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Perioperative Anticoagulation and Antiplatelet Guideline

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Superseded Documents
- Perioperative anticoagulation guideline
- Algorithm for Pre-Operative Management of Patients on Anti-Platelet Therapy
- Guideline for management of hip fracture patients on warfarin

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- Lead Haematologist for NDDH
- Consultant Cardiologists
- Anaesthetists and Surgeons (Divisional Governance Day, 16/10/19)
- Anticoagulation Pharmacists
- Pre-Op Assessment Nurses

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Planned Care - Anaesthetics

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1. **Purpose**

1.1. The purpose of this document is to detail the process for the perioperative management of patients taking anticoagulants and/or antiplatelet medications.

1.2. This guideline applies to all Trust staff.

1.3. Implementation of this guideline will ensure that patients taking anticoagulants and/or antiplatelet medications are managed safely around the time of surgery and in accordance with best practise. This should minimise both bleeding and thrombosis risk for our patients.

1.4. In the context of non-elective surgery, standardisation of practise utilising this guideline should minimise the time to safe surgical intervention.

2. **Definitions**

**Abbreviations**

2.1. **AF** Atrial Fibrillation

2.2. **ACS** Acute Coronary Syndrome

2.3. **AVR** Aortic Valve Replacement

2.4. **APTT** Activated Partial Thromboplastin Time

2.5. **BMS** Bare Metal Stent

2.6. **CABG** Coronary Artery Bypass Grafting

2.7. **CCF** Congestive Cardiac Failure

2.8. **CNS** Central Nervous System

2.9. **CVE** Cerebrovascular Event

2.10. **DAPT** Dual Antiplatelet Therapy

2.11. **DES** Drug-Eluting Stent

2.12. **DOAC** Direct Oral Anticoagulant

2.13. **eGFR** estimated Glomerular Filtration Rate

2.14. **INR** International Normalised Ratio

2.15. **LMWH** Low Molecular Weight Heparin

2.16. **MI** Myocardial Infarction
2.17. **MVR** Mitral Valve Replacement  
2.18. **PAD** Peripheral Arterial Disease  
2.19. **PCI** Percutaneous Coronary Intervention  
2.20. **PT** Prothrombin Time  
2.21. **TIA** Transient Ischaemic Attack  
2.22. **TT** Thrombin Time  
2.23. **VTE** Venous Thromboembolism

**Primary prevention**


**Secondary prevention**

2.25. Antiplatelet treatment in patients with known arterial disease (e.g. MI, CVE, TIA, CABG, PCI +/- coronary stents, PAD, renovascular disease etc.)

**ADP receptor antagonists**

2.26. Adenosine diphosphate receptor antagonists (Clopidogrel, Prasugrel & Ticagrelor)

**Dual antiplatelet therapy (DAPT)**

2.27. Aspirin in combination with an ADP receptor antagonist

**High risk stents**

2.28. Those requiring DAPT beyond 12 months (e.g. long (>36mm) / proximal / overlapping / multiple stent implantation, stents in chronic total occlusions, stents in small vessels or bifurcations).

**High risk situations**

2.29. Less than four weeks after MI, PCI or BMS  
2.30. Less than 12 months after DES*  
2.31. High-risk stents

*Some new drug-eluting stents (polymer-free/bioabsorbable, e.g. Onyx stent) now require as little as one month DAPT. Perioperative management plans should be approved by cardiology.
Risk of bleeding in a closed space

2.32. Spinal surgery and posterior eye chamber surgery.

3. Responsibilities

3.1. Implementation of this guideline is the responsibility of the entire perioperative team

Role of the Listing Surgeon

3.2. The listing surgeon is responsible for:

- Documenting on the listing form whether patients are taking anticoagulant and/or antiplatelet medications
- Documenting on the listing form whether they are happy to operate on any anticoagulant and/or antiplatelet medications identified
- Providing surgical advice on anticoagulation management as requested
- Ensuring anticoagulant and/or antiplatelet medications are re-started as soon as it is clinically safe to do so (i.e. in reference to this guideline and after an assessment of post-operative haemostasis)

Role of the Pre-op Assessment Nurse

3.3. The pre-op assessment nurse is responsible for:

- Ensuring that thrombosis risk is assessed in elective patients for whom cessation of anticoagulant and/or antiplatelet medication has been requested (utilising this guideline)
- Ensuring that the pre-op anaesthetist, listing surgeon, cardiologist and haematologist are consulted where indicated in this guideline in order to formulate an anticoagulation and/or antiplatelet medication management plan for each elective patient
- Ensuring that each elective patient's anticoagulant and/or antiplatelet management plan is clearly documented in their pre-op assessment notes
- Ensuring that each elective patient's anticoagulant and/or antiplatelet management plan is clearly communicated to both staff and patient.

