Guidelines for bridging anticoagulation: the periprocedural management of patients on anticoagulants

1. Scope and exceptions

This guideline applies to:

Setting	Trust-wide
Individuals	Medical, nursing, midwifery staff. Pharmacists.
Speciality	Patients on anticoagulation who require interruption to therapy in order to undergo a procedure

This guideline does not apply to:

Patients who are on parenteral anticoagulation with unfractionated heparin or argatroban.

Patients on the pulmonary vascular diseases unit undergoing a procedure for the investigation for or management of PH; such patients should be managed according to the Sheffield pulmonary vascular disease unit bridging guideline

Pregnant women and those who have given birth, had a miscarriage or had a termination of pregnancy in the previous 6 weeks; these women should be managed in discussion with a haematologist.

Any patient who is not on anticoagulation therapy

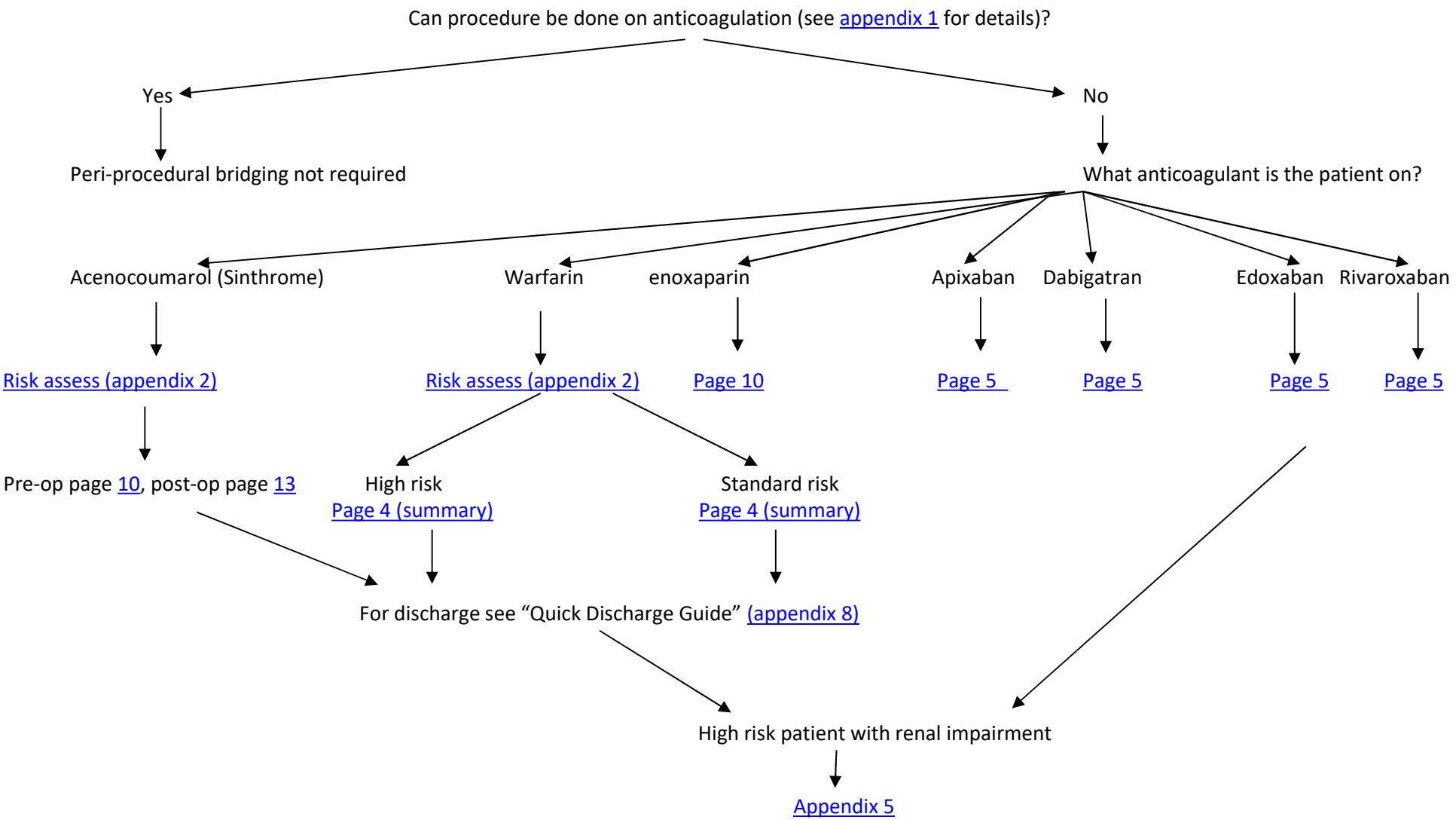
2. Summary

When patients on anticoagulation require surgery or an invasive procedure, the risks and benefits of stopping or continuing anticoagulation must be considered. In many, though not all, cases it is necessary to stop the oral anticoagulant and replace it with low molecular weight heparin (LMWH) until after the procedure. This is known as “bridging anticoagulation”.

3. Table of contents

A sample of the prescription chart to be used with this guideline is available on the STH intranet:
Peri-procedural Bridging Anticoagulation Prescription Chart
The prescription chart is controlled stationary and should be ordered from pharmacy

Flow chart for anticoagulation management



Summary of bridging anticoagulation for patients on warfarin

Summary for patients at **high thrombotic risk**:

Pre-procedure:

Day-5	Day -4	Day -3	Day -2	Day -1	Surgery
Last dose of warfarin	Omit warfarin	Omit warfarin	**Check INR:** if > 1.5 give 1mg oral vit K and re-check INR on day -1 If INR <2 start on twice-daily enoxaparin	Re-check INR: if > than 1.5 on day -2 Give 1mg oral vit K if >1.5 Give last dose of therapeutic enoxaparin in the morning 24-hours pre-op	Re-check INR *(only if it was >1.5 on day -1)*

Post-procedure:

Surgery	Day +1	Day +2	Day +3	Day +4	Day +5	Day +6
Give prophylactic enoxaparin once 6-8 hours post-op	Re-start warfarin at **usual** dose. Continue prophylactic enoxaparin	Give warfarin at usual dose. Continue prophylactic enoxaparin	Continue warfarin at usual dose. Increase prophylactic enoxaparin as per bridging prescription chart		Continue warfarin at usual dose. Increase enoxaparin as per bridging prescription chart. Continue enoxaparin until INR>2	

Summary for patients at **standard thrombotic risk**:

Pre-procedure:

Day-5	Day -4	Day -3	Day -2	Day -1	Surgery
Last dose of warfarin	Omit warfarin	Omit warfarin	Omit warfarin	**Check INR:** if >1.5 give 1mg oral vit K If INR <2, start prophylactic enoxaparin (give last dose at least 12 hours before surgery	Re-check INR *(only if it was >1.5 on day -1)*

Post-procedure:

Surgery	Day +1	Day +2	Day +3	Day +4	Day +5	Day +6
Give prophylactic enoxaparin once 6-8 hours post-op	Re-start warfarin at **usual** dose. Continue prophylactic enoxaparin	Continue warfarin at usual dose. Continue prophylactic enoxaparin until INR>2. Enoxaparin may be omitted after discharge in patients anticoagulated for atrial fibrillation who have not had a previous stroke/ TIA so long as extended prophylaxis would not otherwise be indicated (e.g. lower limb arthroplasty, fractured neck of femur, major cancer surgery in thorax, abdomen or pelvis)				

Key: > greater than; < less than

Treatment should be reviewed daily. Doses should only be escalated when haemostasis is secure.
Pay particular attention if the patient is at high bleeding risk and seek advice if there are any concerns.
If overt bleeding is present, stop anticoagulation and discuss with a haematologist.
After procedures with low bleeding risk, split treatment-dose enoxaparin and warfarin may be restarted at earliest 24 hours after the procedure.

Summary of bridging anticoagulation for patients taking DOACs (apixaban, dabigatran, edoxaban, rivaroxaban)

Prophylactic enoxaparin must not be given pre-operatively when DOAC is omitted.

Peri-procedural summary for patients taking DOACs undergoing procedures with a **low risk** of bleeding:

	Perioperative DOAC Management									
DOAC used:	**Day -5**	**-4**	**-3**	**-2**	**-1**	**0**	**+1**	**+2**	**+3**	**+4**
Apixaban Edoxaban Rivaroxaban	✓	✓	✓	✓	OMIT	**Day of procedure Do not administer DOAC; consider enoxaparin as below**	✓	✓	✓	✓
Dabigatran (Crcl ≥50ml/min)	✓	✓	✓	✓	OMIT		✓	✓	✓	✓
Dabigatran (Crcl <50ml/min)	✓	✓	✓	OMIT	OMIT		✓	✓	✓	✓

Key: ≥ greater than or equal to; < less than

Peri-procedural summary for patients taking DOACs undergoing procedures with a **high risk** of bleeding:

	Perioperative DOAC Management									
DOAC used:	**Day -5**	**-4**	**-3**	**-2**	**-1**	**0**	**+1**	**+2**	**+3**	**+4**
Apixaban Edoxaban Rivaroxaban	✓	✓	✓	OMIT	OMIT	**Day of procedure Do not administer DOAC; consider enoxaparin as below**	OMIT	Resume day +2 or +3		✓
Dabigatran (Crcl ≥50ml/min)	✓	✓	✓	OMIT	OMIT		OMIT	Resume day +2 or +3		✓
Dabigatran (Crcl <50ml/min)	✓	OMIT	OMIT	OMIT	OMIT		OMIT	Resume day +2 or +3		✓

Key: ≥ greater than or equal to; < less than

Give prophylactic enoxaparin on day 0, 6-8 hours post-procedure, so long as there are no bleeding concerns.

This may be omitted in day-case and out- patients whose indication for anticoagulation with DOAC is atrial fibrillation.

In the out-patient setting, a decision as to whether to offer enoxaparin bridging to patients on a DOAC for VTE may be taken based on a number of factors including whether their baseline mobility/ activity level has been compromised by the procedure, how recent their VTE event was, whether they received a general anaesthetic as well as their bleeding risk and the consequence of bleeding post-procedure.

Prophylactic doses of DOACs may be restarted 6-8 hours post procedure.

