

Cardiovascular system

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For full information on treatment side effects, cautions and contraindications, see electronic [British National Formulary](#) or the relevant summary of product characteristics (www.medicines.org.uk).

For information on preparing intravenous medicines for administration, see Medusa Injectable Medicines Guide for the NHS (see Clinical Guidance home page)

1. Hypertension

For further information on how to treat primary uncomplicated hypertension, refer to [Hypertension: Treatment algorithm](#)

This guidance does not cover management of hypertension for Type 2 diabetes (see [NICE guideline NG28](#)) or chronic kidney disease (CKD) (see [NICE guideline CG182](#)).

Offer anti-hypertensive drug treatment to women of childbearing potential, in line with the recommendations in [NICE guidance CG107, Hypertension in pregnancy](#)

Target clinic blood pressure for those on treatment:

Non diabetic patients

Patients < 80 years aim for below 140/90 mmHg

Patients > 80 years aim for below 150/90 mmHg

Renal patients

See [NICE guideline CG182](#)

Diabetic patients

Aim for BP below 140/80 mmHg.

If the patient has kidney, eye or cerebrovascular disease, aim for 130/80mmHg.

NOTE: ambulatory blood pressure targets differ

Step 1.

For patients under 55 years old (except Afro-Caribbean patients):

First choice

ACE inhibitor (ACEI) (ramipril or lisinopril — for dosing see overleaf)

For patients who cannot tolerate an ACEI (eg, because of a cough) *replace* with **Angiotensin receptor blocker (ARB)** (losartan is most cost effective – for dosing see overleaf)

NOTE: Do not combine an ACEI with an ARB to treat hypertension

For patients diagnosed with left ventricular systolic dysfunction (ejection fraction <40%), refer to [heart failure guidelines](#) as **candesartan** is the first choice ARB.) Recheck urea and electrolytes 7–10 days after starting an ACEI or ARB and on each dose increase.

For younger patients in whom ACEIs and ARBs are contraindicated or not tolerated, or for women of child-bearing potential, consider

Bisoprolol 1.25mg, orally, once daily. Increase to 10mg daily if required

For patients over 55 years old (or Afro-Caribbean patients of any age):

First choice

Calcium-channel blocker (CCB) (amlodipine or felodipine MR — for dosing see overleaf)

If a CCB is not tolerated, or if the person has oedema, evidence of heart failure or a high risk of heart failure, consider **thiazide-like diuretic (indapamide** — for dosing see below)

Recommended doses:

ACEIs

- **Ramipril** 1.25mg or 2.5mg, orally, once daily. Titrate upwards according to response at intervals of 1 to 2 weeks. Maximum dose: 10mg daily.
- **Lisinopril** 2.5mg, orally, each morning. Increase to maintenance dose of 10mg to 20mg daily. Usual maximum dose: 40mg daily.

ARBs

- **Losartan** 50mg, orally, once daily. For elderly patients, start at 25mg daily. Increase to 100mg daily if necessary

CCBs

- **Amlodipine** 5mg, orally, once daily. Maximum dose: 10mg daily
- **Felodipine MR** 2.5mg or 5mg, orally, once daily. Maximum dose: 10mg daily.

Thiazide-like diuretics

- **Indapamide standard release** 2.5mg, orally, once daily.

NOTE: For patients taking bendroflumethiazide or hydrochlorothiazide whose BP remains stable and well controlled, continue treatment.

Step 2

For patients not of Afro-Caribbean origin

ACEI (dose as above)

And

CCB (dose as above)

NOTE: If a beta-blocker was used in step 1, add a CCB rather than a thiazide-like diuretic, to reduce the person's risk of developing diabetes.

If a CCB is not suitable (eg, because of oedema, intolerance, or if there is evidence or risk of heart failure), offer a **thiazide-like diuretic** instead (dose as above)

For patients of Afro-Caribbean origin

ARB - losartan (dose as above)

And

CCB (dose as above)

Step 3

ACEI (dose as above)

And

CCB (dose as above)

And

Thiazide-like diuretic (dose as above)

Step 4 (resistant hypertension)

NOTE: Resistant hypertension is where BP remains >140/90 mmHg after optimal or best tolerated step 3 treatment.

If serum potassium is ≤ 4.5 mmol/L

Spironolactone 25mg, orally, once daily (unlicensed indication)

NOTE: Monitor urea & electrolytes closely

If further diuretic therapy is not tolerated, is contraindicated or is ineffective, consider

Atenolol 25mg, orally, once daily. Increase to 50mg daily if required

For patients with LVSD (EF<40%), use a beta blocker that is licensed for heart failure — eg, **bisoprolol**

Or

Doxazosin 1mg, orally, once daily. Increase after 2 weeks to 2mg daily. Maximum dose: 16mg daily.

2. Hypertensive crises

— **ONLY on advice of consultant cardiologist**

True hypertensive emergencies are rare. Rapid reduction of blood pressure is rarely necessary. In the event of a hypertensive emergency, one of the following might be appropriate:

First choice

Glyceryl trinitrate (IV) Administer a 50mg/50mL IV infusion using a Graseby pump. Start at 0.6mL/hour. Titrate upwards in increments of 0.6mL/hour, every 30 minutes, according to blood pressure and chest pain, until the desired systolic arterial pressure is attained.

Max: 6mL/hour.

NOTE: Patients should have their blood pressure monitored after each dose adjustment and hourly thereafter.

GTN infusions should be prescribed on the GTN prescription chart

Or

Labetolol 40 to 120mg/hour as an IV infusion. Prepare a 500mg/500mL infusion bag using glucose 5%. Continue until desired response attained. Alternatively, give 50mg as an IV bolus over at least 1 minute. Dose can be repeated after 5 minutes. Maximum total dose: 200mg.

Second choice

Sodium nitroprusside Initially 0.5 to 1.5 micrograms/kg/minute, by IV infusion. Increase in steps of 0.5 micrograms/kg/minute every 5 minutes until desired response achieved.

Usual range: 0.5 to 8 micrograms/kg/minute. Maximum recommended infusion rate: 8 micrograms/kg/minute. If no response after 10 minutes at the maximum infusion rate, discontinue infusion. See infusion rate table below.

NOTE: Protect the infusion bag and tubing from light. Discontinue after 3 days to avoid cyanide or thiocyanate poisoning but do not discontinue abruptly (do so over

15–30 minutes).

NOTE: This drug is unlicensed

Reconstitute sodium nitroprusside 50mg with 2 to 3mL glucose 5% then dilute with 250mL glucose 5%. Protect from light.