Role of the Anticoagulation Pharmacist

3.4. The Anticoagulation Pharmacists are responsible for:

- Providing first-line anticoagulation advice to the Pre-Operative Assessment Nurses in order to agree a perioperative anticoagulation plan.
• Deferring responsibility to the Pre-Op Anaesthetic Consultants where doubt exists regarding the detail of a perioperative anticoagulation plan
• Facilitating the implementation of a perioperative anticoagulation plan, particularly in the community setting (i.e. pre-admission and post discharge)
• Ensuring that bridging anticoagulation is prescribed and administered safely and in accordance to with best practise guidance
• Providing pharmacy advice on perioperative anticoagulant and/or antiplatelet management as requested prior to non-elective surgery

Role of the Anaesthetist

3.5. The pre-op anaesthetist (i.e. the clinician in the anaesthetic high-risk clinic) is responsible for:
• Providing anaesthetic advice on perioperative anticoagulant and/or antiplatelet management as requested prior to elective surgery

3.6. The on-call/duty anaesthetist is responsible for:
• Providing anaesthetic advice on perioperative anticoagulant and/or antiplatelet management as requested prior to non-elective surgery

Role of the Cardiologist

3.7. The cardiologist is responsible for:
• Providing cardiology advice on perioperative anticoagulant and/or antiplatelet management as requested

Role of the Haematologist

3.8. The haematologist is responsible for:
• Providing haematology advice on anticoagulant and/or antiplatelet management as requested

Role of the Emergency Department

3.9. Specific to patients on warfarin with hip fracture, the emergency department team is responsible for:
• Stopping warfarin in patients admitted with hip fracture
• Sending blood for initial INR
• Giving first dose of Vitamin K
Role of the Admitting Surgeon

3.10. The admitting surgeon is responsible for:

- Ensuring that perioperative anticoagulation is managed safely and in accordance with best practise guidance

3.11. Specific to patients on warfarin with hip fracture, the orthopaedic team is responsible for:

- Ensuring that warfarin is stopped on admission in patients with hip fracture
- Sending blood for INR six hours after first dose of Vitamin K
- Giving further Vitamin K as per guideline according to INR
- Assessing both bleeding and short term thrombosis risk
- Identifying hip fracture patients with mechanical heart valves and establishing whether bridging anticoagulation is indicated pre-operatively
- Proceeding to surgery when INR is considered safe to do so
- Assessing postoperative haemostasis and re-starting anticoagulation accordingly
- Communicating the perioperative anticoagulation plan to the patient

Role of Clinical Audit and Guidelines Group (CAGG)

3.12. The Clinical Audit and Guidelines Group is responsible for:

- Approving this clinical guideline

Role of Medical Director

3.13. The Medical Director has executive responsibility for ensuring compliance with this guideline

4. Perioperative Management of Patients on Anticoagulation Therapy

Decisions regarding perioperative anticoagulant and/or antiplatelet management

4.1. Decisions regarding perioperative anticoagulant and/or antiplatelet management must be made:
• On an individual patient basis
• With reference to this best practise guideline

Perioperative Anticoagulant and Antiplatelet Management Algorithms (see Appendix)

4.2. The appendix of this guideline contains locally-agreed algorithms for the perioperative management of the following common anticoagulant and antiplatelet medications:

- Aspirin
- ADP Receptor Antagonists
- Dual Antiplatelet Therapy (DAPT)
- Warfarin
- Direct Oral Anticoagulants (DOAC’s)
- IV Unfractionated Heparin
- Low Molecular Weight Heparin (LMWH)

These algorithms have been written to facilitate a safe, consistent and efficient approach to perioperative anticoagulant and/or antiplatelet management for the majority of patients:

- They are not intended to supersede clinical judgement.
- Risk-benefit discussions between surgeons and prescribing providers are strongly encouraged.

Guidance is also provided for the management of patients undergoing non-elective surgery:

- Management of anticoagulant and antiplatelet medications in emergency surgery (i.e. where surgery is indicated and time does not permit cessation of these medications)
- Management of anticoagulant and antiplatelet medications in hip fracture surgery
- Regional anaesthesia in patients taking anticoagulants and/or antiplatelet medications
- Tests involved in the monitoring of DOACs

Post-operative re-institution of anticoagulant and/or antiplatelet therapy

4.3. Anticoagulant and/or antiplatelet medications should be re-started as soon as it is clinically safe to do so. This decision should be made by the surgical team and made:

- In reference to this guideline
- After an assessment of post-operative haemostasis

Re-institution of anticoagulant and/or antiplatelet medications should be delayed until at least 48 hr post-operatively in the following situations:

• High bleeding risk surgery
• Patients with an increased bleeding risk
• Any situation where any increased risk of bleeding is unacceptable

