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BHSCT

POLICIES AND GUIDELINES FOR THE TREATMENT OF CARDIOVASCULAR DISEASES

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CONTENTS

PREFACE

Welcome to Cardiology! We hope you will find your time here rewarding and enjoyable. This document aims to provide new members of the junior doctor team working in the BHSCT Cardiology department with guidelines and recommendations that will aid in the initial management of patients presenting to the BHSCT emergency departments (ED) with confirmed or suspected cardiovascular diseases. Information in this document is also relevant to the care of these patients during their inpatient stay and with respect to organising cardiology follow-up via clinically appropriate outpatient pathways.

Please note that this document does not replace support from senior medical staff, who are available at all times and more than happy to offer guidance and support.

BHSCT CARDIOLOGY DEPARTMENT

The BHSCT Cardiology department delivers both inpatient and outpatient care to cardiac patients throughout Northern Ireland. The unit is split across 3 sites (RVH, BCH and MIH). However, from a junior doctor perspective MIH is staffed by a separate cohort of staff and does not form part of your clinical responsibilities. At present all inpatient cardiac care is delivered on the RVH site and the vast majority of junior doctors are allocated each week to this site.

The department is a tertiary referral centre for a number of sub-specialist areas, including:

- Coronary intervention
- Structural heart disease
- Heart failure
- Electrophysiology and advanced rhythm management
- Cardiovascular imaging
- Adult congenital heart disease
- Inherited heart disease
- Cardio-oncology

There are therefore excellent opportunities for junior doctors to gain a wide array of experience in cardiovascular medicine during their attachment. Invasive cardiac procedures are offered in any of the 8 cardiac catheterisation laboratories (6 RVH and 2 BCH).

Cardiology SHO responsibilities

During attachment in the cardiology department, the daily review of patients located in any of the 3 in-patient cardiology wards will be the responsibility of a named SHO each day. The expectation is that every in-patient will be reviewed daily from Monday-Friday with the weekend SHO reviewing selected patients on Saturday and Sunday. SHOs are ward based and are each day are assigned to 5D, 5C, 5B, PTWR or the referral bleep (2010). **All patients have a named Consultant Cardiologist. Each week an SPR is assigned to provide clinical input to that consultant's patients. This is highlighted on the weekly rota. Clinical queries or concerns regarding patients should be directed initially to this named cardiology SPR.**

Handover

- Morning handover is at 0800 and will be attended by the night SHO, PTWR SHO and Bleep SHO.
- Evening handover is at 2000 and will be attended by the long day SHO, night SHO, long day SPR and nights SPR.

5D

- 5D contains 12 CCU beds and 8 additional beds (side rooms and isolation rooms).
- The 12 CCU beds have capacity to offer more intensive nursing care, in addition to non-invasive ventilation and inotropic support.
- Each day the CCU SPR is responsible for the 12 CCU beds and an SHO will be assigned to review the 8 additional beds in 5D.

5B/5C

- 5B and 5C have the majority of the cardiology inpatients: consisting of both elective and emergency admissions, and each day the SHOs assigned to the wards will divide the reviews.

PTWR

- Each day an SPR, SHO and FY1 are assigned to the consultant led PTWR
- It is the responsibility of the SHO to ensure that:
    - All patients requiring review on PTWR are identified and located
    - All investigations requested on the PTWR are organised promptly and results followed up
    - All treatment recommendations made during the PTWR are initiated.

Myocardial perfusion imaging (MPI)

- Every day, one SHO will be assigned to MPI (located on level 2 beside the escalators). This predominantly involves prescribing Regadenoson for the next day. Please ensure when prescribing that the patient has no contraindications e.g. severe COPD (requiring hospital admission/on steroids) and epilepsy.
- On Wednesdays there will usually be an MPI list that needs supervision by an SHO.

Referrals bleep (2010)

- When on the bleep you will receive referrals from ED and from other specialties. This occasionally will include referrals from other sites such as the Royal Maternity Hospital.
- Referrals from BCH, MIH and MPH are not the responsibility of the RVH Cardiology SHO.
- When admitting patients during the day, ensure to discuss them with the PTWR SPR and after 5pm discuss patient admittance with the CCU SPR.
- All referrals (not just admissions) must be documented on the take sheet which can be found on the 5D computer desktop.
- All ward referrals should be discussed with the PTWR SPR or CCU SPR depending on the time of day following review. The 0800 and 2000 handovers act as an opportunity to discuss any cases with the SPR team.

- All referrals from ICU should be directed to the CCU SPR. SHOs should not take referrals from ICU on either the RVH or BCH sites.

BCH/Ambulatory Care Unit (ACU)

- Each day one SHO is assigned to cover the BCH site
- This SHO is responsible for:
    - Cardiac arrest team member
    - Cardiology referrals from BCH inpatient wards, including the Cancer Centre.
    - Clinical assessment of patients referred to ACU
    - Discharge letters of elective patients undergoing invasive procedures

ACUTE CORONARY SYNDROMES

Chest pain presentations to ED

All patients with possible cardiac chest pain presenting to ED should have an ECG performed within 10 minutes of arrival in the department (1). This is to rapidly identify patients with a potential diagnosis of ST segment elevation myocardial infarction (STEMI) and facilitate emergency reperfusion therapy.

ST segment elevation myocardial infarction (STEMI)

A diagnosis of STEMI is made in the presence of both chest pain and:

- 1mm ST segment elevation in 2 contiguous limb leads (I, II, III, AVF or AVL); or
- 2mm ST segment elevation in 2 contiguous chest leads (V1-V6)

Following confirmation of a diagnosis of STEMI, In the BHSCT reperfusion therapy is achieved via primary percutaneous coronary intervention (PPCI). It is recommended that reperfusion should be achieved within:

- 60 minutes (RVH ED patients)
- 90 minutes (NIAS and other ED patients) (1)

The majority of patients receiving PPCI will be referred via the Northern Ireland ambulance service (NIAS) direct to the PPCI service. However, some patients will self-present to ED and be diagnosed with a STEMI in hospital or have an unrecognized STEMI and be brought to ED by NIAS. These patients should be referred immediately by the ED staff to the PPCI coordinator (02890 324444), with an ECG scanned and emailed to ppci.coordinator@belfasttrust.hscni.net. If the on-call cardiology SHO (bleep 2010) or SPR receive a referral for PPCI, these should be immediately redirected to the PPCI referral pathway.

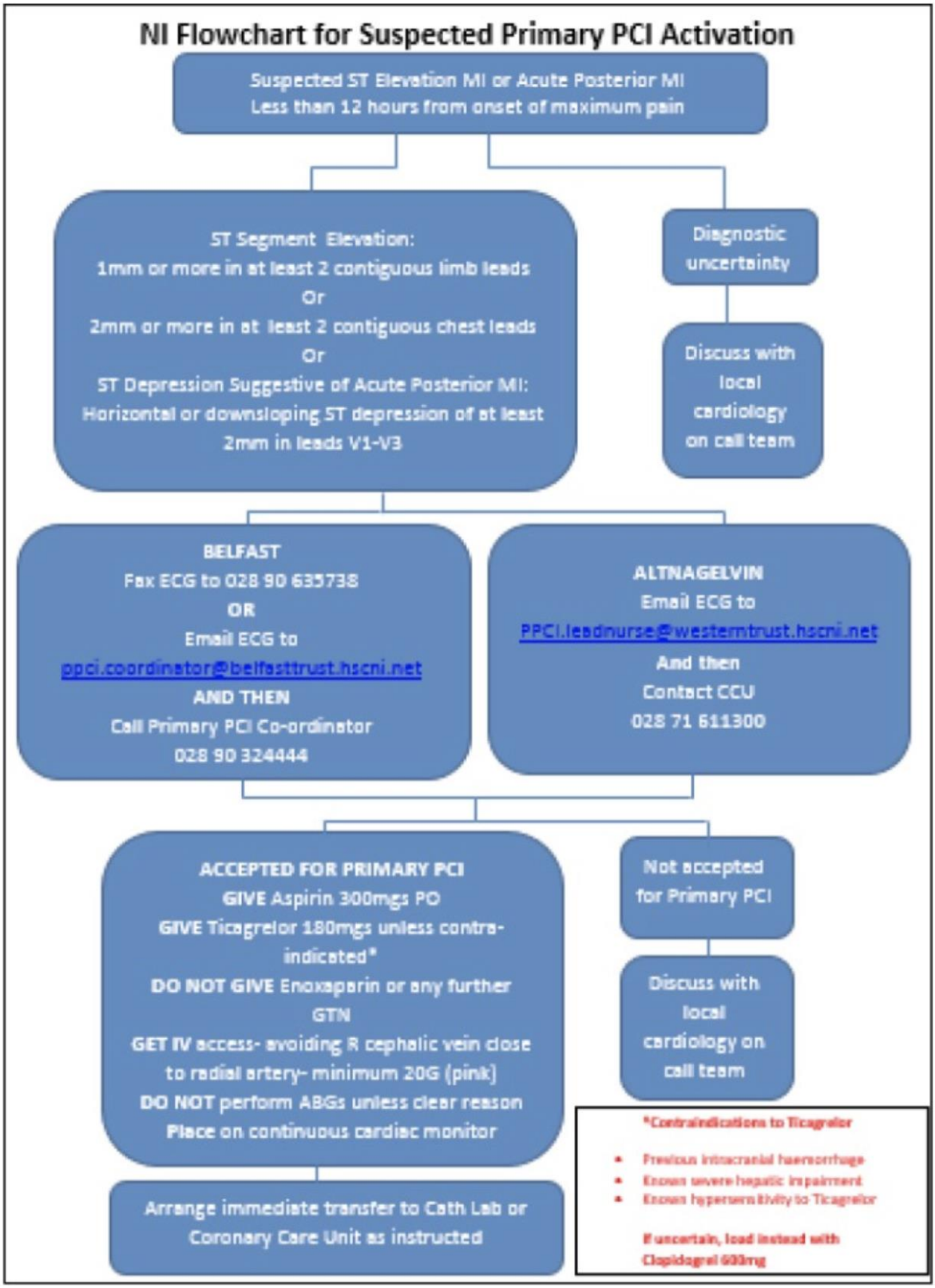
There may be some patients who are turned down initially by the PPCI service appropriately, that subsequently develop ST segment elevation on serial ECG. These patients should be immediately re-referred to the PPCI service.

