NICE National Institute for Health and Care Excellence

NICE guideline

Acute coronary syndromes

NICE guideline

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Your responsibility

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals and practitioners are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or the people using their service. It is not mandatory to apply the recommendations, and the guideline does not override the responsibility to make decisions appropriate to the circumstances of the individual, in consultation with them and their families and carers or guardian.

All problems (adverse events) related to a medicine or medical device used for treatment or in a procedure should be reported to the Medicines and Healthcare products Regulatory Agency using the Yellow Card Scheme.

Local commissioners and providers of healthcare have a responsibility to enable the guideline to be applied when individual professionals and people using services wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with complying with those duties.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.

Contents

This guideline replaces CG172, CG167, CG94, TA230, CG130 and MTG1.

This guideline partially replaces TA152 and TA71.

This guideline is the basis of QS68, QS99 and QS167.

This guideline should be read in conjunction with CG95.

Overview

This guideline covers the early and longer-term (rehabilitation) management of acute coronary syndromes. These include ST-segment elevation myocardial infarction (STEMI), non-ST-segment elevation myocardial infarction (NSTEMI) and unstable angina. The guideline aims to improve survival and quality of life for people who have a heart attack or unstable angina.

See the visual summaries on STEMI, unstable angina NSTEMI, and secondary prevention.

This guideline does not cover management of spontaneous coronary artery dissection.

The recommendations were developed before the COVID-19 pandemic. Acute coronary syndromes are a possible sign of acute myocardial injury in patients with COVID-19. See recommendations on acute myocardial injury in our guideline on managing COVID-19.

Who is it for?

- Healthcare professionals

- Commissioners and providers

- Adults with acute coronary syndromes, their families and carers

Recommendations

People have the right to be involved in discussions and make informed decisions about their care, as described in NICE's information on making decisions about your care.

Making decisions using NICE guidelines explains how we use words to show the strength (or certainty) of our recommendations, and has information about prescribing medicines (including off-label use), professional guidelines, standards and laws (including on consent and mental capacity), and safeguarding.

1.1 STEMI – early management

NICE has produced a visual summary of the recommendations on the early management of STEMI.

Assessment

1.1.1   Immediately assess eligibility (irrespective of age, ethnicity or sex) for coronary reperfusion therapy (either primary percutaneous coronary intervention [PCI] or fibrinolysis) in people with acute ST-segment elevation myocardial infarction (STEMI). **[2013]**

1.1.2   Do not use level of consciousness after cardiac arrest caused by suspected acute STEMI to determine whether a person is eligible for coronary angiography (with follow-on primary PCI if indicated). **[2013]**

1.1.3   Deliver coronary reperfusion therapy (either primary PCI or fibrinolysis) as quickly as possible for eligible people with acute STEMI. **[2013]**

Initial drug therapy

1.1.4   Offer people with acute STEMI a single loading dose of 300 mg aspirin as soon as possible unless there is clear evidence that they are allergic to it. **[2010]**

1.1.5   Do not offer routine glycoprotein IIb/IIIa inhibitors or fibrinolytic drugs before arrival at the catheter laboratory to people with acute STEMI for whom primary PCI is planned. **[2013]**

Coronary angiography with follow-on primary PCI

1.1.6   Offer coronary angiography, with follow-on primary PCI if indicated, as the preferred coronary reperfusion strategy for people with acute STEMI, if:

- presentation is within 12 hours of onset of symptoms **and**

- primary PCI can be delivered within 120 minutes of the time when fibrinolysis could have been given. **[2013]**

1.1.7   Offer coronary angiography, with follow-on primary PCI if indicated, to people with acute STEMI and cardiogenic shock who present within 12 hours of the onset of symptoms of STEMI. **[2013]**

1.1.8   Consider coronary angiography, with follow-on primary PCI if indicated, for people with acute STEMI presenting more than 12 hours after the onset of symptoms if there is evidence of continuing myocardial ischaemia. **[2013]**

1.1.9   Consider coronary angiography, with a view to coronary revascularisation if indicated, for people with acute STEMI who present more than 12 hours after the onset of symptoms and who have cardiogenic shock or go on to develop it. **[2013]**

1.1.10   Consider radial (in preference to femoral) arterial access for people undergoing coronary angiography (with follow-on primary PCI if indicated). **[2013]**

Dual antiplatelet therapy for people with acute STEMI having

primary PCI

1.1.11   For people with acute STEMI who are having primary PCI, offer:

- prasugrel, as part of dual antiplatelet therapy with aspirin, if they are not already taking an oral anticoagulant (for people aged 75 and over, think about whether the person's risk of bleeding with prasugrel outweighs its effectiveness, in which case offer ticagrelor or clopidogrel as alternatives)

- clopidogrel, as part of dual antiplatelet therapy with aspirin, if they are already taking an oral anticoagulant. **[2020]**

    Prasugrel and ticagrelor are recommended as options in NICE technology appraisal guidance for people with acute STEMI having primary PCI. For full details, see the guidance on:

- prasugrel (TA317, 2014)

- ticagrelor (TA236, 2011).

> For a short explanation of why the committee made the 2020 recommendation and how it might affect practice, see the rationale and impact section on dual antiplatelet therapy for people with acute STEMI having primary PCI.
>
> Full details of the evidence and the committee's discussion are in evidence review A: antiplatelet therapy.

Antithrombin therapy during primary PCI

1.1.12   Offer unfractionated heparin with bailout glycoprotein IIb/IIIa inhibitor in combination with dual antiplatelet therapy to people with acute STEMI undergoing primary PCI with radial access. **[2020]**

1.1.13   Consider bivalirudin with bailout glycoprotein IIb/IIIa inhibitor in combination with dual antiplatelet therapy for people with acute STEMI undergoing primary PCI when femoral access is needed.

In November 2020, use of bivalirudin with prasugrel and aspirin was off label. See NICE's information on prescribing medicines. **[2020]**

For a short explanation of why the committee made the 2020 recommendations and how they might affect practice, see the rationale and impact section on antithrombin therapy during primary PCI.

Full details of the evidence and the committee's discussion are in evidence review D: antithrombin therapy in adults with STEMI intended for primary PCI.

Thrombus extraction during primary PCI

1.1.14   Consider thrombus aspiration during primary PCI for people with acute STEMI. **[2013]**

1.1.15   Do not routinely use mechanical thrombus extraction during primary PCI for people with acute STEMI. **[2013]**

Complete or culprit vessel only revascularisation with PCI in people with acute STEMI treated by primary PCI

1.1.16   Offer complete revascularisation with PCI for people with acute STEMI and multivessel coronary artery disease without cardiogenic shock. Consider doing this during the index hospital admission. **[2020]**

1.1.17   Consider culprit vessel only revascularisation with PCI rather than complete revascularisation during the index procedure for people with acute STEMI and multivessel coronary artery disease with cardiogenic shock. **[2020]**

For a short explanation of why the committee made the 2020 recommendations and how they might affect practice, see the rationale and impact section on complete revascularisation with PCI or culprit vessel only PCI.

Full details of the evidence and the committee's discussion are in evidence review E: culprit versus complete revascularisation.

Drug-eluting stents in primary PCI

1.1.18   If stenting is indicated, offer a drug-eluting stent to people with acute STEMI undergoing revascularisation by primary PCI. **[2020]**

For a short explanation of why the committee made the 2020 recommendation and how it might affect practice, see the rationale and impact section on drug-eluting stents in primary PCI.

Full details of the evidence and the committee's discussion are in evidence review F: drug-eluting stents.

Fibrinolysis

1.1.19   Offer fibrinolysis to people with acute STEMI presenting within 12 hours of onset of symptoms if primary PCI cannot be delivered within 120 minutes of the time when fibrinolysis could have been given. **[2013]**

For recommendations in NICE technology appraisal guidance on choosing thrombolytic treatments for acute STEMI, see guidance on the use of drugs for early thrombolysis (TA52, 2002).

1.1.20   When treating people with fibrinolysis, give an antithrombin at the same time. **[2013]**

1.1.21   Offer an electrocardiogram (ECG) to people with acute STEMI treated with fibrinolysis, 60 to 90 minutes after administration. For those who have residual

ST-segment elevation suggesting failed coronary reperfusion:

- offer immediate coronary angiography, with follow-on PCI if indicated

- do not repeat fibrinolytic therapy. **[2013**]

1.1.22   If a person with acute STEMI has recurrent myocardial ischaemia after fibrinolysis, seek immediate specialist cardiological advice and, if appropriate, offer coronary angiography, with follow-on PCI if indicated. **[2013]**

1.1.23   Consider coronary angiography during the same hospital admission for people with acute STEMI who are clinically stable after successful fibrinolysis. **[2013]**

Management for people with STEMI not treated with PCI

1.1.24   Offer ticagrelor, as part of dual antiplatelet therapy with aspirin, to people with acute STEMI not treated with PCI, unless they have a high bleeding risk. **[2020]**

1.1.25   Consider clopidogrel, as part of dual antiplatelet therapy with aspirin, or aspirin alone, for people with acute STEMI not treated with PCI, if they have a high bleeding risk. **[2020]**

For a short explanation of why the committee made the 2020 recommendations and how they might affect practice, see the rationale and impact section on dual antiplatelet therapy for people with STEMI not treated with PCI.