5. Monitoring Compliance with and the Effectiveness of the Guideline

Standards/ Key Performance Indicators

5.1. Key performance indicators comprise:

• Rate of cancellation of surgery due to inappropriate anticoagulant and/or antiplatelet management
• Time to hip fracture surgery (continuously reported via the National Hip Fracture Database)
• Incidence of perioperative thrombotic complications
• Incidence of perioperative haemorrhagic complications
• Perioperative transfusion rate

Process for Implementation and Monitoring Compliance and Effectiveness

5.2. Implementation process:

• Guideline presented at surgical and anaesthetic clinical governance day
• Guideline document published on Trust intranet (BOB) policies site
• Link to guideline document placed on Pre-operative Assessment page of Trust intranet site (BOB)

5.3. Monitoring process:

• Perioperative anticoagulation management will be monitored via:
  ➢ Theatre cancellations data
  ➢ Datix reports

6. References

• Ashouri F et al. Management of Warfarin Anticoagulation in Patients with Fractured Neck of Femur. ISRN Hematology. Volume 2011, Article ID 294628, 5 pages
7. **Associated Documentation**

- Anticoagulation and Antiplatelet Therapy in Endoscopy
- Investigation and Management of Acute Venous Thromboembolism in Pregnancy Guideline
- Oral Anticoagulation Policy
- Octaplex® Infusion for the Rapid Reversal of Oral Anticoagulation in the presence of Serious Bleeding (Standard Operating Procedure)
- Patients receiving dabigatran requiring emergency reversal for surgery or treatment of haemorrhage guideline
- Prothrombin Complex Concentrate (PCC) Guidelines
- Unfractionated Heparin Infusion for Systemic Anticoagulation (Heparin infusion chart)
- Venous Thromboembolism (VTE) Policy
- Venous Thromboembolism (VTE) Prophylaxis in Elective Orthopaedic Surgery
8. Algorithm for Aspirin

Algorithm for the perioperative management of patients taking aspirin but no other antiplatelet therapy:

![Algorithm for Aspirin](image)

N.B. After surgical assessment of haemostasis, early re-institution is important.
9. **Algorithm for ADP Receptor Antagonists**

Algorithm for the perioperative management of patients taking an ADP receptor antagonist but no other antiplatelet therapy

```
ADP receptor antagonists (Clopidogrel/Prasugrel/Ticagrelor)

Surgeon happy to operate on current antiplatelet treatment?  
YES

NO

Previous coronary stents?  
• Recent CVE (<3 months)?  
YES

NO

Stop 7 days pre-op

Continue treatment
*Central neuraxial blockade (spinal/epidural) contraindicated
*Peripheral nerve block relatively contraindicated

Consult pre-op anaesthetist
Consider conversion to aspirin 7 days before surgery
*Central neuraxial blockade (spinal/epidural) contraindicated
*Peripheral nerve block relatively contraindicated

N.B. After surgical assessment of haemostasis, early re-institution is important.
```
10. Algorithm for Dual Antiplatelet Therapy

Algorithm for the perioperative management of patients taking both aspirin and an ADP receptor antagonist:

![Diagram of Dual antiplatelet therapy]

- **High risk situation?**
  - < 4 weeks post-MI, PCI or BMS
  - < 12 months post-drug-eluting stent
  - "High risk stents" (those requiring dual antiplatelet therapy for > 12 months)

  - **NO**
    - Stop ADP receptor antagonist (clopidogrel/prasugrel/ticagrelor)
    - 7 days pre-op.
    - Continue aspirin.

  - **YES**
    - Continue treatment unless otherwise approved by cardiology

- **Risk of bleeding in a closed space?**
  - Posterior segment eye surgery
  - Spinal surgery

  - **NO**
    - Only vital surgery should be performed
    - Do not proceed unless approved by cardiology

  - **YES**
    - N.B. After surgical assessment of haemostasis, early re-institution is important.
11. Algorithm for Warfarin

Algorithm for the perioperative management of patients taking warfarin:

**Perioperative Management of Warfarin**

**Is the listing surgeon happy for warfarin to be continued perioperatively?**

For some procedures warfarin may not need to be stopped:
- Dental
- Joint replacements
- Colorectal
- Some GI endoscopy procedures (see endoscopy guidelines)

This decision is the responsibility of the listing surgeon

**YES**

Stop warfarin 5 days before surgery

**NO**

Continue Warfarin

Monitor INR

Anticoagulation pharmacist to actively manage INR prior to surgery

Check INR on day of surgery

**Pre-op assessment team to consider bridging with treatment dose LMWH**

- Patients with a VTE within the last 3 months and surgery not deferrable (discuss with haematologist to ensure NICE filter)
- Patients with a previous VTE whilst on therapeutic anticoagulation who now have a target INR above 3.5
- Patients in AF with a previous stroke/TIA/arterial embolus in last 3 months
- Patients in AF with mitral stenosis
- Patients with a mechanical heart valve (other than those with a bio-prosthetic valve and no previous DVT/MI/AF); ATRF reduced LV ejection fraction)

