University Hospitals Birmingham NHS
NHS Foundation Trust

CONTROLLED DOCUMENT

Therapeutic Guidelines for Patients With Suspected Myocardial Infarction or other Cardiac Emergencies

CATEGORY:	**Guidelines**
CLASSIFICATION:	**Clinical**
PURPOSE	**To optimise the care of patients with MI and acute cardiac problems**
Controlled Document Number:	**CG067**
Version Number:	**3.1**
Controlled Document Sponsor:	**Clinical Guidelines Group**
Controlled Document Lead:	**Jon Townend, Consultant Cardiologist**
Approved By:	**Clinical Guidelines Group**
On:	**August 2018**
Review Date:	**August 2021**
Distribution:	**Trustwide, all Senior and Junior medical doctors.**

INTRODUCTION

The purpose of this document is to provide a series of recommendations for the management of patients with acute cardiovascular disorders. These recommendations will be subject to regular up date and review in the light of emerging evidence. Please advise the On-Call Cardiologist of situation where you consider it necessary to deviate from the recommendations / or guidelines, or encounter situations not discussed in this document so that future editions can be revised accordingly.

As the recommendations outlined in this document have made no assumptions about your previous cardiological experience, some of the recommendations may seem obvious. The intention of the text is to advise and support clinical practice and so serves to meet the needs of staff with a variety of experiences.

Assessment of patients with chest pain in ED and CDU

- Assess using history (**H**), ECG (**E**), Age (**A**), risk factors (**R**), and Tn (**T**) and calculate HEART score.
- ECG to be performed within 10 minutes of arrival in hospital
- Tn T to be checked on admission and 1-3 hours later. Two values are always required for rule out.

HEART

HEART score for chest pain patients

History (Anamnesis)	Highly suspicious	2	
	Moderately suspicious	1	
	Slightly suspicious	0	
ECG	Significant ST-deviation	2	
	Non-specific repolarisation disturbance / LBBB / PM	1	
	Normal	0	
Age	≥ 65 years	2	
	45 – 65 years	1	
	≤ 45 years	0	
Risk factors	≥ 3 risk factors *or* history of atherosclerotic disease	2	
	1 or 2 risk factors	1	
	No risk factors known	0	
Troponin	≥ 3x normal limit	2	
	1-3x normal limit	1	
	≤ normal limit	0	
		Total	

Risk factors for atherosclerotic disease:

Hypercholesterolemia	Cigarette smoking
Hypertension	Positive family history
Diabetes Mellitus	Obesity (BMI>30)

Actions according to HEART score

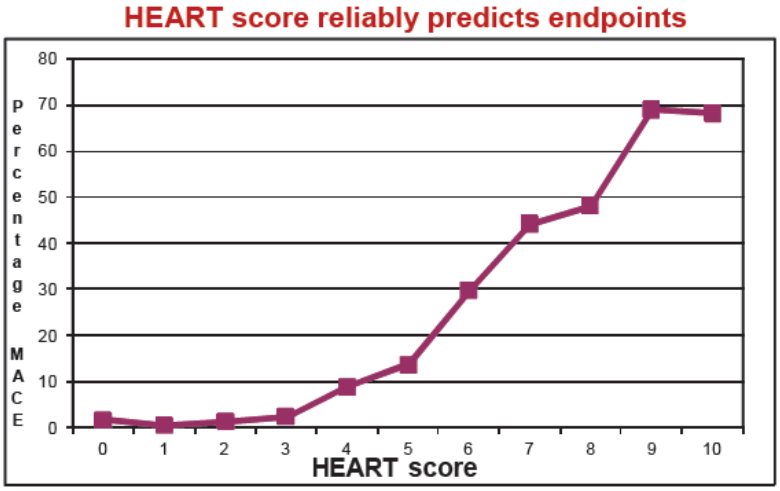
- **In all cases, consider obtaining advice from the cardiology nurse practitioner (CNP) available via phone 12536 (available 8-8 weekdays and 8-4 weekends and bank holidays)**

- HEART score of 3 or less and thought to be non-cardiac chest pain. Refer appropriately if other cause of chest pain sill possible e.g. aortic dissection, pulmonary embolism, pneumothorax. If no other serious cause identified discharge and reassure.

- Clear cut ACS – refer for admission and inform CNP via phone 12536. High risk cases (haemodynamic instability, pulmonary oedema, arrhythmia, marked ST depression on ECG) to be admitted to CCU

- Stable angina on exertion – arrange to start medication with aspirin, statins and beta blockers. Refer to CNP to arrange interval cardiology OPA

- Grey cases – refer early to CNP - phone 12536.
    - CNP will assess and consider use of OP investigation or IP angiogram, CT coronary angiogram etc.
    - CNP to involve consultant cardiologist if required



HEART	~ % pts	MACE/n	MACE	Death	Proposed Policy
0-3	32%	38/1993	1.9%	0.05%	Discharge
4-6	51%	413/3136	13%	1.3%	Observation, risk management
7-10	17%	518/1045	50%	2.8%	Observation, treatment, CAG

*MACE = Major Adverse Cardiac Event = Myocardial Infarction, PCI/CABG, all-cause death. Based on N=6174

MANAGEMENT POLICY FOR A PATIENT REQUIRING ACUTE CARDIAC CARE

Table 1: *Criteria for admission to coronary care unit*

- Admissions to CCU should be made after review by the Cardiology team on-call consultant/SpR/CNPs)
- Suspected or definite acute coronary syndrome (STEMI or NSTEMI) within the preceding 24 hours
- Major dysrhythmias
- Haemodynamic instability of cardiac aetiology including patients requiring inotropic or mechanical support prior to transplant/VAD
- ACS with ongoing chest pan
- Haemodynamically significant pulmonary embolus
- Stable post-primary PCI STEMI patients are monitored on CCU for 12-24 hours

Table 2: *On-call cardiology service at UHB*
• The cardiology nurse practitioners are currently available on weekdays 8-8 and weekends and bank holidays 8-4 and should be the first point of contact for patients with suspected ACS. Contact via phone 12536 or PICS referral. • The cardiology SpR performs 24 hour shifts “on call” and maybe off-site out of hours. When not on site they will be available on site within 30 minutes. • The SpR will be always contactable for advice on the on-call blackberry 12065 or via switchboard. • There is an on-call consultant of the week for general cardiology and an on-call consultant interventional cardiologist for PCI.