Full details of the evidence and the committee's discussion are in evidence review A: antiplatelet therapy.

1.1.26   Offer medical management to people with acute STEMI who are ineligible for any reperfusion therapy. **[2013]**

Tests before discharge

1.1.27   Assess left ventricular function in all people who have had a STEMI. **[2013]**

1.2 NSTEMI and unstable angina – early management

NICE has produced a visual summary of the recommendations on the early management of NSTEMI and unstable angina.

Initial drug therapy

1.2.1   Offer aspirin as soon as possible to all people with unstable angina or non-ST-segment elevation myocardial infarction (NSTEMI) and continue indefinitely unless contraindicated by bleeding risk or aspirin hypersensitivity. **[2010]**

1.2.2   Offer people with unstable angina or NSTEMI a single loading dose of 300-mg aspirin as soon as possible unless there is clear evidence that they are allergic to it. **[2010]**

1.2.3   Offer fondaparinux to people with unstable angina or NSTEMI who do not have a high bleeding risk, unless they are undergoing immediate coronary angiography. **[2020]**

See the recommendation on unfractionated heparin in the section on coronary angiography with follow-on PCI for advice about people with unstable angina or NSTEMI who are undergoing immediate coronary angiography.

> For a short explanation of why the committee made the 2020 recommendation and how it might affect practice, see the rationale and impact section on initial antithrombin therapy for people with unstable angina or NSTEMI.
>
> Full details of the evidence and the committee's discussion are in evidence review C: antithrombin for unstable angina and NSTEMI.

1.2.4   Consider unfractionated heparin, with dose adjustment guided by monitoring of clotting function, as an alternative to fondaparinux for people with unstable angina or NSTEMI and significant renal impairment (creatinine above 265 micromoles per litre). **[2010]**

1.2.5   Carefully consider the choice and dose of antithrombin for people with unstable angina or NSTEMI who have a high risk of bleeding associated with any of the following:

- advancing age

- known bleeding complications

- renal impairment

- low body weight. **[2010]**

1.2.6   Do not offer dual antiplatelet therapy to people with chest pain before a diagnosis of unstable angina or NSTEMI is made. **[2020]**

For a short explanation of why the committee made the 2020 recommendation and how it might affect practice, see the rationale and impact section on dual antiplatelet therapy for people with unstable angina or NSTEMI.

Full details of the evidence and the committee's discussion are in evidence review A: antiplatelet therapy.

Risk assessment

1.2.7   As soon as the diagnosis of unstable angina or NSTEMI is made, and aspirin and antithrombin therapy have been offered, formally assess individual risk of future adverse cardiovascular events using an established risk scoring system that predicts 6-month mortality (for example, Global Registry of Acute Cardiac Events [GRACE]). **[2010]**

1.2.8   Include in the formal risk assessment:

- a full clinical history (including age, previous myocardial infarction [MI] and previous PCI or coronary artery bypass grafting [CABG])

- a physical examination (including measurement of blood pressure and heart rate)

- a resting 12-lead ECG, looking particularly for dynamic or unstable patterns that indicate myocardial ischaemia

- blood tests (such as troponin I or T, creatinine, glucose and haemoglobin). **[2010]**

1.2.9   Record the results of the risk assessment in the person's care record. **[2010]**

1.2.10   Use risk assessment to guide clinical management, and balance the benefit of a treatment against any risk of related adverse events in the light of this assessment. **[2010]**

1.2.11   Use predicted 6-month mortality to categorise the risk of future adverse cardiovascular events as shown in table 1. **[2010]**

Table 1 Categorising risk of future adverse cardiovascular events

Predicted 6-month mortality	Risk of future adverse cardiovascular events
1.5% or below	Lowest
>1.5% to 3.0%	Low
>3.0% to 6.0%	Intermediate
>6.0% to 9.0%	High
over 9.0%	Highest

Categories of risk are derived from the Myocardial Ischaemia National Audit Project (MINAP) database.

Coronary angiography with follow-on PCI

1.2.12   Offer immediate coronary angiography to people with unstable angina or NSTEMI if their clinical condition is unstable. **[2020]**

1.2.13   Consider coronary angiography (with follow-on PCI if indicated) within 72 hours of first admission for people with unstable angina or NSTEMI who have an intermediate or higher risk of adverse cardiovascular events (predicted 6-month mortality above 3.0%) and no contraindications to angiography (such as active bleeding or comorbidity).

See table 2 for information on the benefits and risks of early invasive treatment compared with conservative management. **[2020]**

1.2.14   Consider coronary angiography (with follow-on PCI if indicated) for people with unstable angina or NSTEMI who are initially assessed to be at low risk of adverse cardiovascular events (predicted 6-month mortality 3.0% or less) if ischaemia is subsequently experienced or is demonstrated by ischaemia testing.

See table 2 for information on the benefits and risks of early invasive treatment compared with conservative management. **[2020]**

1.2.15   Be aware that some younger people with low risk scores for mortality at 6 months may still be at high risk of adverse cardiovascular events and may benefit from early angiography. **[2020]**

Table 2 Benefits and risks of early invasive treatment (coronary angiography with PCI if needed) compared with conservative management for people with unstable angina or NSTEMI

Benefits/risks/other factors	Coronary angiography and possible percutaneous coronary intervention (PCI) within 72 hours	Conservative management with later coronary angiography if problems continue or develop
Benefits (advantages)	Reduced deaths from all causes at 6 to 12 months and at 2 years. Reduced deaths from heart problems at 1 and 2 years. Reduced incidence of myocardial infarction (MI) at 30 days, 6 to 12 months and 2 years. Reduced incidence of stroke at 1 year, particularly in people at high risk of future adverse events. Reduced readmission to hospital and difficult-to-treat angina in the medium term, particularly in people at high risk of future adverse events. Psychological benefits – people are not anxious about delaying angiography.	Avoid the immediate risks of invasive treatment, including: • death within 4 months related to the procedure from causes other than MI • procedure-related MI • major bleeding in hospital and up to 2 years after the procedure. These are particularly relevant for people at low risk of future adverse events. Psychological benefits – people are not anxious about having an invasive procedure.

Benefits/risks/other factors	Coronary angiography and possible percutaneous coronary intervention (PCI) within 72 hours	Conservative management with later coronary angiography if problems continue or develop
Risks (disadvantages)	Increased risk of death during the first 4 months, particularly for people at low risk of future adverse events. Risk of procedure-related MI. Increased risk of major bleeding during the index admission, at 30 days and 2 years. Emergency treatment leaves little time for shared decision making.	Increased risk of MI after 6 months. Increased risk of stroke at 1 year, particularly in the people at high risk of future adverse events. Psychological factors – people may be anxious about delaying angiography.
Other factors	Recent advances in PCI might increase early benefit, particularly reducing bleeding. Coronary angiography within 72 hours ensures speedy intervention while allowing time for the correct diagnosis, identifying other conditions and treating symptoms.	–

For a short explanation of why the committee made the 2020 recommendations and how they might affect practice, see the rationale and impact section on early invasive versus conservative management for people with unstable angina or NSTEMI.

Full details of the evidence and the committee's discussion are in evidence review B: early invasive versus conservative management for unstable angina and NSTEMI.

1.2.16   Offer systemic unfractionated heparin in the cardiac catheter laboratory to people with unstable angina or NSTEMI who are undergoing PCI whether or not they have already received fondaparinux.

In November 2020, this was an off-label use of unfractionated heparin. See NICE's information on prescribing medicines. **[2020]**

For a short explanation of why the committee made the 2020 recommendation and how it might affect practice, see the rationale and impact section on antithrombin therapy for people with unstable angina or NSTEMI.

Full details of the evidence and the committee's discussion are in evidence review C: antithrombin for unstable angina and NSTEMI.

1.2.17 For people with unstable angina or NSTEMI who are having coronary angiography, offer:

- prasugrel or ticagrelor, as part of dual antiplatelet therapy with aspirin, if they have no separate indication for ongoing oral anticoagulation (if using prasugrel, only give it once coronary anatomy has been defined and PCI is intended; for people aged 75 and over, think about whether the person's risk of bleeding with prasugrel outweighs its effectiveness)

- clopidogrel, as part of dual antiplatelet therapy with aspirin, if they have a separate indication for ongoing oral anticoagulation. **[2020]**

  Prasugrel and ticagrelor are recommended as options in NICE technology appraisal guidance for some people with unstable angina or NSTEMI who are having coronary angiography. For full details, see the guidance on:

- prasugrel (TA317, 2014)

- ticagrelor (TA236, 2011).