**Cases to be discussed with cardiological:**
- St. Vitus' dancer (likely to need in tranexamic acid/hirudin)
- Coronary stent not on antiplatelet treatment (may need antiplatelet cover)

**Pre-operative bridging**

1. If decision is made to bridge then start treatment dose LMWH (once daily morning dose) two days after stopping warfarin
2. The last dose of LMWH must be at least 24h before surgery
3. In high bleeding risk surgery, consider having the last dose

Check INR on day of surgery

- ≥1.5 for high bleeding risk bridging procedures
- ≥1.5 for other procedures

**Post-op: No bridging**

1. If haemostasis achieved, give prophylactic LMWH at 6 - 9h post surgery if indicated by Trust VTE guideline
2. Surgeon to consider restarting warfarin at 1500hrs on the evening of surgery or the next day if haemostasis adequate and no contraindication (e.g. endocarditis in situ)

**Post-op: Bridging**

1. If adequate haemostasis not achieved, give prophylactic LMWH at 6 - 9h post surgery if indicated by Trust VTE guideline
2. Surgeon to consider restarting warfarin and postoperative bridging (treatment dose LMWH) on the first postoperative day if haemostasis adequate and no contraindication (e.g. endocarditis in situ)
3. Following high risk procedures and in patients with an increased bleeding risk or in any situation where increased risk of bleeding is unacceptable, post-operative bridging should not be started until at least 48h post procedure
4. Continue bridging therapy until INR therapeutic for two days.
12. Algorithm for Direct Oral Anticoagulants (DOAC's)

Algorithm for the perioperative management of patients taking DOAC's:

**Perioperative Management of Direct Oral Anticoagulants (DOAC's)**

There is a lack of evidence for the safety of surgery on these agents

**Stop treatment before surgery**
- DOAC's have predictable pharmacokinetics and can usually be stopped close to the time of surgery.
- Bridging therapy is not indicated.

**Pre-op assessment team to confirm and communicate plan for timing of last dose of DOAC**
1. Check renal function
2. Use results (eGFR) to confirm plan for timing of last dose (see table below)

<table>
<thead>
<tr>
<th>Renal Function (eGFR) (mL/min)</th>
<th>Recommended wait (d)</th>
<th>Timing of last dose of DOAC before surgery</th>
</tr>
</thead>
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<tr>
<td>Disodium佝偻</td>
<td>10</td>
<td>Two days</td>
</tr>
<tr>
<td>250 to &lt;80</td>
<td>15</td>
<td>Three days</td>
</tr>
<tr>
<td>200 to &lt;50</td>
<td>18</td>
<td>Four days</td>
</tr>
<tr>
<td>&lt;30</td>
<td>Consult Haematologist</td>
<td></td>
</tr>
<tr>
<td>Rivaroxaban</td>
<td>9</td>
<td>Two days</td>
</tr>
<tr>
<td>Apixaban</td>
<td>6</td>
<td>Two days</td>
</tr>
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<td>Edoxaban</td>
<td>10-14</td>
<td>Two days</td>
</tr>
<tr>
<td>&lt;30</td>
<td>Three days</td>
<td></td>
</tr>
</tbody>
</table>

**Post-op:**
1. If adequate haemostasis achieved, give prophylactic LMWH at 6–8 hrs post-surgery if indicated by Trust VTE guideline
2. Surgeon to consider resuming full anticoagulation on first post-operative day if haemostasis adequate and no contraindication (e.g., epidural in-situ).
3. Following high risk procedures and in patients with an increased bleeding risk or in any situation where increased risk of bleeding is unacceptable, DOACs should not be re-introduced at full dose until at least 48 h post procedure.
13. Algorithm for heparins (IV unfractionated heparin and LMWH)

Algorithm for the perioperative management of patients on heparins:

### Perioperative Management of Heparins

**IV Unfractionated Heparin**

**Low Molecular Weight Heparin (LMWH)**

**IV Heparin**
- Is run as a continuous infusion
  - (see Heparin Infusion Chart on Trust Policies site under “Unfractionated Heparin Infusion for Systemic Anticoagulation”)

**Prophylactic dose LMWH**
- E.g. Cloxane 40mg s/c OD
  - Administer at 16:00 daily
  - This allows for surgery to be carried out safely during daylight hours the following day should it be required

**Treatment dose LMWH**
- E.g. Cloxane 1.5 mg/kg s/c OD
  - Administer before 06:00 daily
  - This allows for surgery to be carried out safely during daylight hours the following day should it be required

**Pre-op**
- Anticoagulation increases bleeding risk
- Treatment must be stopped prior to surgery
- Heparins have predictable pharmacokinetics and can be stopped close to the time of surgery