Therefore, all patients with recurrent or ongoing chest pain of suspected cardiac origin should have serial electrocardiograms (ECGs) performed and referred for PPCI if a diagnosis of STEMI becomes evident. Other patients may have acute STEMI following a PCI procedure due to acute stent thrombosis. These patients should be also be referred immediately to the Primary PCI coordinator without delay.

Patients with LBBB are no longer accepted for PPCI as evidence has shown that few patients with LBBB have an acute coronary occlusion. However, patients with LBBB and dynamic ST segment elevation should be referred.

For PPCI pathway and pharmacological therapies prior to transfer to the cath lab, see below:

NI Flowchart for Suspected Primary PCI Activation



Management of STEMI patients after PPCI

Following PPCI, patients are transferred to ward 5D. All patients require a formal clerk-in by the on-call SHO or SPR. All patients have a procedure note documented by the consultant/SPR performing the procedure. Please ensure to pay careful attention to the recommended post-procedural instructions and suggested pharmacological therapies. Many patients who are treated through the PPCI pathway will re-patriate to their local hospital following 6 hours in 5D.

All patients who have had STEMI confirmed following angiography and have undergone PCI should have the following pharmacological therapies prescribed:

- Aspirin 75mg OD
- P2Y12 inhibitor (this should be the same as the patient was administered pre-procedure unless specified in the procedure note)
    - Ticagrelor 90mg BD (loading dose 180mg)
    - Clopidogrel 75mg OD (loading dose 600mg)
    - Prasugrel 10mg OD* (loading dose 60mg)
- Prophylactic dose enoxaparin (unless specifically instructed in procedure note to administer treatment dose, see below for treatment enoxaparin dosing)
- ACE inhibitor and Beta blocker dictated by the haemodynamic status
- Atorvastatin 80mg OD
- Paracetamol 1g 4-6 hourly and Ondansetron 4mg 8 hourly PRN

*Prasugrel dose reduced to 5mg OD in patients <60kg or those over the age of 75 years

Please pay careful attention to nausea and vomiting. Patients who have vomited within 2 hours of antithrombotic loading should be considered for reloading with both aspirin and the selected P2Y12 inhibitor.

P2Y12 inhibitor contraindications:

- Ticagrelor
    - History of intracranial haemorrhage
- Prasugrel
    - History of either haemorrhagic or ischaemic stroke or TIA

Non-ST segment elevation myocardial infarction (NSTEMI)

A NSTEMI is defined as an increase in high sensitivity cardiac troponin (Troponin T in RVH) coupled with at least one of the following:

- Symptoms of myocardial ischaemia (acute chest pain and/or dyspnoea)
- New ischaemic ECG changes* (that do not fulfil the diagnostic criteria for STEMI)
- Imaging evidence of a new regional wall motion abnormality consistent with an ischaemic aetiology
- Intracoronary thrombus identified at coronary angiography

*ST segment depression, T wave inversion or pseudonormalisation of T waves

Unstable angina

Less commonly patients with an acute coronary syndrome can present with myocardial ischaemia at rest, but without cell damage and hence no elevation in cardiac troponin.

Baseline Investigations to be performed in all patients with suspected NSTEMI/unstable angina being admitted for further inpatient investigation and/or management:

- Blood tests
    - FBC, U&E, CRP, LFT, Troponin, fasting glucose, HbA1c, lipid profile
- ECG (Baseline and repeat at 6-12-hour interval)
    - **ECG should be repeated immediately if any further symptoms of myocardial ischaemia**
- CXR
- Echocardiogram
    - All patients with elevated troponin

Recommendation for serial troponin measurement

Hs- troponin T rises rapidly, usually within 1 hour after symptom onset and remains elevated for a variable period of time (usually several days).

The time period for troponin assessment has been gradually decreasing over time. A 6hr or 12hr troponin is now no longer generally required.

There is now a 1hr troponin policy in operation, based upon European Society of cardiology guidance (2). If troponin at presentation is <5 and pain began ≥3hrs ago then no further troponin is required and the patient can be discharged.

If the time 0 troponin is <12 and a repeat troponin is taken at 1hr with a rise of <3, the troponin is negative and the patient can be considered for discharge as NSTEMI has effectively been ruled out.

If the troponin at presentation is >52 in the setting of chest pain then a NSTEMI is ruled in and they should be admitted. If the troponin rises from <12 by 5 or more points at 1hr in the setting of chest pain then NSTEMI is ruled in and the patent should be admitted.

About one in four patients will fall into the intermediate group and will require a further troponin at 3hrs and further consideration of the pathway. Generally, a rise in troponin of >50% from time 0 indicates a rule in NSTEMI. If in doubt ask for advice.

Troponin is very sensitive marker for cardiac injury but an elevated measurement should not automatically result in an ACS diagnosis. Troponin can also be elevated in a number of other conditions such as heart failure, CKD, myocarditis and PE, as well as in generally unwell patients with hypoxia or hypotension. Therefore, it is important that an elevated troponin result be interpreted in the context of the individual and their symptoms. Treat the patient, not the troponin result. Similarly, patients may have unstable cardiac chest pain with negative troponin. These patients should be assessed carefully for admission if they have presented with cardiac sounding chest pain, especially if the ECG is abnormal.

Management of NSTEMI/Unstable angina

Pharmacological therapies

- Aspirin 300mg loading dose, then 75mg OD
- Ticagrelor 180mg loading dose, then 90mg BD (in case of contraindication administer clopidogrel 300mg loading dose, then 75mg OD)
- Enoxaparin 1mg/kg BD for 3 days (if troponin negative, administer prophylactic enoxaparin)
    - Age >75 years, reduce to 0.75mg/kg BD
    - eGFR <30, reduce to 1mg/kg OD
    - Age >75 years and eGFR <30, reduce to 0.75mg/kg OD
- **When calculating enoxaparin dose ensure the weight is available and round down to the nearest 10 mg dose (ie 78 kg – 70 mg Enoxaparin)**
- **Never prescribe more than 100mg Enoxaparin, regardless of the patient's weight.**
- Bisoprolol 2.5mg OD
    - Unless HR <60bpm or systolic BP <90mmHg
- Ramipril 2.5mg OD
    - Unless systolic BP <90mmHg, eGFR <30 or significant AKI
- Atorvastatin 80mg OD
- Paracetamol 1g 4-6 hourly PRN
- GTN spray 2 puffs PRN
- Ondansetron 4mg 8 hourly PRN

Please note there is no clear evidence that early administration of P2Y12 inhibitors (ticagrelor/clopidogrel) improves outcomes (2), so if there is any diagnostic ambiguity then please omit P2Y12 inhibitor pending consultant review the following day on the PTWR.

Recommended enoxaparin dosing in ACS

<75 years and eGFR >30

Weight	Dose
40 – 49	40 mg twice daily
50 – 59	50 mg twice daily
60 – 69	60 mg twice daily
70 - 79	70 mg twice daily
80 – 89	80 mg twice daily
90 – 99	90 mg twice daily
>100	100 mg twice daily

>75 years and eGFR >30

Weight	Dose
40 – 54	30mg twice daily
55 – 69	40mg twice daily
70 – 79	50mg twice daily
80 - 94	60mg twice daily
95 – 109	70mg twice daily
>110	80mg twice daily

<75 years and eGFR <30

Weight	Dose
40 - 49	40mg once daily
50 - 59	50mg once daily
60 - 69	60mg once daily
70 - 79	70mg once daily
80 - 89	80mg once daily
90 - 99	90mg once daily
>100	100mg once daily

>75 years and eGFR <30

Weight	Dose
40 – 54	30mg once daily
55 – 69	40mg once daily
70 – 79	50mg once daily
80 - 94	60mg once daily
95 – 109	70mg once daily
>110	80mg once daily

Indications for emergency coronary angiography in NSTEMI

In some instances, patients with NSTEMI and high-risk clinical features should be considered for emergency angiography. Any patient with cardiac chest pain identified as having any of the following clinical features should be discussed immediately with the on-call cardiology SPR:

- Ongoing chest pain despite initial medical therapy
- Hypotension (systolic BP <90mmHg)
- Cardiogenic shock
- Ventricular arrhythmia/cardiac arrest
- Acute heart failure clearly as a consequence of ongoing myocardial ischaemia
- ECG suggestive of high-risk anatomy, particularly if ECG changes persist despite medical therapy (eg ST-segment depression >1mm in 6 leads plus ST-segment elevation in AVR)

NSTEMI treatment in patients on long-term oral anticoagulation

The recommendation for all patients presenting to ED with a NSTEMI who are already on OAC for non-valvular AF or previous VTE:

- Hold OAC from admission
- 300mg loading dose aspirin followed by 75mg OD
- 300mg loading dose clopidogrel followed by 75mg OD
- Commence 1mg/kg enoxaparin BD 24 hours after last dose of OAC (see above dose reductions based on age and renal function)

All patients on long-term anticoagulation for mechanical heart valves should be discussed with the on-call cardiology SPR.

Referral for coronary angiography

The majority of patients with a diagnosis of ACS will undergo IP coronary angiography. Referral for this is via the electronic whiteboard system (nww.networkreferrals.co.uk). Login details and referral access can be obtained from the cardiac scheduler's office in the cath lab. To be proactive draft whiteboard referrals can be completed during the day and overnight by the junior doctor clerking in the patient when a diagnosis of NSTEMI is highly suspected, **but it is**

essential that referrals for coronary angiography are only completed/sent on the direct instruction of the consultant in charge of their care.