For a short explanation of why the committee made the 2020 recommendation and how it might affect practice, see the rationale and impact section on dual antiplatelet therapy for people with unstable angina or NSTEMI.

Full details of the evidence and the committee's discussion are in evidence review A: antiplatelet therapy.

1.2.18 If stenting is indicated, offer a drug-eluting stent to people with unstable angina or NSTEMI undergoing revascularisation by PCI. **[2020]**

For a short explanation of why the committee made the 2020 recommendation and how it might affect practice, see the rationale and impact section on drug-eluting stents.

Full details of the evidence and the committee's discussion are in evidence review F: drug-eluting stents.

Glycoprotein IIb/IIIa inhibitors for complex PCI

1.2.19   Glycoprotein IIb/IIIa inhibitors as an adjunct to PCI are recommended as an option in NICE technology appraisal guidance for people with unstable angina or NSTEMI who are having complex procedures. For full details, see the guidance on glycoprotein IIb/IIIa inhibitors (TA47, 2010).

Management when PCI is not indicated

1.2.20   Consider conservative management without early coronary angiography for people with unstable angina or NSTEMI who have a low risk of adverse cardiovascular events (predicted 6-month mortality 3.0% or less). **[2020]**

For a short explanation of why the committee made the 2020 recommendation and how it might affect practice, see the rationale and impact section on early invasive versus conservative management for people with unstable angina or NSTEMI.

Full details of the evidence and the committee's discussion are in evidence review B: early invasive versus conservative management for unstable angina and NSTEMI.

1.2.21   Offer ticagrelor, as part of dual antiplatelet therapy with aspirin, to people with unstable angina or NSTEMI when PCI is not indicated, unless they have a high bleeding risk. **[2020]**

Ticagrelor is recommended as an option in NICE technology appraisal guidance for treating unstable angina or NSTEMI when PCI is not indicated. For full details, see the guidance on ticagrelor (TA236, 2011).

1.2.22   Consider clopidogrel, as part of dual antiplatelet therapy with aspirin, or aspirin alone, for people with unstable angina or NSTEMI when PCI is not indicated, if they have a high bleeding risk. **[2020]**

For a short explanation of why the committee made the 2020 recommendations and how they might affect practice, see the rationale and impact section on antiplatelet therapy for people with unstable angina or NSTEMI.

Full details of the evidence and the committee's discussion are in evidence review A: antiplatelet therapy.

Advice on management strategies

1.2.23   Offer people with unstable angina or NSTEMI clear information about the risks and benefits of the treatments offered so that they can make informed choices about management strategies. Information should be appropriate to the person's underlying risk of a future adverse cardiovascular event and any comorbidities. **[2010]**

1.2.24   When advising people with unstable angina or NSTEMI about the choice of revascularisation strategy (PCI or CABG), take account of coronary angiographic findings, comorbidities, and the benefits and risks of each intervention. **[2010]**

1.2.25   When the role of revascularisation or the revascularisation strategy is unclear, resolve this by discussion involving an interventional cardiologist, cardiac surgeon and other healthcare professionals relevant to the needs of the person. Discuss the choice of revascularisation strategy with the person. **[2010]**

Tests before discharge

1.2.26   To detect and quantify inducible ischaemia, consider ischaemia testing before discharge for people whose condition has been managed conservatively and who have not had coronary angiography. **[2010]**

1.2.27   Assess left ventricular function in all people who have had an NSTEMI. **[2013]**

1.2.28   Consider assessing left ventricular function in all people with unstable angina. **[2010]**

1.2.29   Record measures of left ventricular function in the person's care record and in correspondence with the primary healthcare team and the person. **[2010]**

1.3 Hyperglycaemia in acute coronary syndromes

Managing hyperglycaemia in inpatients within 48 hours of acute coronary syndrome

1.3.1   Manage hyperglycaemia in people admitted to hospital for an acute coronary syndrome by keeping blood glucose levels below 11.0 mmol/litre while avoiding hypoglycaemia. In the first instance, consider a dose-adjusted insulin infusion with regular monitoring of blood glucose levels. **[2011]**

1.3.2   Do not routinely offer intensive insulin therapy (an intravenous infusion of insulin and glucose with or without potassium) to manage hyperglycaemia (blood glucose above 11.0 mmol/litre) in people admitted to hospital for an acute coronary syndrome unless clinically indicated. **[2011]**

Identifying people with hyperglycaemia after acute coronary syndrome who are at high risk of developing diabetes

1.3.3   Offer all people with hyperglycaemia after acute coronary syndrome and without known diabetes tests for:

- HbA1c levels before discharge

- fasting blood glucose levels no earlier than 4 days after the onset of acute coronary syndrome.

These tests should not delay discharge. **[2011]**

1.3.4 Do not routinely offer oral glucose tolerance tests to people with hyperglycaemia after acute coronary syndrome and without known diabetes if HbA1c and fasting blood glucose levels are within the normal range. **[2011]**

Advice and ongoing monitoring for people with hyperglycaemia after acute coronary syndrome and without known diabetes

1.3.5 Offer people with hyperglycaemia after acute coronary syndrome and without known diabetes lifestyle advice on the following:

- healthy eating

- physical exercise

- weight management

- smoking cessation

- alcohol consumption.

  See the section on lifestyle changes after an MI for more information. **[2011]**

1.3.6 Advise people without known diabetes that if they have had hyperglycaemia after an acute coronary syndrome, they:

- are at increased risk of developing type 2 diabetes

- should consult their GP if they experience the following symptoms:

  — frequent urination

  — excessive thirst

  — weight loss

  — fatigue

- should be offered tests for diabetes at least annually. **[2011]**

1.3.7   Inform GPs that they should offer at least annual monitoring of HbA1c or fasting blood glucose levels to people without known diabetes who have had hyperglycaemia after an acute coronary syndrome. **[2011]**

1.4 Drug therapy for secondary prevention

NICE has produced a visual summary of the recommendations on cardiac rehabilitation and secondary prevention.

1.4.1   For secondary prevention, offer people who have had MI treatment with the following drugs:

- angiotensin-converting enzyme (ACE) inhibitor

- dual antiplatelet therapy (aspirin plus a second antiplatelet) unless they have a separate indication for anticoagulation (see the section on antiplatelet therapy for people with an ongoing separate indication for anticoagulation)

- beta-blocker

- statin. **[2007, amended 2020]**

1.4.2   Ensure that a clear management plan is available to the person who has had an MI and is also sent to the GP, including:

- details and timing of any further drug titration

- monitoring of blood pressure

- monitoring of renal function. **[2013]**

1.4.3   Offer all people who have had an MI an assessment of bleeding risk at their follow-up appointment. **[2013]**

1.4.4   Rivaroxaban, with aspirin and clopidogrel, or aspirin alone, is recommended as an option in NICE technology appraisal guidance for preventing atherothrombotic

events in people who have had an acute coronary syndrome with elevated cardiac biomarkers, taking bleeding risk into account. For full details, see the guidance on rivaroxaban (TA335, 2015).

1.4.5   Rivaroxaban plus aspirin is recommended as an option in NICE technology appraisal guidance for preventing atherothrombotic events in some people with coronary artery disease who are at high risk of ischaemic events, taking bleeding risk into account. For full details, see the guidance on rivaroxaban (TA607, 2019).

