12 hrs after the LMWH dose (Grade 1C).

• In patients receiving higher (treatment) doses of LMWH, such as enoxaparin 1 mg/kg every 12 hrs, enoxaparin 1.5 mg/kg daily, dalteparin 120 U/kg every 12 hrs, dalteparin 200 U/kg daily, or tinzaparin 175 U/kg daily, we recommend delay of at least 24 hrs to ensure normal hemostasis at the time of needle insertion (Grade 1C).
• In patients administered a dose of LMWH 2 hrs preoperatively (general surgery patients), we recommend against a neuraxial techniques because needle placement would occur during peak anticoagulant activity (Grade 1A).

Postoperative LMWH

• Patients with postoperative LMWH thromboprophylaxis may safely undergo single-injection and continuous catheter techniques. Management is based on total daily dose, timing of the first postoperative dose and dosing schedule (Grade 1C).

• Twice-daily dosing. This dosage regimen is associated with an increased risk of spinal hematoma. The first dose of LMWH should be administered no earlier than 24 hrs postoperatively, regardless of anesthetic technique, and only in the presence of adequate (surgical) hemostasis. Indwelling catheters should be removed before initiation of LMWH thromboprophylaxis. If a continuous technique is selected, the epidural catheter may be left indwelling overnight, but must be removed before the first dose of LMWH. Administration of LMWH should be delayed for 2 hrs after catheter removal.

• Single-daily dosing. The first postoperative LMWH dose should be administered 6 to 8 hrs postoperatively. The second postoperative dose should occur no sooner than 24 hrs after the first dose. Indwelling neuraxial catheters may be safely maintained. However, the catheter should be removed a minimum of 10 to 12 hrs after the last dose of LMWH. Subsequent LMWH dosing should occur a minimum of 2 hrs after catheter removal. No additional hemostasis-altering medications should be administered due to the additive effects.
When describing the various regimens of UFH and LMWH, we will use the following short forms:

- **Prophylactic UFH**: UFH 5,000 U SubCut BID or TID.
- **Intermediate-dose UFH**: UFH SubCut BID or TID in doses adjusted to target an anti-Xa level of 0.1 to 0.3 U/mL.
- **Adjusted-dose UFH**: UFH SubCut BID in doses adjusted to target a mid-interval activated partial thromboplastin time (aPTT) into the therapeutic range.
- **Prophylactic LMWH**: e.g., enoxaparin 40 mg SubCut Daily, dalteparin 5,000 IU SubCut Daily, or tinzaparin 4,500 IU SubCut Daily, (although at extremes of body weight modification of dose may be required).
- **Intermediate-dose LMWH**: e.g., enoxaparin 30 mg SubCut BID, or dalteparin 5,000 IU SubCut BID
- **Adjusted-dose LMWH**: weight-adjusted, full treatment doses of LMWH, given once or twice daily (e.g., enoxaparin 1 mg/kg q12h, dalteparin 200 IU/kg or tinzaparin 175 IU/kg Daily)
- **Postpartum anticoagulants**: vitamin K antagonists for 4 to 6 weeks with a target INR of 2.0 to 3.0, with initial UFH or LMWH overlap until the INR is 2.0, or prophylactic LMWH for 4 to 6 weeks.
- **In addition**, the term surveillance refers to clinical vigilance and appropriate objective investigation of women with symptoms suspicious of deep vein thrombosis (DVT) or pulmonary embolism (PE).
Reducing the risk of thrombosis and embolism during pregnancy and the puerperium

Classification of evidence levels

1++  High-quality meta-analysis, systematic reviews of randomized controlled trials or randomized controlled trials with a very low risk of bias

1+   Well-conducted meta-analysis, systematic reviews of randomized controlled trials or randomized controlled trials with a low risk of bias

1-   Meta-analysis, systematic reviews of randomized controlled trials or randomized controlled trials with a high risk of bias

2++  High-quality systematic reviews of case-control or cohort studies or high-quality case-control or cohort studies with a very low risk of confounding, bias or chance and a high probability that the relationship is causal

2+   Well-conducted case-control or cohort studies with a low risk of confounding, bias or chance and a moderate probability that the relationship is causal

2-   Case-control or cohort studies with a high risk of confounding, bias or chance and a significant risk that the relationship is not causal

3    Non-analytical studies; e.g., case reports, case series

4    Expert opinion

Guidelines for Prevention of VTE in Adults (2011)
Grades of recommendations

A At least one meta-analysis, systematic reviews or randomized controlled trial rated as 1++ and directly applicable to the target population; or
A systematic review of randomized controlled trials or a body of evidence consisting principally of studies rated as 1+, directly applicable to the target population and demonstrating overall consistency of results.