Immediate Management of ST elevation MI (STEMI)

Diagnosis

1 ECG:

- Perform **within 10 minutes** of hospital arrival
- Rapidly assess for ST elevation in two contiguous leads - >1mm in limb leads and >2mm in chest leads.
- If changes not typical as above and if history suggestive of acute MI, repeat ECG in 15-30 minutes to assess for evolving changes.
- LBBB – attempt to establish if this is a new abnormality, previous ECGs are stored digitally on portal. If history suggestive of acute MI, however, seek early cardiology advice.

If the diagnosis is STEMI, activate the primary PCI pathway via the Primary PCI phone immediately. If in doubt it is in the patient's interest to activate the PPCI pathway rather than seek a cardiology opinion which may not be immediately available (Time is muscle!). The PPCI phone number is **0121 371 2516.** Internal number is **12516**

- If no ST elevation or LBBB
  - Look for ST depression or T wave inversion or Q waves suggesting a previous MI.
  - ST depression is a high risk feature in ACS – please seek urgent cardiology advice.
  - A normal ECG does not exclude an ACS
  - Ongoing chest pain irrespective of ECGs – please seek urgent cardiology advice.

2 Peripheral IV access:

- Preferably left arm; Large enough (green if possible) to allow rapid administration of fluids if necessary
- Urgent blood tests including renal function / electrolytes; full blood count; clotting, glucose. Lipids routinely.
- A baseline hs-Troponin should be requested only in patients *without* clear ST elevation on ECG

3 Initial Management:

- Aspirin 300mg per oral (PO) (non-enteric coated to be chewed – to optimise bioavailability) if not already given by ambulance crews.
- Ticagrelor – loading dose is 180 mg po. A dispersible tablet is available if required. (If ticagrelor allergic or intolerant use prasugrel, see ACS treatments page 14)
- Analgesia – administer IV morphine (5-10mg) with anti-emetic (Metoclopramide 10mg, Ondansetron 4mg).
- GTN spray (sublingual) – consider IV nitrate infusion if ongoing pain.
- Oxygen – do not routinely administer oxygen. Be guided by pulse oximetry and consider the presence of concomitant chronic airways disease.
- Administer supplemental oxygen to:
  - People with oxygen saturation (SpO2) of less than 94% who are not at risk of hypercapnic respiratory failure, aiming for SpO2 of 94–98%

4 Arterial Blood Gases:

- Should not be performed routinely. (If essential use the left radial artery, the right radial is the access site of choice for any PCI procedure and should be left undamaged)
- Indications:
  - Cardiac arrest
  - Cardiogenic shock
  - Acutely unwell patients with altered consciousness
  - Suspected hypercapnia in patients with chronic respiratory illnesses

Treatment

Primary PCI is the default reperfusion strategy at QEHB.

(If PPCI not appropriate, thrombolytic therapy may be considered (Appendix 1) by the on-call Cardiology SpR and or consultant cardiologist).

Table 1: *Primary PCI for STEMI and unstable NSTEMI*
Primary PCI Activation
1. The majority of STEMIs should be diagnosed and referred by the ambulance service and admitted directly to the cardiac catheter laboratory and not via A&E. 2. For patients admitted to QEHB ED and walk-in patients with STEMI the primary PCI can be activated (See below) by ringing the following numbers **Internal 12516** **External 0121 371 2516** 3. The primary angioplasty phone-holder will receive the patients at the front door and escort them to CCU or cardiac catheter labs. 4. Ensure aspirin 300 mg has been given in A&E or by paramedics Ticagrelor 180 mg loading dose to be administered as soon as decision made for PPCI
Indications for Activation of Primary PCI pathway
1. Ongoing chest pain >15 minutes ***and*** 2. ST elevation >1mm in two contiguous limb leads or >2mm in two contiguous chest leads ***or*** 3. New onset LBBB Repeat ECG if suspicious history and ECG changes not meeting above criteria **When in doubt, activate pathway**
Other Indications for Urgent Cardiology Review
1. Any patient with ST depression with chest pain* 2. Haemodynamic instability 3. Ventricular arrhythmias

* These patients may not have ST elevation / LBBB but have unstable / high-risk ACS requiring emergency revascularisation

Routine Care of Patients After STEMI

- Admission day is day 0. Admit to CCU, bed rest, ECG monitor. Ensure prescription of dual anti-platelet therapy (aspirin plus ticagrelor is the default), atorvastatin 80 mg od and VTE prophylaxis with enoxaparin 40mg (or enoxaparin 20mg if eGFR 15-30ml/min, or body weight <50kg; in patients with eGFR <15mL/min, seek haematology advice).

- Day 1: Manage on CCU for 24 hours post admission. Echocardiogram to assess LV function. Prescribe ACE inhibitors, beta blockers and if appropriate eplerenone.

- ACE inhibitor (e.g. Ramipril) for all if BP > 100 mmHg
- Beta blocker (e.g.Bisoprolol) for all if HR > 60 and no AV block
- Eplerenone if clinical evidence of heart failure or LVEF < 40%.

- Day 2: If the echocardiogram shows evidence of severe left ventricular dysfunction (<40%) refer to the heart failure team via PICS or ring the service extension 15255. Or ring mobile number 07769 711783
  Transfer to cardiology ward if uncomplicated. Ensure review by cardiac rehabilitation team. Consider plan for discharge.

- Day 3: Discharge if uncomplicated: (successful PPCI procedure, preserved LV function, no arrhythmia, no evidence of recurrent ischaemia, no indication for in-patient PCI for 'bystander' disease, ambulant on ward)

Further Advice on Management of patients without ST-Elevation

Initial Assessment

Use HEART score as a diagnostic aid. Obtain advice from CNP or on call registrar if required. If an ACS is identified, use the GRACE score for risk stratification (not diagnosis).

High-sensitivity troponin T (hs-TnT)

- Restrict requests for hs-TNT to those patients with possible cardiac chest pain. Screening patients with other conditions/non specific symptoms may reveal hs-TnT values > 99th centile. This is a non-specific finding usually of little clinical value.
- This is a highly sensitive but modestly specific test and several differentials may need to be considered according to clinical context (Table 2).
- Interpret results in the clinical context. Take in to account pre-test probability of coronary disease, the nature of the chest pain and ECG changes.
- Do NOT use hs-TnT **in isolation** to diagnose or exclude ACS.