ACE inhibitors

1.4.6   Offer people who present acutely with an MI, an ACE inhibitor as soon as they are haemodynamically stable. Continue the ACE inhibitor indefinitely. **[2013]**

1.4.7   Titrate the ACE inhibitor dose upwards at short intervals (for example, every 12 to 24 hours) before the person leaves hospital until the maximum tolerated or target dose is reached. If it is not possible to complete the titration during this time, it should be completed within 4 to 6 weeks of hospital discharge. **[2013]**

1.4.8   Do not offer combined treatment with an ACE inhibitor and an angiotensin II receptor blocker (ARB) to people after an MI, unless there are other reasons to use this combination. **[2013]**

1.4.9   After an MI, offer people who are intolerant to ACE inhibitors, an ARB instead of an ACE inhibitor. **[2013]**

1.4.10   Renal function, serum electrolytes and blood pressure should be measured before starting an ACE inhibitor or ARB and again within 1 or 2 weeks of starting treatment. People should have appropriate monitoring as the dose is titrated upwards, until the maximum tolerated or target dose is reached, and then at least annually. More frequent monitoring may be needed in people who are at increased risk of deterioration in renal function. People with chronic heart failure should be monitored in line with the NICE guideline on chronic heart failure in adults. **[2007]**

1.4.11   Offer an ACE inhibitor to people who have had an MI more than 12 months ago.

Titrate to the maximum tolerated or target dose (over a 4- to 6-week period) and continue indefinitely. **[2013]**

1.4.12　　Offer people who have had an MI more than 12 months ago and who are intolerant to ACE inhibitors an ARB instead of an ACE inhibitor. **[2013]**

Antiplatelet therapy

1.4.13　　Offer aspirin to all people after an MI and continue it indefinitely, unless they are aspirin intolerant or have an indication for anticoagulation (see the section on antiplatelet therapy for people with an ongoing separate indication for anticoagulation). **[2007, amended 2013]**

1.4.14　　Offer aspirin to people who have had an MI more than 12 months ago and continue it indefinitely. **[2013]**

1.4.15　　Continue dual antiplatelet therapy for up to 12 months after an MI unless contraindicated (see recommendations 1.1.11, 1.1.24, 1.1.25, 1.2.17, 1.2.21 and 1.2.22 for more information about dual antiplatelet therapy). **[2020]**

1.4.16　　Ticagrelor with aspirin for up to 3 years is recommended as an option in NICE technology appraisal guidance for preventing atherothrombotic events in people who had an MI more than 12 months ago and are at high risk of a further event. For full details, see the guidance on ticagrelor (TA420, 2016).

1.4.17　　For people with aspirin hypersensitivity who have had an MI, clopidogrel monotherapy should be considered as an alternative treatment. **[2007]**

1.4.18　　People with a history of dyspepsia should be considered for treatment in line with the NICE guideline on gastro-oesophageal reflux disease and dyspepsia in adults. **[2007, amended 2013]**

1.4.19　　After appropriate treatment, people with a history of aspirin-induced ulcer bleeding whose ulcers have healed and who are negative for Helicobacter pylori should be considered for treatment in line with the NICE guideline on gastro-oesophageal reflux disease and dyspepsia in adults. **[2007, amended 2013]**

1.4.20   Offer clopidogrel instead of aspirin to people who also have other clinical vascular disease, and who have:

- had an MI and stopped dual antiplatelet therapy **or**

- had an MI more than 12 months ago. **[2013]**

    Clopidogrel is recommended as an option in NICE technology appraisal guidance to prevent occlusive vascular events in some people. For full details, see the guidance on clopidogrel (TA210, 2010).

Antiplatelet therapy for people with an ongoing separate indication for anticoagulation

1.4.21   For people who have a separate indication for anticoagulation, take into account all of the following when thinking about the duration and type (dual or single) of antiplatelet therapy in the 12 months after an acute coronary syndrome:

- bleeding risk

- thromboembolic risk

- cardiovascular risk

- person's wishes.

    Be aware that the optimal duration of aspirin therapy has not been established, and that long-term continuation of aspirin, clopidogrel and oral anticoagulation (triple therapy) significantly increases bleeding risk. **[2020]**

1.4.22   For people already on anticoagulation who have had PCI, continue anticoagulation and clopidogrel for up to 12 months. If the person is taking a direct oral anticoagulant, adjust the dose according to bleeding risk, thromboembolic risk and cardiovascular risk. **[2020]**

1.4.23   For people with a new indication for anticoagulation who have had PCI, offer clopidogrel (to replace prasugrel or ticagrelor) for up to 12 months and an oral anticoagulant licensed for the indication, which best matches the person's:

- bleeding risk

- thromboembolic risk

- cardiovascular risk

- wishes. **[2020]**

1.4.24   For people already on anticoagulation, or those with a new indication, who have not had PCI (medical management, CABG), continue anticoagulation and, unless there is a high risk of bleeding, consider continuing aspirin (or clopidogrel for people with contraindication for aspirin) for up to 12 months. **[2020]**

1.4.25   Do not routinely offer prasugrel or ticagrelor in combination with an anticoagulant that is needed for an ongoing separate indication for anticoagulation. **[2020]**

1.4.26   For people with an ongoing indication for anticoagulation 12 months after an MI, take into consideration all of the following when thinking about the need for continuing antiplatelet therapy:

- indication for anticoagulation

- bleeding risk

- thromboembolic risk

- cardiovascular risk

- person's wishes. **[2013]**

For a short explanation of why the committee made the 2020 recommendations and how they might affect practice, see the rationale and impact section on antiplatelet therapy for people with an indication for anticoagulation.

Full details of the evidence and the committee's discussion are in evidence review G: combination therapy.

Beta-blockers

1.4.27   Offer people a beta-blocker as soon as possible after an MI, when the person is haemodynamically stable. **[2013]**

1.4.28   Communicate plans for titrating beta-blockers up to the maximum tolerated or target dose – for example, in the discharge summary. **[2013]**

1.4.29   Consider continuing a beta-blocker for 12 months after an MI for people without reduced left ventricular ejection fraction. **[2020]**

1.4.30   Discuss the potential benefits and risks of stopping or continuing beta-blockers beyond 12 months after an MI for people without reduced left ventricular ejection fraction. Include in the discussion:

- the lack of evidence on the relative benefits and harms of continuing beyond 12 months

- the person's experience of adverse effects. **[2020]**

For a short explanation of why the committee made the 2020 recommendations and how they might affect practice, see the rationale and impact section on duration of beta-blocker treatment after an MI.

Full details of the evidence and the committee's discussion are in evidence review H: beta-blockers.

1.4.31   Continue a beta-blocker indefinitely in people with reduced left ventricular ejection fraction. **[2013]**

1.4.32   Offer all people who have had an MI more than 12 months ago, who have reduced left ventricular ejection fraction, a beta-blocker whether or not they have symptoms. For people with heart failure plus reduced left ventricular ejection fraction, manage the condition in line with the NICE guideline on chronic heart failure in adults. **[2013]**

1.4.33   Do not offer people without reduced left ventricular ejection fraction or heart

failure, who have had an MI more than 12 months ago, treatment with a beta-blocker unless there is an additional clinical indication for a beta-blocker. **[2013]**

Calcium channel blockers

1.4.34   Do not routinely offer calcium channel blockers to reduce cardiovascular risk after an MI. **[2007]**

1.4.35   If beta-blockers are contraindicated or need to be discontinued, diltiazem or verapamil may be considered for secondary prevention in people without pulmonary congestion or reduced left ventricular ejection fraction. **[2007]**

1.4.36   For people whose condition is stable after an MI, calcium channel blockers may be used to treat hypertension and/or angina. For people with heart failure with reduced ejection fraction, use amlodipine, and avoid verapamil, diltiazem and short-acting dihydropyridine agents in line with the NICE guideline on chronic heart failure in adults. **[2007, amended 2020]**

Potassium channel activators

1.4.37   Do not offer nicorandil to reduce cardiovascular risk after an MI. **[2007]**

Aldosterone antagonists in people with heart failure and reduced left ventricular ejection fraction

1.4.38   For people who have had an acute MI and who have symptoms and/or signs of heart failure and reduced left ventricular ejection fraction, initiate treatment with an aldosterone antagonist licensed for post-MI treatment within 3 to 14 days of the MI, preferably after ACE inhibitor therapy. **[2007]**

1.4.39   People who have recently had an acute MI and have clinical heart failure and reduced left ventricular ejection fraction, but who are already being treated with an aldosterone antagonist for a concomitant condition (for example, chronic heart failure), should continue with the aldosterone antagonist or an alternative,

licensed for early post-MI treatment. **[2007]**

1.4.40   For people who have had a proven MI in the past and heart failure due to reduced left ventricular ejection fraction, treatment with an aldosterone antagonist should be in line with the NICE guideline on chronic heart failure in adults. **[2007]**

1.4.41   Monitor renal function and serum potassium before and during treatment with an aldosterone antagonist. If hyperkalaemia is a problem, halve the dose of the aldosterone antagonist or stop the drug. **[2007]**

Statins and other lipid-lowering agents

1.4.42   Statin therapy is recommended for adults with clinical evidence of cardiovascular disease in line with recommendations on lipid-lowering treatment for secondary prevention in the NICE guideline on cardiovascular disease: risk assessment and reduction. **[2007]**

1.5 Coronary revascularisation after an MI

1.5.1   Offer a cardiological assessment to everyone who has had a previous MI, but not had coronary revascularisation to consider whether coronary revascularisation is appropriate. This should take into account comorbidity. **[2007, amended 2020]**

1.6 Selected patient subgroups

People with reduced left ventricular ejection fraction

1.6.1   Implantable cardioverter defibrillators, cardiac resynchronisation therapy (CRT) with defibrillator or CRT with pacing are recommended as options in NICE technology appraisal guidance for treating people with heart failure with left ventricular dysfunction with a left ventricular ejection fraction of 35% or less. For full details, see the guidance on implantable cardioverter defibrillators and cardiac resynchronisation therapy (TA314, 2014). **[2007]**