B A body of evidence including studies rated as 2++ directly applicable to the target population and demonstrating overall consistency of results; or
Extrapolated evidence from studies rated as 1++ or 1+

C A body of evidence including studies rated as 2+ directly applicable to the target population and demonstrating overall consistency of results; or
Extrapolated evidence from studies rated as 2++

D Evidence level 3 or 4; or
Extrapolated evidence from studies rated as 2+

Good practice point

Recommended best practice based on the clinical experience of the guideline development group
Reducing the risk of thrombosis and embolism during pregnancy and the puerperium

1. Purpose and scope

The aim of this guideline is to provide advice, based on clinical evidence where available, regarding the prevention of VTE during pregnancy, birth and following delivery. This guideline reviews the risk factors for VTE in pregnancy and the puerperium and provides guidance as to which women require thromboprophylaxis in and after pregnancy. It reviews the safety and efficacy of different forms of thromboprophylaxis. This guideline covers also thromboprophylaxis after caesarean section. As is apparent from the low grading of the evidence for many of the recommendations, they have been developed to provide a broad practical guide for obstetricians in clinical practice. However, it is recognized that, in individual women, alternative approaches may be reasonable, particularly following discussion with the woman concerned and, where available, input from a local expert in the field of thrombosis in pregnancy.

2. Introduction and background epidemiology

Pulmonary embolism remains the leading direct cause of maternal death in the UK (1.56/100 000 maternities) and is the second most common cause of maternal death overall (11% of maternal deaths). Many pulmonary embolisms are preventable with appropriate thromboprophylaxis. NICE estimates that LMWH reduces VTE risk in medical and surgical patients by 60% and 70%, respectively. It is reasonable, therefore, to assume that it may reduce the risk of VTE in obstetric patients by up to two-thirds. Seventy-nine percent of the women who died from pulmonary embolism in the UK between 2003 and 2005 had identifiable risk factors and a similar proportion (70%) from the UK Obstetric Surveillance System cohort (n = 143) of fatal and nonfatal antenatal pulmonary embolisms also had identifiable risk factors. The UK incidence of antenatal pulmonary embolism is 1.3/10 000 maternities. The case fatality rate of pulmonary embolism was 3.5%. Many antenatal VTE events occur in the first trimester and therefore prophylaxis, if given, should begin early in pregnancy.
The highest risk period for VTE, and pulmonary embolism in particular, is during the postpartum period. Caesarean section is a significant risk factor but women having vaginal deliveries are also at risk and 55% (25/45) of the postpartum maternal deaths from VTE in the UK between 1997 and 2005 occurred in women who had delivered vaginally. Although the relative risk of VTE in pregnancy is increased four- to six-fold and this is increased further postpartum, the absolute risk is low, with an overall incidence of VTE in pregnancy and the puerperium of 1–2/1000.

A cohort study from Rochester, Minnesota, showed that the annualized incidence of VTE was five times higher postpartum compared with pregnancy. A large population-based case–control study from the Netherlands found a 60-fold increase in the risk of VTE in the first 3 months after delivery compared with non-pregnant controls. Thus, with approximately 700 000 births/year in the UK, the above incidence of VTE would translate into 700–1400 pregnancy-related VTE episodes/year nationally in addition to those related to miscarriage and termination. Updated internationally developed evidence-based guidelines for antithrombotic therapy in pregnancy have recently been published. As the absolute risk of VTE in pregnancy is low, some form of risk stratification is required to decide which women warrant pharmacological thromboprophylaxis. The threshold for recommending postpartum thromboprophylaxis is lower because the risk/day is higher and the duration of risk is shorter.