Management following coronary angiography +/- PCI

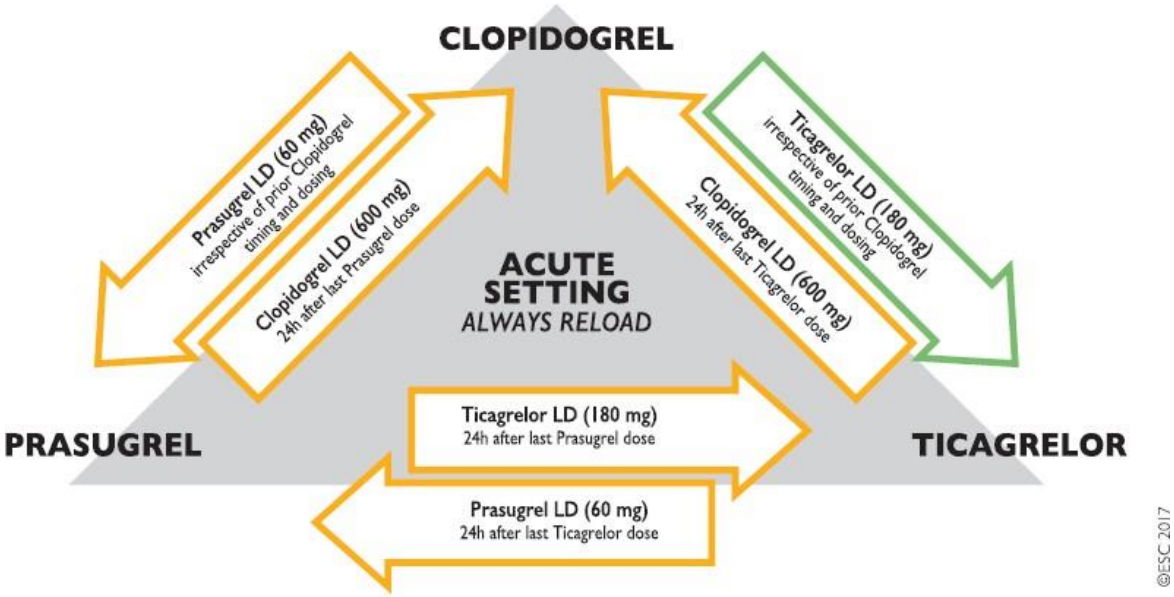
All patients will return from the cath lab with a hand-written procedure note. It is essential that the junior doctor team involved with these patients' care review this entry and carefully follow instructions with specific reference to:

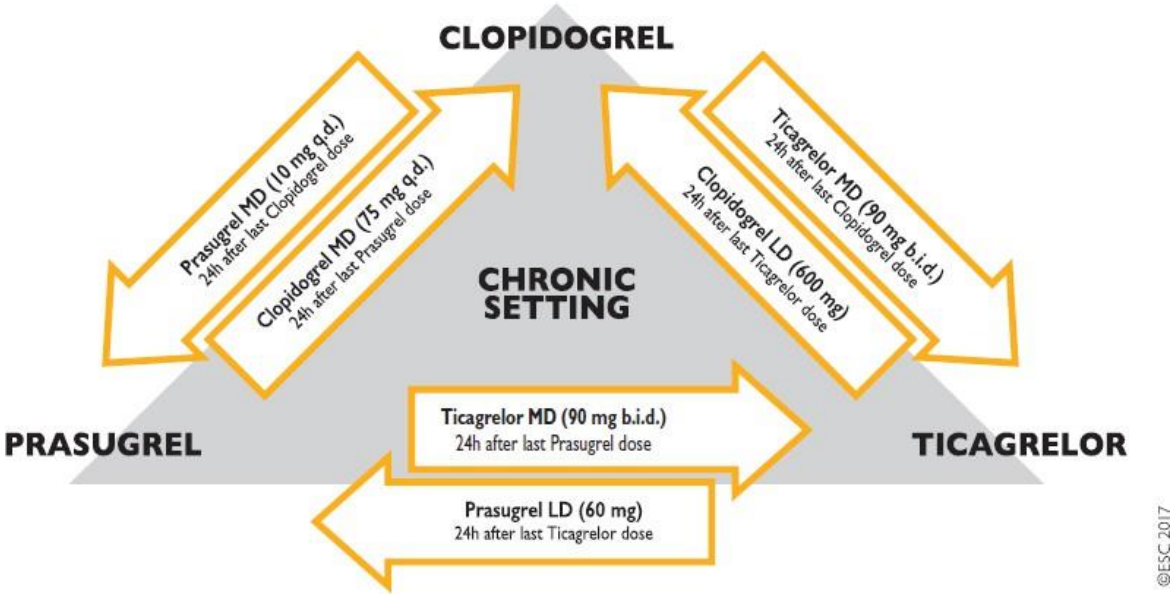
- Discharge planning
- Antithrombotic therapies (initiation date and duration)
- Additional investigations required

Switching P2Y12 inhibitor

If the patient needs to change from one antiplatelet to another (e.g. due to breathlessness with ticagrelor), then ensure that a full loading dose is administered (e.g. 300mg clopidogrel if pre NSTEMI PCI or 600mg if post PCI).

See ESC guidelines below:





Other causes of chest pain to consider

Aortic Dissection

This is a cardiothoracic or vascular surgical emergency depending on the location within the aorta. All patients with suspected aortic dissection should have an emergency CT aorta to exclude the diagnosis.

Patients with either Type A or Type B aortic dissections should not be directly admitted under cardiology. All aortic dissections should referred by ED to either cardiothoracic or vascular surgery. If the surgical teams in charge of their care require advice regarding invasive BP management, these referrals should be directed to the on-call cardiology SPR (07795476632) and not the cardiology SHO.

Selected patients with aortic dissection may be admitted to the Cardiology ward under joint care of Cardiology and relevant surgical specialty. This decision is made at a Consultant level.

Pulmonary embolism (PE)

Patients with PE can present with chest pain and troponin elevations. The diagnosis should be considered in all patients assessed in ED with chest pain. Consider a CTPA if the patient's history and diagnosis are suggestive. A CTPA should be performed as an emergency if the patient is hypotensive.

Myocarditis/Pericarditis

Typically results in global saddle shaped ST segment elevation with or without pathognomic PR depression. ECG changes however can be regional, in which case patients require emergency angiography to exclude STEMI. If there is any doubt with respect to the diagnosis and ECG demonstrates ST elevation, angiography should be considered. Myocarditis is differentiated from pericarditis on the basis of an elevation in serum troponin.

Takotsubo cardiomyopathy

This is a stress-induced cardiomyopathy that can present with chest pain/dyspnoea and ECG changes that can mimic STEMI and NSTEMI. **It should be considered a diagnosis of exclusion. All patients presenting with an ECG suggestive of**

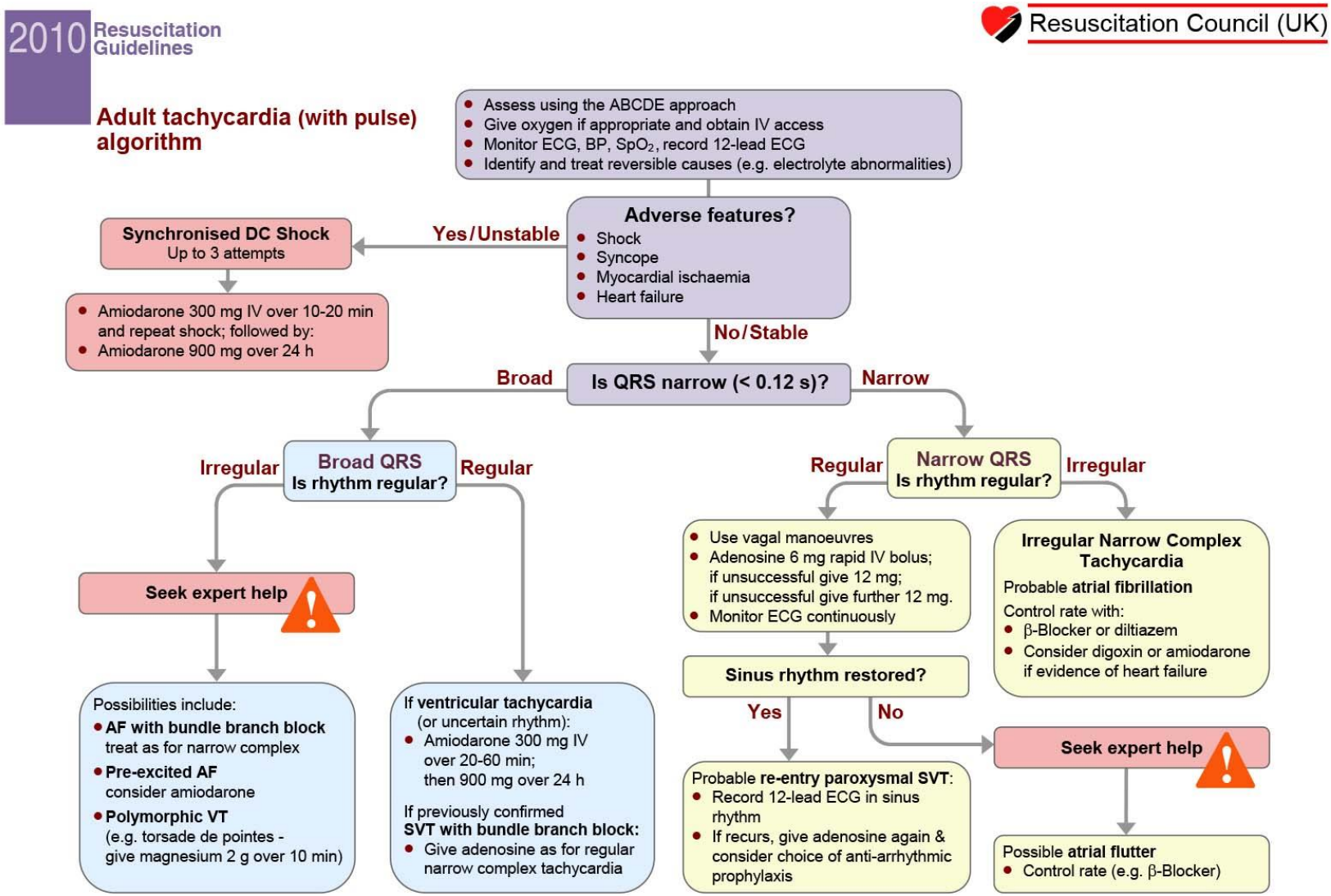
STEMI should be managed as per the PPCI protocol. Patients with troponin positive chest pain that do not have ST segment elevation on their ECG should be managed as per the NSTEMI protocol described above and if chest pain is refractory to medical therapy then emergency coronary angiography considered.

TACHYARRHYTHMIAS

All patients presenting to hospital with a tachyarrhythmia should be managed according to the ALS tachycardia algorithm (see below). Emergency management should be undertaken by the staff in ED and referrals to the cardiology SHO (bleep 2010) made only after initial treatment provided.

In the case of unstable patients or those with arrhythmias refractory to emergency treatment (e.g. VT storm), direct referral should be made to the on-call cardiology SPR (07795476632) by ED. If such referrals for emergency specialist cardiology input are received via the SHO bleep, these should be immediately re-directed to the on-call SPR.