People with hypertension

1.6.2 Treat hypertension in line with the NICE guideline on hypertension in adults. **[2007, amended 2013]**

1.7 Communication of diagnosis and advice

1.7.1 After an acute MI, ensure that the following are part of every discharge summary:

- confirmation of the diagnosis of acute MI

- results of investigations

- incomplete drug titrations

- future management plans

- advice on secondary prevention. **[2007, amended 2013]**

1.7.2 Offer a copy of the discharge summary to the person. **[2007]**

1.8 Cardiac rehabilitation after an MI

1.8.1 All people (regardless of their age) should be given advice about and offered a cardiac rehabilitation programme with an exercise component. **[2007]**

1.8.2 Cardiac rehabilitation programmes should provide a range of options, and people should be encouraged to attend all those appropriate to their clinical needs. People should not be excluded from the entire programme if they choose not to attend certain components. **[2007]**

1.8.3 If a person has cardiac or other clinical conditions that may worsen during exercise, these should be treated if possible before they are offered the exercise component of cardiac rehabilitation. For some people, the exercise component may be adapted by an appropriately qualified healthcare professional. **[2007]**

1.8.4   People with reduced left ventricular ejection fraction who are stable can safely be offered the exercise component of cardiac rehabilitation. **[2007]**

Encouraging people to attend

1.8.5   Deliver cardiac rehabilitation in a non-judgemental, respectful and culturally sensitive manner. Consider employing bilingual peer educators or cardiac rehabilitation assistants who reflect the diversity of the local population. **[2013]**

1.8.6   Establish people's health beliefs and their specific illness perceptions before offering appropriate lifestyle advice and to encourage attendance to a cardiac rehabilitation programme. **[2013]**

1.8.7   Offer cardiac rehabilitation programmes designed to motivate people to attend and complete the programme. Explain the benefits of attending. **[2013]**

1.8.8   Discuss with the person any factors that might stop them attending a cardiac rehabilitation programme, such as transport difficulties. **[2013]**

1.8.9   Offer cardiac rehabilitation programmes in a choice of venues (including at the person's home, in hospital and in the community) and at a choice of times of day, for example, sessions outside of working hours. Explain the options available. **[2013]**

1.8.10   Provide a range of different types of exercise, as part of the cardiac rehabilitation programme, to meet the needs of people of all ages, or those with significant comorbidity. Do not exclude people from the whole programme if they choose not to attend specific components. **[2013]**

1.8.11   Offer single-sex cardiac rehabilitation programme classes if there is sufficient demand. **[2013]**

1.8.12   Enrol people who have had an MI in a system of structured care, ensuring that there are clear lines of responsibility for arranging the early initiation of cardiac rehabilitation. **[2013]**

1.8.13   Begin cardiac rehabilitation as soon as possible after admission before discharge from hospital, and invite the person to a cardiac rehabilitation session. This should start within 10 days of their discharge from hospital. **[2013]**

1.8.14   Contact people who do not start or do not continue to attend the cardiac rehabilitation programme with a further reminder, such as:

- a motivational letter

- a prearranged visit from a member of the cardiac rehabilitation team

- a telephone call

- a combination of the above. **[2013]**

1.8.15   Seek feedback from cardiac rehabilitation programme users and aim to use this feedback to increase the number of people starting and attending the programme. **[2013]**

1.8.16   Be aware of the wider health and social care needs of a person who has had an MI. Offer information and sources of help on:

- economic issues

- welfare rights

- housing and social support issues. **[2013]**

1.8.17   Make cardiac rehabilitation equally accessible and relevant to all people after an MI, particularly people from groups that are less likely to access this service. These include people from black, Asian and minority ethnic groups, older people, people from lower socioeconomic groups, women, people from rural communities, people with a learning disability and people with mental and physical health conditions. **[2007, amended 2013]**

1.8.18   Encourage all staff, including senior medical staff, involved in providing care for people after an MI, to actively promote cardiac rehabilitation. **[2013]**

Health education and information needs

1.8.19   Comprehensive cardiac rehabilitation programmes should include health education and stress management components. **[2007]**

1.8.20   A home-based programme validated for people who have had an MI (such as NHS Lothian's heart manual) that incorporates education, exercise and stress management components with follow ups by a trained facilitator may be used to provide comprehensive cardiac rehabilitation. **[2007]**

1.8.21   Take into account the physical and psychological status of the patient, the nature of their work and their work environment when giving advice on returning to work. **[2007]**

1.8.22   Be up to date with the latest Driver and Vehicle Licensing Agency (DVLA) guidelines. Regular updates are published by the DVLA. **[2007]**

1.8.23   After an MI without complications, people who wish to travel by air should seek advice from the Civil Aviation Authority. People who have had a complicated MI need expert individual advice. **[2007, amended 2013]**

1.8.24   People who have had an MI who hold a pilot's licence should seek advice from the Civil Aviation Authority. **[2007]**

1.8.25   Take into account the person's physical and psychological status, as well as the type of activity planned when offering advice about the timing of returning to normal activities. **[2007]**

1.8.26   An estimate of the physical demand of a particular activity, and a comparison between activities, can be made using tables of metabolic equivalents (METS) of different activities (for further information, please refer to the information from the Centers for Disease Control and Prevention). Advise people how to use a perceived exertion scale to help monitor physiological demand. People who have had a complicated MI may need expert advice. **[2007]**

1.8.27   Advice on competitive sport may need expert assessment of function and risk, and is dependent on what sport is being discussed and the level of

competitiveness. **[2007]**

Psychological and social support

1.8.28   Offer stress management in the context of comprehensive cardiac rehabilitation. **[2007]**

1.8.29   Do not routinely offer complex psychological interventions such as cognitive behavioural therapy. **[2007]**

1.8.30   Involve partners or carers in the cardiac rehabilitation programme if the person wishes. **[2007]**

1.8.31   For recommendations on managing clinical anxiety or depression, refer to the NICE guidelines on anxiety, depression in adults and depression in adults with a chronic physical health problem. **[2007]**

Sexual activity

1.8.32   Reassure people that after recovery from an MI, sexual activity presents no greater risk of triggering a subsequent MI than if they had never had an MI. **[2007]**

1.8.33   Advise people who have made an uncomplicated recovery after their MI that they can resume sexual activity when they feel comfortable to do so, usually after about 4 weeks. **[2007]**

1.8.34   Raise the subject of sexual activity within the context of cardiac rehabilitation and aftercare for people who have had an MI. **[2007]**

1.9 Lifestyle changes after an MI

Changing diet

1.9.1   Advise people to eat a Mediterranean-style diet (more bread, fruit, vegetables and fish; less meat; and replace butter and cheese with products based on plant oils). **[2007]**

1.9.2   Do not routinely recommend eating oily fish for the sole purpose of preventing another MI. If people choose to consume oily fish after an MI, be aware that there is no evidence of harm, and fish may form part of a Mediterranean-style diet. **[2013]**

1.9.3   Do not offer or advise people to use the following to prevent another MI:

  - omega-3 fatty acid capsules

  - omega-3 fatty acid supplemented foods. **[2013]**

1.9.4   If people 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. **[2013]**

1.9.5   Advise people not to take supplements containing beta-carotene. Do not recommend antioxidant supplements (vitamin E and/or C) or folic acid to reduce cardiovascular risk. **[2007]**

1.9.6   Offer people an individual consultation to discuss diet, including their current eating habits, and advice on improving their diet. **[2007]**

1.9.7   Give people consistent dietary advice tailored to their needs. **[2007]**

1.9.8   Give people healthy eating advice that can be extended to the whole family. **[2007]**

Alcohol consumption

1.9.9   For advice on alcohol consumption, see the UK government drinking guidelines. **[2020]**

Regular physical activity

1.9.10   Advise people to undertake regular physical activity sufficient to increase exercise capacity. **[2007]**

1.9.11   Advise people to be physically active for 20 to 30 minutes a day to the point of slight breathlessness. Advise people who are not active to this level to increase their activity in a gradual, step-by-step way, aiming to increase their exercise capacity. They should start at a level that is comfortable, and increase the duration and intensity of activity as they gain fitness. **[2007]**

1.9.12   Advice on physical activity should involve a discussion about current and past activity levels and preferences. The benefit of exercise may be enhanced by tailored advice from a suitably qualified professional. **[2007]**

Smoking cessation

1.9.13   Advise all people who smoke to stop and offer assistance from a smoking cessation service in line with the NICE guideline on tobacco. **[2007]**

1.9.14   If a person is unable or unwilling to accept a referral to a stop smoking service, they should be offered pharmacotherapy in line with the NICE guideline on tobacco. **[2007, amended 2020]**

Weight management

1.9.15   After an MI, offer all people who are overweight or obese advice and support to achieve and maintain a healthy weight in line with the NICE guideline on overweight and obesity management. **[2007]**

Terms used in this guideline

Bailout glycoprotein IIb/IIIa inhibitor

Bailout glycoprotein inhibitor (GPI) refers to the use of GPI when the PCI operator has not intended to use GPI from the outset, but considers that clinical or angiographic features (such as worsening or persistent thrombus burden) have changed during the course of the procedure, such that there may be benefit to giving the patient GPI.