If there is concern about absorption of DOAC post-procedure, enoxaparin may be continued longer at a dose depending on the thrombotic risk.

Treatment should be reviewed daily. Doses should only be escalated when haemostasis is secure.

Check U&E/LFT before re-starting DOAC. **Do not restart DOAC if the patient has an epidural in situ.**

Administer the last dose of enoxaparin the day before re-starting the DOAC.

If overt bleeding is present, **stop anticoagulation** and discuss with a haematologist

Summary of bridging anticoagulation for patients taking enoxaparin

Summary for patients on prophylactic doses of enoxaparin

Patients on prophylactic doses of enoxaparin (according to their weight and renal function) can have their last dose at least 12 hours before any procedure and can be re-started at earliest 6 – 8 hours post-operatively provided there is no concern about bleeding.

Summary for patients on therapeutic doses of enoxaparin who are at high thrombotic risk

Pre-operative management

Creatinine clearance	Timing of last pre-operative dose
≥30mls/min	A minimum of 24 hours pre-op
15-29mls/min and not in AKI	
Less than 15mls/min **or** in AKI and CrCl 15-29mls/min	Discuss with Anticoagulation Nurse Specialists via ICE in-reach

Post-operative management

Day	0	+1	+2	+3	+4	+5	+6
CrCl ≥30mls/min	Give prophylactic enoxaparin* once 6-8 hours post-op	Continue prophylactic enoxaparin*				Check U&E/LFT Restart therapeutic enoxaparin at the earliest on day +5, depending on bleeding tendency. DO NOT restart if epidural *in situ*	
	**use weight-adjusted doses as per the prescription chart for patients at high risk of thrombosis*						
CrCl 15-29ml/min	Give prophylactic enoxaparin** once 6-8 hours post-op	Continue prophylactic enoxaparin **				Check U&E/LFT Restart therapeutic enoxaparin at the earliest on day +5, depending on bleeding tendency. DO NOT restart if epidural *in situ*	
	***use weight-adjusted doses as per appendix 5 if high-bleeding-risk procedure and appendix 6 if low bleeding-risk procedure*						
CrCl <15ml/min or in AKI and CrCl 15-29mls/min	Discuss with Anticoagulation Nurse Specialists via ICE in-reach						

Situations covered by this guideline

This guideline provides recommendations for the management of peri-procedural anticoagulation for patients on:

- **the vitamin K-antagonists warfarin and acenocoumarol (Sinthrome®)**
- **the direct oral anticoagulants (DOACs) apixaban, dabigatran (Pradaxa®), edoxaban (Lixiana®) or rivaroxaban**
- **long-term treatment with enoxaparin**

who need interruption of anticoagulant therapy (with an INR of less than 1.5 if on a vitamin K antagonist) for a procedure. Additional advice may be required from a haematologist regarding acenocoumarol.

This guideline does not cover the management of the following groups of patients:

- **Pregnant patients:** advice should always be sought from a haematologist.
- **Pulmonary hypertension patients:** patients on the pulmonary vascular diseases unit should be managed according to the Sheffield pulmonary vascular disease unit bridging guideline

This document provides guidance only. In all cases, the risks of stopping anticoagulant therapy to prevent procedure related bleeding must be balanced against the risk of a further thromboembolic event.

If there are any uncertainties/concerns regarding these recommendations, discuss with the coagulation registrar (RHH bleep 2132) the liaison registrar (via switch) or the on-call haematologist out of hours. The on-call anaesthetist can be contacted via switchboard.

Throughout this guideline, the terms “Standard risk” and “High risk” refer to a patient’s thrombotic risk.

Pre-operative assessment and management

Assessment of elective patients should be carried out at pre-operative assessment clinic. Where the procedure does not warrant a formal pre-operative assessment, the clinician ordering the procedure should ensure that the guidance is followed.

Certain procedures **may** be done whilst on therapeutic anticoagulation - see appendix 1 for further guidance.

If anticoagulation is to be interrupted, patients will need to be given clear instructions about when to take their last dose of anticoagulant:

For patients on a vitamin K antagonist (warfarin, acenocoumarol (Sinthrome)):

- **Use the *peri-procedural bridging anticoagulation prescription chart* to determine whether a patient is in the standard risk or high risk category** (see appendix 2 for criteria for stratification of thrombotic risk).
- Use the peri-procedural bridging anticoagulation prescription chart to prescribe the appropriate treatments.

For patients on a DOAC, see page 14 for further guidance

If there is any uncertainty as to which category a patient should be assigned, discuss with the cardiothoracic team (mechanical valve patients), cardiology/relevant medical team (AF and risk factors for stroke) or haematology/relevant medical team (venous thromboembolic disease patients) prior to admission. It may be appropriate to involve a senior anaesthetist at this stage.

Certain patients should be discussed with senior clinicians before commencing bridging:
Patients who are at particularly high risk of thrombosis should be discussed with the senior clinician and anaesthetist involved; these include:

- patients with a venous thrombosis in the last 3 months
- patients with recent stroke (within the previous 6 months) or any history of cardiac thromboembolism
- patients with a left-ventricular assist device
- patients within 1 month of a bare-metal stent insertion or 3 months of a drug-eluting stent insertion

Procedures which carry a very high bleeding risk: these patients can follow the pre-operative bridging guideline but post-operative bridging may need to be individualised (e.g. spinal surgery, cardiac surgery, radical prostatectomy). All patients undergoing cardiac or thoracic procedures should have their last dose of enoxaparin no later than 0800 hours on the day before procedure (-1). They must not receive a dose of enoxaparin on the evening prior to surgery.

Patients with antithrombin deficiency should be discussed with a haematologist as treatment with antithrombin concentrates may be required.

Where there is uncertainty about the management of any patient, discuss with the senior clinician and anaesthetist involved.

Patients on a vitamin K antagonist without any complicating factors (e.g. renal impairment, weight greater than 200kg, etc) should follow the treatment plans as described on the peri-procedural bridging anticoagulation prescription chart.

Patients on therapeutic treatment with enoxaparin should have their anticoagulation discontinued at least 24 hours prior to surgery. Post procedure patients should follow the treatment plan as described on the peri-procedural bridging anticoagulation prescription chart according to their thrombotic risk.

Patients at high thrombotic risk who are expected to require epidural/spinal anaesthesia or analgesia for more than 48 hours post-operatively should be considered for an alternative method of analgesia, as high dose enoxaparin and therapeutic doses of DOACs are incompatible with safe removal of epidural catheters. If no other mode of anaesthesia/analgesia is suitable, the patient must be discussed with a haematologist.

Patients with renal impairment

Standard risk patients on enoxaparin should have the dose reduced if their eGFR is less than 30ml/min/1.73m^2. eGFR should only be used to dose enoxaparin for standard risk patients and must NOT be used to dose enoxaparin for high-risk patients. Dose reductions are advised in patients with eGFR 15-29ml/min/1.73m^2; these are detailed in appendix 5. Standard risk patients with eGFR less than 15ml/min/1.73m^2 should be discussed with a haematologist.

High risk patients on enoxaparin should have the dose reduced if their calculated creatinine clearance (CrCl) is less than 30ml/min.

Renal function for high-risk patients should be estimated using the following calculation:

$$\text{CrCl} = \frac{(140 - \text{age}\_\_\_) \times \text{weight}\ \_\_\_(\text{kg})}{\text{Serum Creatinine (micromol/L)}\ \_\_\_} \quad \begin{matrix} \text{X 1.04 (female)} \\ \text{X 1.23 (male)} \end{matrix} = \_\_\_\_\_\ (\text{mL/min})$$

High risk patients with a creatinine clearance of 15-29ml/min may be managed according to guidance in appendix 5. All high risk patients with a Crcl of less than 30mls/min *must* be discussed individually with haematology, for advice regarding anti-Xa monitoring, before bridging is commenced. Renal transplant patients, irrespective of creatinine clearance *must* be discussed with haematology for suitability of enoxaparin.

Patients on a DOAC who have renal impairment should be managed according to the guidance given on page 14. Renal function for all patients should be calculated using the above equation; eGFR should not be used to estimate renal function.

Patients weighing more than 200kg should be discussed with a haematologist as dose adjustments of enoxaparin and monitoring of anti-Xa activity may be required.

GPs should not normally be asked to prescribe or monitor bridging anticoagulation. Prior to the procedure, management should be by the medical/surgical team looking after the patient (this may be via pre-op assessment clinic if applicable). Following discharge from hospital, the patient should be referred to the STH Anticoagulation Clinic. There may be exceptions to this if the patient lives outside the Sheffield area: see specific guidance within this document.

If surgery is cancelled see advice in appendix 3. It is the responsibility of the person cancelling the patient to inform pre-assessment clinic staff as patients will need advice regarding their bridging therapy.

Guidance for pre-operative assessment clinics / waiting list staff / secretaries is in appendix 4

Periprocedural management of patients taking vitamin K antagonists (warfarin or acenocoumarol (Sinthrome®))

Pre-operative investigations & management

- A full blood count must be taken in the week prior to surgery (this may be performed at the same time as the pre-op INR). If the patient has acute or chronic thrombocytopenia (platelets less than 150 $x10^9$/L) then discussion with a haematologist is recommended.
- A U&E must be taken within 6 weeks prior to surgery. This should be repeated in the week prior to surgery for accurate assessment of renal function (calculated creatinine clearance).
- A weight within the 3 months prior to the procedure should be measured and documented in the patients notes. Estimated weights must not be used.
- For those patients who are anticoagulated with warfarin:
    - High risk patients: an INR will be required on day -2 (and again on day -1 if the INR on day -2 was greater than 1.5)
    - Standard risk patients: an INR will be required on day -1
    - Near patient testing is acceptable however, the patient must have a venous INR on either day -1 or -2 pre-operatively. Post operatively the patient must have venous samples undertaken whilst an inpatient but may return to near patient testing once discharged.

Warfarin: Patients should be instructed to take their last dose 5 days pre-operatively (i.e. 4 clear days before surgery) and attend for INR checks as appropriate. Patients should be advised that they may need to continue receiving injections of enoxaparin after discharge from hospital until their INR is therapeutic. Patients or carers should be trained to inject enoxaparin wherever possible.