Infusion rates (mL/hour) for sodium nitroprusside 50mg/250mL (0.2mg/ml) solution

Dose micrograms/kg/minute	Body weight (kg)						
	40	50	60	70	80	90	100
0.5	6	8	9	11	12	14	15
1	12	15	18	21	24	27	30
2	24	30	36	42	48	54	60
4	48	60	72	84	96	108	120
6	72	90	108	126	144	162	180
8	96	120	144	168	192	216	240

3. Heart failure — acute

There are several components to treatment:

- i) Intravenous therapy
- ii) Pain relief
- iii) Cardiogenic shock treatment

i) Intravenous therapy

To reduce fluid overload

Furosemide 20 to 80mg, by IV bolus, at a rate not exceeding 4mg/minute. Doses over 50mg should be given as an IV infusion (avoid diluting if possible).

If response is insufficient, add

Glyceryl trinitrate Administer a 50mg/50mL IV infusion using a Graseby pump. Start at 0.6mL/hour. Titrate upwards in increments of 0.6mL/hour according to blood pressure and chest pain. The rate can be increased after 30 minutes until a satisfactory response is achieved. Max: 6mL/hour.

NOTE: Patients should have their blood pressure monitored after each dose adjustment and hourly thereafter.

GTN infusions should be prescribed on the GTN prescription chart

ii) Pain relief

Morphine 2.5mg by slow IV injection, up titrate to 5mg by slow IV injection if necessary (max: 10mg).

NOTE: Only for patients who are in pain or distress

iii) Cardiogenic shock treatment

Dobutamine 2.5 to 10 micrograms/kg/minute by IV infusion. Occasionally, doses as low

as 0.5 micrograms/kg/minute will elicit a response. Rarely, doses up to 40 micrograms/kg/minute may be required. Adjust dosage according to response. See infusion rate table below.

NOTE: Decrease dosage gradually rather than discontinue therapy abruptly. Use with caution as dobutamine increases oxygen demand.

Prepare the infusion bag using 500mg dobutamine in 500mL of sodium chloride 0.9% or glucose 5%.

Infusion rates (mL/hour) for dobutamine 500mg/500mL (1mg/mL) solution:

Dose micrograms/kg/minute	Body weight (kg)						
	40	50	60	70	80	90	100
1	2	3	4	4	5	5	6
2.5	6	8	9	11	12	14	15
5	12	15	18	21	24	27	30
7.5	18	23	27	32	36	41	45
10	24	30	36	42	48	54	60

Fluid restricted patients requiring dobutamine should be managed on a critical care unit. A higher strength of dobutamine (1000mg in 250mL of glucose 5% — ie, 4mg/mL) is available to critical care areas from pharmacy on request.

4. Heart failure (chronic management)

There are several components to treatment:

- i) Fluid overload management
- ii) ACE inhibitors/angiotensin-II receptor blockers
- iii) Beta blockers
- iv) Aldosterone antagonists

i) Management of fluid overload

Furosemide Initially 40mg, orally, once daily. Dose can be increased as necessary according to symptoms.

Or

Bumetanide Initially 1mg, orally, once daily. Dose can be increased as necessary according to symptoms.

For resistant oedema, a thiazide diuretic can be added

Bendroflumethiazide 2.5mg, orally, daily or on alternate days. Increase to 5mg if indicated.

NOTE: Urea and electrolytes should be monitored closely for patients taking bendroflumethiazide with loop diuretics.

If oedema persists, add

Metolazone (unlicensed medicine) 2.5-5mg, orally, daily or on alternate days.

NOTE: This should only be started by a cardiology or renal consultant

NOTE: Urea and electrolytes should be monitored closely for patients taking

metolazone

NOTE: Refer to [shared care guideline](#) for monitoring and prescribing requirements

ii) ACE inhibitors/angiotensin-II receptor blockers

ACE inhibitors **MUST** be considered for all patients with left ventricular systolic dysfunction — ie, ejection fraction $\leq 40\%$.

Ramipril 1.25 to 2.5mg, orally, once daily to start. Intermediate dose: 2.5 to 5mg daily. Target dose: 10mg daily.

Or

Lisinopril 2.5mg, orally, once daily to start. Intermediate dose: 5mg daily. Target dose: 20mg daily.

For patients with an intolerable cough with ACE inhibitors

Candesartan 2mg, orally, once daily. Intermediate dose 8mg daily. Target dose: 32mg daily.

iii) Beta blockers

All heart failure patients with a left ventricular ejection fraction less than 40% (except those who are contraindicated) should start treatment with:

Bisoprolol 1.25mg, orally, once daily for 1 week. Then 2.5mg daily for one week, then 3.75mg daily for one week, then 5mg daily for 4 weeks, then 7.5mg daily for 4 weeks. The dose can be increased faster for hospital inpatients. Maintenance dose: 10mg daily.

Or

Carvedilol 3.125mg, orally, twice daily for at least 2 weeks (in practice 4 to 6 weeks allows for stabilisation if heart failure worsens). Then 6.25mg twice daily for at least two weeks, then 12.5mg twice daily for at least two weeks. Maintenance dose (<85kg): 25mg twice daily; maintenance dose (>85kg): 50mg twice daily.

iv) Aldosterone antagonists

Aldosterone antagonists should be considered for all patients with reduced ejection fraction (less than 40%) who are NYHA III to IV on optimal ACE inhibitor and beta-blocker.

First choice

Spironolactone 12.5 to 25mg, orally, once daily. Maximum dose 50mg, orally, once daily.

If a patient experiences painful gynaecomastia secondary to spironolactone, switch to **eplerenone** 25mg, orally, once daily. Maximum dose 50mg, orally, once daily

NOTE: Contraindications to aldosterone antagonists include a baseline creatinine >250mmol/L or serum potassium >5.5mmol/L (at baseline or during treatment).

If the patient is 3-14 days post MI with a left ventricular ejection fraction less than or equal to 40% use **epplerenone** 25mg, orally, once daily. Maximum dose 50mg orally once daily.

Due to the risk of severe hyperkalaemia with concomitant use of spironolactone or eplerenone and ACEI or ARB, U&Es should be checked:

- Fortnightly for first month after the combination is prescribed
- Monthly for six months
- At the GPs discretion thereafter

(See [MHRA Drug Safety Update- Spironolactone and renin-angiotensin system drugs in heart failure: risk of potentially fatal hyperkalaemia](#))

Other treatment options

Angiotensin-II receptor blocker (eg, candesartan) *and* an **ACE inhibitor** can be used together (**ONLY under specialist supervision**)

NOTE: Triple therapy with an ACEI, ARBs and aldosterone antagonist should NOT be used in combination.