3. **Prepregnancy and antenatal risk assessment**

What are the risk factors for VTE in pregnancy and the puerperium? What is the magnitude of risk for these factors?
Reducing the risk of thrombosis and embolism during pregnancy and the puerperium

**Table 5: Risk factors for venous thromboembolism in pregnancy**

<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-existing</td>
<td>Previous venous thromboembolism</td>
</tr>
<tr>
<td></td>
<td>Thrombophilia:</td>
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<tr>
<td></td>
<td><em>Heritable:</em></td>
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<tr>
<td></td>
<td>Antithrombin deficiency</td>
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<td></td>
<td>Protein C deficiency</td>
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<td></td>
<td>Protein S deficiency</td>
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<tr>
<td></td>
<td>Factor V Leiden</td>
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<tr>
<td></td>
<td>Prothrombin gene G20210A</td>
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<tr>
<td></td>
<td><em>Acquired (antiphospholipid syndrome):</em></td>
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<tr>
<td></td>
<td>Persistent lupus anticoagulant</td>
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<tr>
<td></td>
<td>Persistent moderate/high-titre anticardiolipin antibodies or β2 glycoprotein 1 antibodies</td>
</tr>
<tr>
<td></td>
<td>Medical comorbidities (e.g., heart or lung disease, SLE, cancer, inflammatory conditions (inflammatory bowel disease or inflammatory polyarthropathy), nephrotic syndrome (proteinuria &gt; 3 g/day), sickle cell disease, intravenous drug user)</td>
</tr>
<tr>
<td></td>
<td>Age &gt; 35 years</td>
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<tr>
<td></td>
<td>Obesity (BMI &gt; 30 kg/m) either pre-pregnancy or in early pregnancy</td>
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<tr>
<td></td>
<td>Parity ≥ 3</td>
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<tr>
<td></td>
<td>Smoking</td>
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<tr>
<td></td>
<td>Gross varicose veins (symptomatic or above knee or with associated phlebitis, oedema/skin changes)</td>
</tr>
<tr>
<td></td>
<td>Paraplegia</td>
</tr>
<tr>
<td>Obstetric</td>
<td>Multiple pregnancy, assisted reproductive therapy</td>
</tr>
<tr>
<td></td>
<td>Pre-eclampsia</td>
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<tr>
<td></td>
<td>Caesarean section</td>
</tr>
<tr>
<td></td>
<td>PPH (&gt; 1 litre) requiring transfusion</td>
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<tr>
<td></td>
<td>Prolonged labour, mid-cavity rotational operative delivery</td>
</tr>
<tr>
<td>New-onset/transient</td>
<td>Surgical procedure in pregnancy or puerperium (e.g., ERPC, appendicectomy, postpartum sterilisation)</td>
</tr>
<tr>
<td>Potentially reversible*</td>
<td>Hyperemesis, dehydration</td>
</tr>
<tr>
<td></td>
<td>Ovarian hyperstimulation syndrome</td>
</tr>
<tr>
<td></td>
<td>Admission or immobility (≥3 days bed rest) e.g., symphysis pubis dysfunction restricting mobility systemic infection (requiring antibiotics or admission to hospital) e.g., Pneumonia, pyelonephritis, postpartum wound infection</td>
</tr>
<tr>
<td></td>
<td>Long-distance travel (&gt; 4 hours)</td>
</tr>
</tbody>
</table>

BMI = body mass index; ERPC = evacuated PPH = postpartum haemorrhage; evacuation of retained products of conception; SLE = systemic lupus erythematosus

*May develop at later stages in gestation than the initial risk assessment or may resolve and therefore continuing individual risk assessment is important
All women should undergo a documented assessment of risk factors for VTE in early pregnancy or before pregnancy. This assessment should be repeated if the woman is admitted to hospital for any reason or develops other intercurrent problems. The assessment should be repeated again intrapartum or immediately postpartum.

Any woman with three or more current or persisting risk factors shown in Figure 1 and Table 5 (other than previous VTE or thrombophilia) should be considered for prophylactic LMWH antenatally and will usually require prophylactic LMWH for 6 weeks postnatally; a postnatal risk reassessment should be made.

Any woman with two or more current or persisting risk factors shown in Figure 1 and Table 5 (other than previous VTE or thrombophilia) should be considered for prophylactic LMWH for at least 7 days postpartum.