Pre-operative warfarin management for patients at **standard** thrombosis risk:

Day-5	Day -4	Day -3	Day -2	Day -1	Surgery
Last dose of warfarin	Omit warfarin	Omit warfarin	Omit warfarin	**Check INR:** if >1.5 give 1mg oral vit K Give prophylactic enoxaparin at least 12 hours before surgery	Re-check INR *(only if it was >1.5 on day -1)*

Pre-operative warfarin management for patients at **high** thrombotic risk:

Day-5	Day -4	Day -3	Day -2	Day -1	Surgery
Last dose of warfarin	Omit warfarin	Omit warfarin	**Check INR:** if >2 give 1mg oral vit K and re-check on day -1 If 1.5-2 give 1mg oral vit K and re-check on day -1. Start on twice-daily enoxaparin If <1.5 start on twice-daily enoxaparin	Re-check INR: if > than 1.5 on day -2 Give 1mg oral vit K if >1.5 Give last dose of therapeutic enoxaparin in the morning	Re-check INR *(only if it was >1.5 on day -1)*

Acenocoumarol (Sinthrome®): has a shorter half-life than warfarin, hence a shorter duration of action and more rapid onset of action. Patients should be advised to take their last dose 3 days pre-operatively (i.e. 2 clear days before surgery) and attend for INR checks as appropriate. As above these patients should be advised that they may need to continue receiving injections of enoxaparin after discharge from hospital until their INR is therapeutic.

Pre-operative acenocoumarol management for patients at high or standard risk:

Day-3	Day -2	Day -1	Surgery
Last dose of acenocoumarol	Omit acenocoumarol	**Check INR:** if >1.5 give 1mg oral vit K Give prophylactic enoxaparin at least 12 hours before surgery	Re-check INR *(only if it was >1.5 on day -1)*

Emergency pre-operative management of patients taking vitamin K antagonists

For emergency procedures consider **warfarin /acenocoumarol** reversal with vitamin K and/or prothrombin complex concentrate (Beriplex™) pre-operatively. Further guidance can be found on the back of the STH Warfarin Prescription and Monitoring Chart. Consider discussion with a haematologist.

Post-Operative Management

Follow the appropriate treatment plan according to the patient's thrombotic risk.

Treatment should be reviewed daily. Doses should only be escalated when haemostasis is secure. Pay particular attention if the patient is at high bleeding risk and seek advice if there are any concerns. If overt bleeding is present, stop anticoagulation and discuss with a haematologist. Enoxaparin doses should be adjusted according to the patient's weight and renal function – refer to specific guidance on the *peri--procedural bridging anticoagulation prescription chart*.

Patients undergoing cardiac surgery should not be given enoxaparin on the day of surgery. Neurosurgical patients may have the initiation of their enoxaparin delayed according to bleeding risk at the discretion of the Consultant Neurosurgeon.

Patients with renal impairment

Standard risk patients on enoxaparin should have the dose reduced if their eGFR is less than 30ml/min/1.73m^2. Dose reductions are advised in patients with eGFR 15-29ml/min/1.73m^2; these are detailed in appendix 5. Standard risk patients with eGFR less than 15ml/min/1.73m^2 should be discussed with a haematologist.

High risk patients on enoxaparin should have the dose reduced if their calculated creatinine clearance (CrCl) is less than 30ml/min.

Renal function for high-risk patients should be estimated using the following calculation:

$$\text{CrCl} = \frac{(140 - \text{age}\_\_\_) \times \text{weight}\ \_\_\_(\text{kg})}{\text{Serum Creatinine (micromol/L)}\ \_\_\_} \quad \begin{matrix} \text{X 1.04 (female)} \\ \text{X 1.23 (male)} \end{matrix} = \_\_\_\_\_\ (\text{mL/min})$$

High risk patients with a creatinine clearance of 15-29ml/min may be managed according to guidance in appendix 5. All high risk patients with a Crcl of less than 30mls/min *must* be discussed individually with haematology, for advice regarding anti-Xa monitoring, before bridging is commenced. Renal transplant patients, irrespective of creatinine clearance *must* be discussed with haematology for suitability of enoxaparin.

Patients or their carers should be trained to inject enoxaparin whilst they are in hospital. Many patients are capable of self-injecting enoxaparin after discharge, and failure to train them appropriately places an unnecessary burden on the community nursing service. Training should be carried out in accordance with the STH Self-administration of medicines policy.

Patients with atrial fibrillation without prior stroke/TIA and no other risk factors for stroke do not need enoxaparin beyond discharge even if their INR is less than 2 if they are medically fit and would not otherwise be a candidate for extended thromboprophylaxis (see STH Guidelines for the Prevention of Venous Thromboembolic Disease)

Post-operative warfarin management for patients at **standard thrombotic risk**

Surgery	Day +1	Day +2	Day +3	Day +4	Day +5	Day +6
Give prophylactic enoxaparin once 6-8 hours post-op	Re-start warfarin at **usual** dose. Continue prophylactic enoxaparin	Continue warfarin at usual dose. Continue prophylactic enoxaparin until INR>2. Enoxaparin may be omitted after discharge in patients anticoagulated for atrial fibrillation who have not had a previous stroke/ TIA so long as extended prophylaxis is not indicated (e.g. lower limb arthroplasty, fractured neck of femur, major cancer surgery in thorax, abdomen, pelvis)				

Post-operative warfarin management for patients at **high thrombotic risk**

Surgery	Day +1	Day +2	Day +3	Day +4	Day +5	Day +6
Give prophylactic enoxaparin once 6-8 hours post-op	Re-start warfarin at **usual** dose. Continue prophylactic enoxaparin	Give warfarin at usual dose. Continue prophylactic enoxaparin	Continue warfarin at usual dose. Increase prophylactic enoxaparin as per bridging prescription chart		Continue warfarin at usual dose. Increase enoxaparin as per bridging prescription chart. Continue enoxaparin until INR>2	

Warfarin should be re-started at the patient's usual dose on the first day post-procedure. It will take up to 2 weeks for the INR to become therapeutic. Additional loading or boost doses of warfarin are not recommended. Enoxaparin should be continued until the INR is greater than 2 for **all patients** including those with a higher INR target range.
After procedures with low bleeding risk, high dose enoxaparin and warfarin may be restarted **at earliest** 24 hours after the procedure.

Post-operative summary for patients on acenocoumarol (Sinthrome®)

Post-operative acenocoumarol management for patients at **standard** thrombotic risk

Surgery	Day +1	Day +2	Day +3	Day +4	Day +5	Day +6
Give prophylactic enoxaparin once 6-8 hours post-op	Continue prophylactic enoxaparin		Re-start acenocoumarol at usual dose between days 3 & 5 (earliest day 3) Continue prophylactic enoxaparin until INR is >2 (unless standard-risk AF as above)			

Acenocoumarol may be re-started on day +1 following discussion with haematology after a low bleeding-risk procedure.

Post-operative acenocoumarol management for patients at **high** thrombotic risk

Surgery	Day +1	Day +2	Day +3	Day +4	Day +5	Day +6
Give prophylactic enoxaparin once 6-8 hours post-op	Continue prophylactic enoxaparin		Re-start acenocoumarol at usual dose between days 3 & 5 (earliest day 3) Increase dose of enoxaparin as per bridging prescription chart. Continue enoxaparin until INR is >2			

Peri-procedural management of patients taking DOACs

Pre-operative investigations & management:

- A full blood count must be taken in the week prior to surgery. If the patient has acute or chronic thrombocytopenia (platelets less than 150 x10^9/L) then discussion with a haematologist is recommended.
- A U&E must be taken within 6 weeks prior to surgery. This should be repeated in the week prior to surgery for accurate assessment of renal function (calculated creatinine clearance).
- A weight within the 3 months prior to the procedure should be measured and documented in the patients notes. Estimated weights must not be used.

Pre-procedural summary for patients taking DOACs undergoing procedures with a **low risk** of bleeding:

	Pre-operative DOAC management					
DOAC used:	**Day -5**	**-4**	**-3**	**-2**	**-1**	**0**
Apixaban Edoxaban Rivaroxaban	✓	✓	✓	✓	OMIT	**Day of procedure Do not administer any DOAC**
Dabigatran (Crcl ≥50ml/min)	✓	✓	✓	✓	OMIT	
Dabigatran (Crcl <50ml/min)	✓	✓	✓	OMIT	OMIT	

Pre-procedural summary for patients taking DOACs undergoing procedures with a **high risk** of bleeding:

	Pre-operative DOAC management					
DOAC used:	**Day -5**	**-4**	**-3**	**-2**	**-1**	**0**
Apixaban Edoxaban Rivaroxaban	✓	✓	✓	OMIT	OMIT	**Day of procedure Do not administer any DOAC**
Dabigatran (Crcl ≥50ml/min)	✓	✓	✓	OMIT	OMIT	
Dabigatran (Crcl <50ml/min)	✓	OMIT	OMIT	OMIT	OMIT	

Key: ≥ greater than or equal to < less than

Prophylactic enoxaparin must **not** be given *pre-operatively* when DOAC is omitted.

Emergency pre-procedural management of emergency patients taking apixaban, dabigatran, edoxaban or rivaroxaban:

Please refer to the drug-specific guidelines for apixaban, dabigatran, edoxaban and rivaroxaban **and** discuss with haematology.

Post-Operative Management: Follow the appropriate treatment plan according to the **procedural bleeding risk**.

Post-procedural summary for patients taking DOAC undergoing procedures with a **low risk** of bleeding:

	Post-operative DOAC management				
DOAC used:	**0**	**+1**	**+2**	**+3**	**+4**
Apixaban, Edoxaban, Rivaroxaban	**Day of procedure Do not administer DOAC; consider enoxaparin as below**	✓	✓	✓	✓
Dabigatran (Crcl ≥50ml/min)		✓	✓	✓	✓
Dabigatran (Crcl <50ml/min)		✓	✓	✓	✓

Give prophylactic enoxaparin on day 0, 6-8 hours post-procedure, so long as there are no bleeding concerns. **This may be omitted in day-case patients whose indication for anticoagulation is atrial fibrillation**.
DOACs can be re-started at their usual dose 24-hours post-procedure. Administer the last dose of enoxaparin the day before restarting DOAC.