For patients with refractory symptoms despite optimal therapy with an ACE inhibitor or ARB, beta blocker and aldosterone antagonist, consider:

Digoxin 62.5 to 125 micrograms, orally, once daily

NOTE: Digoxin has a limited role for patients with heart failure who are in sinus rhythm. Marginal symptomatic benefits need to be weighed against the risks associated with digoxin toxicity. There is greater risk of toxicity in patients with renal impairment and elderly women.

If failed on, or contraindicated for, all other formulary treatments;

Ivabradine 5mg, orally, twice a day. Review dose after two weeks. Maintenance dose: 2.5 to 7.5mg twice a day.

NOTE: Patients taking ivabradine should be monitored for bradycardia. Treatment should ONLY be started if patient is in sinus rhythm and resting heart rate is above 70 beats per minute and should be stopped if heart rate is persistently falls below 50 bpm. (See [warning from MHRA](#))

NOTE: To be initiated by a consultant cardiologist ONLY, as per NICE technology appraisal 267 (www.nice.org.uk/ta267)

Or

Sacubitril valsartan 49mg/51mg, orally, twice a day for two to four weeks. Increase to 97mg/103mg, twice daily if tolerated. Consider a starting dose of 24mg/26mg twice daily if SBP \geq 100 to 110mmHg.

NOTE: To be initiated by a consultant cardiologist ONLY, as per NICE technology appraisal 388 (www.nice.org.uk/guidance/ta388)

5. Acute chest pain, angina and acute coronary syndromes (including STEMI and NSTEMI)

See the [Chest pain care pathway \(adults\)](#) for guidance on the acute treatment of cardiac chest pain (Secondary Care document only).

For all patients with cardiac-sounding chest pain:

- i) Glyceryl trinitrate
- ii) IV nitrates
- iii) Opiates
- iv) Antiemetics

i) Glyceryl trinitrate

Glyceryl trinitrate 500microgram (tablets) or 400microgram (spray), sublingually, when required. Can repeat dose after 5 minutes

NOTE: If a patient's systolic blood pressure is less than 100mmHg, do not administer nitrates (sublingual or intravenous) without medical review.

ii) IV nitrates — consider for patients with ongoing chest pain

Glyceryl trinitrate Administer a 50mg/50mL IV infusion using a Graseby pump. Start at 0.6mL/hour (10micrograms per minute). Titrate upwards in increments of 0.6mL/hour according to blood pressure, headache and chest pain. Max: 6mL/hour.

GTN infusions should be prescribed on the GTN prescription chart

iii) Opiates

Morphine 5mg by slow IV injection, followed by 2.5–5mg by slow IV injection if necessary (max: 20mg)

iv) Antiemetics

Metoclopramide 10mg, orally, stat and then three times a day when required.

Diagnoses may fall into the following categories

- i) ST-segment elevation myocardial infarction (STEMI)
- ii) NSTEMI or unstable angina
- iii) Stable angina

i) ST-segment elevation myocardial infarction (STEMI)

First choice — primary percutaneous coronary intervention (PPCI) currently available at Liverpool Heart and Chest Hospital. Prescribe the following before transfer to LHCH:

Aspirin 600mg, orally, stat

And

Ticagrelor 180mg, orally, stat

NOTE: Ticagrelor should NOT be prescribed pre- or post-thrombolysis

If ticagrelor is contraindicated, replace with

Clopidogrel 600mg, orally, stat

Second choice — thrombolysis (for patients who are not suitable for PPCI)

Heparin sodium 5,000 units, by IV bolus, stat (if patient weighs less than 65kg give 4,000 units)

And

Tenecteplase Administer by IV bolus stat (give dose according to patient's weight — see [Chest pain care pathway \(adults\)](#)) (Secondary Care document only).

And

Aspirin 300mg, orally, stat and then 75mg daily (lifelong)

And

Clopidogrel 300mg, orally, stat and then 75mg daily for at least 4 weeks

And — one of the following according to the patient's renal function

- If creatinine clearance is **MORE** than 20mL/min **BUT** full anticoagulation **IS NOT** required
Fondaparinux 2.5mg, by SC injection, stat and then daily for at least 48 hours and until the patient is discharged from hospital (maximum duration: 8 days)
- If creatinine clearance is **MORE** than 30mL/min **AND** full anticoagulation **IS** required
Enoxaparin* 1mg/kg, by SC injection, stat and then twice daily for at least 48 hours and until the patient is discharged from hospital (usually up to 8 days)
- If creatinine clearance is **LESS** than 30mL/min
Enoxaparin* 1mg/kg, by SC injection, stat and then once daily for at least 48 hours and until the patient is discharged from hospital (usually up to 8 days)

If necessary, **unfractionated heparin can be used in place of a low molecular weight heparin. For further information, see section 12 ("[Use of unfractionated heparin](#)").*

Where standard treatment (**aspirin**, **ticagrelor** and **fondaparinux/enoxaparin** is not suitable, **rivaroxaban** can be used with **aspirin** and **clopidogrel** as per [NICE TA 335](#).

For all STEMI patients — following initial treatment

Bisoprolol 2.5mg – 5mg, orally, once daily

And

Lipid-lowering therapy — see [Lipid-lowering Guidelines](#)

And

Ramipril 2.5mg, orally, twice daily to start. Then titrate dose up daily (less frequently if not being monitored in hospital) to a maximum of 5mg twice daily. On discharge, the dose can be given once daily if clinically appropriate.

If bisoprolol is contraindicated — consider

Diltiazem MR - The brand must always be specified as dose varies according to preparation used. See current edition of BNF for dosing information. When initiating diltiazem prescribe most cost effective ONCE daily preparation.

Or

Verapamil MR 240–360mg, orally, daily in 1–2 divided doses.

NOTE: NEVER prescribe concurrently with beta-blockers.

If chest pain persists

Isosorbide mononitrate MR 30–60mg, orally, once daily. Increase to 120mg daily if necessary.

ii) NSTEMI or unstable angina

Initial treatment is determined after calculation of GRACE risk category — as directed by the chest pain pathway.