**IV Heparin**
- Stop infusion 4-6 hours prior to surgery

**Prophylactic dose LMWH**
- E.g. Cloxane 40mg s/c OD
  - Stop at least 12 hours prior to surgery

**Treatment dose LMWH**
- E.g. Cloxane 1.5 mg/kg s/c OD
  - Stop at least 24 hours prior to surgery

**Post-op**
- Anticoagulation increases bleeding risk
- Surgeon must assess haemostasis prior to re-starting treatment

**IV Heparin**
- Surgeon to consider re-starting IV heparin 6-12 hours post-operatively if haemostasis adequate and no contraindication (e.g. epidural in situ)

**Prophylactic dose LMWH**
- E.g. Cloxane 40mg s/c OD
  - If adequate haemostasis achieved, give prophylactic LMWH at 6 – 8 hrs post-surgery

**Treatment dose LMWH**
- E.g. Cloxane 1.5 mg/kg s/c OD
  - If adequate haemostasis achieved, give prophylactic LMWH at 6 – 8 hrs post-surgery if indicated by Trust VTE guideline
  - Surgeon to consider re-starting treatment dose LMWH on first post operative day if haemostasis adequate and no contraindication (e.g. epidural in situ)
  - Following high risk procedures and in patients with an increased bleeding risk or in any situation where increased risk of bleeding is unacceptable, treatment should not be re-started until at least 48 hours post procedure

14.1. The following guidance is taken from the British Journal of Haematology publication “Perioperative management of anticoagulation and antiplatelet therapy” 2016:

**Perioperative Management of Antiplatelet Medications in Emergency Surgery**

**Urgent high bleeding-risk surgery**

When urgent high bleeding-risk surgery is indicated and time does not permit cessation of one or both antiplatelet agents:

- Given the uncertain net benefit of platelet transfusion, **consider the use of pre-operative intravenous tranexamic acid**
- If, despite tranexamic acid, there is excessive peri- or post-operative bleeding, or if the bleeding risk is perceived to be very high, **consider infusion of 2 pools of donor platelets**. This may improve haemostasis if given at least two hours after the last dose of aspirin, though even higher doses of donor platelets 12–24 hours after the last dose of clopidogrel may have a lesser effect.

**Urgent low bleeding-risk surgery**

When urgent low bleeding-risk surgery is indicated and time does not permit cessation of one or both antiplatelet agents, **routine platelet transfusion should not be given**.

**Neuraxial anaesthesia/analgesia**

Neuraxial techniques (spinal/epidural) should be avoided in patients taking ADP-receptor antagonists (e.g. clopidogrel / prasugrel / ticagrelor).
15. **Emergency Surgery Guidance (Anticoagulants)**

15.1. The following guidance is taken from the British Journal of Haematology publication “Perioperative management of anticoagulation and antiplatelet therapy” 2016:

**Perioperative Management of Anticoagulants in Emergency Surgery**

**Warfarin**

*If surgery can wait for 6–8 h:*

- Give 5 mg of intravenous vitamin K
- Check INR at six hours

*If surgery cannot wait:*

- **Reverse anticoagulation with 25–50 u/kg of four-factor prothrombin complex concentrate**
- Check INR at 30 mins

Post-operative management should follow the same strategy as for elective surgery.

**Direct Oral Anticoagulants (DOAC’s)**

**Coagulation studies**

DOAC measurement by indirect methods using dilute thrombin time, ecarin clotting time and calibrated anti-Xa assays should currently be interpreted with caution in the management of patients receiving a DOAC who require emergency surgery:

- A normal prothrombin time (PT) and activated partial thromboplastin time (APTT) do not exclude significant concentrations of dabigatran, rivaroxaban or apixaban
- A normal thrombin time (T) can be interpreted as indicating that there is a minimal circulating concentration of dabigatran

**Regional anaesthesia/regional anaesthesia**

- If an anticoagulant effect cannot be excluded, neuraxial techniques (spinal/epidural) should be avoided

**Reversal and perioperative coagulation management**

- Prothrombin complex concentrates should not be routinely used in patients on DOACs prior to emergency surgery
- **Tranexamic acid is likely to reduce bleeding in patients who have a residual anticoagulant effect**
- Drugs and colloids that impair the hemostatic mechanism should be avoided in the perioperative management of patients receiving DOACs
- **Idarucizumab should be used to reverse dabigatran** therapy prior to emergency invasive procedures and surgery where the bleeding risk is considered significant (see “Patients receiving dabigatran requiring emergency reversal for surgery or treatment of haemorrhage guideline” for practical advice on reversal process)
- **Andexanet, when available, should be used to reverse apixaban, rivaroxaban or edoxaban** prior to emergency invasive procedures and surgery where the bleeding risk is considered significant (UK licence expected 2020)
16. Hip Fracture Surgery Guidance (Warfarin)