Post-procedural summary for patients taking DOAC undergoing procedures with a **high risk** of bleeding:

	Post-operative DOAC management				
DOAC used:	**0**	**+1**	**+2**	**+3**	**+4**
Apixaban, Edoxaban, Rivaroxaban	**Day of procedure Do not administer DOAC; consider enoxaparin as below**	OMIT	Resume day +2 or +3		✓
Dabigatran (Crcl ≥50ml/min)		OMIT	Resume day +2 or +3		✓
Dabigatran (Crcl <50ml/min)		OMIT	Resume day +2 or +3		✓

Give prophylactic enoxaparin on day 0, 6-8 hours post-procedure, so long as there are no bleeding concerns. **This may be omitted in day-case patients whose indication for anticoagulation is atrial fibrillation.** In the out-patient setting, a decision as to whether to offer enoxaparin bridging to patients on a DOAC for VTE may be taken based on a number of factors including whether their baseline mobility/ activity level has been compromised by the procedure, how recent their VTE event was, whether they received a general anaesthetic as well as their bleeding risk and the consequence of bleeding post-procedure.
Enoxaparin doses should be adjusted according to the patient's weight and renal function – refer to specific guidance on the *peri--procedural bridging anticoagulation prescription chart* and in appendix 5.
Patients undergoing cardiac surgery should not be given enoxaparin on the day of surgery.
Treatment should be reviewed daily. Doses should only be escalated when haemostasis is secure.
If there is concern about absorption of DOAC post-procedure, enoxaparin may be continued for longer at a dose depending on the thrombotic risk group. Check U&E/LFT before re-starting DOAC. **Do not restart DOAC if epidural in situ.** Prophylactic doses of rivaroxaban (10mg OD), apixaban (2.5mg BD) dabigatran (150/220mg OD) may be restarted 6-8 hours post op.

Monitoring for heparin-induced thrombocytopaenia (HIT)
All patients receiving enoxaparin must have a full blood count performed in the week prior to starting treatment. Full blood counts must be repeated every 3 to 4 days (i.e. twice weekly) for the first two weeks of treatment with enoxaparin as inpatients. Patients discharged from hospital on enoxaparin only require HIT monitoring if they have undergone cardiothoracic surgery or they have received unfractionated heparin (prophylactic or treatment doses) within the last 100 days. If the platelet count falls by 30-50% from baseline or to less than $150x10^9$/L, and/or the patient develops new signs of thrombosis, suspect HIT: contact a haematologist for advice.

Management of spinal or epidural anaesthesia or analgesia
The risks of spinal haematoma with spinal/epidural anaesthesia are greatest at times of needle/catheter insertion and removal.

Patients on prophylactic enoxaparin (i.e. any "standard risk" patients, or "high risk" patients on days 0, 1 or 2 post-operatively):

- Spinal/epidural catheters must be inserted or removed **at least** 12 hours after the last dose of prophylactic enoxaparin
- The next dose of prophylactic enoxaparin must be given **at least** 4 hours after inserting or removing a spinal/epidural catheter
- If a patient is on twice daily dosing of prophylactic enoxaparin, a dose should be delayed by 4 hours to allow removal of the spinal/epidural catheter

Patients on escalating doses of enoxaparin (i.e. "high risk" patients from day 3 post-operatively):

- If a "high risk" patient is expected to require spinal/epidural analgesia for more than 48 hours post-operatively then an alternative route of analgesia should be considered. Escalating dose enoxaparin is incompatible with safe removal of spinal/epidural catheters.
- If a patient receiving escalating dose enoxaparin still has a spinal/epidural catheter in situ, advice should be sought from a haematologist and anaesthetist regarding management of the patient.
- Spinal/epidural catheters must be inserted or removed at least 24 hours after the last dose of escalating dose enoxaparin.
- Escalating dose enoxaparin must not be administered within 12 hours of insertion or removal of a spinal/epidural catheter.

Patients taking a DOAC should be managed according to the DOAC bridging protocol for **high bleeding** procedures (page 8) when spinal/epidural catheters are to be removed or inserted.

Patients taking warfarin should have an INR of 1.4 or less when epidural catheters are inserted or removed.

Be vigilant for the signs of spinal cord compression due to spinal haematoma: backache, leg weakness, loss of perineal and leg sensation, loss of bladder control. These must be acted upon promptly with urgent referral to the on-call anaesthetist.

Discharging patients

Patients taking warfarin:

Standard risk patients with atrial fibrillation can stop enoxaparin on discharge provided continuing thromboprophylaxis is not indicated for other reasons. All other standard and high-risk patients should remain on enoxaparin until their INR is greater than 2.0

If the patient's INR is greater than 2.0 at the time of discharge, patients should be referred back to their usual anticoagulation provider using the STH Anticoagulation Referral Form. Patients must have an INR check within 7 days of discharge (sooner if clinically indicated).
If the INR is 2.0 or less, the discharge arrangements differ depending on where the patient lives:

Patients registered with a Sheffield GP:

These patients can be discharged before the INR is therapeutic if they are medically fit.
They must be referred to **STH Anticoagulation Clinic** for outpatient bridging management irrespective of who their usual anticoagulation provider is, via ICE referral. These patients should **not** be referred to their GP.
Patients should be prescribed a 10-day supply of enoxaparin on their TTO. The patient or their carer should be trained to administer enoxaparin wherever possible; if this is not possible they should be referred to the community nursing team.

Patients registered with a non-Sheffield GP:

These patients should be discussed on an individual basis with their usual anticoagulation provider and the following agreed and understood:

- the hospital and anticoagulation provider's responsibilities for prescribing warfarin and enoxaparin
- the correct dosing of warfarin and enoxaparin, and the correct time to discontinue enoxaparin
- the monitoring requirements (INR and HIT monitoring, where applicable)

If the usual anticoagulation provider is unable to support peri-operative bridging after discharge, patients may be referred to the STH anticoagulation clinic via ICE for bridging management post-discharge, providing the patient is prepared to attend the clinic at the Royal Hallamshire Hospital for blood tests until their INR is back in range. Where these arrangements are not suitable the patient should remain in hospital until the INR is greater than 2.0.

Patients with atrial fibrillation without prior stroke/TIA and with no other risk factors for stroke may be discharged without enoxaparin before their INR is therapeutic if they are medically fit. The patient's warfarin should be restarted at their usual dose, and they MUST be referred to their regular anticoagulation provider for INR monitoring. These patients do not need to be "bridged" with enoxaparin on discharge from hospital. For further guidance, see appendix 9.

Patients taking DOACs (rivaroxaban, dabigatran, apixaban or edoxaban):

- Patients taking DOACs should be managed according to the peri-operative guidance on page 8.
- Enoxaparin MUST be **discontinued** the day before the DOAC is restarted.
- INR monitoring is not required in patients who are taking DOACs and there is no referral required on discharge.

BACKGROUND AND RATIONALE FOR RECOMMENDATIONS

Introduction

The purpose of this document is to provide recommendations for the management of peri-procedural anticoagulation for patients on oral anticoagulant therapy who need to stop anticoagulation prior to surgery (INR of less than 1.5 prior to the procedure or interruption of dabigatran/ rivaroxaban/ apixaban/ edoxaban). They are part of a trust wide initiative to implement NPSA guidance for safer anticoagulation and are adapted from the guidelines by the American College of Chest Physicians (Douketis *et al*, 2012) and the British Committee for Standards in Haematology (refer to: Peri-operative management of anticoagulation and antiplatelet therapy . Keeling, Campbell Tait, Watson, and on behalf of the British Committee of Standards for Haematology. BJHaem 2016 Volume 175, Pages 602–613)

There are an estimated 500,000 patients in the UK using oral anticoagulants, the majority for atrial fibrillation (AF) and mechanical heart valves (Baglin *et al*, 2007). In the USA approximately 10% of patients on oral anticoagulants are thought to require surgery or invasive procedures annually (Douketis *et al*, 2012) making peri-operative bridging anticoagulation a common occurrence. A risk assessment by the National Patient Safety Agency demonstrated wide variation in practice of the peri-operative management of patients on oral anticoagulation both between and within hospital trusts as well as deficiencies in training of staff dealing with anticoagulation issues (National Patient Safety Agency, 2006). This can lead to potentially unnecessary admissions for pre-procedural anticoagulation, delays in discharge because of unstable anticoagulation, and unsafe anticoagulation management with potentially increased morbidity and mortality.

For patients on oral anticoagulant therapy requiring invasive procedures, the risk of a thromboembolic event in the peri-operative period when anticoagulation is interrupted must be balanced against the risk of bleeding when these are continued. If the risk of procedure-related bleeding whilst continuing oral anticoagulation is thought to be small, anticoagulation may be continued. This applies to some minor dental (Douketis *et al*, 2012;Perry *et al*, 2007), ophthalmic (Douketis *et al*, 2012) and dermatological (Douketis *et al*, 2012) procedures and should be discussed with the relevant team. Recent guidelines from the British Society of Gastroenterology suggest that diagnostic endoscopic procedures with or without biopsy, biliary or pancreatic stenting and diagnostic endoscopic ultrasound can also be performed whilst the patient is on therapeutic anticoagulation (Veitch *et al*, 2008). Similarly, patients requiring invasive cardiology procedures may be at low risk of bleeding and these procedures can be done whilst anticoagulated. These patients should be discussed with the cardiology team before anticoagulation is altered. Patients requiring diagnostic angiography also have a low risk of bleeding and procedures can generally be done on warfarin provided the INR is less than 3 and the guidance as given by vascular radiology should be followed. A list of procedures that may be undertaken whilst a patient's INR is less than 3 is given below, and in appendix 1 of this document.

If the risk of procedure-related bleeding is thought to outweigh the risk of thromboembolic events, anticoagulation should be stopped and bridging anticoagulation considered depending on the thrombotic risk. If bridging anticoagulation is instituted, this should be done in a manner whereby both the time without anticoagulation and the bleeding risk are minimised. The peri-procedural management therefore depends both on individual patient characteristics and the type of procedure done.

Bleeding risk associated with procedures

Note that this list is not comprehensive and is intended as guidance only.