1. High risk (According to GRACE score)

Aspirin 300mg, orally, stat and then 75mg daily (lifelong)

And

Ticagrelor 180mg, orally, stat and then 90mg twice daily for 12 months

And

Bisoprolol 2.5 to 5mg, orally, once daily

If ticagrelor is contraindicated, replace with

Clopidogrel 300mg, orally, stat and then 75mg daily for 12 months

And — one of the following according to the patient's renal function

- If creatinine clearance is **MORE** than 20mL/min **BUT** full anticoagulation **IS NOT** required
Fondaparinux 2.5mg, by SC injection, stat and then daily for at least 48 hours and until the patient is discharged from hospital (maximum duration: 8 days)
- If creatinine clearance is **MORE** than 30mL/min **AND** full anticoagulation **IS** required
Enoxaparin* 1mg/kg, by SC injection, stat and then twice daily for at least 48 hours and until the patient is discharged from hospital (usually up to 8 days)
- If creatinine clearance is **LESS** than 30mL/min
Enoxaparin* 1mg/kg, by SC injection, stat and then once daily for at least 48 hours and until the patient is discharged from hospital (usually up to 8 days)

If necessary, **unfractionated heparin can be used in place of a low molecular weight heparin. For further information, see section 12 ("[Use of unfractionated heparin](#)").*

Where standard treatment (**aspirin**, **ticagrelor** and **fondaparinux/enoxaparin** is not suitable, **rivaroxaban** can be used with **aspirin** and **clopidogrel** as per [NICE TA 335](#).

For bailout situations or patients with thrombotic complications — consider **Tirofiban** 0.4microgram/kg/minute, by IV infusion, for 30minutes followed by a maintenance dose of 0.1microgram/kg/minute. Continue infusion for a minimum of 48 hours and a maximum of 108 hours (4½ days).

NOTE: Tirofiban should not be given to patients whose coronary anatomy is not known.

For patients with moderate to severe renal impairment (creatinine clearance LESS than 30mL/min), reduce doses by half.

Administration: tirofiban is available as a 12.5mg/250mL bag (0.05mg/mL) ready to infuse.

Table 3: Infusion rates (mL/hour) for tirofiban 12.5mg/250mL(0.05mg/mL) solution

Body weight (kg)	Most patients		Patients with CrCl < 30mL/min	
	Loading infusion rate (mL/hour) — for 30 mins	Maintenance infusion rate (mL/hour)	Loading infusion rate (mL/hour) — for 30 mins	Maintenance infusion rate (mL/hour)
30–37	16	4	8	2
38–45	20	5	10	3
46–54	24	6	12	3
55–62	28	7	14	4
63–70	32	8	16	4
71–79	36	9	18	5
80–87	40	10	20	5
88–95	44	11	22	6
96–104	48	12	24	6
105–112	52	13	26	7
113–120	56	14	28	7
121–128	60	15	30	8
129–137	64	16	32	8
138–145	68	17	34	9
146–153	72	18	36	9

And, if chest pain persists

Glyceryl trinitrate Administer a 50mg/50mL IV infusion using a Graseby pump. Start at 0.6mL/hour. Titrate upwards in increments of 0.6mL/hour every 30 minutes according to blood pressure and chest pain. Max: 6mL/hour.

GTN infusions should be prescribed on the GTN prescription chart

2. Medium risk (According to GRACE score)

Aspirin 300mg, orally, stat and then 75mg daily

And — one of the following according to the patient's renal function

- If creatinine clearance is **MORE** than 20mL/min **BUT** full anticoagulation **IS NOT** required
Fondaparinux 2.5mg, by SC injection, stat and then daily for at least 48 hours and until the patient is discharged from hospital (maximum duration: 8 days)
- If creatinine clearance is **MORE** than 30mL/min **AND** full anticoagulation **IS** required
Enoxaparin* 1mg/kg, by SC injection, stat and then twice daily for at least 48 hours and until the patient is discharged from hospital (usually up to 8 days)
- If creatinine clearance is **LESS** than 30mL/min
Enoxaparin* 1mg/kg, by SC injection, stat and then once daily for at least 48 hours and until the patient is discharged from hospital (usually up to 8 days)

*If necessary, **unfractionated heparin** can be used in place of a low molecular weight heparin. For further information, see section 12 ("[Use of unfractionated heparin](#)").

The following can be considered (criteria for consideration can be found in the chest pain pathway)

Ticagrelor 180mg, orally, stat and then 90mg twice daily for 12 months

And

Bisoprolol 2.5mg, oral, once daily. Increase gradually to 10mg daily

If ticagrelor is contraindicated, replace with

Clopidogrel 300mg, orally, stat and then 75mg daily for 12 months

Or, if chest pain persists

Glyceryl trinitrate Administer a 50mg/50mL IV infusion using a Graseby pump. Start at 0.6mL/hour. Titrate upwards in increments of 0.6mL/hour, every 30 minutes, according to blood pressure and chest pain. Max: 6.0mL/hour.

GTN infusions should be prescribed on the GTN prescription chart

3. Low risk (According to GRACE score)

Aspirin 300mg, orally, stat and then 75mg daily.

The following can be considered (criteria for consideration can be found in the chest pain pathway)

Ticagrelor 180mg, orally, stat and then 90mg twice daily for 12 months

For all NSTEMI or unstable angina patients — following initial treatment

Bisoprolol 2.5mg, orally, once daily. Increase gradually to 10mg daily

And

Lipid-lowering therapy — see [Lipid-lowering Guidelines](#)

And

Ramipril 2.5mg, orally, once daily for 1 week then 5mg daily. Increase after a further 3 weeks to 10mg daily.

If bisoprolol is contraindicated — consider

Diltiazem MR- The brand must always be specified as dose varies according to preparation used. See current edition of BNF for dosing information. When initiating diltiazem prescribe most cost effective ONCE daily preparation.

Or

Verapamil MR 240-360mg, orally, daily in 1–2 divided doses.

If chest pain persists

Isosorbide mononitrate MR 30 to 60mg, orally, once daily. Increase to 120mg daily if necessary.

iii) Stable angina

Treatment can be for:

- a) Prevention of symptoms
- b) Reduction of cardiovascular risk

a) Prevention of symptoms

Step 1

Bisoprolol 2.5mg, orally, once daily. Increase gradually maximum dose 20mg.

If bisoprolol is contraindicated

Diltiazem MR -The brand must always be specified as dose varies according to preparation used. See current edition of BNF for dosing information. When initiating diltiazem prescribe most cost effective ONCE daily preparation.

Or

Verapamil MR 240 to 360mg, orally, daily in 1 or 2 divided doses.

For patients in whom a beta blocker, diltiazem and verapamil is contraindicated

Ivabradine 5mg, orally, twice daily. Increase if necessary after 3 to 4 weeks to 7.5mg twice daily. For elderly patients, start at 2.5mg twice daily.

Step 2 – add

Amlodipine 5mg, orally, once daily. Maximum dose: 10mg daily

Or

Felodipine MR 2.5mg or 5mg, orally, once daily. Maximum dose: 10mg daily.

NOTE: NOT to be used with verapamil or diltiazem. Useful for patients who are also hypertensive.