The risk of VTE should be discussed with women at risk and the reasons for individual recommendations explained.
Antenatal Assessment and Management
(to be assessed at booking and repeated if admitted)

Obstetric thromboprophylaxis risk assessment and management

**High risk**
Requires antenatal prophylaxis with LMWH
Refer to trust-nominated thrombosis in pregnancy expert/team

**Intermediate risk**
Consider antenatal prophylaxis with LMWH
Seek trust-nominated thrombosis in pregnancy expert/team advice

**Lower risk**
Mobilisation and avoidance of dehydration

---

**Single previous VTE+**
- Thrombophilia or family history
- Unprovoked/estrogen-related

Previous recurrent VTE (>1)

**Single previous VTE with no family history or thrombophilia**
Thrombophilia + no VTE
MEDICAL COMORBITIES, e.g. heart or lung disease, SLE, cancer, inflammatory conditions, nephrotic syndrome, sickle cell disease, intravenous drug user
Surgical procedure, e.g. appendicectomy

**Age > 35 years**
Obesity (BMI > 30kg/m²)
Parity ≥ 3
Smoker
Gross varicose veins
Current systemic infection
Immobility, e.g. paraplegia, SPD, long-distance travel
Pre-eclampsia
Dehydration/hyperemesis/OHSS
Multiple pregnancy or ART

---

3 or more risk factors
2 or more if admitted

< 3 risk factors

---

Guidelines for Prevention of VTE in Adults (2011)
Antenatal prophylactic dose of LMWH

Weight < 50kg = 20mg enoxaparin/2500 units dalteparin/3500 units tinzaparin daily
Weight 50-90kg = 40mg enoxaparin/5000 units dalteparin/4500 units tinzaparin daily
Weight 91-130kg = 60mg enoxaparin/7500 units dalteparin/7000 units tinzaparin daily
Weight 131-170kg = 80mg enoxaparin/10000 units dalteparin/9000 units tinzaparin daily
Weight > 170kg = 0.6mg/kg/day enoxaparin; 75 units/kg/day dalteparin/75 units/kg/day tinzaparin

Key

ART = assisted reproductive therapy
BMI = body mass index (based on booking weight)
gross varicose veins = symptomatic, above the knee or associated with phlebitis/oedema/skin changes
immobility = ≥ 3days
LMWH = low-molecular-weight heparin
OHSS = ovarian hyperstimulation syndrome
PPH = postpartum haemorrhage
SLE = systemic lupus erythematosus
SPD = symphysis pubis dysfunctin with reduced mobility
thrombophilia = inherited or acquired
long-distance travel = > 4 hours
VTE = venous thromboembolism
Postnatal Assessment and Management
(to be assessed at booking and repeated if admitted)

Obstetric thromboprophylaxis risk assessment and management

Any previous VTE+
Anyone requiring antenatal LMWH

Caesarean section in labour
Asymptomatic thrombophilia (inherited or acquired)
BMI > 40 kg/m²
Prolonged hospital admission
MEDICAL COMORBIDITIES, e.g. heart or lung disease, SLE, cancer, inflammatory conditions, nephrotic syndrome, sickle cell disease, intravenous drug user

Age > 35 years
obesity (MBI > 30kg/m²)
Parity ≥ 3
Smoker
Elective caesarian section
Any surgical procedure in the puerperium
Gross varicose veins
Current systemic infection
Immobility, e.g. paraplegia, SPD, long distance travel
Pre-eclampsia
Mid-cavity rotational operative delivery
Prolonged labour (> 24 hours)
PPH > 1 litre or blood transfusion

High risk
At least 6 weeks postnatal prophylactic LMWH

Intermediate risk
At least 7 days postnatal prophylactic LMWH
Note: if persisting or > 3 risk factors, consider extending thromboprophylaxis with LMWH

Lower risk
Mobilisation and avoidance of dehydration

< 2 risk factors

2 or more risk factors
Postnatal prophylactic dose of LMWH

Weight < 50kg = 20mg enoxaparin/2500 units dalteparin/3500 units tinzaparin daily
Weight 50-90kg = 40mg enoxaparin/5000 units dalteparin/4500 units tinzaparin daily
Weight 91-130kg = 60mg enoxaparin/7500 units dalteparin/7000 units tinzaparin daily
Weight 131-170kg = 80mg enoxaparin/10000 units dalteparin/9000 units tinzaparin daily
Weight > 170kg = 0.6mg/kg/day enoxaparin; 75 units/kg/day dalteparin/75 units/kg/day tinzaparin daily