Very high risk[1]	High risk	Low risk[2]	Procedures which may be performed on warfarin [3]
Cardiac surgery Neurosurgery Spinal surgery Radical prostatectomy	Major orthopaedic surgery Major vascular surgery Major gynaecological and urological surgery Major cancer surgery Other major abdominal and thoracic surgery Renal biopsy	Minor procedures as specified by treating surgeon/physician	Diagnostic GI endoscopic procedures ± biopsy (Veitch *et al*, 2008) Biliary or pancreatic stenting (Veitch *et al*, 2008) Diagnostic EUS (Veitch *et al*, 2008) minor dermatological surgery (Douketis *et al*, 2012) Minor dental surgery (Perry *et al*, 2007) Minor ophthalmological surgery (cataract extraction) (Douketis *et al*, 2012)

[1] Procedures with very high bleeding risk can follow this guideline pre-operatively. Post operative enoxaparin should not be escalated before day +3 and some may need an individualised decision.

*[2] Procedures at low risk of bleeding but where warfarin needs to be stopped should be identified by the treating physician or surgeon. In patients with a high thrombotic risk undergoing a low-bleeding risk procedure, high dose enoxaparin **may** be restarted **at earliest** 24 hours after the procedure. Caution may be needed with procedures that appear to have a low bleeding risk but have been associated with higher bleeding rates. These include resection of large pedunculated polyps or broad based flat (sessile) polyps requiring EMR and pacemaker or defibrillator implantation.*

[3] Guidelines on selected procedures that may be done whilst on warfarin are available from the British Society for Gastroenterology (Veitch et al, 2008), ACCP (Douketis et al, 2012) and British Committee for Standards in Haematology (Perry et al, 2007) (Keeling et al, 2011). Other minor vascular and cardiological procedures may also be possible whilst on warfarin but should be discussed with the relevant team.

Assessment of thrombotic risk

This guideline recommends stratification of thrombotic risk as Standard risk or High risk. Bridging with therapeutic doses of enoxaparin should be considered in those at highest thrombotic risk (Keeling et al 2016):

VTE	Patients with a VTE within previous 3 months. Very high risk patients such as patients with a previous VTE whilst on therapeutic anticoagulation who now have a target INR of 3.5.
AF	Patients with a previous stroke/TIA in last three months. Patients with a previous stroke/TIA and three or more of the following risk factors: • Congestive cardiac failure • Hypertension (> 140/90 mmHg or on medication) • Age >75 years • Diabetes mellitus
MHV	MHV patients other than those with a bileaflet aortic valve and no other risk factors

Mechanical heart valves

The risk of thrombosis is highest in mechanical mitral valve prosthesis and aortic valve prosthesis using caged ball or tilting disc devices. The risk is lower in modern bileaflet aortic valves. Most studies assessing the use of low molecular weight heparin (LMWH) as bridging anticoagulation have used therapeutic dose regimens (for a review see Douketis *et al*, 2012). Two studies have used low dose LMWH (including patients with mitral valve prosthesis) but it is not clear if this is sufficient as it can be argued that higher doses of LMWH are needed for the prevention of arterial thrombosis. The latter however is also not established.

This guideline therefore classifies all patients with mechanical valve prosthesis as high risk **except** those with bileaflet aortic valves without any other risk factors for stroke.

Atrial Fibrillation

Patients at highest risk for stroke are those with a previous stroke/TIA in the last 3 months, patients with rheumatic valvular heart disease and patients who suffered a previous TIA/stroke over 3 months ago and who have 3 of the following risk factors:

- Congestive cardiac failure
- Hypertension (>140/90mmHg or on medication)
- Age >75 years
- Diabetes mellitus

These patients should be bridged according to the high-risk guideline (BCSH guidelines). The BRIDGE trial showed that bridging is associated with a significant risk of major bleeding whilst it does not reduce the risk of stroke in patients with a CHADS2 score of up to and including 4. There were too few patients to draw conclusions with a CHADS2 score of 5 and 6 (Douketis et al 2015).

For all other patients with AF this guideline recommends using prophylactic doses of enoxaparin whilst an inpatient. If there is any uncertainty as to which category a patient should be assigned, this should be discussed with the cardiology team/relevant medical team prior to admission.

Previous venous thrombotic events (VTE)

In contrast to arterial thrombotic events, there is evidence that prophylactic dose enoxaparin therapy decreases the post-operative thrombotic risk. Therefore, there is a clear role for the use of prophylactic dose enoxaparin in patients with a previous VTE who are on long term anticoagulation with warfarin and have a target INR of 2 – 3.

Patients with VTE in the previous 3 months are at high risk of recurrence and any procedures (for which interruption of anticoagulation is necessary) should preferably be delayed for 3 months. If this is not possible, a temporary IVC filter should be considered after discussion with a Haematologist or Coagulation Consultant prior to admission.

Patients with antiphospholipid syndrome (who have had either arterial or venous thrombotic events) and those with recurrent thrombosis whilst on warfarin (who are managed with a target INR of 3.5) are at high risk of recurrence: they should be managed according to the high-risk guideline. Patients with antithrombin deficiency may require peri-procedural antithrombin concentrate and should also be discussed with a Haematology Coagulation Consultant prior to admission.

The use of low molecular weight heparin (LMWH) for bridging anticoagulant therapy

LMWH given subcutaneously has a 90 – 100% bioavailability and a more predictable anticoagulant response than unfractionated heparin (UFH). It has a half-life of approximately 4 hours and is given in weight adjusted doses. Dosage monitoring is generally not necessary except in patients with renal failure, at extremes of body weight, and during pregnancy. Compared to unfractionated heparin, it has a favourable benefit to risk ratio in animal models and when used to treat VTE (Hirsh *et al*, 2008). In addition, LMWH can be given in the outpatient setting. Because of these advantages LMWH is recommended in preference to unfractionated heparin (UFH) for anticoagulation bridging.

Standard risk patients should receive prophylactic doses of LMWH until oral anticoagulation with warfarin has become therapeutic (INR greater than 2.0). In patients taking rivaroxaban, apixaban, edoxaban or dabigatran, the last LMWH dose should be 24 hours before restarting rivaroxaban, apixaban, edoxaban or dabigatran.

High risk patients should receive LMWH with the dose increasing at increments post-operatively until full therapeutic doses have been achieved. LMWH should continue in patients taking warfarin until it has become therapeutic (INR greater than 2.0). In patients taking rivaroxaban, dabigatran, edoxaban or apixaban, the last LMWH dose should be 24 hours before the DOAC. Both the creatinine clearance and liver function tests should be checked before restarting rivaroxaban, dabigatran, edoxaban or apixaban and their doses checked against these parameters.

Dose adjustments for LMWH are necessary for patients with renal impairment. Patients requiring low "prophylactic" doses of enoxaparin should have doses reduced if their eGFR is less than 30ml/min/1.73m^2, and additional monitoring of anti-Xa levels carried out. Advice should be sought from a Haematologist regarding the management of these patients.

For patients who require high dose ("therapeutic dose") enoxaparin and who have renal impairment (creatinine clearance less than 15 ml/min), the use of unfractionated heparin infusion may be preferable. Patients requiring therapeutic doses of enoxaparin and who have a CrCl between 15 & 29 ml/min can have reduced doses as outlined in appendix 5. These patients ***must*** be discussed with a Haematologist and additional monitoring of anti-Xa levels will be required. Alternatively unfractionated heparin infusion may be considered.

Timescale for peri-operative anticoagulation

Stopping vitamin K antagonists

Prospective cohort studies stopped warfarin 5 – 6 days prior to surgery (for a review see Douketis *et al*, 2008). One study stopping anticoagulation 5 days before surgery found that 7% of patients had an INR greater than 1.5 the day before surgery which was corrected with 1mg oral vitamin K (Kovacs *et al*, 2004). In another retrospective study including 43 patients with an INR of 1.5 – 1.9, administration of 1mg oral vitamin K resulted in INR normalisation in 91% of the patients (Woods *et al*, 2007). An INR greater than 1.5 on the day of operation is more likely in patients with a higher INR target (e.g. mechanical heart valves and patients with recurrent VTE whilst on warfarin) and elderly patients. This guideline recommends taking the last dose of warfarin 5 days prior to surgery (4 clear days), checking the INR the day prior to surgery and giving 1mg oral vitamin K if INR greater than 1.5. Patients at high thrombotic risk should have their INR checked on day -2 and should be started on enoxaparin; their INR should be rechecked on day -1 if INR was greater than 1.5 on day -2. Advice on starting enoxaparin is detailed below.

Acenocoumarol (Sinthrome) has a shorter half-life and a shorter duration of action. It should be stopped closer to the date of surgery; as per guidance outlined above.

The direct oral anticoagulants

Renal Function CrCl ml/min	Estimated half-life (hours)	Low bleeding risk	High bleeding risk
Dabigatran			
>80	13	24 hours	48 hours
>50 to <80	15	24-48 hours	48-72 hours
>30 to <50	18	48-72 hours	96 hours
Rivaroxaban			
>30	9	24 hours	48 hours
<30		48 hours	72 hours
Apixaban			
>30	8	24 hours	48 hours
<30		48 hours	72 hours
Edoxaban			
>30	10-14	24 hours	48 hours
<30		48 hours	72 hours

The direct oral anticoagulants have a different mode of action to vitamin K antagonists and require different management. They are renally excreted and therefore the timescale for stopping and re-starting peri-operatively is partly dependent on renal function.

Rivaroxaban, dabigatran, edoxaban and apixaban have shorter half-lives in comparison to warfarin and an onset of action within 2 hours if intestinal absorption is normal. As a result, it can be assumed that interrupting anticoagulation with these drugs is sufficient to ensure haemostasis and that surgery is safe (Schulman & Crowther 2012).

Rivaroxaban, edoxaban & apixaban
This guideline recommends:

- Patients taking therapeutic doses of rivaroxaban, edoxaban and apixaban who are to undergoing procedures with a low bleeding risk, should omit these drugs for at least 24 hours.
- Patients taking therapeutic doses of rivaroxaban, edoxaban and apixaban undergoing procedures with high bleeding risk, should omit these drugs for at least 48 hours.