Algorithm for the management of hip fracture patients on warfarin:

**Guideline for the Management of Hip Fracture Patients on Warfarin**

**Emergency Department Team**
1. Stop warfarin
2. Send INR on all patients
3. Do not wait for INR result
4. Give Vitamin K 2 mg iv ASAP

**Orthopaedic Team**

- Recheck INR after approximately six hours and give further dose of Vitamin K if INR > 2
  - INR 2-4: give 2 mg Vitamin K iv
  - INR 4-6: give 5 mg Vitamin K iv
  - INR 6-8: give 4 mg Vitamin K iv
  - INR >8: give 5 mg Vitamin K iv

**Assess short-term risk of thrombosis**

**Low/Medium Thrombosis Risk**
- Tissue heart valves and other warfarin indications (excluding mechanical heart valves)

**High Thrombosis Risk**
- Mechanical heart valves

**PRE-OPERATIVELY**
- No bridging anticoagulation
- Assess VTE risk and treat as per VTE protocol

**POST-OPERATIVELY**
- If adequate haemostasis, give prophylactic dose LMWH 6-8 hours post-surgery
- Surgeon to consider re-starting warfarin at 11:00 on first post-op day if haemostasis adequate and no contraindication (e.g. epidural in situ)
- Suggest delay by further 24-48 hours in surgery with high bleeding risk

**PRE-OPERATIVELY**
- Only consider pre-operative bridging anticoagulation if:
  - Surgery will not take place within 24 hours
  - OR - Star-Edwards caged-ball valve in situ (consult Cardiologist)
  - Surgery and spinal/epidural are contraindicated within 24 hrs of a treatment dose of LMWH

**POST-OPERATIVELY**
- If adequate haemostasis, give prophylactic dose LMWH 6-8 hours post-surgery
- Surgeon to consider re-starting warfarin and treatment dose LMWH on first post-operative day if haemostasis adequate and no contraindication (e.g. epidural in situ)
- Suggest delay by further 24-48 hours in surgery with high bleeding risk
17. Hip Fracture Surgery Guidance (Antiplatelets and DOAC’s)

The following guidance is based upon the pragmatic approach described within the Royal Devon & Exeter Anticoagulation Policy 2019:

### Hip Fracture Surgery Guidance
(Antiplatelets and DOAC’s)

#### Antiplatelets
- Hip fracture surgery should not be delayed due to antiplatelet therapy
- Neuraxial techniques (spinal/epidural) should be avoided in patients taking ADP-receptor antagonists (e.g. clopidogrel/prasugrel/ ticagrelor)

#### Rivaroxaban/Apixaban/Edoxaban
- Stop treatment and check renal function
- eGFR > 50: Proceed to surgery > 24 hours after last dose
- eGFR < 50: Proceed to surgery > 48 hours after last dose
- If an anticoagulant effect cannot be excluded, neuraxial techniques (spinal/epidural) should be avoided

#### Dabigatran
- Excretion is highly dependent on renal function:
  - Stop treatment
  - Check Thrombin Time (TT) 24 hours after last dose
  - Re-check every 12 hours as necessary until TT normalises
  - When TT normal, proceed to surgery
  - If concern of further delay, consider idarucizumab (reversal agent) and discuss with haematology (see “Patients receiving dabigatran requiring emergency reversal for surgery or treatment of haemorrhage guideline” for practical advice on reversal process)
  - If an anticoagulant effect cannot be excluded, neuraxial techniques (spinal/epidural) should be avoided
18. Regional anaesthesia guidance

The following guidance is taken from the Association of Anaesthetists of Great Britain and Ireland guideline “Regional anaesthesia and patients with abnormalities of coagulation” 2013:

**Regional Anaesthesia in Patients Taking Anticoagulants and/or Antiplatelets**

Recommendations relate to drugs used to modify coagulation. Recommended minimum times are based in most circumstances on time to peak drug effect (elimination half-life) or, after which time 1/4 of the peak drug level will be present. For those drugs whose actions are unrelated to plasma levels, this calculation is not relevant. Data used to populate this Table are derived from ASRA and ESRA guidelines and information provided by drug manufacturers. These recommendations relate primarily to neuraxial blocks and to patients with normal renal function except where indicated.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Time to peak effect</th>
<th>Elimination half-life</th>
<th>Acceptable time after drug for block performance</th>
<th>Administration of drug while spinal or epidural catheter in place</th>
<th>Acceptable time after block performance or catheter removal for next drug dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heparins</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UFH sc prophylaxis</td>
<td>&lt; 30 min</td>
<td>1 - 2 h</td>
<td>4 - 6 h (normal APTT)</td>
<td>Caution</td>
<td>1 h</td>
</tr>
<tr>
<td>UFH iv treatment</td>
<td>&lt; 5 min</td>
<td>1 - 2 h</td>
<td>4 - 6 h (normal APTT)</td>
<td>Caution</td>
<td>4 h</td>
</tr>
<tr>
<td>LMWH sc prophylaxis</td>
<td>3.4 - 3.7 h</td>
<td>3.7 h</td>
<td>12 h</td>
<td>Caution</td>
<td>4 - 6 h</td>
</tr>
<tr>
<td>LMWH iv treatment</td>
<td>3.4 - 3.7 h</td>
<td>3.7 h</td>
<td>24 h</td>
<td>Caution</td>
<td>4 - 6 h</td>
</tr>
<tr>
<td>Heparin alternatives</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Danaparoid prophylaxis</td>
<td>4 - 5 h</td>
<td>24 h</td>
<td>Avoid (consider anti-Xa levels)</td>
<td>Not recommended</td>
<td>6 h</td>
</tr>
<tr>
<td>Danaparoid treatment</td>
<td>4 - 5 h</td>
<td>24 h</td>
<td>Avoid (consider anti-Xa levels)</td>
<td>Not recommended</td>
<td>6 h</td>
</tr>
<tr>
<td>Bivalrudin</td>
<td>5 - 30 min</td>
<td>25 min</td>
<td>Not recommended</td>
<td>6 - 12 h</td>
<td></td>
</tr>
<tr>
<td>Argatroban</td>
<td>&lt; 30 min</td>
<td>30 - 35 min</td>
<td>4 - 6 h (normal APTT)</td>
<td>Not recommended</td>
<td>6 h</td>
</tr>
<tr>
<td>Fondaparinux prophylaxis</td>
<td>1 - 2 h</td>
<td>17 - 20 h</td>
<td>36 - 42 h (consider anti-Xa levels)</td>
<td>Not recommended</td>
<td>6 - 12 h</td>
</tr>
<tr>
<td>Fondaparinux treatment</td>
<td>1 - 2 h</td>
<td>17 - 20 h</td>
<td>Avoid (consider anti-Xa levels)</td>
<td>Not recommended</td>
<td>6 - 12 h</td>
</tr>
<tr>
<td>Antiplatellet drugs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspirin</td>
<td>1 - 2 h</td>
<td>1 - 2 h</td>
<td>No additional precautions</td>
<td>No additional precautions</td>
<td>No additional precautions</td>
</tr>
<tr>
<td>Clopidogrel</td>
<td>12 - 24 h</td>
<td>Not relevant; irreversible effect</td>
<td>7 days</td>
<td>No additional precautions</td>
<td>No additional precautions</td>
</tr>
<tr>
<td>Prasugrel</td>
<td>15 - 30 min</td>
<td></td>
<td>Not recommended</td>
<td>6 days</td>
<td></td>
</tr>
<tr>
<td>Ticagrelor</td>
<td>2 h</td>
<td>8 - 12 h</td>
<td>Not recommended</td>
<td>6 days</td>
<td></td>
</tr>
<tr>
<td>Tirolibran</td>
<td>&lt; 5 min</td>
<td>4 - 8 h</td>
<td>Not recommended</td>
<td>6 days</td>
<td></td>
</tr>
<tr>
<td>Epifibatide</td>
<td>&lt; 5 min</td>
<td>4 - 8 h</td>
<td>Not recommended</td>
<td>6 days</td>
<td></td>
</tr>
<tr>
<td>Abciximab</td>
<td>&lt; 5 min</td>
<td>24 - 48 h</td>
<td>Not recommended</td>
<td>6 days</td>
<td></td>
</tr>
<tr>
<td>Dipyridamole</td>
<td>75 min</td>
<td>10 h</td>
<td>No additional precautions</td>
<td>No additional precautions</td>
<td>No additional precautions</td>
</tr>
<tr>
<td>Oral anticoagulants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warfarin</td>
<td>3 - 5 days</td>
<td>4 - 5 days</td>
<td>INR ≤ 1.4</td>
<td>Not recommended</td>
<td>After catheter removal</td>
</tr>
<tr>
<td>Rivaroxaban prophylaxis</td>
<td>3 h</td>
<td>7 - 9 h</td>
<td>18 h</td>
<td>Not recommended</td>
<td>After catheter removal</td>
</tr>
<tr>
<td>Rivaroxaban treatment</td>
<td>3 h</td>
<td>7 - 11 h</td>
<td>48 h</td>
<td>Not recommended</td>
<td>After catheter removal</td>
</tr>
<tr>
<td>Dabigatran prophylaxis or treatment</td>
<td>(CIC &gt; 30 mg/l)</td>
<td>5 - 10 h</td>
<td>12 - 17 h</td>
<td>Not recommended</td>
<td>48 h</td>
</tr>
<tr>
<td>Dabigatran treatment</td>
<td>(CIC &gt; 30 mg/l)</td>
<td>5 - 10 h</td>
<td>12 - 17 h</td>
<td>Not recommended</td>
<td>48 h</td>
</tr>
<tr>
<td>Apixaban prophylaxis</td>
<td>3.4 h</td>
<td>12 h</td>
<td>24 - 48 h</td>
<td>Not recommended</td>
<td>6 days</td>
</tr>
<tr>
<td>Thromboelitic drugs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alteplase, anistreplase, reteplase, streptokinase</td>
<td>&lt; 5 min</td>
<td>4 - 24 min</td>
<td>10 days</td>
<td>Not recommended</td>
<td>10 days</td>
</tr>
</tbody>
</table>
19. **Tests involved in the monitoring of DOACs**