- The 99th centile or cut off value for the QEHB laboratory is 13ng/l. This indicates the likely presence of myocyte injury. Higher values are associated with higher risk
- hs-TnT release occurs within 6 hours of chest pain and the negative predictive value of an initial result is 95%, especially if the pain was more than 6 hours ago. The negative predictive value increases to close to 100% if the test is repeated at 1 or 3 hours (Figure 2).
- Any substantial rise or fall in comparison with the previous value suggests an acute cardiac insult such as an ACS; a change of > 50% is a useful guideline but there is no precise figure that defines the clinical significance.

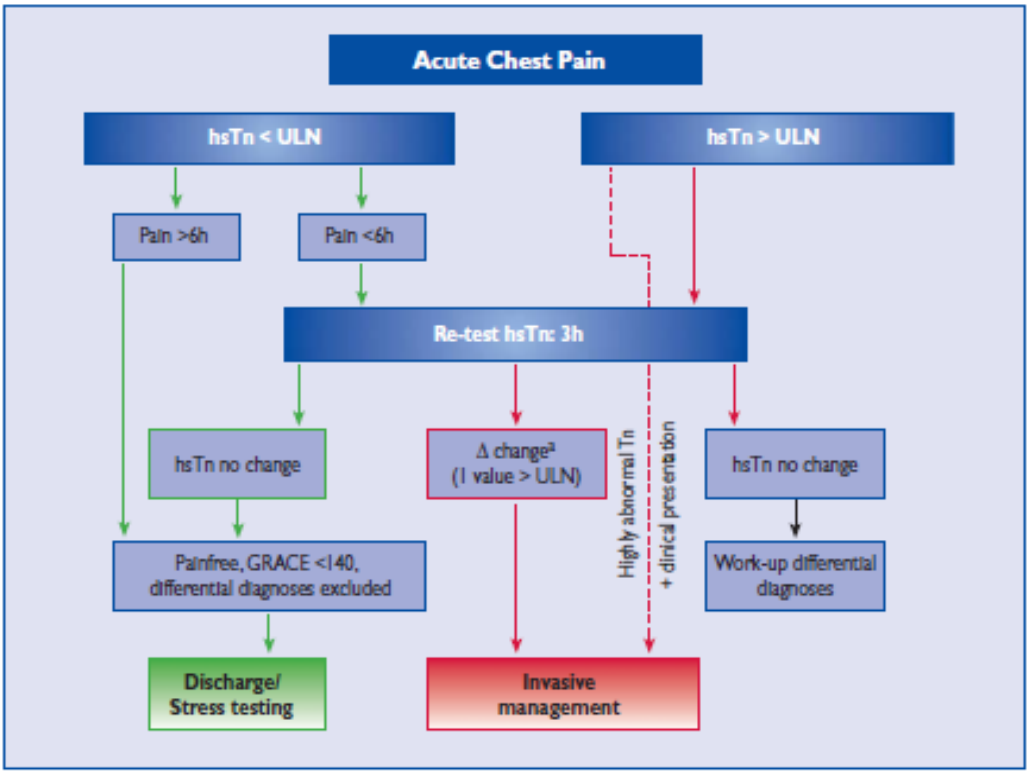


Figure 2: Interpretation of hs-TnT in ACS. (Re-test can now be done a 1 hour)

(ESC guidelines on management of ACS; EHJ 2011;32:2999-3054)

Table 2: *Causes of cardiac marker release*

Myocardial injury related to primary myocardial ischaemia
Coronary plaque rupture Coronary intraluminal thrombus Coronary vasospasm or vasculitis
Myocardial injury related to supply / demand imbalance
Arrhythmias including AF and bradycardias Aortic dissection

Severe valve disease Shock – septic, hypovolaemic Severe respiratory failure Severe anaemia Accelerated hypertension
Myocardial injury unrelated to ischaemia
Cardiac contusion EP Ablation / Defibrillation Recent major surgery Myocarditis Cardiotoxic drugs Rhabdomyolysis with cardiac involvement
Multifactorial or indeterminate myocardial injury
Heart failure Stress (Tako-Tsubo) Cardiomyopathy Pulmonary embolism Sepsis and critically ill patients Renal failure Hypotension of any cause Hypoxia/exacerbation of COPD Acute neurological disease (SAH , Stroke) Infiltrative cardiac disease – amyloidosis, sarcoidosis

Adapted from *Third Universal Definition of Myocardial Infarction.* EHJ 2012; 33: 2551-67

Risk Stratification of ACS

- All patients diagnosed with ACS should be risk-stratified according to their 6 month mortality risk as predicted by the GRACE score (*This can be found under the patient tab on PICS)*