Recommendations for research

The guideline committee has made the following recommendations for research.

Key recommendations for research

1 Dual antiplatelet therapy for people aged 75 and over

What is the most clinically and cost-effective dual antiplatelet therapy for people aged 75 and over with an acute coronary syndrome, who are having percutaneous coronary intervention (PCI)? **[2020]**

Why this is important

The evidence reviewed for this guideline found that prasugrel is the most clinically and cost-effective antiplatelet therapy when used with aspirin for the general acute coronary syndrome population having PCI, particularly for people with ST-segment elevation myocardial infarction (STEMI). However, the summary of product characteristics for prasugrel states that its use in people aged 75 and over 'is generally not recommended and should only be undertaken with caution after a careful individual benefit/risk evaluation by the prescribing physician indicates that benefits in terms of prevention of ischaemic events outweigh the risk of serious bleedings'. There were not enough data available for this guideline to determine whether prasugrel is less effective, or even harmful, in people aged 75 and over. Further research is needed to determine the optimal dual antiplatelet therapy for this group of older people.

2 Primary PCI and fibrinolysis in people with acute STEMI who have a long anticipated transfer time for primary PCI

In people with acute STEMI who present more than 1 hour after the onset of symptoms, is a primary PCI-related delay of 120 to 180 minutes associated with outcomes similar to, better or worse than pre-hospital administered fibrinolysis? **[2013]**

Why this is important

Primary PCI is the preferred coronary reperfusion therapy provided it can be delivered 'in a timely fashion'. It is suggested that primary PCI is the preferred reperfusion strategy for primary PCI-related delays of at least up to 2 hours. However, there is inadequate evidence to conclude whether primary PCI is still preferable at primary PCI-related time delays of more than 2 hours.

No specifically designed randomised controlled trial (RCT) or observational study has addressed the issue of the extent to which primary PCI-related time delay (and other factors such as presentation delay and a person's risk profile) diminishes the advantages of primary PCI over fibrinolysis. For example, in more geographically remote areas, a short presentation delay together with an anticipated long primary PCI-related delay could favour a strategy of pre-hospital fibrinolysis.

To answer this question, an RCT of pre-hospital fibrinolysis versus primary PCI in people with acute STEMI who have a primary PCI-related time delay of 2 hours or more is needed. Primary endpoints would include cardiovascular and all-cause mortality and other major adverse cardiovascular events.

3 Ischaemia testing

What is the role of ischaemia testing in people after an acute coronary syndrome and what is the comparative efficacy and cost effectiveness of the different non-invasive tests (for example, stress electrocardiogram [ECG], echocardiography, radionuclide scanning and MRI)? **[2010]**

Why this is important

An increasing number of non-invasive tests are now available for the investigation of suspected myocardial ischaemia. These tests need different equipment, different clinical expertise, come at different costs and may differ in their ability to detect and quantify myocardial ischaemia. Their place in the routine investigation of patients admitted with unstable angina and non-ST-segment elevation myocardial infarction (NSTEMI) (particularly those who have not undergone angiography), as opposed to their selective use, is not clear. Management of unstable angina and NSTEMI would be enhanced if the relative place of these investigations were better understood and an assessment of their cost effectiveness made.

4 Relationship between volume of procedures and clinical outcomes

What is the relationship between hospital volume of primary PCI procedures and optimal outcomes in people with acute STEMI? **[2013]**

Why this is important

There is a suggestion that outcomes may be better in larger-volume primary PCI units, and some retrospective registries have reported data to support this. However, the quality of the data is poor and still leaves the question open. In the UK, primary PCI is provided by units that vary greatly in the number of cases per year. The development of services has been ad hoc and not designed specifically around the provision of primary PCI. If it was possible to conclusively show that people were or were not better off having treatment in larger-volume units, then it would have important implications for the national provision of primary PCI.

5 Risk assessment – risk scoring systems

What is the clinical and cost effectiveness of the systematic use of risk scoring systems (in addition to clinical assessment) for ischaemic outcomes and bleeding complications in the management of unstable angina and NSTEMI (at all levels of risk) compared with clinical assessment alone? **[2010]**

Why this is important

Most risk scoring systems currently predict the likelihood of mortality or ischaemic cardiovascular events at various times after a patient's admission to hospital with an acute coronary syndrome. A number of interventions (such as drugs and revascularisation procedures) have been shown to reduce these adverse outcomes. This effect tends to be greatest in patients at highest risk. However, as a broad generalisation, patients who are at highest ischaemic risk are also those who are at higher risk of bleeding complications associated with the use of multiple antiplatelet and antithrombin agents. There are fewer scoring systems that predict bleeding risk, but we know that bleeding complications are associated with a significantly worse outcome. Using a combination of scoring systems assessing ischaemic and bleeding risk when evaluating data from randomised trials and registries may help to determine where the net clinical benefit (reduction in ischaemic risk minus any increase in bleeding risk) lies.

Other recommendations for research

6 Risk assessment – data from cardiac registries

For patients with unstable angina and NSTEMI (at differing levels of risk), how do clinical outcome data (adverse cardiovascular events and bleeding complications) collected in cardiac registries compare with data derived from RCTs? **[2010]**

Why this is important

Patients recruited to participate in clinical trials are often highly selected; trials tend not to include patients who are very elderly, are at high risk, or have significant comorbidity. On the other hand, good registry data include information on all patients, but are observational and not randomised. Often there is uncertainty about how the outcome data from RCTs can be applied to the much larger unselected population of patients admitted to UK hospitals with unstable angina or NSTEMI. A greater understanding of the differences between RCT and registry populations, and their levels of ischaemic and bleeding risk would help inform future management. Collection of well-validated registry data is essential if conclusions from RCTs are to be applied appropriately to all patients with unstable angina and NSTEMI, not just to patients who are comparable to trial populations.

7 Management of hyperglycaemia

What is the optimal management of hyperglycaemia in people with acute coronary syndrome who have diagnosed or previously undiagnosed diabetes? **[2011]**

Why this is important

Existing studies on the optimal management of hyperglycaemia in people who have acute coronary syndrome and diagnosed or previously undiagnosed diabetes are generally of poor quality.

It is recommended that a large RCT is conducted for people with acute coronary syndrome and hyperglycaemia (blood glucose 11 mmol/litre and over) stratified by NSTEMI and STEMI and by known diabetes and without a previous diagnosis of diabetes.

The interventions for the trial should be intravenous insulin or subcutaneous insulin

administered within 4 hours of presentation to hospital. The aim is to achieve blood glucose between 6 and 11 mmol/litre for at least 24 hours. The comparator should be standard care.

8 Beta-blockers

Does continuing beta-blocker treatment beyond 1 year after a myocardial infarction (MI) improve outcomes for people with normal left ventricular systolic function? **[2013]**

Why this is important

Recent cohort studies have suggested that continuing treatment with a beta-blocker beyond a year after an acute MI may not confer any benefit to the person in terms of reduced morbidity or mortality. This is particularly relevant given recent changes in acute management strategies. While beta-blockers are valuable in reducing mortality and morbidity for up to a year after an MI, they have side effects and represent an additional treatment burden to people who are already taking many other medications. However, there is also some suggestion that there are risks associated with withdrawal of beta-blockers in this population. The balance of risks and benefits of long-term beta blockade has not been clearly determined, particularly in the context of modern acute treatment of MI.

Rationale and impact

These sections briefly explain why the committee made the recommendations and how they might affect practice.

Dual antiplatelet therapy for acute STEMI intended for primary PCI

Recommendation 1.1.11

Why the committee made the recommendation

Evidence was reviewed comparing the clinical effectiveness of clopidogrel, prasugrel and ticagrelor, each in combination with aspirin, at time-points of 30 days and 1 year. Prasugrel and ticagrelor were more effective than clopidogrel at both time-points. In a network meta-analysis of the 30-day data, prasugrel was more effective than ticagrelor, although with some uncertainty around this conclusion. Prasugrel was more effective than ticagrelor at 1 year with noteworthy differences in all-cause mortality and re-infarction. A detailed cost-effectiveness analysis was also performed incorporating data at both time-points with either prasugrel or ticagrelor being most cost effective in different scenarios using different clinical data. The results favouring prasugrel were driven by the ISAR-REACT 5 trial that directly compared ticagrelor and prasugrel and these were considered the most relevant. The committee agreed that clinical evidence and cost-effectiveness results are directly applicable to the treatment of ST-segment elevation myocardial infarction (STEMI) in the NHS, and recommended prasugrel for people with STEMI undergoing percutaneous coronary intervention (PCI).