Or

Isosorbide mononitrate MR 30 to 60mg, orally, once daily. Increase to 120mg daily if necessary.

Step 3 — initiation by cardiologist or GP with special interest in cardiology ONLY

Ranolazine 375mg, orally, twice daily. Increase after 2 to 4 weeks to 500mg twice daily. Then adjust according to response. Maximum: 750mg twice daily.

Step 4 — add

Nicorandil 10mg, orally, twice daily (5mg twice daily if susceptible to headaches). Increase to 20mg twice daily if necessary. Maximum: 30mg twice daily.

[See MHRA Drug safety alert-Nicorandil \(Ikorel\): now second-line treatment for angina - risk of ulcer complications](#)

b) Reduction of cardiovascular risk

First choice

Aspirin 75mg, orally, once daily

Second choice – for patients who are genuinely intolerant of aspirin

Clopidogrel 75mg, orally, once daily

NOTE: Ticagrelor should NOT be prescribed as it is not licensed for monotherapy

And

Lipid-lowering therapy — see [Lipid-lowering Guidelines](#)

6. Arrhythmias

These may be classed as:

- i) Supraventricular arrhythmias
- ii) Atrial flutter
- iii) Wolff-Parkinson-White syndrome
- iv) Ventricular arrhythmias
- v) Bradyarrhythmias

i) Supraventricular arrhythmia

This section refers to treatment of AV re-entrant tachycardia, AV nodal re-entrant tachycardia and atrial tachycardia.

For advice on treating atrial flutter, see [below](#).

For advice on treating atrial fibrillation, see [section 7](#) of this chapter.

To terminate supra-ventricular tachycardia (SVT)

Adenosine 3mg, by rapid IV injection. Follow, if necessary, after 1–2 minutes with 6mg by IV injection and then 12mg after a further 1–2 minutes

Long-term prophylaxis

This is unnecessary if the patient suffers infrequent attacks and has minimal symptoms. If treatment is required:

First line

Bisoprolol 2.5mg, orally, once daily. Maximum: 10mg daily

Or

Verapamil MR 120–240mg, orally, once daily. Increase if necessary but give doses above 240mg daily in two divided doses. Maximum: 480mg daily.

Second line

Consider referral to electrophysiology for EP study and ablation

Or

Amiodarone 200mg, orally, three times daily for 7 days, then 200mg twice daily for 7 days, then 200mg daily (or minimum dose to control rhythm)

NOTE: Lung function should be monitored for patients on medium- or long-term therapy

Or

Flecainide 50mg, orally, twice daily. Increase if necessary to a maximum of 150mg twice daily.

Or

Sotalol 40mg, orally, twice daily. Increase after 2 to 3 days to 80mg twice daily. Maximum 160mg twice daily.

ii) Atrial flutter

First line — pending cardioversion

Bisoprolol 2.5mg, orally, stat and then daily. Titrate according to response. Max: 10mg

Or

Diltiazem MR The brand must always be specified as dose varies according to preparation used. See current edition of BNF for dosing information. When initiating diltiazem prescribe most cost effective ONCE daily preparation.

Or

Verapamil modified release (XL) 240mg, orally, stat and then daily

And

Anticoagulation See "[Thromboprophylaxis](#)" within the Atrial fibrillation section of this chapter. Patients must have therapeutic anticoagulation for three weeks before the procedure and for four weeks after the procedure. For warfarin, this requires the INR to be in therapeutic range or above. For new oral anticoagulants, this means that no doses can have been missed.

Second line

Refer to electrophysiology for ablation at first recurrence or if arial flutter is associated with heart failure or if there is a 1:1 ratio between the atrial rate and ventricular rate

iii) Wolff-Parkinson-White syndrome

All patients should be referred for radio frequency ablation. While waiting for ablation:
Amiodarone 200mg, orally, three times daily for 7 days, then 200mg twice daily for 7 days, then 200mg daily (or minimum dose to control rhythm)

NOTE: Lung, liver and thyroid function should be monitored for patients on medium- or long-term therapy

Or

Flecainide 50mg, orally, twice daily. Increase if necessary to a maximum of 150mg twice daily.

NOTE: Flecainide should not be used for patients with left ventricular failure or ischaemic heart disease, and should be used cautiously in all patients.

iv) Ventricular arrhythmias

Immediate management of sustained ventricular arrhythmia (excluding pulseless VT)

Amiodarone 300mg (or 5mg/kg), by IV infusion, in 250ml glucose 5% over 1 hour. Followed by 900mg (15mg/kg), by IV infusion, in 500ml glucose 5%, over 23 hours at 22ml/hour.

And, if required

Magnesium sulphate 2g (8mmol Mg²⁺), by IV injection, given over 10 to 15 minutes. Repeat once if necessary

Long-term management

Amiodarone 200mg, orally, three times daily for 7 days, then 200mg twice daily for 7 days, then 200mg daily (or minimum dose to control rhythm)

Patients may also benefit from an implantable cardiac defibrillator and should be referred for assessment if their ejection fraction is less than 30%.

v) *Bradyarrhythmias*

Atropine 600micrograms to 1.2mg, by IV bolus injection. Repeat every 3 to 5 minutes, if necessary, to a maximum of 3mg.

Or

Isoprenaline 1 to 10 micrograms/minute by IV infusion. Adjust dose according to response. Remove 10ml from a 500ml bag of glucose 5% and then add isoprenaline (2mg in 2mL) — creating a 4micrograms/ml solution for infusion. Continue the infusion until pacing is achieved.

Infusion rates (mL/hour) for Isoprenaline 2mg/500mL (4micrograms/ml) solution

Dose micrograms/minute	Infusion Rate (mL/hour)
1	15
2	30
3	45
4	60
5	75
6	90
7	105
8	120
9	135
10	150

NOTE: The use of this product for this indication is unlicensed and is only used as a bridge to pacing.

7. Atrial fibrillation

See [Atrial Fibrillation Care Pathway](#) for algorithm for treating atrial fibrillation (Secondary Care Document). In addition, thromboprophylaxis should be considered for **ALL** patients diagnosed with AF (see "[Thromboprophylaxis](#)" section of this chapter).