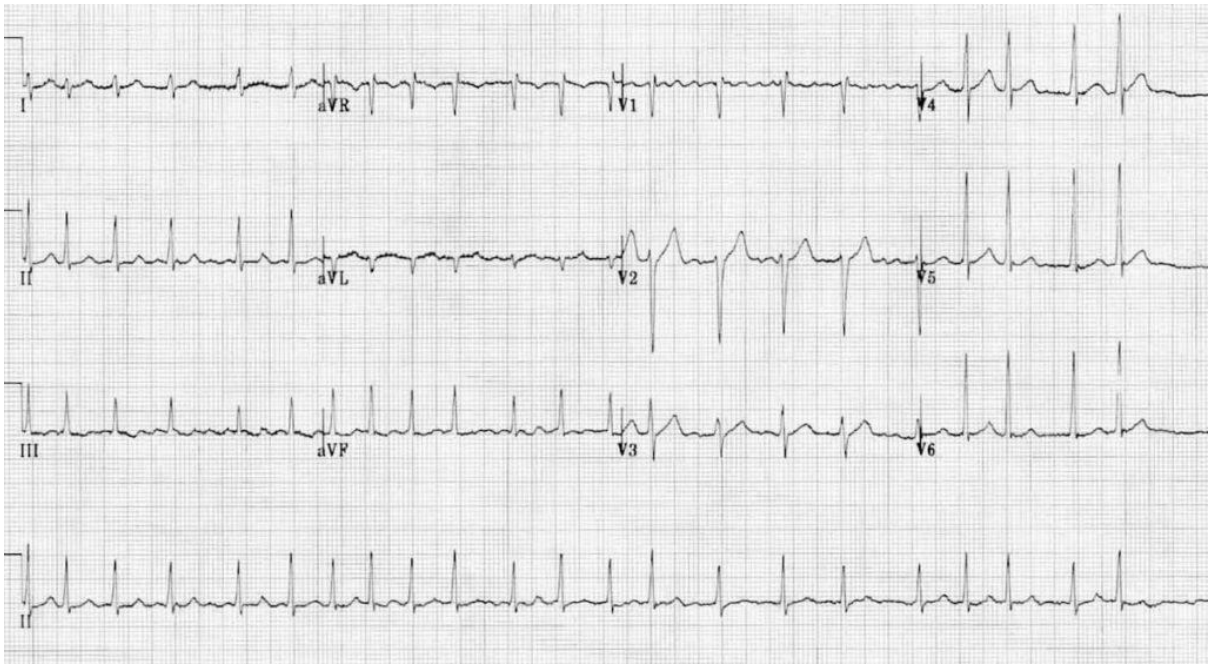
ALS Tachycardia Algorithm



Narrow complex tachycardias (NCTs)

This by definition is any rhythm with a rate >100bpm and QRS duration <120ms. The most important diagnostic question is whether the rhythm is regular or irregular. Irregular NCTs are highly likely to be AF. Regular NCTs can be caused by numerous mechanisms (Atrial flutter, sinus tachycardia, atrial tachycardia, atrioventricular nodal re-entry tachycardia (AVNRT), atrioventricular re-entry tachycardia (AVRT)).

Atrial fibrillation/atrial flutter



Generally, there are 2 main considerations:

1. Anticoagulation based on stroke risk as assessed by CHA_2DS_2-VASc score
2. Rate vs rhythm control strategy

1. Anticoagulation based on stroke risk as assessed by CHA_2DS_2-VASc score

All patients with new AF should have a thorough clinical history in order to ascertain both thromboembolic and bleeding risk factors. If oral anticoagulant (OAC) initiation is clinically indicated, this should be commenced in hospital and patients should not be discharged for OP follow-up without prescribing OAC.

Occasionally you may get phonecalls about OAC prescription from other departments. **Avoid advising prescription of OAC over the phone if you have not seen the patient's ECG or assessed the patients bleeding risk.**

CHA_2DS_2-VASc scoring system

- Congestive heart failure= 1 point
- Hypertension= 1 point
- Age ≥75 years= 2 points
- Diabetes mellitus= 1 point
- Previous stroke= 2 points
- Vascular disease= 1 point
- Age 65-74 years= 1 point
- Female sex= 1 point

Recommendations based on CHA_2DS_2-VASc score

- OAC is recommended for stroke prevention in AF patients with CHA_2DS_2-VASc score ≥2 in men or ≥3 in women (class 1A recommendation).
- OAC should be considered for stroke prevention in AF patients with a CHA_2DS_2-VASc score of 1 in men or 2 in women. (class IIa B recommendation).

In the BHSCT OAC should not be commenced without consultant approval in the presence of:

- Active bleeding at presentation
- Severe thrombocytopenia (<50 platelets/μL)
- Previous intracranial haemorrhage
- Recent serious bleeding episodes (e.g. oesophageal varices or other serious GI bleeding)

OAC should not be prescribed alongside other antithrombotic therapies, unless specifically recommended by a senior clinician (e.g. in the setting of recent PCI). Initiation of OAC in patients within 12 months of PCI should only be done following discussion with a senior clinician (SPR/consultant).

2. Rate vs rhythm control strategy

A rate control strategy refers to the use of rate-limiting medications to achieve a target heart rate, whereas a rhythm control strategy refers to an attempt to restore and maintain sinus rhythm. Optimal rate control is defined as a HR <110bpm based on the RACE II trial (3). Based on current evidence a rate control strategy is non-inferior to a rhythm control strategy with respect to prognosis. However, a rhythm control strategy may be chosen to reduce AF related symptoms and improve quality of life.

If haemodynamic deterioration occurs perform immediate synchronised DC conversion starting at 150J then 200J.

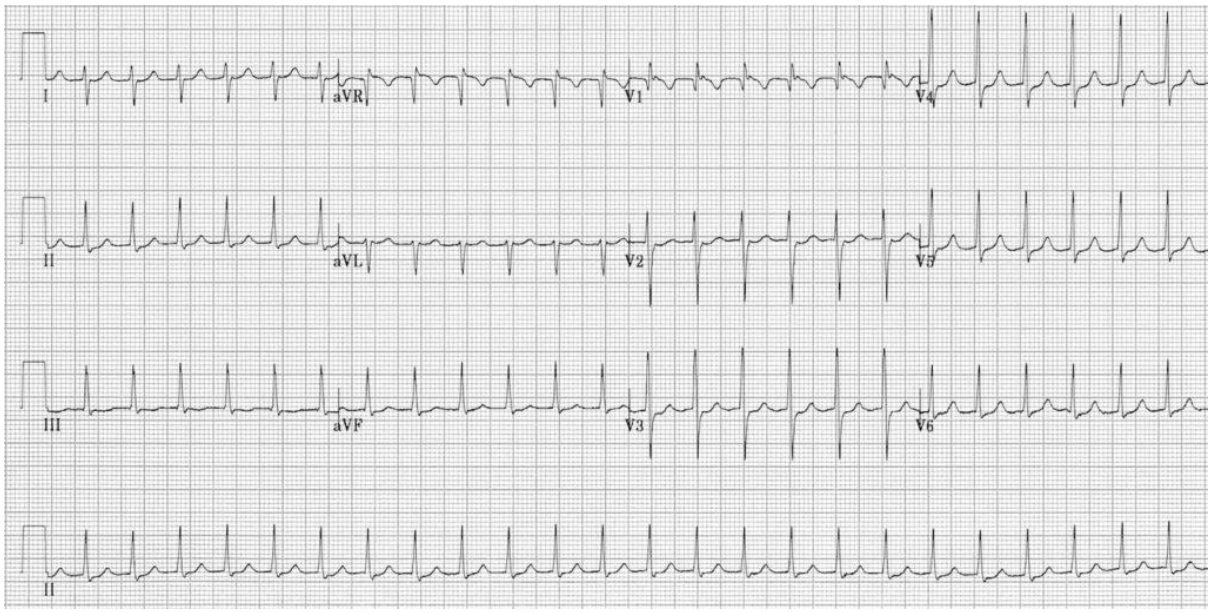
If no haemodynamic deterioration and onset is within 48 hours consider pharmacological conversion to sinus rhythm:

- Amiodarone 300mgs by IV infusion in 250mls 5% dextrose into a large vein, given over 1 hour followed by an infusion of 900mg over 24 hours if required.

For patients with unknown or longer duration of AF adopt a rate control strategy:

- 1st line- B-blocker e.g. Bisoprolol 2.5mg - 5mg
    - Consider rate limiting channel blockers only in patients with severe asthma or in those truly intolerant of B blockers. Rate-limiting calcium channel blockers are contraindicated in patients with a history of HFrEF (LVEF <40%)
- 2nd line- Digoxin (500 mcg stat. then 250 mcg after 6 hours, then daily maintenance dose of 125mcg or 62.5mcg) if aim is rate control. Reduce dose in renal impairment and elderly.

Supraventricular tachycardia



Haemodynamically unstable

Immediate synchronised DC cardioversion

Haemodynamically stable

Adenosine given as a rapid bolus (6 mg) followed immediately by large IV 0.9% NaCl flush, followed at 2 min intervals if needed by 12 mgs (and exceptionally 18 mgs) will terminate most junctional tachycardia and slow ventricular rate in atrial flutter to facilitate diagnosis by visualisation of flutter waves. Adenosine should not be used in patients with asthma, a history of WPW or suspicion of pre-excited AF on ECG. Warn the patient that they will feel terrible for a few seconds.