The final wording of the recommendation reflects the wording of the summary of product characteristics for prasugrel. If there is particular concern about bleeding risk from prasugrel in a person aged 75 or over, either ticagrelor or clopidogrel might be used instead; although ticagrelor is the more cost effective of the two, it also carries a higher bleeding risk.

An exception was added for people needing anticoagulation for a separate reason (for example, ongoing atrial fibrillation). For these people, clopidogrel is preferred because of

the high bleeding risk of full anticoagulation plus prasugrel.

How the recommendation might affect practice

In the UK, prasugrel is currently used less than ticagrelor or clopidogrel. The recommendation will therefore require a change in prescribing for most centres, but should be easily achievable. Prasugrel costs less than ticagrelor, but considerably more than clopidogrel, and although some areas will see a cost saving from switching to prasugrel from ticagrelor, the overall effect of this recommendation will be an increase in cost to the NHS.

Return to recommendations

Antithrombin therapy during primary PCI for acute STEMI

Recommendations 1.1.12 and 1.1.13

Why the committee made the recommendations

When considering the evidence on the effectiveness of bivalirudin for people with acute STEMI undergoing primary PCI, the committee gave more weight to studies that were closest to current UK practice. These included studies that used bailout or selective, rather than routine, glycoprotein inhibitors (GPIs) and radial artery rather than femoral artery access. The committee concluded that there was no convincing difference between bivalirudin and the main alternative, heparin, in terms of mortality, and that bivalirudin is inferior to heparin in reducing the need for subsequent unplanned revascularisation. The committee discussed data on bleeding risk and agreed that there is no clinically significant difference between bivalirudin and heparin when radial access is used, but bivalirudin probably lowers the bleeding risk when access via the femoral artery is needed. The committee noted that heparin is cheaper than bivalirudin and easier to administer.

How the recommendations might affect practice

The committee agreed that the recommendations generally reflect current practice and are not expected to result in a substantial resource impact to the NHS in England.

Complete revascularisation with PCI or culprit vessel only PCI for acute STEMI

Recommendations 1.1.16 and 1.1.17

Why the committee made the recommendations

Evidence showed that complete revascularisation with multivessel PCI reduced cardiovascular mortality, myocardial infarction (MI) and repeat revascularisation at 1 year, compared with culprit vessel only PCI for people with acute STEMI without cardiogenic shock. It was also associated with lower overall costs.

Although the evidence clearly favoured complete revascularisation, there was less certainty about the timing of the non-culprit procedure. There are a number of different possible approaches to multivessel PCI: undertaking multivessel revascularisation at the time of primary PCI; treating the culprit vessel during the primary procedure and then bringing the person back to the catheter laboratory for revascularisation of other vessels later in the index admission; or treating the culprit vessel during primary PCI, discharging the person and then electively readmitting them for further revascularisation. The committee agreed that multivessel PCI during the index admission should be considered, either at the time of primary PCI or later during the same admission. They were concerned that the clinical benefits may be lower and costs may be higher when people are discharged and readmitted, and noted that delaying treatment of the non-culprit lesions is worrying for patients. However, they agreed that the optimal timing within the index admission will depend on a number of variables and is best left to the discretion of the clinical team.

People with cardiogenic shock were excluded from these studies of multivessel PCI and the committee agreed that, in view of the results from the separate CULPRIT-SHOCK trial, it was not appropriate to recommend multivessel PCI for this group during the index admission.

How the recommendations might affect practice

Current practice is variable across centres and also within centres. Some offer multivessel

PCI during the first procedure for acute STEMI but others may postpone this (either to later within the index admission or to a later readmission). Some operate on the culprit vessel only. The recommendations are therefore likely to result in a change in practice, but not for all centres or all professionals performing PCI. Because the recommendations allow for multivessel PCI to be either at the time of primary PCI or later within the index admission, they offer flexibility to accommodate situations in which there are a number of other people waiting for primary PCI. Healthcare professionals can move on to treat the next person after completing revascularisation of the culprit vessel, minimising the overall impact on primary PCI services.

There will be a resource impact for centres not currently undertaking multivessel PCI, because multivessel PCI has higher costs than culprit vessel only PCI. Audit data reported by MINAP (the Myocardial Ischaemia National Audit Project) between April 2016 and March 2017 show there were 33,797 cases of STEMI reported in England, Wales, Northern Ireland and the Isle of Man. It is estimated that around 30% will present with multivessel disease, which would be around 10,000 people. However, it is unclear for how many of these people multivessel PCI would be suitable. The change from current practice is likely to be cost saving overall because of the reduction in later revascularisation procedures.

Return to recommendations

Drug-eluting stents

Recommendations 1.1.18 and 1.2.18

Why the committee made the recommendations

Evidence from angiography studies showed that drug-eluting stents are less likely to fail than bare metal stents in terms of both recurrence of obstruction to the target vessel and the need for further revascularisation. The evidence also shows that drug-eluting stents may be beneficial in reducing deaths (all-cause and cardiac) and there is a reduced incidence of MI in the 3 years after revascularisation when drug-eluting stents are used. Costs of drug-eluting stents are higher than bare metal stents, but analyses using current cost and benefit data suggest that they are a cost-effective use of resources.

How the recommendations might affect practice

The use of drug-eluting stents has been slowly increasing over recent years in the UK and the most recent national audit data show that 91% of PCIs for acute coronary syndromes used stents and 97% of these used drug-eluting stents. The recommendation will therefore involve little change from current practice and will not have a substantial resource impact for the NHS in England.

Return to recommendations

Antiplatelet therapy for STEMI not treated with PCI

Recommendations 1.1.24 and 1.1.25

Why the committee made the recommendations

The UK licence for prasugrel is for people with acute coronary syndrome who are proceeding to coronary angiography with a view to PCI. Although this is usual practice for most people with STEMI, for some people, either medical management without coronary revascularisation or coronary artery surgery are better options. Direct evidence in these patient groups was lacking; the evidence comparing the clinical effectiveness of clopidogrel and ticagrelor was largely for people receiving PCI. This showed convincing superiority of ticagrelor in reducing mortality (cardiac and all-cause) and in preventing re-infarction and the need for future revascularisation procedures, although there was some evidence of an increased risk of bleeding complications. The committee agreed to recommend ticagrelor for people with STEMI having medical management unless they are at high risk of bleeding when clopidogrel or no second antiplatelet may be the safer option. However, the committee were aware that some of the excess bleeding risk comes from complications of a PCI procedure, which is not relevant to this particular group of people with acute coronary syndrome. They therefore made a recommendation to offer ticagrelor in most cases but to consider clopidogrel as an alternative when the bleeding risk is high.

How the recommendations might affect practice

In the UK, both ticagrelor and clopidogrel are currently used for STEMI that is managed

without PCI. The recommendations require a change in practice for most, but not all, people who would otherwise receive clopidogrel. Ticagrelor costs considerably more than clopidogrel, and although the recommendations apply to a minority of people with STEMI, the effect will be an increase in cost to the NHS.

Return to recommendations

Initial antithrombin therapy for unstable angina and NSTEMI

Recommendations 1.2.3 and 1.2.16

Why the committee made the recommendations

The 2010 NICE guideline on unstable angina and NSTEMI recommended fondaparinux rather than low molecular weight heparin for initial management. The recommendation was based mainly on evidence from a single large study (the OASIS-5 study). This study showed a small risk of catheter thrombosis when fondaparinux was the only antithrombin used before angiography, and therefore the 2010 guideline recommended not to use fondaparinux when angiography is planned within 24 hours. The thrombosis risk was noted by the OASIS-5 investigators before the study ended, and in the later phase of the study, people were given intravenous unfractionated heparin with fondaparinux during angiography; this appeared to remove the excess risk of catheter thrombosis. Two further small studies published after 2010 have confirmed that giving unfractionated heparin during angiography to people already receiving fondaparinux removed the excess risk of catheter thrombosis. The committee considered that unfractionated heparin is already used in this way in many centres, agreed with the 2010 guideline that fondaparinux is the most cost-effective option, and were able to remove the caveat about avoiding fondaparinux if catheterisation is planned within 24 hours. They recommended that fondaparinux should be given to people who are not at high risk of bleeding unless they are having immediate angiography. People receiving fondaparinux should be given additional systemic unfractionated heparin in the catheter laboratory.

How the recommendations might affect practice

Fondaparinux is already used before angiography in many centres in the UK, with additional unfractionated heparin given during the procedure. The recommendations will

affect those centres currently withholding fondaparinux from people having angiography in the next 24 hours. Fondaparinux is a cheaper option than low molecular weight heparin so the recommendation could be cost saving in these centres.