Treatment is divided into:

- i) Asymptomatic AF
- ii) New onset AF (less than 48 hours)
 - a. Anticoagulation
 - b. Medical cardioversion
- iii) AF (lasting more than 48 hours)
 - a. Rate control
 - b. Rhythm control
 - c. Maintenance of sinus rhythm
- iv) Paroxysmal AF
- v) Thromboprophylaxis

i) Asymptomatic AF

Refer to cardiology clinic (secondary care) or the Heart Centre at St Catherine's Hospital (primary care).

ii) New onset AF that has lasted less than 48 hours

Patients presenting with their first episode of AF (if it has lasted less than 48 hours) can be medically cardioverted without prior oral anticoagulation (although a low molecular weight heparin is usually started unless already anticoagulated). These patients should be transferred to CCU.

a. Anticoagulation

- If the patient is also being treated for acute coronary syndrome
Enoxaparin* 1mg/kg, by SC injection, twice daily
- If the patient has renal impairment (creatinine clearance **LESS** than 30ml/min)
Enoxaparin* 1mg/kg, by SC injection, once daily
- For all other patients
Enoxaparin 1.5mg/kg, by SC injection, once daily (doses are calculated according to weight banding to ensure that full syringes are used)

Anticoagulation should continue until successful cardioversion is achieved.

If necessary, **unfractionated heparin can be used in place of a low molecular weight heparin. For further information, see section 12 ("[Use of unfractionated heparin](#)")*

b. Medical cardioversion

Amiodarone 600mg, orally, three times daily for 2 days (with ECG monitoring on cardiac ward ONLY).

NOTE: The use of amiodarone for this indication is not licensed.

Or

Flecainide 2mg/kg, by IV infusion, stat. Dilute dose (maximum: 150mg) in 250ml glucose 5% or 500ml sodium chloride 0.9%. Administer over 30 minutes (with ECG monitoring on CCU).

If required, following the initial dose, flecainide treatment may be extended by administering a continuous IV infusion (also, with ECG monitoring on CCU).

First hour: Dilute **flecainide** 450mg in 250mL glucose 5% (or 900mg in 500mL sodium chloride — necessary to prevent precipitation). Administer according to body weight at 1.5mg/kg/hour. The following table converts body weight into the required dose (in mL/hour) for a 1.8mg/mL solution.

Infusion rates (mL/hour) for flecainide 1.8mg/mL solution

	Body weight (kg)						
	40	50	60	70	80	90	100
Administration rate (mL/hr)	33	42	50	58	67	75	83

Second hour onwards: Dilute **flecainide** 300mg in 500mL of glucose 5% or sodium chloride 0.9%. Administer according to body weight at 100 to 250micrograms/kg/hour. The following table converts body weight into the required dose (in mL/hour) for a 600microgram/mL solution.

Infusion rates (mL/hour) for flecainide 600micrograms/mL solution

	Dose (micrograms/kg/hour)	Body weight (kg)						
		40	50	60	70	80	90	100
Administration rate (mL/hour)	100	7	8	10	12	13	15	17
	200	13	17	20	23	27	30	33
	250	17	21	25	29	33	38	42

The duration of this infusion should not exceed 24 hours. Maximum cumulative dose of flecainide during the first 24 hours is 600mg. If a longer infusion is considered necessary, plasma concentration monitoring is recommended.

c. DC cardioversion

If medical cardioversion fails, consider DC cardioversion (see “Rhythm control” section of following page).

iii) AF (lasting longer than 48 hours)

Clinicians need to decide whether such patients require rhythm or rate control (see care pathway for details).

a. Rate control

First choice

Bisoprolol 1.25mg, orally, once daily for 1 week. Then 2.5mg daily for one week, then 3.75mg daily for one week, then 5mg daily for 4 weeks, then 7.5mg daily for 4 weeks. The dose can be increased faster for hospital inpatients. Maintenance dose: 10mg daily.

NOTE: Ejection fraction should be checked for all patients with AF. Do not start high doses of bisoprolol for patients with poor EF or before the EF has been determined

Second choice

Diltiazem MR- Different brands have different dosing schedules therefore ensure a brand with the correct schedule is prescribed.

Or

Verapamil modified release (XL) 240mg, orally, stat and then daily

Third choice

Digoxin 500micrograms, orally, stat and then a usual maintenance dose of 125 to 250 micrograms for patients with normal renal function. A lower dose of 62.5 micrograms should be considered in the elderly. Consider digoxin monotherapy for people with non-paroxysmal AF only if they are sedentary (ie, do little or no physical exercise).

If monotherapy does not control symptoms, and if continuing symptoms are thought to be due to poor ventricular rate, consider combination therapy with two of the above.

b. Rhythm control

Patients who have been in AF for longer than 48 hours will need to be adequately anticoagulated before DC cardioversion takes place. In preparation for this procedure, patients should be treated with:

Amiodarone 200mg, orally, three times a day for 1 week, then 200mg twice daily for one week, then 200mg daily thereafter. Begin treatment four weeks before procedure and continue beyond procedure as directed by a cardiologist.

And

Anticoagulation See "[Thromboprophylaxis](#)" section of this chapter. Patients must have therapeutic anticoagulation for three weeks before the procedure and for four weeks after the procedure. For warfarin, this requires the INR to be in therapeutic range or above. For direct oral anticoagulants (DOACs), this means that no doses can have been missed.

c. To maintain sinus rhythm

First line

Bisoprolol 1.25mg, orally, daily then titrate to according to response (max: 10mg daily).

Second line

Flecainide 50mg, orally, twice daily. Increase to a maximum of 150mg twice daily.

NOTE: Flecainide is contraindicated in heart failure or post myocardial infarction.

Third line (first line for patients with left ventricular impairment or heart failure)

Amiodarone 200mg, orally, three times daily for 7 days, then 200mg twice daily for 7 days, then 200mg daily (or the minimum dose required to control rhythm) thereafter.

Loading dose can be given over a longer period. Maintenance dose of 300mg daily can be used.

NOTE: Lung function should be monitored for patients on medium- or long-term therapy

If failed on, or contraindicated for, all other formulary treatments

Dronedarone 400mg, orally, twice a day with meals

NOTE: To be initiated by a consultant cardiologist ONLY, as per NICE technology appraisal 197 (www.nice.org.uk/ta197)

iv) Paroxysmal AF

First choice

Bisoprolol 1.25mg, orally, daily then titrate to according to response (max: 10mg daily)

Or

Diltiazem MR The brand must always be specified as dose varies according to preparation used. See current edition of BNF for dosing information. When initiating diltiazem prescribe most cost effective ONCE daily preparation.

Or

Verapamil MR 240–360mg, orally, daily in 1–2 divided doses.

If rate-limiting drugs are already being taken, add or replace with **Flecainide** 50mg, orally, twice daily. Increase if necessary to a maximum of 150mg twice daily. Flecainide can also be used as part of the “pill in the pocket” regimen. This involves 50-100mg when required. A second dose can be taken after 1 hour. No more than 2 doses in 24 hours.

Or

Amiodarone 200mg, orally, three times a day for 1 week, then 200mg twice daily for one week, then 200mg daily thereafter.