Key
BMI = body mass index (based on booking weight),
gross varicose veins = symptomatic, above the knee or associated with phlebitis/oedema/skin changes
immobility = ≥ 3days
LMWH = low-molecular-weight heparin
PPH = postpartum haemorrhage
SLE = systemic lupus erythematosus
SPD = symphysis pubis dysfunction with reduced mobility
thrombophilia = inherited or acquired
long-distance travel = > 4 hours
VTE = venous thromboembolism
Guidelines for Prevention of VTE in Adults (2011)

Women with a previous non-estrogen-related VTE provoked by a minor risk factor should undergo testing for thrombophilia, as this will influence management and decisions regarding thromboprophylaxis antenatally.

Recommendations for women with a previous VTE

Women at high risk of VTE pregnancy, such as those with previous VTE, should be offered prepregnancy counselling and a prospective management plan for thromboprophylaxis in pregnancy. Those who become pregnant before receiving such counselling should be referred to a consultant obstetrician or trust-nominated expert in thrombosis in pregnancy early in pregnancy.

Women with a previous single provoked (excluding estrogen-related) VTE (and no other risk factors) require close surveillance antenatally and thromboprophylaxis with LMWH for 6 weeks postpartum.

Women with previous recurrent VTE or a previous unprovoked or estrogen/pregnancy-related VTE or a previous VTE and a history of VTE in a first-degree relative (or a documented thrombophilia) or other risk factors should be offered thromboprophylaxis with LMWH antenatally and for 6 weeks postpartum.
Women with asymptomatic inherited thrombophilia without other risk factors may be managed with close surveillance antenatally but should be considered for LMWH for at least 7 days postpartum. Exceptions are in women with antithrombin deficiency or more than one thrombophilic defect (including homozygous factor V Leiden, homozygous prothrombin G20210A and compound heterozygotes) or those with additional risk factors where advice of a local expert should be sought and antenatal prophylaxis considered.

**Recommendations on thrombophilia**

Women should be stratified according to level of risk associated with their thrombophilia and the presence or absence of a family history or other risk factors.

If thromboprophylaxis is given antenatally for a persisting risk factor, it should be continued postpartum for 6 weeks.

Women with previous thromboses and antiphospholipid syndrome should be offered both antenatal and 6 weeks of postpartum thromboprophylaxis. Women with persistent antiphospholipid antibodies with no previous VTE and no other risk factors or fetal indications for LMWH may be managed with close surveillance antenatally but should be considered for LMWH for 7 days postpartum.
4. **Timing of initiation of thromboprophylaxis**

Antenatal thromboprophylaxis should begin as early in pregnancy as practical.

Women receiving antenatal LMWH should be advised that if they have any vaginal bleeding or once labour begins, they should not inject any further LMWH. They should be reassessed on admission to hospital and further doses should be prescribed by medical staff.

Thromboprophylaxis should be continued for 6 weeks in women at high risk of postpartum VTE and for 1 week in women with intermediate risk.

5. **VTE risk assessment after delivery**

All women with class-3 obesity (BMI greater than 40 kg/m²) should be considered for prophylactic LMWH for 7 days after delivery.

In women who have additional persistent (lasting more than 7 days postpartum) risk factors, such as prolonged admission or wound infection, thromboprophylaxis should be extended for up to 6 weeks or until the additional risk factors are no longer present.

All women with a previous history of confirmed VTE should be offered thromboprophylaxis with LMWH or warfarin for 6 weeks postpartum, regardless of the mode of delivery.
All women with known heritable or acquired thrombophilia should be considered for LMWH for at least 7 days following delivery, even if they were not receiving antenatal thromboprophylaxis. This could be extended to 6 weeks if there is a family history or other risk factors present.

All women who have had an emergency caesarean section (category 1-3) should be considered for thromboprophylaxis with LMWH for 7 days after delivery.

All women who have had an elective caesarean section (category 4) who have one or more additional risk factors (such as age over 35 years, BMI greater than 30) should be considered for thromboprophylaxis with LMWH for 7 days after delivery.