The following table is taken from guidance published in the Journal of Thrombosis and Haemostasis 2017:

<table>
<thead>
<tr>
<th>Drugs</th>
<th>Laboratory tests</th>
<th>Utility/interpretation</th>
<th>Availability</th>
<th>Dependence of the reagent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dabigatran</td>
<td>APTT*</td>
<td>Interpretation: Normal APTT excludes above on-therapy dabigatran levels but does not exclude the presence of dabigatran in the on-therapy range</td>
<td>24/7, all laboratories</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>TT</td>
<td>Interpretation: Normal TT excludes the presence of dabigatran. A prolonged TT could suggest either the presence of clinically relevant or trivial levels of dabigatran.</td>
<td>24/7, all laboratories</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>dTT</td>
<td>Interpretation: Based on plasma concentration estimation in relation to the clinical context. Note: Some methodologies (i.e. the Hemoelot Thrombin Inhibitors (HTI)) require specific calibrators for plasma concentrations &lt; 50 ng mL⁻¹.</td>
<td>Can be implemented with all coagulometers</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>ECA</td>
<td>Interpretation: Based on plasma concentration estimation in relation to the clinical context.</td>
<td>Can be implemented with all coagulometers</td>
<td>No</td>
</tr>
<tr>
<td>Rivaroxaban</td>
<td>PT*</td>
<td>Interpretation: Rivaroxaban: normal PT (with sensitive reagents) excludes above on-therapy rivaroxaban levels but does not exclude the presence of rivaroxaban in the on-therapy range. Edoxaban: normal PT (with sensitive reagents) would exclude above on-therapy edoxaban levels at peak but would not exclude the presence of above on-therapy edoxaban at trough.</td>
<td>24/7, all laboratories</td>
<td>Yes</td>
</tr>
<tr>
<td>(Edoxaban)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rivaroxaban</td>
<td>Chromogenic anti-Xa assays*</td>
<td>Interpretation: Based on plasma concentration estimation in relation to the clinical context. Note: Some methodologies (i.e. the Biophen Direct Factor Xa Inhibitors (DiXa)) require specific calibrators for plasma concentrations &lt; 50-50 ng mL⁻¹. Note: If near to the LOQ, heparin or LMWH-calibrated chromogenic anti-Xa assays can be used to rule out the presence of clinically relevant direct FXa inhibitors.</td>
<td>Can be implemented with all coagulometers</td>
<td>No</td>
</tr>
<tr>
<td>Apixaban</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Edoxaban</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dabigatran</td>
<td>LC-MS/MS</td>
<td>Interpretation: Based on plasma concentration estimation in relation to the clinical context.</td>
<td>Requires trained staff; only in specialized laboratories</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Rivaroxaban</td>
<td>dRVV-T (DRVV-DOAC)*</td>
<td>Interpretation: Normal dRVV result can exclude DOAC concentrations &gt; 50 ng mL⁻¹.</td>
<td>Can be implemented with all coagulometers</td>
<td>Yes, but &lt; than PT</td>
</tr>
<tr>
<td>Edoxaban</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*APTT, activated partial thromboplastin time; dRVV, dilute Russell’s viper venom time; TT, dilute thrombin time; ECA, ecarin chromogenic assay; ECT, ecarin clotting time; HPLC-MS/MS, high-performance liquid chromatography-tandem mass spectrometry; LOD, limit of detection; LOQ, limit of quantitation; PT, prothrombin time; TT, thrombin time. *None of these tests are able to discriminate between therapies. Thrombin-specific tests can easily identify dabigatran because it is the only direct oral thrombin inhibitor, but also other direct thrombin inhibitors such as argatroban or hirudin can influence them. For direct factor (F) Xa inhibitors, only the Biophen® Direct Factor Xa Inhibitor assay can discriminate between heparins and direct FXa inhibitors but cannot differentiate between direct FXa inhibitors. Mass spectrometry is the only technique able to directly discriminate between therapies.