NOTE: Lung, thyroid and liver function should be monitored for patients on medium- or long-term therapy

v) *Thromboprophylaxis*

An antiembolic risk score (**CHA₂DS₂VASC**) should be performed for **ALL** patients diagnosed with AF to determine the most appropriate anticoagulant treatment.

The **CHA₂DS₂VASC** risk assessment can be found in the Atrial Fibrillation Care Pathway (Secondary Care Only Document).

Each patient’s bleeding risk should also be considered.

Risk score	Estimated stroke/embolus risk	Treatment
HIGH RISK CHA ₂ DS ₂ VASC SCORE ≥ 2	4.0% - 18.2% ANNUAL RISK	For advice on selecting the most appropriate anticoagulant (warfarin, apixaban, dabigatran, edoxaban or rivaroxaban), see Antiplatelets and anticoagulation in stroke – quick reference guide
MEDIUM-RISK CHA ₂ DS ₂ VASC SCORE = 1	2.8% ANNUAL RISK	
Low-RISK CHA ₂ DS ₂ VASC SCORE = 0	1.9% ANNUAL RISK	No antithrombotic therapy

For more information on monitoring, doses and contraindications to treatments, see [Oral Anticoagulants – Guidelines for prescribing, monitoring and management](#).

8. Stroke and TIA

All patients diagnosed with a suspected stroke should be entered onto the Time is brain / Stroke Pathway (Secondary Care Only Document). This pathway provides further information on management.

All patients with suspected stroke should undergo a CT scan to confirm the diagnosis and the type of stroke that has been suffered. The two types of stroke are:

- i) Ischaemic stroke
- ii) Haemorrhagic stroke

i) Ischaemic stroke and TIA

Alteplase See thrombolysis pathway (available on the Acute Stroke Unit) for details on dosing, administration and criteria for use.

ONLY to be prescribed by Stroke Consultants and administered to patients on the Acute Stroke Unit.

NOTE: Avoid aspirin and heparin within 24 hours of thrombolysis.

All thrombolysed patients must have a repeat CT scan 24 hours after thrombolysis. Haemorrhage must be excluded on this scan before antiplatelets are started for secondary prevention.

Do not prescribe prophylactic low molecular weight heparins unless the risk of venous thromboembolism is considered to outweigh the risk of bleeding.

Secondary prevention for ischaemic stroke or TIA

A. Antiplatelet treatment — ONLY after haemorrhage is excluded

A [quick reference guide](#) summarising the use of anticoagulants and antiplatelet drugs is available.

For all patients

Clopidogrel 75mg, orally, once daily as monotherapy

For patients unable to tolerate clopidogrel, or in whom clopidogrel is contraindicated

Aspirin 300mg, orally or rectally, stat then 75mg, orally, daily

And

Dipyridamole MR 200mg, orally, twice daily. Continue combination treatment.

For patients with new onset of AF

Aspirin 300mg, orally, daily. Consider **warfarin** when the risk of haemorrhagic transformation has passed (2 to 4 weeks after the acute stroke).

For information on other treatments, see [“Thromboprophylaxis”](#) within the Atrial fibrillation section of this chapter.

For patients with existing AF (already taking warfarin)

Seek specialist advice from the stroke team.

B. Blood pressure control

During acute phase

For most patients, DO NOT start antihypertensives during acute phase of ischaemic stroke.

If patients are admitted on antihypertensives continue treatment but adjust doses if necessary to avoid inducing hypotension (less than 120/60mmHg).

For patients unable to continue oral antihypertensives because of dysphagia — consider **Atenolol** 2.5 to 5mg, by IV injection, once daily. Only give if advised by the stroke team.

Or

Labetolol infusion — for dose, see [hypertensive crisis](#)

Or

IV GTN 10-15 micrograms per minute

Or

IV nicardipine initial dose of 3-5mg/hr to a maximum of 15mg/hr. Dilute 100mg of drug in 500mg of 5% glucose

NOTE: ONLY use under the advice of a Stroke Consultant on the Acute Stroke Unit

After acute phase

After one week, new hypertension should be treated, aiming for a target blood pressure of 140/85mmHg (130/80mmHg in diabetics). See section [1. Hypertension](#), or [Hypertension: Treatment algorithm](#).

C. Cholesterol reduction

Consider lipid lowering therapy in all patients with ischaemic stroke who have a total cholesterol level above 3.5mmol/L.

First choice

Simvastatin 40mg, orally, daily at night

Second choice

See [Lipid-lowering Guidelines](#)

ii) Haemorrhagic stroke

A. Antiplatelet treatment

NOTE: Antiplatelets and anticoagulation should be avoided in patients who have had a haemorrhagic stroke.

B. Blood pressure control

Uncontrolled hypertension (ie, 220/120mmHg) may require early antihypertensive treatment in some patients with cerebral haemorrhage. Advice should be sought from the stroke team.

Treatment should not reduce blood pressure any lower than 160/80mmHg.

After the acute phase (after approx 1 week), treatment should follow hypertension guidelines aiming for a target blood pressure of 140/85mmHg (130/80mmHg for diabetics).

If patient able to swallow

Treat as for ischaemic stroke.

If patient unable to swallow

Atenolol 2.5–5mg, by IV injection, once daily. Only give if advised by the stroke team.

Or

Labetolol infusion — for dose, see [hypertensive crisis](#).

Or

IV GTN 10-15 micrograms per minute

Or

IV nicardipine initial dose of 3-5mg/hr to a maximum of 15mg/hr. Dilute 100mg of drug in 500mg of 5% glucose

NOTE: ONLY use under the advice of a Stroke Consultant on the Acute Stroke Unit

C. Cholesterol reduction

NOTE: Statins should not be used routinely following haemorrhagic stroke unless the risk of ischaemic events outweighs the risk of further bleeding.

9. Venous thromboembolism (treatment)

For comprehensive information on using low molecular weight heparins, including dose, contraindications and use in primary care, see [Enoxaparin – prescribing, monitoring and administration](#). Acute treatment should be followed by secondary prevention.

For pregnant patients

Enoxaparin* 1mg/kg, by SC injection, twice a day. Refer to Venous Thromboembolism Prophylaxis and Treatment (Maternity) (Secondary Care only document)

For all other patients

Treat as per [Oral anticoagulation prescribing guidelines](#) using one of the following medicines:

- **Apixaban**
- **Dabigatran**
- **Edoxaban**
- **Enoxaparin**
- **Rivaroxaban**
- **Warfarin**
- **Unfractionated heparin** (see section 12 “Use of unfractionated heparin”)

Advice on the duration of treatment can be found in the [Oral anticoagulation prescribing guidelines](#).