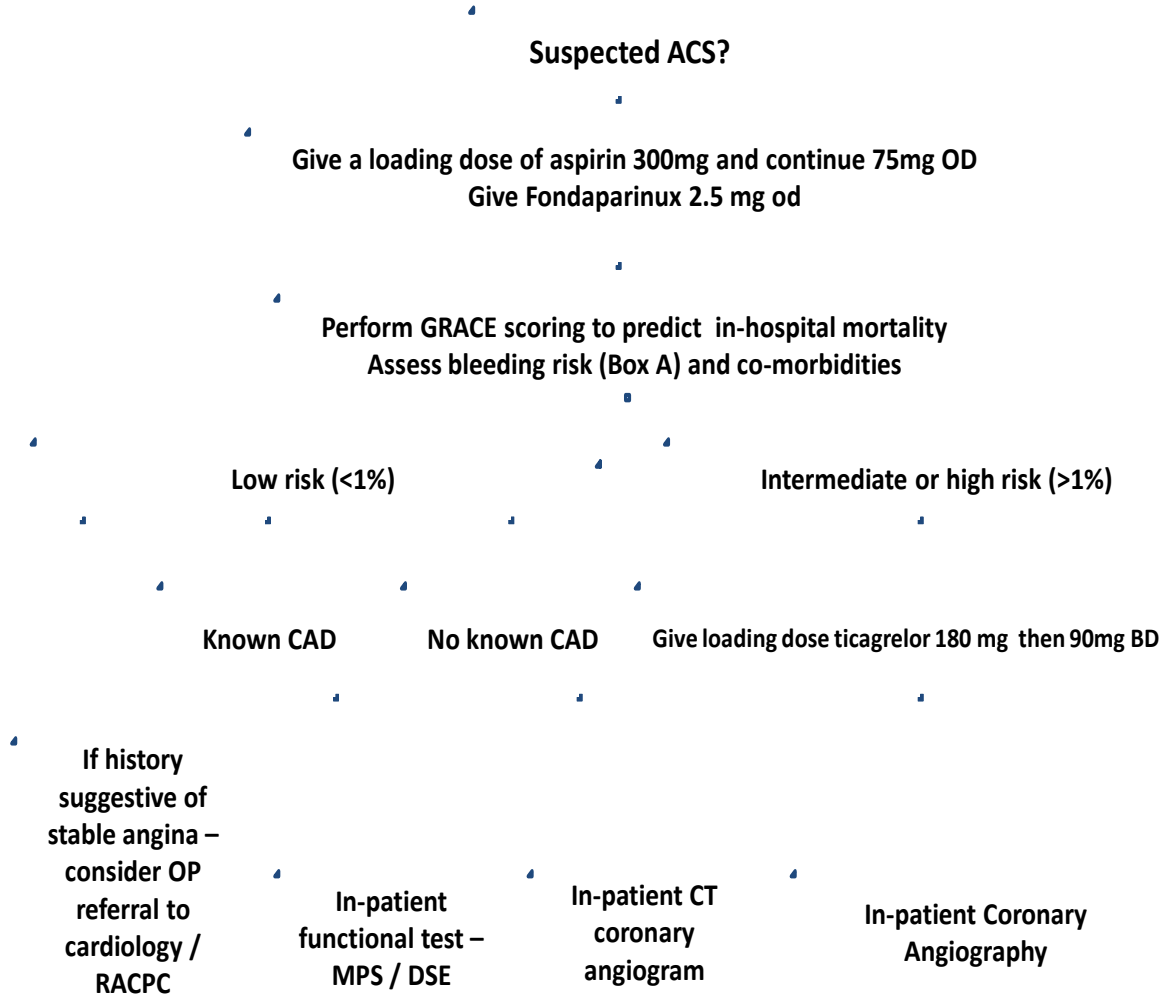


Figure 3: Risk stratification and management of patients presenting with ACS

- Intermediate of high risk patients (GRACE risk of 6 month mortality >1%) should undergo coronary angiography, ideally within 24 hours (NICE standard is < 72 hours) with a view to revascularisation.

- Low risk patients (GRACE risk <1%) who remain stable during hospital stay and have no further chest pain should be assessed non-invasively with functional testing in those with known CAD. CT Coronary angiography maybe used to exclude CAD in low-risk ACS patients not known to have CAD.

- It is important to note that hs-TnT is only one of the features contributing to the GRACE Score. Troponin should not be used in isolation to diagnose or manage ACS.

Medical therapy after all ACS events (See appendix 2)

Anti-platelet therapy

Before starting APT, consider bleeding risk and exclude recent bleeding, history of ICH and active peptic ulcer.

In most cases use

- Aspirin 300 mg PO then 75 mg od plus **one of the following**
- Ticagrelor 180mg PO loading dose then 90mg BD, is the default second anti-platelet agent in all acute coronary syndromes (STEMI, NSTEMI, unstable angina) .
- If this is not tolerated an alternative drug is Prasugrel 60 mg PO loading dose then 10 mg od (See table 3 below for indications)
- If this is not tolerated or contra-indicated (see below) use clopidogrel 600 mg PO loading dose then 75 mg od

Ticagrelor Dose
• Loading – 180mg PO • Maintenance 90 mg BD PO
Indications
• STEMI undergoing primary PCI • NSTEMI • Unstable angina
Contra-indications
• History of intracranial haemorrhage

Prasugrel Dose
• Loading – 60mg PO • Maintenance – 10mg od PO
Indications
• STEMI undergoing primary PCI • Unstable angina or NSTEMI undergoing immediate of delayed PCI • Patients with known resistance or sensitivity to clopidogrel • Patients presenting with stent thrombosis on clopidogrel
Contra-indications
• Age >75 years • Weight <60kg • History of CVA / TIA (ischaemic or haemorrhagic)

Anti-thrombotic therapy

- Default treatment for all STEMI, NSTEMI and unstable angina cases is Fondaparinux 2.5 mg od (must not be used when creatinine clearance < 20 20ml/min/1.73m²; no dose reduction is needed when creatinine clearance > 20ml/min/1.73m²).

- In cases of severe CKD with eGFR < 2020ml/min/1.73m², use IV heparin according to APTT

Anti-ischaemic therapy

Heart rate control

- Beta blocker titrated to achieve HR<60 bpm
- Use Ivabradine if in sinus rhythm and beta-blocker contra-indicated. Start with 5 mg BD PO and increase to 7.5 mg BD PO after 24 hours if HR still > 60 bpm.
- Diltiazem PO may also be used though rate control in patients with normal LV function although it less effective.

Secondary prevention

Must be initiated in all cases as soon as diagnosis is made if clinically appropriate

- Statin – the default for ACS cases is Atorvastatin 80 mg OD.

- ACE-Inhibitors should be commenced on day 1 if renal function is normal and BP allows
- Eplerenone – 25mg OD should be commenced on day 1 in all patients with LV dysfunction (EF<40%).
- Beta blockers – commence on day 1 and titrate to achieve HR < 65. Defer if bradycardia or ECG conduction problems.

Coronary angiography

- Emergency angiography is indicated in:
    - All ACS presenting with ST elevation / new LBBB
    - ACS patients with continuing chest pain and dynamic ECG changes in spite of standard medical management
    - ACS patients with haemodynamic instability

- All other ACS patients should have coronary angiography within 72 hours and if possible within 24 hours of diagnosis.

Management of hyperglycaemia

Hyperglycaemia at the time of admission with ACS is a powerful predictor of poorer survival and increased risk of complications while in hospital, regardless of whether or not the patient has diabetes.
NICE guidelines suggest the following:

Hyperglycaemia during the first 48 hours

- Manage hyperglycaemia by keeping blood glucose levels below 11.0 mmol/litre while avoiding hypoglycaemia. In the first instance, use a dose-adjusted insulin infusion with regular monitoring of blood glucose levels (see CG256 on intranet for UHB protocol)

- Do not routinely offer intensive insulin therapy (an intravenous infusion of insulin and glucose with or without potassium)

Identifying patients with hyperglycaemia after ACS who are at high risk of developing diabetes

- Offer all patients with hyperglycaemia after ACS and without known diabetes tests for HbA1c levels before discharge and fasting blood glucose levels no earlier than 4 days after the onset of ACS. These tests should not delay discharge. Abnormal values to be notified to GP.