6. **Which agent to be used for thromboprophylaxis?**

LMWHs are the agents of choice for antenatal thromboprophylaxis. They are at least as effective and safer than unfractionated heparin.
Suggested thromboprophylactic doses for antenatal and postnatal LMWH

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>Enoxaparin</th>
<th>Dalteparin</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 50</td>
<td>20 mg daily</td>
<td>2500 units daily</td>
</tr>
<tr>
<td>50 - 90</td>
<td>40 mg daily</td>
<td>5000 units daily</td>
</tr>
<tr>
<td>91 - 130</td>
<td>60 mg daily*</td>
<td>7500 units daily*</td>
</tr>
<tr>
<td>131 - 170</td>
<td>80 mg daily*</td>
<td>10000 units daily*</td>
</tr>
<tr>
<td>&gt; 170</td>
<td>0.6 mg/kg/day*</td>
<td>75 units/kg/day*</td>
</tr>
<tr>
<td></td>
<td>40 mg 12-hourly</td>
<td>5000 units 12-hourly</td>
</tr>
</tbody>
</table>

High prophylactic (intermediate) dose for women weighing 50-90 kg

Treatment dose

* may be given in two divided doses

7. **Agents for postpartum thromboprophylaxis**

LMWH is appropriate for postpartum thromboprophylaxis although, if women are receiving long term anti coagulation with warfarin, this can be started when the risk of haemorrhage is low, usually 5-7 days after delivery.

Both warfarin and LMWH are safe when breastfeeding.

8. **Contraindication to LMWH**

LMWH should be avoided, discontinued or postponed in women who are risk of bleeding after careful consideration of the balance of risks of bleeding and clotting

- women with active antenatal or postpartum bleeding
- women considered at increased risk of major haemorrhage (such as placenta previa)
- women with a bleeding diathesis, such as von Willebrand’s disease, haemophilia or acquired coagulopathy
- women with thrombocytopenia (platelet count less than 75 x 109)
- acute stroke in the last 4 weeks (ischaemic or haemorrhagic)
- severe renal disease (glomerular filtration rate less than 30 ml/minute/1.73 m²)
- severe liver disease (prothrombin time above normal range or known varices)
- uncontrolled hypertension (blood pressure greater than 200 mmHg systolic or greater than 120 mmHg diastolic).

9. Risk Assessment Model

<table>
<thead>
<tr>
<th>Pre-existing risk factors</th>
<th>Tick</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous recurrent VTE</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Previous VTE - unprovoked or estrogen related</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Previous VTE - provoked</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Family history of VTE</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Known thrombophilia</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Medical comorbidities</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Age (&gt; 35 years)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Obesity</td>
<td>1/2a</td>
<td></td>
</tr>
<tr>
<td>Parity ≥ 3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Smoker</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Gross varicose veins</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Obstetric risk factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-eclampsia</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Dehydration/hyperemesis/OHSS</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Multiple pregnancy or ART</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Caesarean section in labour</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Elective caesarean section</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Mid-cavity or rotational forceps</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>PPH (&gt;1 litre or transfusion)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Transient risk factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current systemic infection</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Immobility</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Surgical procedure in pregnancy or ≤ 6 weeks postpartum</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

| Total                                             |      |       |

Thromboprophylaxis with LMWH should be considered if:

- ≥ three risk factors antenatally and managed as an outpatient
- ≥ two risk factors antenatally and managed as an inpatient or any postnatal woman who is with in 6 weeks of delivery

For women with an identified bleeding risk, the balance of risks of bleeding and clotting should be discussed in consultation with a haematologist with experience of thrombosis and bleeding in pregnancy.

Score 1 for BMI > 30 kg/m²; 2 for BMI > 40 kg/m² (BMI based on booking weight)
Enoxaparin dosing in patients with severe renal impairment

Recommended dosage regimens for patients with severe renal impairment (creatinine clearance <30 mL/min)

<table>
<thead>
<tr>
<th>Indication</th>
<th>Dosage regimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVT prophylaxis in: Abdominal surgery</td>
<td>30 mg SubCut once a day</td>
</tr>
<tr>
<td>Hip or knee-replacement surgery</td>
<td></td>
</tr>
<tr>
<td>Medical patients during acute illness</td>
<td></td>
</tr>
<tr>
<td>Prophylaxis of ischemic complications of UA/NSTEMI*</td>
<td>1 mg/kg SubCut once a day (when concurrently administered with aspirin)</td>
</tr>
<tr>
<td>Inpatients with acute DVT with or without PE</td>
<td>1 mg/kg SubCut once a day (in conjunction with warfarin sodium therapy)</td>
</tr>
<tr>
<td>Outpatients with acute DVT without PE</td>
<td>1 mg/kg SubCut once a day (in conjunction with warfarin sodium therapy)</td>
</tr>
</tbody>
</table>