Advice on managing bleeding in patients taking warfarin or other anticoagulants can be found in **Bleeding — management of patients taking oral anticoagulants (Secondary Care only document)**. Refer to specific guidance if reviewing warfarin patients with a high INR in primary care setting [High INR Pathway](#).

10. Thromboprophylaxis

ALL patients who are admitted to hospital should have their risk of developing a venous thromboembolism (VTE) assessed as soon as possible.

The risk assessment form that should be used is accessed via PCIS.

For comprehensive information on using low molecular weight heparins, including dose, contraindications and use in primary care, see [Enoxaparin – prescribing, monitoring and administration](#). Treatment guidelines differ depending on whether the patient is:

1. Medical
2. Orthopaedic
3. Surgical (other than orthopaedic)
4. A pregnant woman

1. Medical inpatients

For patients deemed to be at risk of developing a VTE and with a creatinine clearance greater than/equal to 30mL/min

Enoxaparin* 40mg, by SC injection, stat and then 40mg daily at night.

For patients deemed to be at risk and with a creatinine clearance **LESS** than 30mL/min

Enoxaparin* 20mg, by SC injection, stat and then 20mg daily at night.

If necessary, **unfractionated heparin can be used in place of a low molecular weight heparin. For further information, see section 12 (“[Use of unfractionated heparin](#)”).*

2. Orthopaedic inpatients

All patients who undergo orthopaedic procedures should also have their risk of developing a VTE assessed. Types of procedure and appropriate treatment can found in **Venothromboembolism Prophylaxis: Trauma & Orthopaedics (Secondary Care Only document)**.

The guidelines specify which medical treatment is appropriate

First choice

Rivaroxaban 10mg, orally, daily; starting 6 to 10 hours after surgery (continue for 35 days after total hip replacement or 14 days after a total knee replacement).

For patients with a creatinine clearance **LESS** than 15ml/min

Enoxaparin 20mg, by SC injection, once daily at night.

If failed on, or contraindicated for, all other formulary treatments

Apixaban 2.5mg, orally, twice a day (for 10 days following total knee replacement or for 32 days following total hip replacement)

Or

Dabigatran 110mg, orally, on the day of surgery, and then 220mg daily (continue for 28 days after total hip replacement or 10 days after a total knee replacement). The first dose should be taken 1–4 hours after surgery, provided haemostasis has been established.

NOTE: Both apixaban and dabigatran are to be initiated on the recommendation of a consultant orthopaedic surgeon ONLY, as per NICE technology appraisal 245 (www.nice.org.uk/ta245) or 157 (www.nice.org.uk/ta157)

3. Surgical inpatients (not orthopaedic)

The risk of thrombosis (therefore the need for thromboprophylaxis) is determined according to the type of procedure and the presence of patient-specific risk factors. Information on the level of risk can be found in **Surgical procedures — level of risk (Secondary Care only document)**.

A. For HIGH RISK surgery

Enoxaparin 40mg*, by SC injection, stat and then 40mg daily at night.

NOTE: The last preoperative dose should be given AT LEAST 12 HOURS BEFORE the operation.

*Other considerations:

- **Is the patient renally impaired?**

*If the patient has a creatinine clearance **less** than 30mL/min*

Enoxaparin 20mg, by SC injection, stat and then 20mg daily at night

NOTE: The last preoperative dose should be given AT LEAST 2 HOURS BEFORE the operation.

- **Will the patient have an epidural?**

Enoxaparin should be given at least 12 hours before the procedure. If in doubt, ask the relevant surgeon or anaesthetist.

- **Has the patient been admitted on the day of surgery?**

Reduced dose **enoxaparin** (20mg) can be given 2 hours before a procedure so could be a more suitable first dose.

B. For MEDIUM RISK surgery

Enoxaparin 20mg, by SC injection, stat and then 20mg daily at night.

NOTE: The last preoperative dose should be given AT LEAST 2 HOURS BEFORE the operation.

C. For LOW RISK surgery

No thromboprophylaxis required.

D. For patients taking warfarin

Patients who are taking warfarin might need perioperative treatment with unfractionated heparin. For more information, see section 12 ("[Use of unfractionated heparin](#)").

4. Pregnant women

All pregnant women should have their risk of VTE assessed by a midwife or obstetrician at the following stages of pregnancy:

- Booking
- Following development of intercurrent problems (eg, pre-eclampsia)
- On admission to hospital
- Weekly (if an inpatient)
- Following delivery
- Following onset of complications in the six weeks following birth

The assessment tool to be used can be found in Appendix A of **Venous Thromboembolism Prophylaxis and Treatment (Maternity) (Secondary Care Only document)**

If a LMWH is indicated

Enoxaparin Administer by SC injection, stat and then daily at night. The dose is determined according to the patient's weight:

Weight	Enoxaparin dose
<50 kg	20mg daily
50–90 kg	40mg daily
91–130 kg	60mg daily*
131–170 kg	80mg daily*
>171 kg	0.6mg/kg/day daily*

11. Cholesterol reduction

For further information on when to prescribe lipid-lowering drugs and which medicines to prescribe, see [Lipid-lowering Guidelines](#).

12. Use of unfractionated heparin

Intravenous unfractionated heparin is available for use in situations where the use of low molecular weight heparins (ie, enoxaparin) is considered inappropriate or when a shorter duration of action is desirable.

It **may be considered** for patients with:

- Renal failure (although enoxaparin can be often be used — even for patients with a creatinine clearance below 20mL/min)
- A body weight greater than 130kg (although dosing with a LMWH might still be possible — seek advice from pharmacy)

For information on administering and adjusting the dose of heparin, see WUTH clinical guideline on **Unfractionated Heparin Infusion — for Adult Patients (Secondary Care Only Document)**.

Use of protamine

Protamine can be used to reverse the effects of heparin or low molecular weight heparin. It can be used if excessive bleeding occurs and when an overdose has inadvertently been given.

To reverse the effect of a heparin infusion

Protamine 25 to 50mg, by slow IV injection, stat.

The heparin infusion MUST be stopped.

To reverse the effect of a low molecular weight heparin

Protamine For information on dosing, see the overdose section of the summary of product characteristics for the relevant low molecular weight heparin (accessed via [the electronic medicines compendium](#)).

13. Peripheral vascular disease

This section is under development.

Cilostazol, naftidrofuryl oxalate, pentoxifylline and **inositol nicotatate** are available for initiation by consultant vascular surgeons ONLY provided they are prescribed in accordance with NICE technology appraisal 223 (www.nice.org.uk/ta223).