- Do not routinely offer oral glucose tolerance tests to patients with hyperglycaemia after ACS and without known diabetes if HbA1c and fasting blood glucose levels are within the normal range.

Advice and ongoing monitoring for patients with hyperglycaemia after ACS and without known diabetes

- Offer patients with hyperglycaemia after ACS and without known diabetes lifestyle advice relating to diet, exercise, smoking, weight management and alcohol consumption (cardiac rehabilitation service).

- Advise patients without known diabetes that if they have had hyperglycaemia after an ACS they are at risk of developing type 2 diabetes and should seek medical attention if they have osmotic symptoms and also have annual screening for diabetes.

- Inform GPs that they should offer at least annual monitoring of HbA1c and fasting blood glucose levels to people without known diabetes who have had hyperglycaemia after an ACS.

Cardiac rehabilitation and discharge

All patients who have sustained a myocardial infarction will be offered and encouraged to attend the cardiac rehabilitation programme. Referral to the rehabilitation team should be made at the earliest opportunity so that patients are seen prior to discharge (ext.14711/14993/14705 /Bleeps 1151/2297). Patients should receive the contact number for the Cardiac Rehabilitation Service which is **0121 371 4711** (message service available out of hours).

Rehabilitation services will include;

- One to one consultation as an inpatient, discussing the benefits of cardiac rehabilitation, lifestyle risk factors, medical risk management.
- Referral to external centres on discharge if residing outside South and Central Birmingham CCG. Contact details of relevant rehabilitation service should be given to the patient.
- Follow up telephone contact within 3 working days of discharge for patients residing within South and Central CCG.
- Invitation to attend the 4 week education programme
- Invitation via telephone contact to attend the exercise programme within 10 working days after the acute event, which includes an exercise capacity assessment using a Shuttle Walk test, 6 minute walk test or a Chester Step test.if the patients Duke Score is 0. If the patient has a Duke score > 0 on the PCI database the patient will be referred for a medically supervised Exercise Tolerance Test (ETT).
- As well as a gym based exercise programme patients are offered alternative opportunities for access to Cardiac Rehabilitation expertise such as Tai Chi, Low Impact or a dance class.
- Access to Smoking cessation, Clinical Psychology, Physiotherapy and Dietetic services at any point during the pathway.

The rehabilitation team will consider:

- Smoking – refer to cessation service if required
- Blood pressure – systolic BP target is <130 mmHg
- Weight/body mass index – need for dietitian referral
- Diet - NICE Guidelines state:
    - Not to routinely recommend patients eat oily fish for the sole purpose of preventing another MI. If patients after an MI choose to consume oily fish, be aware that there is no evidence of harm, and fish may form part of a Mediterranean – style diet.
    - Not to offer or advise patients to use the following to prevent another MI:
        - Omega-3 fatty acid capsules
        - Omega -3 fatty acid supplemented foods.
    - If patients choose to take omega-3 fatty acid capsules or eat omega-3 fatty acid supplemented foods, be aware that there is no evidence of harm.
    - Patients should be advised to eat a Mediterranean-style diet (more bread, fruit, vegetables and fish; less meat; and replace butter and cheese with products based on vegetable and plant oils).
    -

At discharge clear advice should have been given on the following subjects:

- Return to daily activities, including sexual intercourse
- Return to driving. After STEMI or NSTEMI, patients may return to group one driving after 1 week providing LVEF > 40%, no further urgent revascularisation planned (urgent means within 4 weeks of acute event), or there is no other disqualifying condition, otherwise must delay for 4 weeks. Need not inform the DVLA.
- The latest details on driving for group I and II licence holders can be downloaded from the following link: http://www.dvla.gov.uk/medical/ataglance.aspx
- Return to work, if relevant.

The following arrangements should have been made

- Letter to GP, detailing medications
- Referral for cardiac rehabilitation
- Referral to heart failure service if required
- OP clinic appointment
- Plans for any further investigations or revascularisation should be in place if required

ALL PATIENTS SHOULD BE GIVEN A COPY OF THEIR DISCHARGE ECG

Management of Arrhythmias

A 12 lead ECG should be recorded in any patient experiencing sustained arrhythmias including a long rhythm strip of lead II and V1.

- Always ensure serum K^+ is > 4.5 mmol/l
- Check calcium and magnesium levels
- Consider use of Adenosine (6-12 mg IV bolus) to aid diagnosis

VENTRICULAR ARHYTHMIAS

1. Ventricular tachycardia / Ventricular fibrillation

Loss of consciousness / pulse – FOLLOW RESUSCITATION ALGORITHMS – emergency defibrillation using biphasic defibrillator at 150J. (see Appendix 4)

No immediate loss of consciousness

- If compromised; ie, sBP < 90 mmHg, and evidence of heart failure, arrange DC cardioversion. Call anaesthetist urgently
- If VT well tolerated, give Lidocaine 100 mg by slow IV injection. If ineffective, arrange DC cardioversion. Refer for EP advice after restoration of SR

Anti-arrhythmic therapy for ventricular tachycardia

- Primary VT (within 24 hours of STEMI) should be treated with Lidocaine 100 mg bolus then infusion according to CCU protocol. No further anti-arrhythmic therapy is required unless VT is recurrent.

- For recurrent VT or late VT (> 24 hours after STEMI) the first choice agent is **Amiodarone** (see appendix 3). Please do not use any other anti-arrhythmic drugs without EP team guidance.

- The management of late VT is complex and requires referral to EP for further investigation and possible ICD implantation. (NICE Guidance on the use of implantable cardioverter defibrillators is given in Appendix 5).

2. Premature Beats (VPBs)

Always ensure serum K^+ is > 4.5 mmol/l

VPBs associated with bradycardia – Treat bradycardia first with IV atropine 0.5 – 1.0 mg with repeated doses up to 1.2 mg

VPBs where no bradycardia present – If no bradycardia present and serum potassium >4.5 mmol/l observe only

NEW ATRIAL FLUTTER / FIBRILLATION

If patient NOT compromised

- Atrial arrhythmias are often short lived after myocardial infarction. Do not treat unless ventricular rate is above 120 beats per minute for > 1 hour.
- If rate is > 120/min and the arrhythmia is sustained use metoprolol 50 mg BD PO or digoxin 250 μg OD PO, if beta-blocker contra-indicated.
- All patients with sustained atrial fibrillation/flutter should be anticoagulated with IV heparin and considered for long term oral anti-coagulation according to standard criteria
- Check thyroid function in all cases of SVT.