* UA/NSTEMI = Unstable Angina and non-0-wave myocardial infarction

Cockcroft-Gault equation for estimating creatinine clearance

**In men:**
Creatinine clearance = \[rac{(140 - \text{age}) \times \text{weight (kg)}}{72 \times \text{serum creatinine (mg/dL)}}\]

**In women:**
Creatinine clearance = \[rac{(140 - \text{age}) \times \text{weight (kg)}}{72 \times \text{serum creatinine (mg/dL)}} \times 0.85\]


Use of this equation and others like it may not always be as accurate as the actual measurement of creatinine clearance.
Enoxaparin dosing in special populations

For moderate and mild renal impairment*

- Moderate renal impairment: creatine clearance 30-50 mL/min
- Mild renal impairment: creatine clearance 50-80 mL/min

* No dose adjustment is recommended for these populations; however, all such patients should be observed carefully for signs and symptoms of bleeding.

For low-weight or obese patients†

- Low-weight women (<45 kg)
- Low-weight men (<57 kg)
- Obese men and women

† There are no recommendations for dose adjustments for these populations; however, low-weight patients should be observed carefully for signs and symptoms of bleeding.

Clinical pharmacology information

- Anti-Xa exposure after a non-weight-adjusted (prophylaxis) dose is 52% higher in low-weight women (<45 kg) and 27% higher in low-weight men (<57 kg)

- In obese men and women (BMI 30-48 kg/m²), anti-Xa exposure after weight-adjusted doses is marginally higher at steady state, while Amax is not increased.
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIS</td>
<td>Acute Ischemic Stroke</td>
</tr>
<tr>
<td>DUS</td>
<td>Doppler Ultrasound</td>
</tr>
<tr>
<td>DVT</td>
<td>Deep Venous Thrombosis</td>
</tr>
<tr>
<td>GCS</td>
<td>Gradual Compression Stocking</td>
</tr>
<tr>
<td>HFS</td>
<td>Hip Fracture Surgery</td>
</tr>
<tr>
<td>ICH</td>
<td>Intra Cerebral Hematoma</td>
</tr>
<tr>
<td>IPC</td>
<td>Intermittent Pneumatic Compression</td>
</tr>
<tr>
<td>LDUH</td>
<td>Low Dose Unfractionated Heparin</td>
</tr>
<tr>
<td>LMWH</td>
<td>Low Molecular Weight Heparin</td>
</tr>
<tr>
<td>PE</td>
<td>Pulmonary Embolism</td>
</tr>
<tr>
<td>RCT</td>
<td>Randomized Clinical Trials</td>
</tr>
<tr>
<td>SCI</td>
<td>Spinal Cord Injury</td>
</tr>
<tr>
<td>TKA</td>
<td>Total Knee Arthroplasty</td>
</tr>
<tr>
<td>THA</td>
<td>Total Hip Arthroplasty</td>
</tr>
<tr>
<td>THR</td>
<td>Total Hip Replacement</td>
</tr>
<tr>
<td>VKA</td>
<td>Vitamin K Antagonist</td>
</tr>
<tr>
<td>VTE</td>
<td>Venous Thrombo-Embolism</td>
</tr>
<tr>
<td>VFP</td>
<td>Venous Foot Pump</td>
</tr>
</tbody>
</table>
These guidelines are based for most part on the recommendations of the 8th ACCP Conference on Anti-thrombotic and thrombolytic therapy.


The guidelines for VTE prophylaxis with neuroaxial anesthesia are based on the above document in addition to The Second ASRA Consensus Conference on Neuroaxial Anesthesia and anticoagulation.


The guidelines for VTE prophylaxis during pregnancy and postpartum is based on:

1. The recommendations of the Royal College of Obstetricians and Gynaecologists Thromboprophylaxis During Pregnancy, Labor, and After Vaginal Delivery.