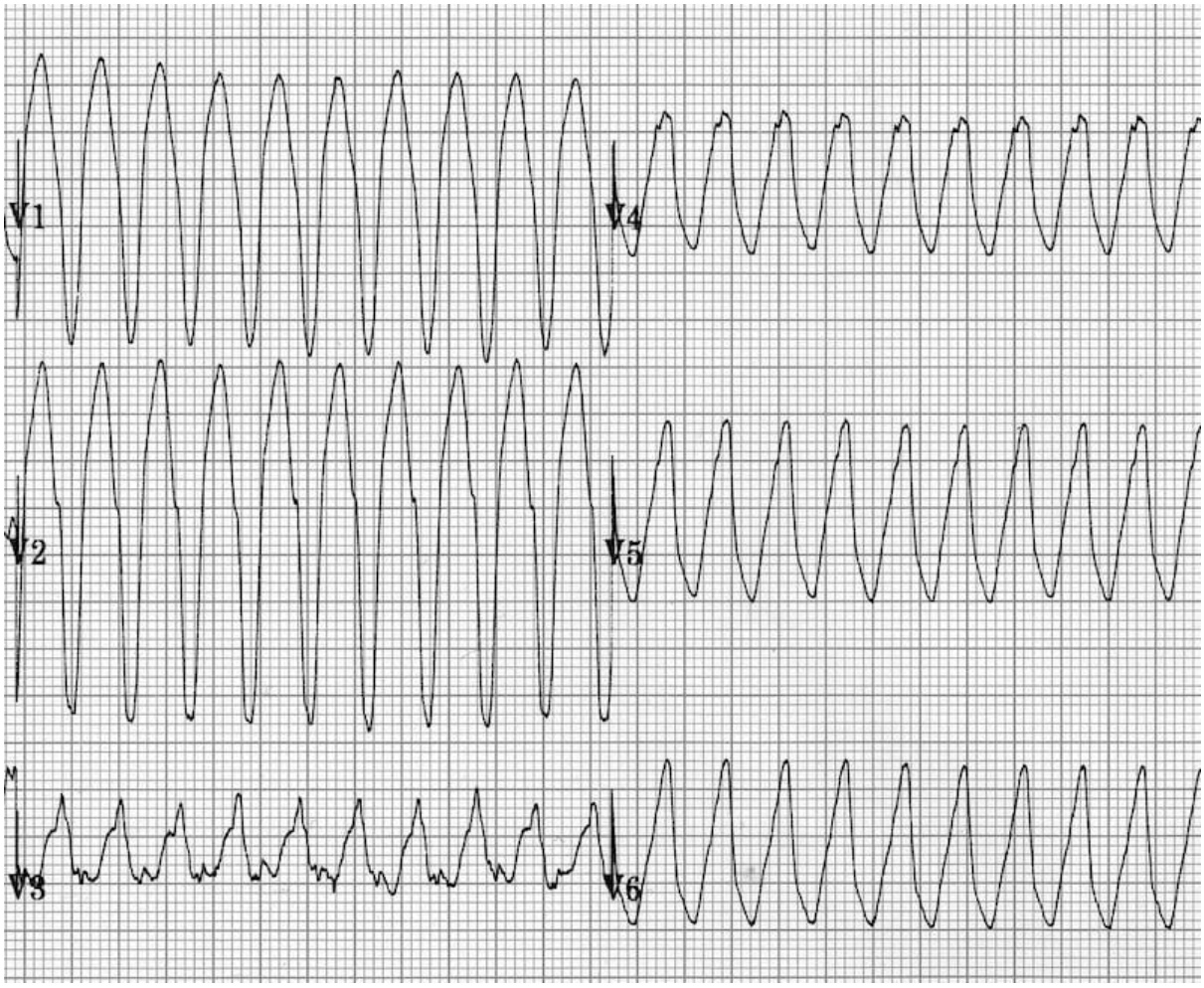
If adenosine fails to convert the patient to sinus then discuss with cardiology SPR on-call regarding ongoing management. Can consider beta blockers and amiodarone in the rare instance of adenosine failing to cardiovert a true SVT.

Broad complex tachycardias

This by definition is any rhythm with a rate >100bpm and QRS duration >120ms. Broad complex tachycardias (BCTs) can be due to both ventricular tachycardia (VT) and supraventricular tachycardia (SVT). However, where diagnostic uncertainty arises with ECG interpretation all BCTs should be treated as VT until proven otherwise.

Monomorphic Ventricular Tachycardia

The on-call cardiology SPR should be contacted for all cases of suspected sustained VT.



Indications for emergency synchronized DC cardioversion (150-200J) include:

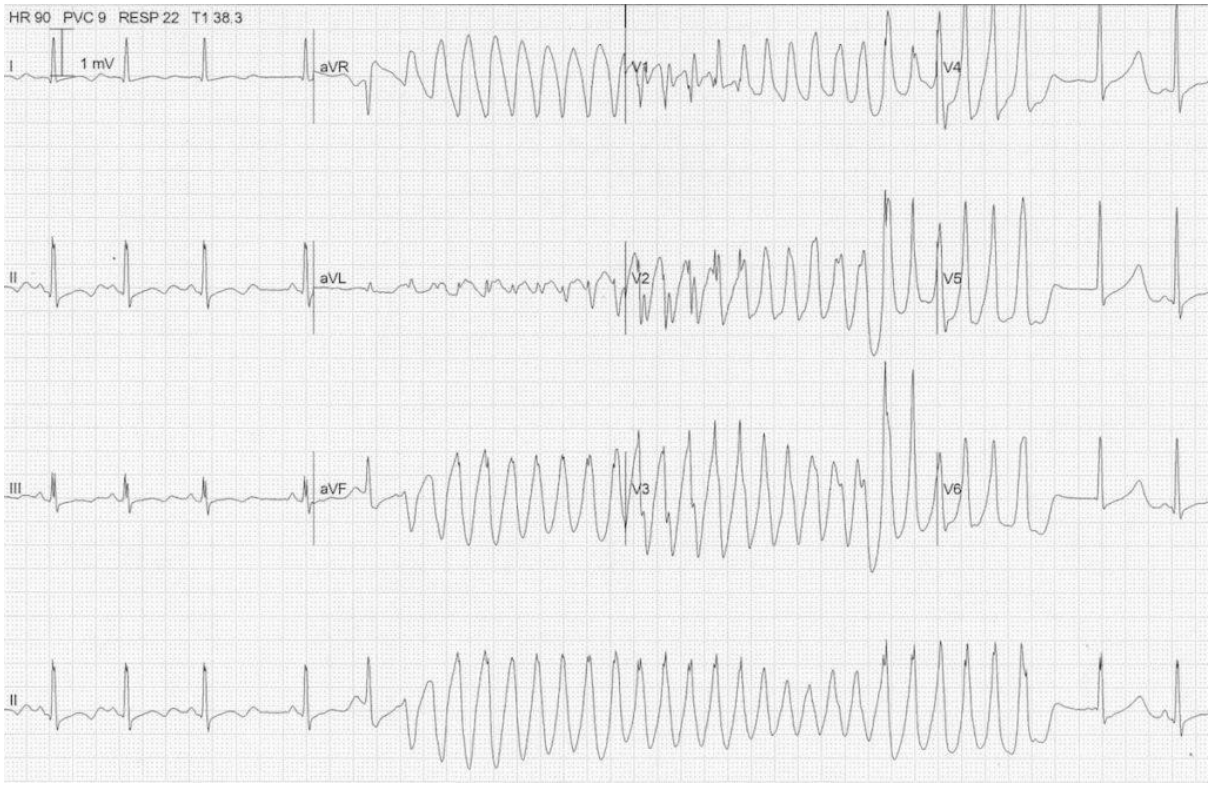
- Shock (systolic BP <90mmHg)
- Pulmonary oedema
- Acute myocardial ischaemia

In the absence of these adverse features, patients with haemodynamically stable VT should be administered 300mg IV amiodarone in 250ml 5% dextrose over 1 hour followed by an infusion of 900mg IV amiodarone in 500ml 5% dextrose over 24 hours. Additional therapies for the treatment of VT (e.g. IV lignocaine) should only be administered following discussion with the on-call cardiology SPR/consultant.

Following restoration of sinus rhythm a 12-lead ECG should be performed immediately to ensure no evidence of myocardial ischaemia as a precipitant to the arrhythmia. Patients with both STEMI and NSTEMI presenting with ventricular arrhythmias should be discussed with the on-call cardiology SPR and considered for emergency coronary angiography.

<u>Polymorphic Ventricular Tachycardia (aka Torsades de pointes)</u>

IV amiodarone should be avoided due to QT prolongation and risk of worsening arrhythmia burden. Polymorphic VT should be treated with immediate administration of 5g MgSO4 and emergency electrical cardioversion for persistent arrhythmia with haemodynamic instability. Patients presenting with Polymorphic VT should be discussed with the on-call SpR.



BRADYARRHYTHMIAS

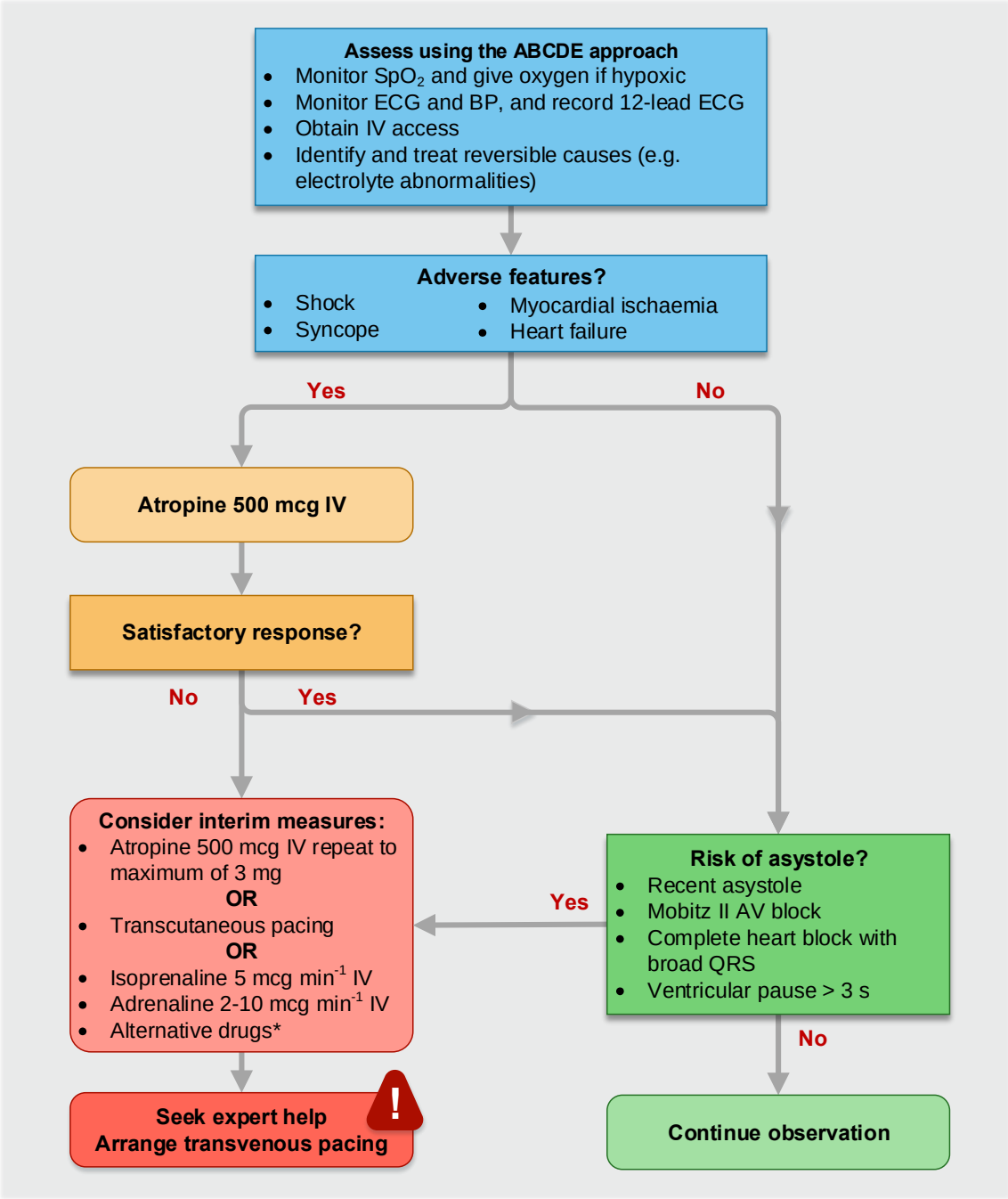
All patients presenting to hospital with a bradyarrhythmia should be managed according to the ALS bradycardia algorithm (see below). Emergency management should be undertaken by the staff in ED and referrals to the cardiology SHO (bleep 2010) made only after initial treatment provided.