Patients taking prophylactic doses of rivaroxaban (10mg OD) must have taken their last dose of rivaroxaban at least 18 hours prior to the procedure (Keeling et al 2016).
These drugs are contraindicated in a creatinine clearance of less that 15ml/min and these patients should be discussed with haematology.

Dabigatran
Patients taking therapeutic doses of dabigatran:

- Low bleeding risk procedure:
  - Creatinine clearance of greater than or equal to 50ml/min should omit the drug 24 hours prior to procedure.
  - Creatinine clearance less than 50ml/min should omit the drug 48 hours prior to procedure.
- High bleeding risk procedure
  - Creatinine clearance of greater than or equal to 50ml/min should omit the drug 48 hours prior to procedure.
  - Creatinine clearance less than 50ml/min should omit the drug 96 hours prior to procedure.

Dabigatran is contra-indicated in patients with a creatinine clearance of less than 30ml/min and these patients should be discussed with Haematology.

Influence of rivaroxaban, dabigatran, apixaban and edoxaban on routine coagulation testing.
A normal thrombin time effectively excludes the presence of dabigatran but a normal APTT and PT do not exclude significant concentrations of apixaban, rivaroxaban or edoxaban in a sample (Keeling et al 2016). Specific drug level measurements may be considered after discussion with haematology for example for emergency surgery when omission of the drug by the timescales in this guidance is not feasible or acute renal failure when there is concern about drug accumulation.

Restarting anticoagulation and bleeding risk
When to restart anticoagulation after a procedure depends on the bleeding risk associated with the type of procedure and the proximity of surgery. The ultimate dose is dependent on the thrombotic risk of the patient. The risk of bleeding is highest in patients who receive therapeutic doses of anticoagulation in the immediate post-operative period. The ACCP and BCSH guidelines suggest that therapeutic-dose LMWH should not be restarted within 24 hours of minor procedures with a low bleeding risk and not within 48 – 72 hours of surgery with a high bleeding risk.

Very little data are available on surgery with a very high bleeding risk. There continue to be concerns about potential high bleeding rates in patients where therapeutic anticoagulation has been started post-operatively. Studies are underway randomising patients with high risk AF and mechanical heart valves to bridging with low molecular weight heparin versus no bridging and PERIOP-2 study (http://clinicaltrials.gov/ct2/show/NCT00432796)].

Provided surgical haemostasis is secure, low dose prophylactic enoxaparin can usually be restarted 6 – 8 hours after surgery. Patients at high risk of thrombosis should initially be started on low-dose enoxaparin; the dose can subsequently be escalated at 72 hours provided haemostasis is secure and full dose enoxaparin can be given on day 5 and continued until the INR is greater than 2.

Warfarin can be restarted at the patient's usual dose on the day after surgery (day +1) provided haemostasis is secure. Loading or boost doses of warfarin should be avoided as these increase the risk of over-anticoagulation. It will take 1 to 2 weeks for the patient's INR to become therapeutic. Enoxaparin should be continued until the INR is greater than 2.0, irrespective of the target INR. Enoxaparin can be discontinued in standard risk patients with AF provided there is no indication for prolonged thromboprophylaxis (see STH guidelines for prevention of venous thromboembolism for a list of procedures where extended thromboprophylaxis is indicated).

Acenocoumarol should be re-started later after surgery due to its short half-life and more rapid onset of action as by the tables above.

Prophylactic doses of DOACs may be restarted 6-8 hours post-op provided haemostasis is secure. Patients who normally take therapeutic doses of rivaroxaban (15 OD or BD or 20mg OD), dabigatran (110 or 150mg BD), apixaban (5mg BD) or edoxaban (30 or 60mg OD) should restart these drugs based on the bleeding risk of the procedure (refer to summary on page 9). Enoxaparin MUST be discontinued once rivaroxaban/dabigatran/apixaban/edoxaban have been restarted.

4. References

Baglin,T.P., Cousins,D., Keeling,D.M., Perry,D.J., & Watson,H.G. (2007) Safety indicators for inpatient and outpatient oral anticoagulant care: [corrected] Recommendations from the British Committee for Standards in Haematology and National Patient Safety Agency. *Br.J.Haematol.*, **136**, 26-29.

Douketis,J.D., Spyropoulos,A.C., Spencer,A.S., Mayr,M, Jaffer,K.J, Eckman,M.H, Dunn,A.S, & Kunz,R (2012) Perioperative management of antithrombotic therapy: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines (9th edition). *Chest,* **141**, 326S-350S
http://chestjournal.chestpubs.org/content/141/2_suppl/e326S.full.html

Garcia,D.A, Baglin,T.P, Weitz,J.I. & Samama,M.M., (2012) Parenteral anticoagulants: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines (9th Edition). *Chest*, **141**, 24S-43S
http://chestjournal.chestpubs.org/content/141/2_suppl/e24S.full.html

Douketis et al. Perioperative Bridging Anticoagulation in Patients with Atrial Fibrillation. N Engl J Med 2015;373:823-33. http://www.nejm.org/doi/pdf/10.1056/NEJMoa1501035

Douketis et al. Perioperative Management of Patients with Atrial Fribrillation receiving a Direct Oral Anticoagulant. JAMA 2019 179(11):1469-1478. Doi: 10.1001/jamainternmed.2019.2431
https://pubmed.ncbi.nlm.nih.gov/31380891/

Keeling,D., Baglin,T., Taite,C. *et al* (2011) Guidelines on oral anticoagulation with warfarin – fourth edition. British Journal of Haematology doi:10.1111/j.1365-2141.2011.08753.x
http://www.bcshguidelines.com/documents/warfarin_4th_ed.pdf

Kovacs,M.J., Kearon,C., Rodger,M., Anderson,D.R., Turpie,A.G., Bates,S.M., Desjardins,L., Douketis,J., Kahn,S.R., Solymoss,S., & Wells,P.S. (2004) Single-arm study of bridging therapy with low-molecular-weight heparin for patients at risk of arterial embolism who require temporary interruption of warfarin. *Circulation*, **110**, 1658-1663.

National Patient Safety Agency (2007) Actions that can make anticoagulant therapy safer.
http://www.nrls.npsa.nhs.uk/resources/?EntryId45=59814

Pengo,V., Cucchini,U., Denas,G., Erba,N., Guazzaloca,G., La,R.L., De,M., V, Testa,S., Frontoni,R., Prisco,D., Nante,G., & Iliceto,S. (2009) Standardized low-molecular-weight heparin bridging regimen in outpatients on oral anticoagulants undergoing invasive procedure or surgery: an inception cohort management study. *Circulation*, **119**, 2920-2927.

Perry,D., Nokes,T., & Helliwell,P. (2007) Guidelines for the management of patients on oral anticoagulants requiring dental surgery http://www.bcshguidelines.com/documents/WarfarinandentalSurgery_bjh_264_2007.pdf

Schulman, S. & Crowther M. A. (2012) How I treat with anticoagulants in 2012: new and old anticoagulants, and when and how to switch. *Blood,* **119,** 3016-3023.
http://bloodjournal.hematologylibrary.org/content/119/13/3016.full.pdf

Singer,D.E., Albers,G.W., Dalen,J.E., Fang,M.C., Go,A.S., Halperin,J.L., Lip,G.Y., & Manning,W.J. (2008) Antithrombotic therapy in atrial fibrillation: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines (8th Edition). *Chest*, **133**, 546S-592S
http://chestjournal.chestpubs.org/content/133/6_suppl/546S.full?sid=269090ce-e1de-4474-93f0-01f3272563c6

Veitch,A.M., Baglin,T.P., Gershlick,A.H., Harnden,S.M., Tighe,R., & Cairns,S. (2008) Guidelines for the management of anticoagulant and antiplatelet therapy in patients undergoing endoscopic procedures. *Gut*, **57**, 1322-1329.
http://gut.bmj.com/content/57/9/1322.full.pdf

Woods,K., Douketis,J.D., Kathirgamanathan,K., Yi,Q., & Crowther,M.A. (2007) Low-dose oral vitamin K to normalize the international normalized ratio prior to surgery in patients who require temporary interruption of warfarin. *J.Thromb.Thrombolysis.*, **24**, 93-97.

5. Appendices

Appendix 1

Procedures which may be performed on warfarin with an INR of less than 3

Diagnostic angiographic procedures by vascular radiology: guidance given in the vascular handbook should be followed, i.e.

- Check INR in pre-assessment clinic
- If INR less than 3.0, check the INR on the day-ward, proceed with angiography and discharge on usual dose of warfarin
- If the INR is greater than 3.0 and the patient is non-urgent, adjust dose accordingly and proceed when the INR is less than 3.0
- If the INR is greater than 3.0 and the patient is urgent discuss with Radiologist and a Haematologist

Some invasive cardiology procedures may be done whilst the patient is anticoagulated on warfarin: these patients should be discussed with the cardiology team before anticoagulation is altered.

Minor dental, ophthalmic, (cataract surgery) and dermatological surgery: these patients should be discussed with the relevant team before anticoagulation is altered.

Diagnostic GI endoscopies, biliary or pancreatic stenting and diagnostic endoscopic ultrasound: these patients should be discussed with the relevant team before anticoagulation is altered.

Procedures which may be performed on therapeutic doses of DOACs

Procedures with low bleeding risk for which clear guidelines exist to be done whilst on warfarin may also be possible to do on therapeutic doses of apixaban, dabigatran, edoxaban or rivaroxaban. Although this is recommended internationally (Spyropoulos 2012), evidence of safety is lacking. These procedures include:

Dental procedures including minor oral surgery or up to 3 dental extractions, Prosthodontics, conservation, endodontics, hygiene phase therapy and orthodontics.

Minor ophthalmic, (cataract surgery) and dermatological surgery.

Diagnostic GI endoscopies.

In patients taking DOACs, we suggest omitting the dose taken in the morning of the procedure and restarting/ continuing after the procedure, provided there are no concerns about bleeding.

Appendix 2

ASSESSMENT OF THROMBOTIC RISK

All patients with antithrombin deficiency should be discussed with a Haematologist before bridging is commenced, as some may require antithrombin replacement.