# Proposed VTE RAM for surgical and medical patients

## Step 1: Exposing risk factors associated with clinical setting

<table>
<thead>
<tr>
<th>Assign 1 Factor</th>
<th>Assign 2 Factors</th>
<th>Assign 3 Factors</th>
<th>Assign 4 Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Minor Surgery*</td>
<td>• Major Surgery*</td>
<td>• Myocardial infarction</td>
<td>• Elective major lower extremity arthroplasty</td>
</tr>
<tr>
<td></td>
<td>• Immobilizing plaster cast</td>
<td>• Congestive heart failure</td>
<td>• Hip, pelvis, or leg fracture</td>
</tr>
<tr>
<td></td>
<td>• Medical or surgical patients confined to bed &gt; 72 hours</td>
<td>• Severe sepsis/infection</td>
<td>• Stroke</td>
</tr>
<tr>
<td></td>
<td>• Central venous access</td>
<td></td>
<td>• Multiple trauma</td>
</tr>
</tbody>
</table>

*Operation in which the dissection is important or that last longer than 45 minutes, including laparoscopic procedures.

Baseline risk factor score (if score = 5, go to step 3):

## Step 2: Predisposing risk factors associated with patient

<table>
<thead>
<tr>
<th>Assign 1 Factor unless otherwise noted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical setting</td>
</tr>
<tr>
<td>Clinical setting</td>
</tr>
</tbody>
</table>

### Proposed VTE RAM for surgical and medical patients

#### Step 1: Exposing risk factors associated with clinical setting
- Minor Surgery*
- Major Surgery*
- Immobilizing plaster cast
- Medical or surgical patients confined to bed > 72 hours
- Central venous access
- Myocardial infarction
- Congestive heart failure
- Severe sepsis/infection
- Elective major lower extremity arthroplasty
- Hip, pelvis, or leg fracture
- Stroke
- Multiple trauma
- Acute spinal cord injury

#### Assign 1 Factor
- Assign 2 Factors
- Assign 3 Factors
- Assign 4 Factors

#### Step 2: Predisposing risk factors associated with patient
- Age 40 to 60 years (1 factor)
- Age over 60 years (2 factors)
- History of DVT/PE (3 factors)
- Pregnancy or postpartum (<1 month)
- Malignancy (2 factors)
- Varicose veins
- Inflammatory bowel disease
- Obesity (>20% ideal body weight)
- Combined oral contraceptive/hormonal replacement therapy
- Factor V Leiden/activated protein C resistance (3 factors)
- Antithrombin III deficiency (3 factors)
- Proteins C and S deficiency (3 factors)
- Dysfibrinogenemia (3 factors)
- Homocysteinemia (3 factors)
- 20210A prothrombin mutation (3 factors)
- Lupus anticoagulant (3 factors)
- Antiphospholipid antibodies (3 factors)
- Myeloproliferative disorders (3 factors)
- Disorders of plasminogen and plasmin activation (3 factors)
- Heparin-induced thrombocytopenia (3 factors)
- Hyperviscosity syndromes (3 factors)
- Homocysteinemia (3 factors)

#### Step 3: Total risk factors (exposing + predisposing)

<table>
<thead>
<tr>
<th>Low risk</th>
<th>Moderate risk</th>
<th>High risk</th>
<th>Highest risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Factor</td>
<td>2 Factors</td>
<td>3-4 Factors</td>
<td>5 or more Factors</td>
</tr>
</tbody>
</table>

Instructions for using Enoxaparin: Administration

1. Pick an area on the **right or left side of the abdomen** in a laying or sitting position, at least 2 inches from the naval and out toward the waist. Clean the injection site with a sterile alcohol swab and let dry. Alternate injection sites between left and right sides.

2. Carefully remove the needle cap by firmly pulling it straight off the syringe and discard. If required, dose adjustment must be done prior to injection. **Do not expel the air bubble from the syringe before the injection.**

3. Gently pinch the cleaned area of the abdomen between your thumb and index finger to make a fold in the skin. Insert the full length of the needle at **90° angle** into the fold of the skin. Inject using standard technique. pushing the plunger to the bottom of the syringe.
Remove the needle from the injection site, keeping your finger on the plunger. To minimize bruising do not rub the injection site after completion of the injection.

Immediately dispose of the syringe in the nearest sharps collector.
Guidelines for Prevention of VTE in Adults (2011)