N.B: Patients presenting with new atrial fibrillation outside the setting of acute STEMI or NSTEMI should be considered for early cardioversion using a defibrillator or intravenous flecainide. Contact cardiology registrar for advice as management will vary according to the clinical setting.

If patient compromised by hypotension or pulmonary oedema associated with atrial fibrillation

- Treat as above but if compromise is severe (BP < 90 mmHg) or no response to treatment, load with Amiodarone (see Appendix 3) and plan for synchronised DC cardioversion under anaesthetic.
- Obtain U&Es
- Contact Anaesthetist for urgent cardioversion

MANAGEMENT OF BRADYARRHYTHMIAS

If a patient is experiencing a symptomatic bradycardia administer oxygen and IV ATROPINE 0.5–1.0 mg and repeat as necessary.

First Degree Heart Block

- Treatment is not usually necessary unless first degree AV block is associated with a symptomatic bradycardia. In this instance treat as for action point 5.

- Observe closely for progression to more advanced degrees of block.

Second Degree Heart Block and Third Degree (complete) Heart Block

Inferior MI

- Treat only if associated with hypotension, syncope, cardiac failure, or ventricular ectopic rhythms. In these instances temporary pacing should be considered.
- If asystole or extreme bradycardia refer to the On-Call Cardiologist. Use external transthoracic urgent pacemaker whilst awaiting transvenous pacemaker.

Complete Heart Block

- If chronic should be treated with a permanent pacemaker once hypothyroidism excluded.

- Emergency transvenous temporary pacing is indicated for chronic or acute CHB only if the patient has a symptomatic bradycardia, which is associated with haemodynamic compromise, syncope and/or ventricular tachyarrhythmias.
- Use external pacemaker if required as an emergency.

Indications for Temporary Pacemaker Insertion

- Bradycardia unresponsive to atropine and associated with symptoms, syncope or cardiac failure (including sinus bradycardia)
- New tri-fascicular block (RBBB + LAD, or RBBB + RAD) and prolonged PR interval in an anterior STEMI
- Second or third degree AV block with anterior MI

Management of conditions associated with acute haemodynamic compromise

Acute Heart Failure and Pulmonary Oedema

Oxygen Therapy
Patients with an arterial oxygen saturation of <93% should receive high flow oxygen of 8L per minute aiming for a saturation of > 94% unless contra-indicated; eg, severe respiratory disease.

Drug Therapy
- Morphine 5 – 10 mg IV bolus
- Furosemide 40-80mg iv; consider continuous infusion of furosemide at 10 mg/hr.
- GTN infusion 2-10mg/hr aiming to maintain sBP 90-100 mmHg.

Ventilation
- Patients with severe hypoxia or impending type 2 respiratory failure despite appropriate medical management should be considered early for CPAP which can be delivered on CCU
- Consider type 2 respiratory failure in patients with reduced conscious levels, especially in those with known respiratory disease.
- Liaise with ITU early to consider invasive or non-invasive ventilation

Initiation of long term treatment for heart failure

Patients with evidence of LV dysfunction (clinical, radiological or echo ejection fraction < 40%) should receive:

- ACE inhibitors beginning at 24-72 hours post MI. Start at low dose (e.g. 1.25 mg Ramipril) Titrate dose up to maximum if possible, see below.
- Once established on ACE inhibitors patients with heart failure should also be treated with beta-blockers. Carvedilol and bisoprolol are convenient to use in and licensed in heart failure. Again titrate dose up to maximum.
- Patients with heart failure or impaired left ventricular function (EF < 40%) after STEMI should also be treated with Eplerenone 25 mg od. (Monitor renal function and potassium)

Combined use of ACE inhibitors, aldosterone inhibitors and beta blockers is beneficial via separate mechanisms.

Suggested ACE inhibitors (depending on adequate BP)
Start with low (test) dose. Aim for high final dose as below:

Lisinopril	5 – 20 mg OD PO
Ramipril	1.25 – 10 mg OD PO
Perindopril	2 – 8 mg OD PO

Cardiogenic Shock

Definition of cardiogenic shock: Hypotension – systolic BP < 90 mmHg in presence of an appropriate heart rate, associated with signs of critically reduced cardiac output such as oliguria (< 30 mls/hr), confusion, cold peripheries and acidosis with elevated lactate

Principles of Management

- In the context of ACS, transfer to catheter lab for attempted full revascularisation
- Insert a urinary catheter for hourly input/output measurements
- Check ABG to assess acidosis and gas exchange. Consider anaesthetic support
- Patients will require a central venous line and inotropic support typically with adrenaline
- Early consideration should be given to the use of mechanical support including intra-aortic balloon pumping, percutaneous ventricular assist device (VAD) support (Impella) and or ECMO.
- Urgent echo to assess LV and RV function and exclude mechanical problems such as acute ventricular septal rupture or mitral regurgitation

NB: The administration of 'blind' (non Swan Ganz guided) intravenous fluids to patients with hypotension following STEMI is strongly discouraged. In cases of respiratory failure request anaesthetic assistance for possible ventilatory support.

Exclude / Treat the Following Causes:

Right Ventricular Infarction

Associated with inferior STEMIs, right ventricular infarction (RVI) is suspected where patients present with a raised venous pressure but no signs of pulmonary congestion/oedema. RVI can be diagnosed with the help of ECG leads V3R and V4R (1 mm St elevation), an echocardiogram and haemodynamic data from Swan-Ganz catheterisation. In RVI right atrial and right ventricular pressures are elevated with low or normal pulmonary artery wedge pressure.

- Avoid Nitrates
- Consider inotropes if systolic BP below 100 mgHg and acidotic.
- Volume expansion may be useful but this should be guided by invasive haemodynamic monitoring. Use normal saline 250 ml and reassess haemodynamic parameters between each fluid challenge.

Cardiac Tamponade/Pericardial Effusion

Consider tamponade if hypotension, JVP elevated, pulsus paradoxus or oliguria.