In the case of unstable patients, who present with haemodynamic instability or require transcutaneous temporary pacing, direct referral should be made to the on-call cardiology SPR (07795476632) by ED. If such referrals for emergency specialist cardiology input are received via the SHO bleep, these should be immediately re-directed to the on-call SPR for consideration of emergency transvenous temporary pacing wire insertion.

ALS Bradycardia Algorithm

Resuscitation Council (UK) GUIDELINES 2015

Adult Bradycardia Algorithm

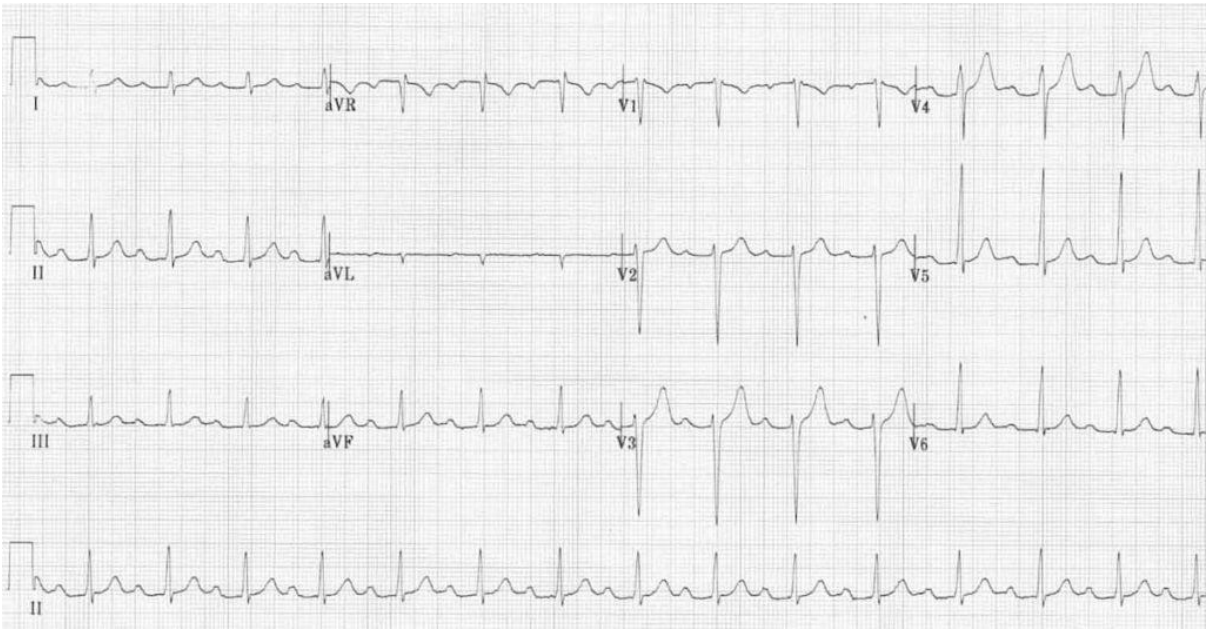


*** Alternatives include:**

- Aminophylline
- Dopamine
- Glucagon (if bradycardia is caused by beta-blocker or calcium channel blocker)
- Glycopyrrolate (may be used instead of atropine)

1st degree AV block

No specific treatment required, but raises the clinical suspicion of intermittent progressive higher degrees of AV block in patients with syncope.

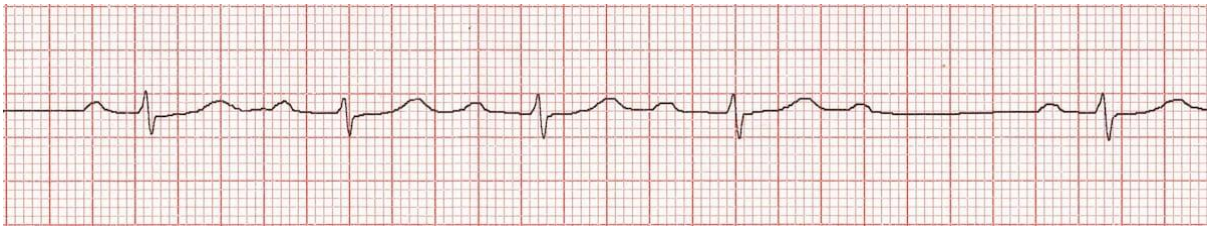


2nd degree AV block

Mobitz Type I (Wenckebach)

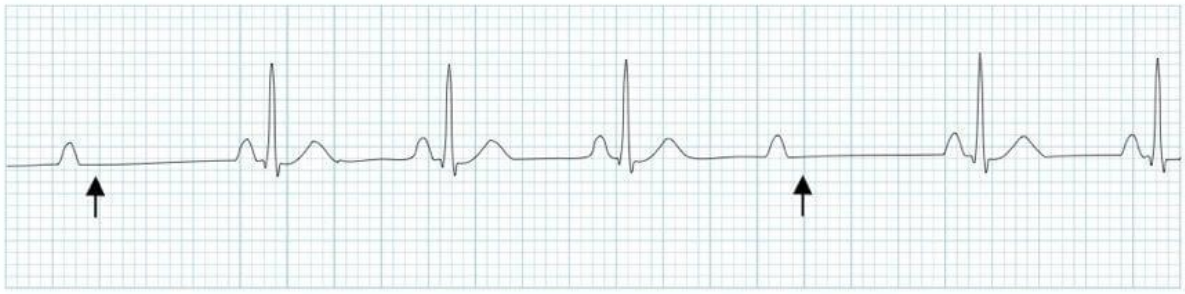
Progressively increasing PR interval then a dropped QRS complex. No treatment or further inpatient monitoring is required if the patient is asymptomatic.

Permanent pacemaker implantation can be considered in the setting of syncope or clear correlation to symptoms. Patients with syncope and Mobitz type I should be admitted for a period of IP cardiac monitoring. Stop any possible drug cause e.g. Beta- blockers, verapamil, diltiazem, digoxin and amiodarone.



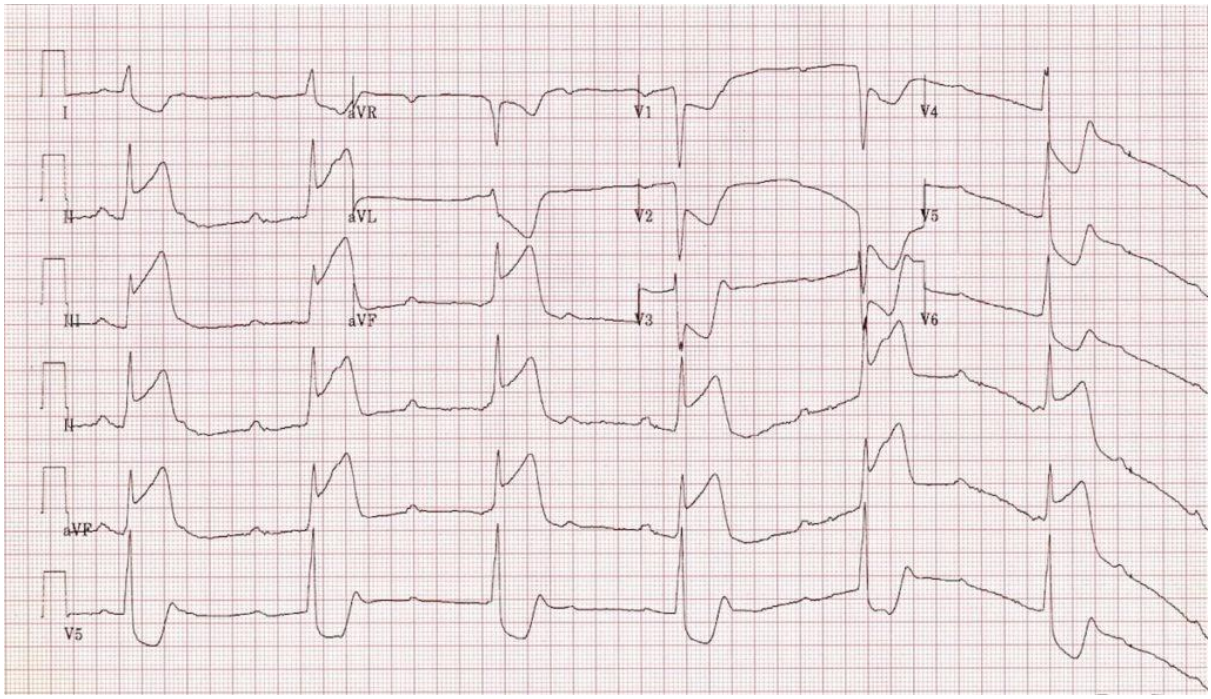
Mobitz Type II

Fixed PR interval with either intermittent dropped QRS complexes occurring without warning or regular dropped beats, e.g. 2:1, 3:1, 4:1, etc., A-V conduction). Will need referred on electronic whiteboard as an inpatient for permanent pacemaker implantation pre-discharge. **Whiteboard referral should only be completed/sent following instruction by consultant in charge of patient's care.**



Complete Heart Block

Complete AV dissociation, with no discernable connection between P waves and QRS complexes on ECG.