Reason for anticoagulation	STANDARD RISK	HIGH RISK
Prosthetic heart valve	Bileaflet mechanical aortic valve with no other risk factors for stroke *and* more than 3 months after implantation	Any mechanical mitral valve Any mechanical aortic valve within 3 months of implantation Caged ball or tilting disc aortic valve Bileaflet mechanical aortic valve *and* one or more of the following stroke risk factors: chronic atrial fibrillation (AF) left ventricular dysfunction age over 75 years hypertension diabetes prior stroke or TIA
	Bioprosthetic valves with no other risk factors for stroke – anticoagulation not required. Give thromboprophylaxis if indicated.	
Chronic atrial fibrillation (AF)	AF without prior stroke/TIA or rheumatic valvular heart disease	AF with previous stroke/TIA within the last 3 months AF with rheumatic valvular heart disease AF with previous stroke/TIA & 3 or more of following risk factors: age >75 congestive cardiac failure hypertension (>140/90mmHg or on medication) diabetes mellitus
VTE or antiphospholipid syndrome	Previous VTE and now on long term anticoagulant therapy (target INR 2.5) *(If previous VTE but no longer on oral anticoagulation, manage according to the STH Guidelines for the Prevention of Venous Thromboembolic Disease)*	Recent episode of VTE (within 3 months) – discuss with senior clinician & anaesthetist: consider postponing surgery or placing an IVC filter Antiphospholipid syndrome with a history of venous or arterial thrombosis Recurrence of VTE on oral anticoagulation (target INR 3.5) *Patients with anti-thrombin deficiency should be discussed with haematology.*
Pulmonary hypertension *(where procedure not for investigation or management of PH*	**PH patients with chronic thromboembolic pulmonary hypertension or IVC filter in situ:** discuss with PH consultants regarding risk stratification, then manage according to this guideline. **PH patients with other risk factors**: risk stratify according to the risk factors as above **PH patients who are on warfarin for survival benefit only:** anticoagulation bridging is not required.	

Appendix 3
CANCELLATION OF SURGERY

Patients on warfarin
Cancellation of surgery will lead to an increased period of bridging (even if warfarin is restarted). There is the potential for patients to receive inadequate anticoagulation or no anticoagulation during this time. This would put them at increased risk of thromboembolic events.

- Cancellation should be avoided if at all possible.
- If cancellation is unavoidable, postpone the surgery or procedure for a **maximum** of 1 week.
- The person cancelling the surgery or procedure must inform the relevant pre-assessment clinic immediately:
- On weekdays contact pre-assessment clinic immediately
- If a patient is cancelled at the weekend, ensure pre-assessment clinic is informed by 9.00am on Monday morning. Provide high risk patients with enoxaparin (see doses below) and ask them to attend pre-assessment clinic at 8.00 am on Monday morning.
- Teach patients or carers to inject enoxaparin wherever possible, to avoid unnecessary community nurse workload.
- If surgery is to be postponed for more than 1 week, take an anti-Xa after 3-5 days of enoxaparin and contact a Haematologist with the result for advice: a decision on an individual basis should be made.

Enoxaparin dosing for HIGH-RISK PATIENTS & STANDARD RISK AF PATIENTS who have been cancelled and rescheduled within 1 week with calculated Creatinine Clearance 30ml/min or greater						
Weight less than 48kg	**Weight 48-73kg**	**Weight 74-88 kg**	**Weight 89-109 kg**	**Weight 110-130 kg**	**Weight 131-159 kg**	**Weight 160-199kg***
40mg BD	60mg BD	80mg BD	100mg BD	120mg BD	150mg BD	180mg BD
The last dose should be given in the morning on the day prior to procedure/surgery						

Enoxaparin dosing for HIGH-RISK PATIENTS & STANDARD RISK AF PATIENTS who have been cancelled and rescheduled within 1 week with calculated Creatinine Clearance 15-29/min						
Weight less than 48kg	**Weight 48-73kg**	**Weight 74-88 kg**	**Weight 89-109 kg**	**Weight 110-130 kg**	**Weight 131-159 kg**	**Weight 160-199kg***
20mg BD	40mg am 20mg pm	40mg BD	60mg am 40mg pm	60mg BD	80mg BD	100mg am 80mg pm
The last dose should be given in the morning on the day prior to procedure/surgery						

For doses in high-risk patients and standard-risk AF patients who have been cancelled whose CrCl is less than 15ml/min, discuss with a haematologist.

Enoxaparin dosing for STANDARD RISK PATIENTS with previous venous thrombosis with eGFR 30ml/min/1.73m^2 or greater **who have been cancelled and rescheduled within 1 week**			
Weight less than 45kg	Weight 45 – 100kg	Weight 101 – 150kg	Weight greater than 150kg
Enoxaparin 20mg **once daily** in the evening	Enoxaparin 40mg **once daily** in the evening	Enoxaparin 40mg **twice daily**	Enoxaparin 60mg **twice daily**
The last dose should be given in the evening on the day prior to procedure/surgery			

Enoxaparin dosing for STANDARD RISK PATIENTS with previous venous thrombosis with eGFR 15-29ml/min/1.73m^2 or greater **who have been cancelled and rescheduled within 1 week**			
Weight less than 45kg	**Weight 45 – 100kg**	**Weight 101 – 150kg**	**Weight greater than 150kg**
Enoxaparin 20mg **once daily** in the evening	Enoxaparin 20mg **once daily** in the evening	Enoxaparin 40mg **once daily** in the evening	Enoxaparin 60mg **once daily** in the evening
The last dose should be given in the evening on the day prior to procedure/surgery			

For doses in standard-risk patients who have been cancelled whose eGFR is less than 15mls/min/1.73m2 anti-Xa monitoring may be required, discuss with a haematologist.

Patients on rivaroxaban, dabigatran, edoxaban or apixaban
If surgery is cancelled for patients on rivaroxaban, dabigatran, edoxaban or apixaban and either drug has been stopped, it should be re-started as soon as possible. Enoxaparin is not necessary given the short onset of action of these drugs.

Appendix 4
NOTES FOR PRE-OPERATIVE ASSESSMENT CLINICS / WAITING LIST STAFF / SECRETARIES

Patients on anticoagulants should be assessed for thrombotic risk using the Peri-procedural bridging anticoagulation prescription chart. This chart should then be placed in the patient's notes with the pre-assessment prescription chart.

Pre-assessment clinic staff will ensure the last three INR results are included in the pre-operative document, along with the current dose of warfarin.

Pre-assessment clinic staff will identify on the feedback sheet that is returned to each secretary/waiting list co-ordinator which patients need to have U&E and INR checks and when.

When patients are dated for surgery the waiting list coordinator / secretary will book patients for INR checks in either pre-assessment clinic, or the designated area at the weekends and the notes will be sent to the relevant area.

Arrangements **must** be made to ensure that the patient knows when to take their last dose of anticoagulant and when they are to re-start it post-procedure.

Patients will have an appointment made to attend the pre-assessment clinic and will be entered as a ward attender when they return to the main hospital for checks.

Where INR checks will take place:
NGH: Monday to Friday patients to attend central pre-assessment clinic; Weekends: patients to attend Surgical Assessment Centre
RHH: Every day: patients to attend appropriate ward according to specialty

Appointment Times:
Standard risk patients will attend the day prior to surgery at 10.00am (to give Vitamin K the necessary time to take effect if it is necessary). Any necessary treatment will be given at this time.

High risk patients will attend 48 hours pre-surgery date at 07.30 for bloods and treatment as identified on the prescription chart and again at 19.30 for the 2nd dose of enoxaparin (if patient is not self-administering it). Pre-assessment clinic staff will make individual patient arrangements for the 19.30 injection. If patient or carer is administering the enoxaparin they must be trained and provided with a sharps bin.

High risk patients may need to return for a further INR check on the day prior to surgery at 08.00 (depending on the previous day's INR) and again any necessary treatment will be given.

Prescriptions
The Peri-procedural anticoagulation bridging prescription chart sets out what treatment is required. It should be used to prescribe vitamin K (if required) and enoxaparin.
The STH Warfarin Prescription and Monitoring Chart should be used to prescribe the patient's warfarin.

Prescriptions for enoxaparin
All prescriptions will be completed on receipt of U&E (within last 6 weeks) and INR result.
Between Monday and Friday all prescriptions will be completed by the anaesthetists in pre-assessment clinic. On the weekend prescriptions to be completed by FY1 doctors.

Pre-assessment clinic and ward areas to keep stock of prophylactic doses of enoxaparin and vitamin K 1mg (phytomenadione 2mg/0.2mL).
Enoxaparin for high-risk patients will need to be ordered from pharmacy on an individual basis.

If there are any questions/queries when patient attends for INR check these should be discussed with the attendant anaesthetist first. If needed, advice can be sought from a Haematologist.

Admission Plan
All patients can be admitted on the day of surgery, unless they have other co-morbidities that require them to be admitted earlier.

All patients will need to have their INR checked on day of surgery and bridging therapy continued as per the treatment plan throughout admission.

Notes for waiting list staff/secretaries.
NGH:
Patients attending pre-assessment for INR checks: please ring 66235 for appointment to be made and a letter to be sent to patient. Medical notes will then be sent to pre-assessment clinic for these appointments. On completion of treatment the notes will be returned to admissions so they can be distributed to the TAU for admission.

To book patients into the ward areas; please ring the wards direct and book into their diary. Secretaries/ waiting list co-ordinators need to send out a letter for these patients and the notes should then be taken to the ward area. Notes will need to be taken to designated ward by 3pm on the Friday before the weekend. On Monday morning notes will need to be taken to TAU by the relevant wards for admission at 7am.

RHH:
To book patients into the ward areas; please ring the wards direct and book into their diary. Secretaries/waiting list co-ordinators need to send out a letter for these patients and the notes should then be taken to the ward area. Notes will need to be taken to designated ward by 3pm on the day before the patient attends.

Notes will need to be taken to the admitting ward before 7am on the day of admission

Cancellations:
It is the responsibility of the person cancelling the patient to inform pre-assessment clinic staff as patients will need advice regarding their bridging therapy.
Please remember patients will have stopped their warfarin 5 days prior to their day of surgery.

Avoid cancellation if at all possible: patients are to be given some priority by general managers/bed managers when considering which patients to cancel due to lack of beds. This will be managed by the individual specialities. See Appendix 3 for further advice regarding cancellation.