- Review CXR to determine size of cardiac silhouette.
- Request urgent in-patient assessment by cardiology registrar.
- If pericardial effusion without tamponade present, refer to cardiology consultant on call for routine review.

Acute Mitral Regurgitation or Ventricular Septal Defect

This can result from infarction and patients will present with a new pan-systolic murmur and pronounced haemodynamic deterioration.

- Urgent echo
- Urinary catheterisation and hourly input/output charting
- Insert a central line or Swan-Ganz sheath
- These patients need mechanical stabilisation with IABP or other left / right ventricular support devices
- Early consideration for device closure or surgical repair

Appendix 1 – Thrombolytic therapy

In patients who decline treatment by primary PCI or if for any reason primary PCI is not available, consider the use of intravenous thrombolytic therapy with tenecteplase which is given as a single bolus over 10 seconds. For concurrent heparin therapy: Patients weighing less than 67 kg use a 4,000 unit bolus followed by 800 units per hour. Patients over 67 kg use a 5,000 unit bolus followed by 1,000 units per hour

Absolute Contra-indications to thrombolytic therapy

- Surgery within 3 weeks of STEMI (including dental extractions)
- Stroke within 12 months of STEMI
- Haemorrhagic stroke at any time
- GI bleed within 1 month
- Suspected aortic dissection

Relative Contra-indications

- Severe uncontrolled hypertension; If BP > or above 200 mmHg/110 mmHg. Reduce this by administering intravenous nitrates or an intravenous beta blocker eg metoprolol 5 mg slow IV bolus
- Active peptic ulceration (not vague history of indigestion)
- Trauma; eg, from prolonged resuscitation > 10 minutes

Appendix 2: Key drugs in the management of acute coronary syndromes

Drug	Eligible patient groups	Evidence
Beta-blockers Metoprolol Propranolol Carvedilol (CHF only) Bisoprolol	All STEMI cases without specific contra-indications. Treat for at least 12 months In cases of heart failure start at low dose and titrate up slowly	ISIS-1 GMT BHAT
Aspirin	All without specific contra-indications. Treat indefinitely If allergic use Clopidogrel 75 mg OD PO	ISIS-2
Clopidogrel	STEMI and non STEMI in addition to aspirin. Load with 300 mg (600 mg if PCI to be undertaken that day) and continue on 75 mg OD PO for 12 months.	CURE CLARITY COMMIT
Prasugrel	STEMI treated by PPCI Diabetics with STEMI/NSTEMI treated by stenting Patients who have suffered previous stent thrombosis. Other stented patients at high risk of stent thrombosis (NB. Do not use if history of CVA/TIA. Load with prasugrel if required but do not use long term if age>75 yrs or weight< 60Kg)	TRITON-TIMI38
Ticagrelor	STEMI and NSTEMI in addition to aspirin.	PLATO
ACE Inhibitors Ramipril Perindopril Enalapril Lisinopril	Treat all. Particular benefit in those with clinical, echo or radiological evidence of LV dysfunction Treat indefinitely	ISIS-4 GISSI AIRE (X) TRACE HOPE
Statins Simvastatin Atorvastatin	Treat all. Aim: Reduce total cholesterol to < 4.0 or LDL to <2.0 mmol/l. Suggest use Atorvastatin 80 mg od if tolerated or minimum of 40 mg of Simvastatin.	4S CARE LIPID MIRACL HPS PROVE IT TNT
Insulin	Diabetic patients Ensure liaison with hospital diabetic service (via PICS)	DIGAMI
Warfarin	Patients developing atrial fibrillation or atrial flutter. Patients with poor LV function (EF<20%), LV aneurysm or thrombus Refer to Cardiologist	BAATHAF

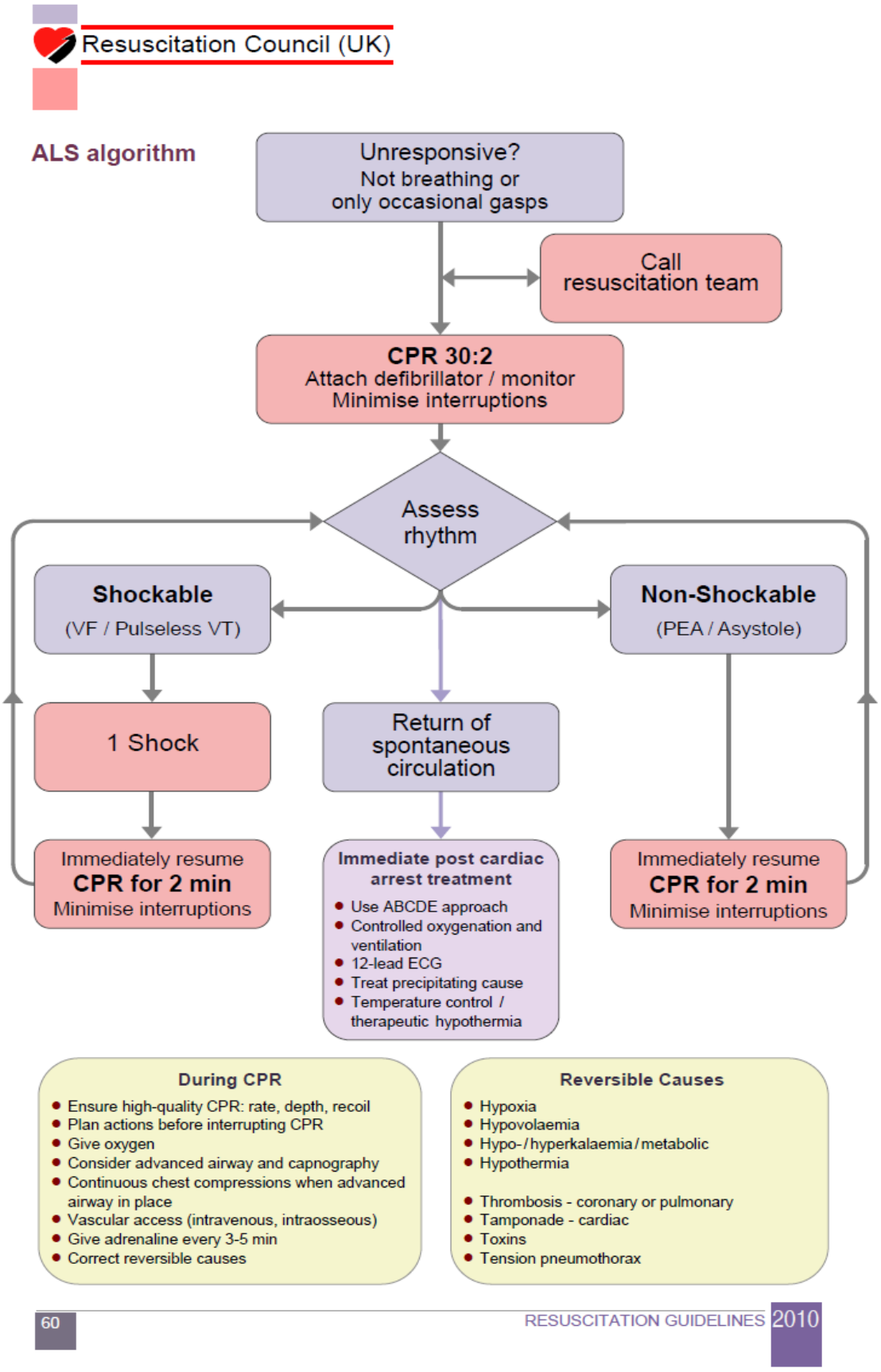
Amiodarone	Patients developing VT or VF > 24 hours post MI NB These patients should be also considered for ICD implantation. Refer to Cardiologist	CAMIAT EMIAT MADIT
Eplerenone	All cases of heart failure and all cases of LV dysfunction after STEMI	EPHESUS