All cases of complete heart block should be discussed with the on-call cardiology SPR. Consider Isoprenaline infusion if:

- Haemodynamically unstable (Systolic BP <90mmHg)
- Evidence of hypoperfusion despite normal BP

- Recurrent P wave asystole
- Recurrent pre-syncope or syncope

A temporary transvenous pacemaker should be considered in all patients with persistent or transient haemodynamic instability, particularly if this occurs refractory to isoprenaline.

Isoprenaline hydrochloride is administered at a dose of 2mg in 500mls Dextrose 5% with dose up-titration depending on effect. Start at 7.5-15 mls/hour and increase up to 30ml/hr .

HEART FAILURE

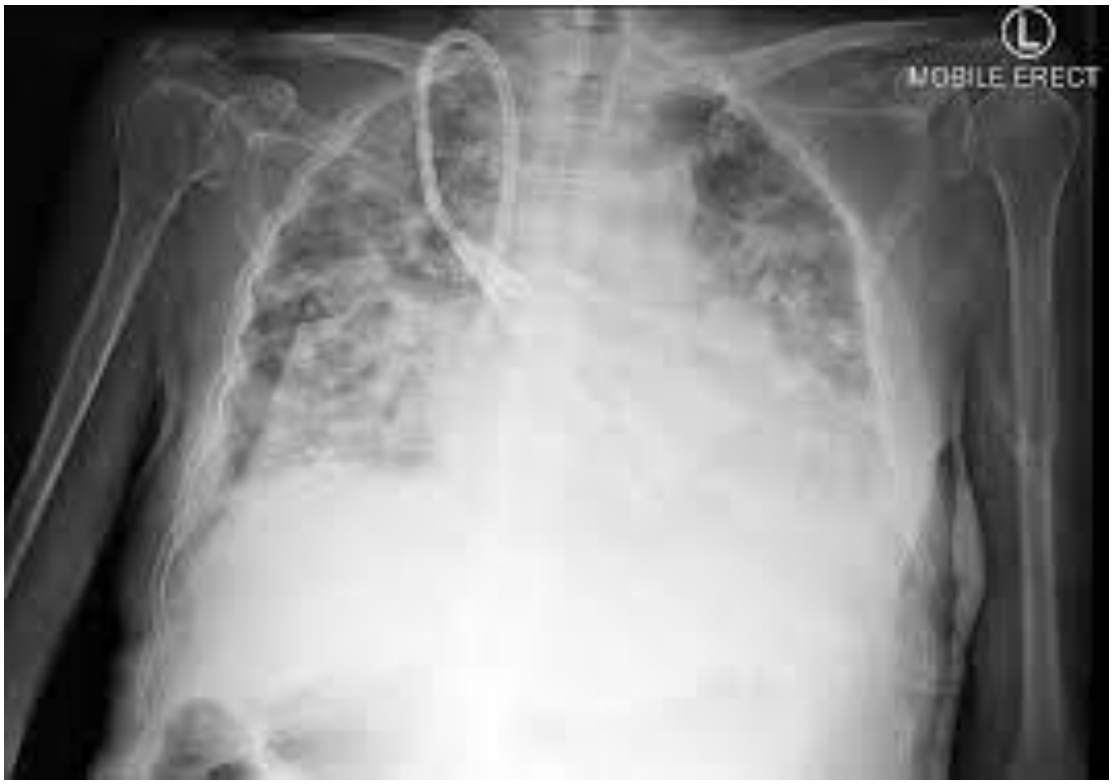
Acute heart failure

Acute heart failure refers to signs and/or symptoms suggestive of heart failure (e.g. dyspnoea, orthopnoea, paroxysmal nocturnal dyspnoea or peripheral oedema) that are sufficiently severe to prompt an unplanned admission to hospital or emergency department attendance. The term acute heart failure encompasses clinical presentations that include:

- Acute pulmonary oedema
- Decompensation of chronic heart failure
- Cardiogenic shock with or without clinical evidence of fluid overload

All patients presenting to hospital with suspected acute heart failure should undergo a comprehensive panel of baseline investigations to both confirm the diagnosis and identify any potentially life-threatening or reversible causes.

Acute Pulmonary Oedema



Baseline Investigations

- Bloods incl FBC, U&E, LFT, CRP, NT-proBNP and TFT
- ECG
- CXR
- ABG (if O2 sats <94% on room air)
- TTE (as an emergency if patient is hypotensive)

Initial Treatment

- ABCDE assessment
- Sit the patient upright if dyspnoeic or hypoxic
- Oxygen therapy if O2 sats <94% on room air
    - Early consideration to non-invasive ventilation or referral to ICU if severe hypoxia refractory to high flow oxygen
- Administer IV furosemide
    - If diuretic naïve- 40mg IV furosemide
    - If on pre-admission diuretics- IV furosemide dose equivalent to total daily dose of PO furosemide, but not to exceed 100mg (i.e. if on 40mg BD PO furosemide, then administer 80mg bolus)

- Assess BP and tailor additional therapies to haemodynamics
    - Systolic BP <90mmHg or clinical evidence of hypoperfusion (AKI, elevated lactate or acute liver function derangement)
        - Inotropic support (e.g. dobutamine 2.5mcg/kg/min). **SEEK SENIOR SUPPORT IMMEDIATELY**
    - Systolic BP >140mmHg
        - Commence GTN infusion at 0.6ml/hr and up titrate as per BP response

Decompensation of chronic heart failure

Provided lack of compliance is not the cause of admission, patients should be commenced on an initial daily diuretic dose 2x higher than their pre-admission oral dose (e.g. a patient on 40mg furosemide BD PO should be commenced on 80mg IV furosemide BD) (4).

All patients with decompensated heart failure should have daily assessment of:

- Clinical status
    - Heart rate
    - Blood pressure
    - Oxygen saturations and changes in oxygen requirement
- Fluid status
- Previous 24 hours fluid balance
    - Negative diuresis
    - Intake less than 1200ml
- Weight
- U&E

Treatment of heart failure with reduced ejection fraction (HFrEF)

HFrEF is defined as a left ventricular ejection fraction of <40%. In the absence of contraindications, patients with HFrEF should be commenced on 4 medications that form the mainstay of disease modifying therapy:

1. ACE inhibitor (e.g. Ramipril or Enalapril) or angiotensin receptor-neprilysin inhibitor (Entresto)
2. Beta blocker (e.g. bisoprolol or carvedilol)
3. Mineralocorticoid receptor antagonist (e.g. eplerenone or spironolactone)
4. SGLT2 inhibitor (e.g. dapagliflozin or empagliflozin (5)

Ivabradine should be considered in symptomatic patients with LVEF <35%, in sinus rhythm with a resting heart rate >70 bpm, despite treatment with an evidence-based dose of beta-blocker, or in patients truly intolerant to beta blockers (5). Initiation of heart failure pharmacological therapies should only be considered in patients who are haemodynamically stable and not maintained on inotropic support. ACE-I, ARNI, ARB and MRA should be used with caution in patients with chronic kidney disease and should not be initiated in the setting of an acute kidney injury.

Cardiogenic shock

Cardiogenic shock is a medical emergency associated with significant in-hospital mortality. Patients with suspected cardiogenic shock should be assessed rapidly by a senior cardiology clinician to ensure reversible aetiologies are promptly identified and specific treatment initiated. If referrals from ED are received for suspected cardiogenic shock by the cardiology SHO, the cardiology SPR should be contacted immediately (07795476632).

Commonest aetiologies of cardiogenic shock to identify

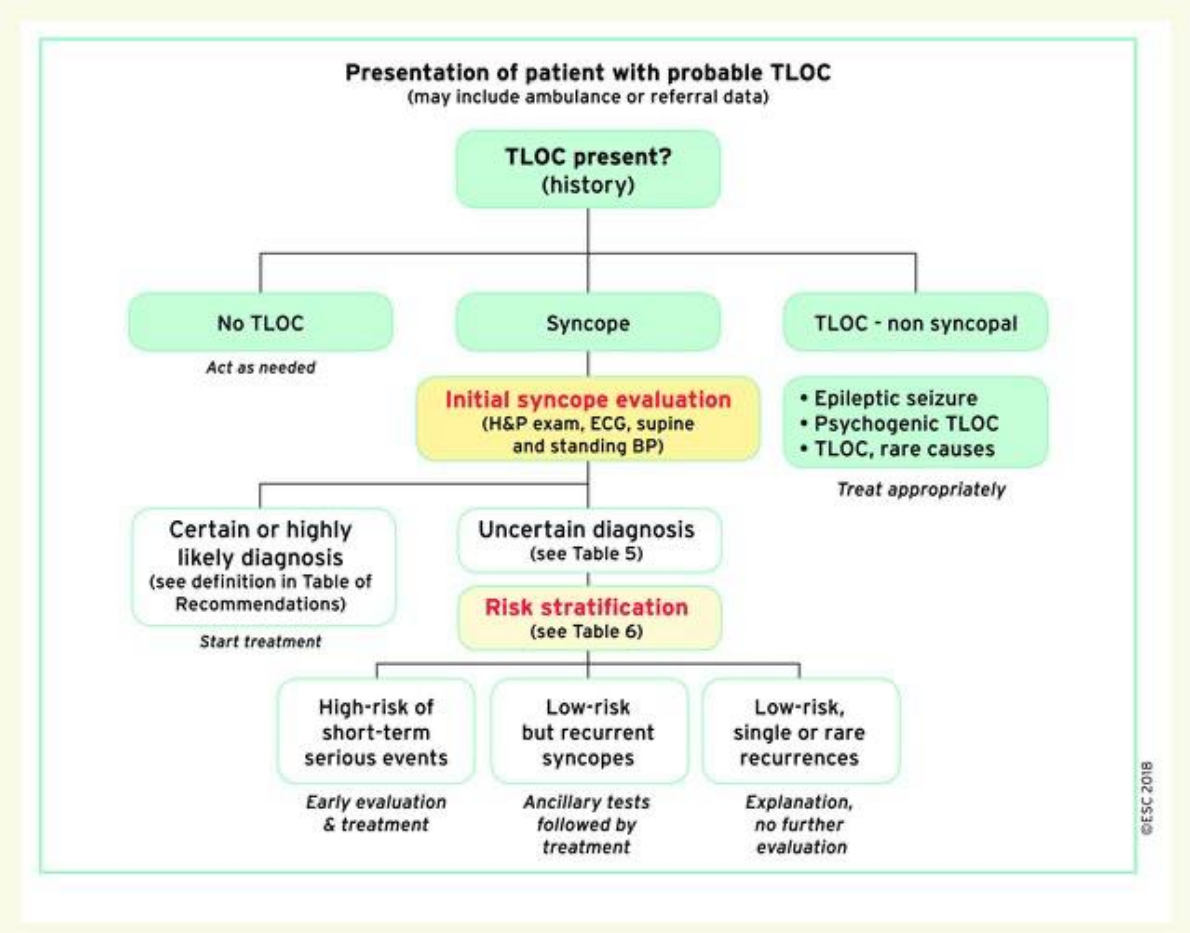
- Acute coronary syndrome
- Hypertensive crisis
- Arrhythmia
- Mechanical (mechanical complication of MI, chest trauma, aortic dissection or acute native or prosthetic valve dysfunction)
- Pulmonary embolism
- Infections
- Cardiac tamponade

Acute myocardial infarction should be considered immediately in all patients with cardiogenic shock. In the absence of ECG evidence of MI, an emergency echocardiogram should be performed in ED to identify patients who require emergency cardiac or cardiac surgical procedures. If the diagnosis remains unclear after ECG and echocardiogram consider CT chest to diagnose PE or aortic dissection.