Other issues
Out-of-Sheffield patients and patients needing transport will be assessed for suitability of being admitted for bridging therapy or attending on an outpatient basis. This should be discussed at their pre-assessment appointment and an agreed plan documented on the pre-assessment document.

Appendix 5 Peri-operative management of patients with eGFR 15-29mls/min/1.73m^2 (standard risk) or CrCl 15-29ml/min (high risk)

Patients at standard risk of thrombosis
Weight-based thromboprophylactic dosing of enoxaparin for patients with eGFR 15-29mls/min/1.73m^2

Weight	Less than 45kg	45-99kg	100-149kg	150kg & above
Enoxaparin dose	20mg OD	20mg OD	40mg OD	60mg OD

Patients at high risk of thrombosis and CrCl 15-29ml/min:
For procedures with a low risk of bleeding:

Pre-operative enoxaparin dosing							
Day	**Less than 47kg**	**48-73kg**	**74-88kg**	**89-109kg**	**110-130kg**	**131-159kg**	**160-199kg***
-5	Last dose of warfarin today (4 clear days) – ensure patient has clear instructions on peri-operative bridging plan						
-2	**Check INR:** if greater than 1.5 give 1mg oral vitamin K and recheck on day -1. Start twice daily enoxaparin if INR less than 2.0.						
	20mg BD	40mg OM 20mg pm	40mg BD	60mg OM 40mg pm	60mg BD	80mg BD	100mg OM 80mg pm
-1	20mg OM	40mg OM	40mg OM	60mg OM	60mg OM	80mg OM	100mg OM
Post-operative enoxaparin dosing							
Day							
0 (6-8 hours post-op)	20mg OD	20mg OD	20mg OD	40mg OD	40mg OD	40mg OD	60mg OD
+1	20mg OD	20mg OD	20mg OD	40mg OD	40mg OD	40mg OD	60mg OD
	Re-start warfarin at the patient's usual dose						
+2	20mg OD	20mg OD	20mg OD	40mg OD	40mg OD	40mg OD	60mg OD
+3	The following doses may be started 24 hours post-procedure if haemostasis is secure. Monitor anti-Xa levels after 3-5 doses						
	20mg BD	40mg OM 20mg pm	40mg BD	60mg OM 40mg pm	60mg BD	80mg BD	100mg OM 80mg pm

*Patients who weigh 200kg or more should be discussed with haematology

Appendix 5 cont. Peri-operative management of patients with eGFR 15-29mls/min/1.73m^2 (standard risk) or CrCl 15-29ml/min (high risk)
Patients at high risk of thrombosis and CrCl 15-29ml/min:
For procedures with a high risk of bleeding:

Pre-operative enoxaparin dosing							
Day	**Less than 47kg**	**48-73kg**	**74-88kg**	**89-109kg**	**110-130kg**	**131-159kg**	**160-199kg***
-5	Last dose of warfarin today – ensure patient has clear instructions on peri-operative bridging plan						
-4/ -3	No warfarin						
-2	**Check INR:** if greater than 1.5 give 1mg oral vitamin K and recheck on day -1. Start twice daily enoxaparin if INR less than 2.0.						
	20mg BD	40mg OM 20mg pm	40mg BD	60mg OM 40mg pm	60mg BD	80mg BD	100mg OM 80mg pm
-1	20mg OM	40mg OM	40mg OM	60mg OM	60mg OM	80mg OM	100mg OM
Post-operative enoxaparin dosing							
Day							
0 (6-8 hours post-op)	20mg OD	20mg OD	20mg OD	40mg OD	40mg OD	40mg OD	60mg OD
+1	20mg OD	20mg OD	20mg OD	40mg OD	40mg OD	40mg OD	60mg OD
	Re-start warfarin at the patient's usual dose						
+2	20mg OD	20mg OD	20mg OD	40mg OD	40mg OD	40mg OD	60mg OD
+3	20mg OD	20mg BD	20mg BD	40mg BD	40mg BD	40mg BD	60mg BD
+4	20mg OD	20mg BD	20mg am 40mg pm	40mg BD	40mg am 60mg pm	60mg BD	60mg am 80mg pm
+5	20mg BD	40mg OM 20mg pm	40mg BD	60mg OM 40mg pm	60mg BD	80mg BD	100mg OM 80mg pm

- *Patients who weigh 200kg or more should be discussed with haematology
- **Pre-operatively:** no anti-Xa monitoring is required provided the patient is not taking for longer than 3 days. Cancellations should be avoided in this patient cohort
- **Post-operatively:** peak anti-Xa monitoring is required from day +5 onwards once the patient has received 3 – 5 doses. Samples should be taken 3-4 hours post dose and levels discussed with haematology.

Appendix 6: Peri-operative management of all patients with CrCl less than 15ml/min or on dialysis
For procedures with a low risk of bleeding:

Pre-operative plan							
Day							
-5	Last dose of warfarin today (4 clear days) – ensure patient has clear instructions on peri-operative bridging plan						
-4/ -3	No warfarin						
-2	**Check INR:** if greater than 1.5 give 1mg oral vitamin K and recheck on day -1. Admit patient and start unfractionated heparin if INR is less than 2.0.						
-1	**Re-Check INR** only if INR greater than 1.5 on day -2 and give further 1mg oral vitamin K if INR > 1.5. If INR less than 2.0 start unfractionated heparin.						
0	**Stop unfractionated heparin 6 hours before the procedure**						
Post-operative enoxaparin dosing according to weight							
Day/ weight	**Less than 47kg**	**48-73kg**	**74-88kg**	**89-109kg**	**110-130kg**	**131-159kg**	**160-199kg***
0 (6-8 hours post-op)	20mg OD	20mg OD	20mg OD	20mg OD	40mg OD	40mg OD	40mg OD
+1	**Commence unfractionated heparin until INR ≥ 2.0**						
	Re-start warfarin at the patient's usual dose						

*Patients who weigh 200kg or more should be discussed with haematology

Appendix 6 cont.: Peri-operative management of high-risk patients with CrCl less than 15ml/min or on dialysis

For procedures with a high risk of bleeding:

	Pre-operative treatment plan						
Day							
-5	Last dose of warfarin today (4 clear days) – ensure patient has clear instructions on peri-operative bridging plan						
-4/ -3	No warfarin						
-2	**Check INR:** if greater than 1.5 give 1mg oral vitamin K and recheck on day -1. Admit patient and start unfractionated heparin if INR is less than 2.0.						
-1	**Re-Check INR** only if INR greater than 1.5 on day -2 and give further 1mg oral vitamin K if INR > 1.5. If INR less than 2.0 start unfractionated heparin.						
0	**Stop unfractionated heparin 6 hours before the procedure**						
	Post-operative enoxaparin dosing according to weight						
Day/ weight	**Less than 47kg**	**48-73kg**	**74-88kg**	**89-109kg**	**110-130kg**	**131-159kg**	**160-199kg***
0 (6-8 hours post-op)	20mg OD	20mg OD	20mg OD	20mg OD	40mg OD	40mg OD	40mg OD
+1	20mg OD	20mg OD	20mg OD	20mg OD	40mg OD	40mg OD	40mg OD
	Re-start warfarin at the patient's usual dose						
+2	20mg OD	20mg OD	20mg OD	20mg OD	40mg OD	40mg OD	40mg OD
+3	**Commence unfractionated heparin until INR ≥ 2.0**						

*Patients who weigh 200kg or more should be discussed with haematology

Appendix 7
Periprocedural bridging anticoagulation prescription chart

Appendix 8
Quick guide to discharging warfarin patients on peri-procedural anticoagulation (bridging)

6. Document control

Version	8
Status	Current
Document Sponsor	Dr Rhona Maclean
Controlled Document Lead / Author*	Dr Joost van Veen (Consultant Haematologist) Becs Walsh (Lead Pharmacist; Anticoagulation & Thrombosis Prevention)
Approval body	Thrombosis Group
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Review date	September 2029

7. Version history

Version	Date issued	Brief summary of changes	Author
8	June 2026	Update to DOAC peri-operative bridging following new evidence Major review following STH switch from dalteparin to enoxaparin	Joost van Veen Becs Walsh
7.5	July 2023	Update to DOAC peri-operative bridging (adopted from DOAC bridging summary)	Giorgia Saccullo Abdul Basat
7.4	July 2019	Amendment regarding peri-operative guidance for cardiac surgery	Joost van Veen Jannat Muen
7.3	May 2019	Amendment to appendix 5: guidance for renal bridging	Joost van Veen Jannat Muen
7.2	September 2018	Addition of guidance regarding peri-operative management of patients taking treatment dose LMWH	Joost van Veen Jannat Muen
7.1	January 2017	Amendments to include new guidance regarding peri-operative management of patients taking DOACs	Joost van Veen Jannat Muen
6.1	December 2015	Amendment to include neurosurgical patients. Amendment to guideline to include management of patients on edoxaban	Joost van Veen Jannat Muen
5.1	November 2014	Amendments to appendix 3 regarding cancellation of surgery and amendment to guidance to include near patient testing.	Joost van Veen Jannat Muen

4.1	July 2014	Amendments to guideline to include management of patients on apixaban and long term dalteparin. Amendments to guidance for bridging patients with renal impairment	Joost van Veen Jannat Muen
3.1	April 2013	Amendments to guideline for pulmonary hypertension and urology procedures. Amendment to advice following cardiac surgery. Amendments to include management of patients on rivaroxaban and dabigatran.	Joost van Veen Jannat Muen
2.1	January 2012	Major review following STH switch of LMWH from enoxaparin to dalteparin. Title amended. Introduction of prescription chart.	Joost van Veen Rebecca Ellis
1.1	August 2009	New guideline "Bridging anticoagulation: The Peri-Operative Management of patients on Oral Anticoagulant Therapy (excluding neurosurgery)"	Joost Van Veen

8. Consultation and review

Groups / persons consulted	Date
Drs Maclean, Sims & Mapplebeck – Consultants in Haemostasis & Thrombosis	Date
Anticoagulation Pharmacists	May 2026
VTE & Anticoagulation Nurse Specialists	May 2026

9. Document imprint

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