Appendix 3: Drug protocols

ADENOSINE	Administer a 6 mg as a fast intravenous bolus (then flush) if no response administer a 12 mg fast intravenous bolus
ADRENALINE (EPINEPHRINE)	In CPR events; follow European Resuscitation Council guidelines. Intravenous infusion – seen nomogram
AMIODARONE	Load orally with 400 mg TDS PO for 7 days then 200 mg OD PO. If very rapid loading is needed or oral route not available administer IV **via a central line**. Give 5 mg/kg loading dose intravenously over one hour followed by a 1200 mg maintenance infusion over 24 hours. (In emergencies, a bolus dose can be given via a large bore peripheral cannula). NB In cases of severe LV dysfunction or haemodynamic compromise try and avoid IV use as it causes reduced cardiac output and can precipitate severe hypotension. If IV use is unavoidable omit the 5 mg/kg loading use and use the 1200 mg/24 hour infusion rate
ATROPINE	In CPR events; follow European Resuscitation guidelines
CALCIUM GLUCONATE / CHLORIDE	In CPR events; follow European Resuscitation Council guidelines
CLOPIDOGREL	Load with 600 mg PO stat. Continue on 75 mg once daily
MORPHINE	Administer IV with anti-emetic cover. Up to 10 mg every 2 hours can be administered for severe pain. Use proportionately smaller doses for elderly patients
DIGOXIN	The loading dose can be 500 micrograms infused in 50 ml over one hour can be given repeated after 6 hours, the dose can be given orally depending on the patients condition
DOBUTAMINE	See Cardiac IV nomogram protocol
DOPAMINE	See Cardiac IV nomogram protocol
FONDAPARINUX	Dose 2.5 mg OD SC. Do not use when GFR < 20 ml/min/1.73m^2

GTN	See Cardiac IV protocol
ISOPRENALINE	See Cardiac IV protocol
LABETOLOL	See Cardiac IV protocol
LIDOCAINE	See Cardiac IV protocol
SODIUM BICARBONATE	In CPR events; follow European Resuscitation Council guidelines
SODIUM NITROPRUSSIDE	See Cardiac Directorate IV nomogram protocol
TICAGRELOR	Load with 180 mg PO Maintenance 90 mg OD PO

Appendix 4: Resuscitation algorhithm



Appendix 5: NICE guidance on the use of implantable cardioverter defibrillators for arrhythmias 2014

Please use guidance below. If at review LV function is poor with an EF < 35% or there are reasons to consider ICD or CRT therapy please arrange a 24 hour tape and refer to EP/devices

Guidance

1 Guidance

This guidance replaces NICE technology appraisal guidance 95 issued in January 2006 and NICE technology appraisal guidance 120 issued in May 2007.

1.1 Implantable cardioverter defibrillators (ICDs) are recommended as options for:

- treating people with previous serious ventricular arrhythmia, that is, people who, without a treatable cause:
  - have survived a cardiac arrest caused by either ventricular tachycardia (VT) or ventricular fibrillation **or**
  - have spontaneous sustained VT causing syncope or significant haemodynamic compromise **or**
  - have sustained VT without syncope or cardiac arrest, and also have an associated reduction in left ventricular ejection fraction (LVEF) of 35% or less but their symptoms are no worse than class III of the New York Heart Association (NYHA) functional classification of heart failure.
- treating people who:
  - have a familial cardiac condition with a high risk of sudden death, such as long QT syndrome, hypertrophic cardiomyopathy, Brugada syndrome or arrhythmogenic right ventricular dysplasia **or**
  - have undergone surgical repair of congenital heart disease.

1.2 Implantable cardioverter defibrillators (ICDs), cardiac resynchronisation therapy (CRT) with defibrillator (CRT-D) or CRT with pacing (CRT-P) are recommended as treatment options for people with heart failure who have left ventricular dysfunction with a left ventricular ejection fraction (LVEF) of 35% or less as specified in table 1.

Table 1 Treatment options with ICD or CRT for people with heart failure who have left ventricular dysfunction with an LVEF of 35% or less (according to NYHA class, QRS duration and presence of LBBB)

	NYHA class			
QRS interval	**I**	**II**	**III**	**IV**
<120 milliseconds	**ICD if there is a high risk of sudden cardiac death**			**ICD and CRT not clinically indicated**
120–149 milliseconds without LBBB	ICD	ICD	ICD	CRT-P
120–149 milliseconds with LBBB	ICD	CRT-D	CRT-P or CRT-D	CRT-P
≥150 milliseconds with or without LBBB	CRT-D	CRT-D	CRT-P or CRT-D	CRT-P
LBBB, left bundle branch block; NYHA, New York Heart Association				

Auditable Outcomes

Performance should be monitored according to the **NICE quality standards on acute coronary syndromes (including myocardial infarction)** which were published in consultation format in April 2014 (http://guidance.nice.org.uk/QSD/72/QSConsultation/DraftQS/pdf/English) and will be published in full in October 2014.