SYNCOPE

Transient loss of consciousness (TLOC) is defined as a state of real or apparent LOC, characterised by amnesia for the period of LOC, abnormal motor control and loss of responsiveness. Syncope is when TLOC is due to cerebral hypoperfusion. It is characterised by a rapid onset, short duration and spontaneous recovery.

Cardiology referrals with TLOC where syncope is suspected should be evaluated and managed in ED as per the ESC recommendation (6) for the initial evaluation and risk stratification of syncope:



A thorough history, clinical examination and ECG are required to identify the presence of clinical features that suggest low- or high-risk features about the presentation.

Low- and high-risk features of syncope (6)

SYNCOPAL EVENT
Low-risk
• Associated with prodrome typical of reflex syncope (e.g. light-headedness, feeling of warmth, sweating, nausea, vomiting)[36,49] • After sudden unexpected unpleasant sight, sound, smell, or pain[36,49,50] • After prolonged standing or crowded, hot places[36] • During a meal or postprandial[51] • Triggered by cough, defaecation, or micturition[52] • With head rotation or pressure on carotid sinus (e.g. tumour, shaving, tight collars)[53] • Standing from supine/sitting position[54]
High-risk
Major
• New onset of chest discomfort, breathlessness, abdominal pain, or headache[26, 44, 55] • Syncope during exertion or when supine[36] • Sudden onset palpitation immediately followed by syncope[36]
Minor (high-risk only if associated with structural heart disease or abnormal ECG):
• No warning symptoms or short (<10 s) prodrome[36, 38, 49, 56] • Family history of SCD at young age[57] • Syncope in the sitting position[54]
PAST MEDICAL HISTORY
Low-risk
• Long history (years) of recurrent syncope with low-risk features with the same characteristics of the current episode[58] • Absence of structural heart disease[27, 58]
High-risk
Major
• Severe structural or coronary artery disease (heart failure, low LVEF or previous myocardial infarction)[26, 27, 35, 55, 59]
PHYSICAL EXAMINATION
Low-risk
• Normal examination

PHYSICAL EXAMINATION	
High-risk	
Major	
• Unexplained systolic BP in the ED <90 mmHg[26, 55] • Suggestion of gastrointestinal bleed on rectal examination[44] • Persistent bradycardia (<40 b.p.m.) in awake state and in absence of physical training • Undiagnosed systolic murmur[60]	
ECG[a]	
Low-risk	
• Normal ECG[26, 35, 36, 55]	
High-risk	
Major	**Minor** (high-risk only if history consistent with arrhythmic syncope)
• ECG changes consistent with acute ischaemia • Mobitz II second- and third-degree AV block • Slow AF (<40 b.p.m.) • Persistent sinus bradycardia (<40 b.p.m.), or repetitive sinoatrial block or sinus pauses >3 seconds in awake state and in absence of physical training • Bundle branch block, intraventricular conduction disturbance, ventricular hypertrophy, or Q waves consistent with ischaemic heart disease or cardiomyopathy[44, 56] • Sustained and non-sustained VT • Dysfunction of an implantable cardiac device (pacemaker or ICD) • Type 1 Brugada pattern • ST-segment elevation with type 1 morphology in leads V1–V3 (Brugada pattern) • QTc >460 ms in repeated 12-lead ECGs indicating LQTS[46]	• Mobitz I second-degree AV block and 1°degree AV block with markedly prolonged PR interval • Asymptomatic inappropriate mild sinus bradycardia (40–50 b.p.m.), or slow AF (40–50 b.p.m.)[56] • Paroxysmal SVT or atrial fibrillation[50] • Pre-excited QRS complex • Short QTc interval (≤340 ms)[46] • Atypical Brugada patterns[46] • Negative T waves in right precordial leads, epsilon waves suggestive of ARVC[46]

Once the presence or absence of high-risk clinical features have been evaluated the patient can be appropriately risk stratified leading to one of 3 pathways:

- **Low-risk features only**- Discharge from ED with no follow-up
- **No high- or low-risk features (or recurrent syncope)-** Discharge from ED with referral to ambulatory cardiology (ACU)
- **Any high-risk feature-** Admission to cardiology for further observation/investigation

Any patient being discharged from either the ward or ED should receive advice regarding driving restrictions. The DVLA provide clear guidance on driving restrictions based on both the clinical presentation and underlying pathology: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1084397/assessing-fitness-to-drive-may-2022.pdf

ADULT CONGENITAL HEART DISEASE

The RVH is Northern Ireland's tertiary referral centre for adult congenital heart disease (ACHD). This patient group are highly complex, can deteriorate rapidly and depending on their underlying anatomy are often less able to tolerate minor physiological insults. The management of these patients is challenging, and all patients presenting to RVH ED with a background of ACHD should be discussed with the on-call cardiology SPR.

Patients with complex ACHD who present with non-cardiovascular pathology are often looked after in the cardiology ward with specialist input from the ACHD team. Please be considerate to ED and other staff who may refer these patients and consider where the safest environment to look after these patients is.

MANAGEMENT OF PATIENTS FOLLOWING INVASIVE CARDIAC PROCEDURES

A wide array of invasive cardiac procedures are offered within the BHSCT. A detailed explanation of each procedure and associated complications is beyond the scope of this document. Junior doctors may be asked to provide input regarding pharmacological therapies to be initiated post procedure and for clinical review in the event of a post procedural deterioration.

All patients have documentation of a procedure note in which a detailed plan will be available specifying the recommended post procedural medications. The most important of which is the antithrombotic recommendations. The inappropriate administration or omission of antithrombotics can have life-threatening complications for patients. If any ambiguity arises following review of the procedural note then please contact the SPR in charge of the patient's care or the operator performing the procedure.

Any clinical deterioration post procedure should be assessed immediately. Any suspected procedural adverse event or complication needs discussed with the cardiology SPR and/or Consultant. Any post procedural haemodynamic alteration should be treated as potentially life threatening and is a presumed to be a major cardiac or vascular injury until proven otherwise.

OUTPATIENT PATHWAYS FOR THE INVESTIGATION AND MANAGEMENT OF SUSPECTED CARDIOVASCULAR DISEASES

Referrals to the cardiology SHO from ED may not require admission to hospital for further investigation or inpatient treatment. All patients being considered for discharge from ED must be discussed with the on-call cardiology SPR. **Patients should not be discharged from ED directly by the cardiology SHO without senior consultation. It is also essential that patients are reviewed in ED by the on-call SHO prior to any consideration of discharge for OP follow-up.**

Many patients discharged from ED will require some form of OP cardiology follow-up. The most suitable pathway will be dictated by the patient's presenting symptoms, pre-existing cardiovascular history and urgency that future cardiology input is required. Broadly this can be divided into 3 OP pathways:

1. Ambulatory Cardiology Unit (ACU)
2. Rapid Access Angina Clinic (RAAC)
3. Consultant led OP clinic

Ambulatory Cardiology Unit (ACU)

- Urgent OP clinic in BCH for early clinical follow-up. Referral form can be found on the Hub by searching for "ambulatory cardiology". Ensure all referrals are sent with a copy of an ECG. Send referral to ACUreferrals@belfasttrust.hscni.net
- Inclusion criteria:
    - New AF/other atrial arrhythmias
    - Suspected Heart Failure (ACU is not for patients with a pre-existing diagnosis of heart failure known to a consultant and/or heart failure service)
    - Syncope that merits OP follow-up as per the syncope section above
    - Uncomplicated pericarditis
    - Palpitations with abnormal ECG/syncope or presyncope/known or suspected structural heart disease/family history of inherited cardiac disease or family history of sudden cardiac death.

- Exclusion criteria:
    - Suspected coronary artery disease (In the absence of ACS these patients should be referred to the RAAC)
    - Patients under regular cardiology follow-up presenting with a deterioration of symptoms, but that do not require admission
        - Correspondence should be sent to their responsible consultant detailing their attendance
    - Patients from outside the BHSCT catchment area who have been transferred to RVH/BCH for tertiary referral care by another specialty (e.g. neurosurgery). These patients should be referred to their local cardiology service for follow-up.

Do not refer in-patients in other wards to the Ambulatory Care Unit. These patients should be discussed with the SpR or RVH COW

Rapid Access Angina Clinic

- Suitable for referral from ED for low-risk Troponin negative chest pain suspicious of angina without ECG changes
- May also be suitable for patients with atypical troponin negative chest pains but a high-risk factor profile, or minor non-dynamic ECG changes
- Document on front of ED flimsy for referral to RAAC and ask trackers in ED to make the referral onwards.
- Do not refer low risk patients with non-cardiac chest pain and a normal 12-lead ECG to the RAAC.
- **Patients with an elevated troponin or ECG suggestive of acute ischaemia should not be referred to RAAC**.

OP Clinic Referral

- If reviewing a patient who is already known to a Cardiology Consultant then a letter should be sent to this Consultant for a follow up if they are suitable for discharge. You should send an email to this consultant to explain why the

patient presented to the hospital and the need for OP follow-up. This is both a courtesy and ensures safe patient follow up.

- Some patients will have a new diagnosis cardiovascular detected in ED, but not require urgent OP follow-up (e.g. incidental finding of mild-moderate aortic stenosis or asymptomatic rate-controlled AF after anticoagulation initiated). These patients should be referred to the consultant of the week (COW) on-call at the time of referral.

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