Return to recommendations

Early invasive versus conservative management for unstable angina and NSTEMI

Recommendations 1.2.12 to 1.2.15 and 1.2.20

Why the committee made the recommendations

The 2010 guideline on unstable angina and non-ST-segment elevation MI (NSTEMI) recommended a comprehensive assessment of baseline risk of adverse events. The committee agreed that this should influence the choice between early invasive intervention (coronary angiography, with PCI if indicated) and conservative management (initial medical management, proceeding to coronary angiography and PCI if there is evidence of recurrent ischaemia). Studies comparing these options show a short-term harm with an invasive strategy, but this is offset by the clinical benefits in the months following the procedure. A cost-effectiveness analysis found that routine early invasive intervention was cost effective in people at higher risk of adverse events, but conservative management was the most cost-effective option for people at lower risk. This was because overall health gains were greater in those at higher baseline risk.

Most of the evidence was already available at the time of the 2010 guideline, and the committee recognised that the data may be less applicable to modern practice than had been the case in 2010. Nonetheless, they agreed that early angiography should be the default recommendation for most people at intermediate or higher baseline risk of adverse outcomes. They accepted the previous committee's interpretation of the appropriate risk cut-offs based on their detailed work mapping of the evidence to real-world UK risk data. However, the committee also recognised that the risk prediction models might be less applicable to the youngest people with unstable angina and NSTEMI who are relatively under-represented in the dataset, and therefore added a cautionary recommendation to this effect.

The committee noted that the 2010 guideline had recommended that angiography should

be done within 96 hours of admission for those who are likely to benefit from an early invasive strategy. However, they considered this a conservative target and knew that angiography within 72 hours is now common practice. This allows time for a correct diagnosis, immediate stabilisation and treatment of symptoms, and transfer to a centre with PCI facilities if necessary. The available evidence does not permit a definitive statement about the optimal timing, but a recommendation to consider angiography within 72 hours was agreed.

How the recommendations might affect practice

The recommendations largely reflect current NHS practice. Although the timeframe for early invasive management has been reduced from 96 hours, 72 hours has been specified in the NICE quality standard for a number of years and a best practice tariff on the same basis was introduced in 2017. Audit data are only currently available from the same year as the introduction of the tariff and report that, of people who are admitted to a hospital that can perform angiography, 56% received angiography within 72 hours and 69% within 96 hours. The proportion receiving angiography within 72 hours is likely to be higher since the introduction of the best practice tariff. Performing angiography earlier is likely to result in a shorter hospital stay. The recommendations are unlikely to result in a substantial resource impact for the NHS.

Return to recommendations

Antiplatelet therapy for unstable angina and NSTEMI

Recommendations 1.2.6, 1.2.17, 1.2.21 and 1.2.22

Why the committee made the recommendations

Dual antiplatelet therapy on initial presentation

The committee agreed that dual antiplatelet therapy should not be offered to people with chest pain before a diagnosis of unstable angina or NSTEMI is made. In their experience, dual antiplatelet therapy had caused harm (bleeding) in some people presenting with chest pain not caused by an acute coronary syndrome.

Unstable angina and NSTEMI intended for PCI

Evidence was reviewed comparing the clinical effectiveness of clopidogrel, prasugrel and ticagrelor, each in combination with aspirin, at time-points of 30 days and 1 year. A detailed cost-effectiveness analysis for people with unstable angina or NSTEMI undergoing PCI was performed incorporating these data. Although the overall conclusion was that prasugrel is a more effective agent than ticagrelor, which in turn is more effective than clopidogrel, there was considerable uncertainty around the cost-effectiveness results, with either prasugrel or ticagrelor being most cost effective in different scenarios using different clinical data. The results favouring prasugrel were driven by the ISAR-REACT 5 trial, in which time to angiography was much shorter than is currently achieved in the UK for people with unstable angina or NSTEMI. This could cause practical difficulty in using prasugrel because its licence effectively prevents its use before angiography, and this could leave people with unstable angina or NSTEMI without dual antiplatelet therapy for several days. The committee therefore recommended either prasugrel or ticagrelor for people with unstable angina or NSTEMI intended for PCI, depending on individual circumstances. The final wording of the recommendation reflects the wording of the summary of product characteristics for prasugrel.

Unstable angina and NSTEMI – management when PCI is not indicated

Although many people with unstable angina or NSTEMI proceed to PCI, for some medical management without coronary revascularisation or coronary artery surgery are better options. Prasugrel is not licensed in these circumstances. The evidence available for medical management shows better outcomes with ticagrelor than clopidogrel. This is consistent with results from the larger datasets for people having PCI. The committee therefore recommended ticagrelor for people with unstable angina or NSTEMI having either medical management without coronary revascularisation or coronary artery surgery. However, the committee also noted that clopidogrel may be the safer agent for people who are at high risk of bleeding but still need dual antiplatelet therapy, although this is based on evidence of higher bleeding risk with ticagrelor in people with an acute coronary syndrome generally rather than specific evidence from those at higher risk. They therefore made a recommendation to consider using clopidogrel in this situation.

How the recommendations might affect practice

In the UK, prasugrel is currently used less than ticagrelor or clopidogrel. The recommendations may therefore involve a change in practice for some centres. Prasugrel

costs less than ticagrelor, but considerably more than clopidogrel, and although some areas will see a cost saving from switching to prasugrel from ticagrelor, others will see an increase where either prasugrel or ticagrelor is used instead of clopidogrel. The overall effect of these recommendations will be an increase in cost to the NHS.

Return to recommendations

Antiplatelet therapy for people with an indication for anticoagulation

Recommendations 1.4.21 to 1.4.25

Why the committee made the recommendations

The committee noted that current practice is to use dual antiplatelet therapy at the time of PCI, and found no evidence to recommend changing this practice for people who are on an anticoagulant at the time of admission. In practice, the anticoagulant will often be suspended for a short period (perhaps using heparin cover). The evidence available showed that continuing dual antiplatelet therapy plus an anticoagulant after the acute PCI phase increases the risk of bleeding complications, and so a recommendation raising awareness of this issue was included. The committee therefore agreed that either aspirin or the second antiplatelet agent should be stopped, but unfortunately there was no evidence to show at what point this should happen.

In the absence of any conclusive data, recommendations for treatment after the initial phase were based on the knowledge and experience of the committee. For people who have had PCI and stent insertion, they agreed that it would be safest to combine an anticoagulant with a potent antiplatelet agent (clopidogrel), whereas for those who have had medical management or had angioplasty without stenting, the anticoagulant should be combined with aspirin. There was not enough evidence for the committee to recommend a particular anticoagulant.

How the recommendations might affect practice

Current practice is variable, with people taking different combinations of antiplatelets and anticoagulants. The number of people affected is small. It is estimated that between 5% and 15% of people with an acute coronary syndrome will have an indication for oral

anticoagulation. The recommendations are mostly unchanged from the 2013 guideline and the minor changes that have been made are unlikely to result in a substantial resource impact for the NHS in England.

Return to recommendations

Duration of beta-blocker treatment after an MI

Recommendations 1.4.29 and 1.4.30

Why the committee made the recommendations

There was no direct evidence on the optimal duration of beta-blocker treatment for people who have had an MI but do not have reduced left ventricular ejection fraction. The 2013 guideline recommended beta-blocker treatment for at least 12 months. In the absence of any conclusive evidence, the committee agreed that they could not recommend a definite time for stopping treatment. However, they agreed that healthcare professionals should discuss the absence of clear evidence for benefit of continuing beyond 12 months with people taking beta-blockers after an MI who have normal left ventricular function. This should prompt a personalised approach to stopping or continuing beta-blockers based on the person's attitude to risk and experience of side effects.

How the recommendations might affect practice

Beta-blockers are currently offered for at least 12 months after an MI to people without reduced left ventricular ejection fraction. Audit data show that around 97% of people with MI are discharged on beta-blockers. A discussion of the absence of clear evidence for benefit of continuing treatment beyond 12 months is likely to lead to more people deciding to stop treatment at this point. Any reduction in prescriptions for beta-blockers will be cost saving.

Return to recommendations

Context

Acute coronary syndromes due to ischaemic heart disease remain a significant cause of morbidity and mortality. In 2015, heart disease remained the leading cause of death in men and the second most common cause of death in women in England. In 2015/16, more than 58,000 people were admitted to hospital in England with a heart attack. Although many more people now survive than in the past, there remains considerable scope to reduce their future risk of death, angina, heart failure and further heart attack.

National audits continue to show variation in practice across the UK in the treatments offered for acute coronary syndromes. This, combined with evidence of novel ways of treating acute coronary syndromes and updates to existing treatments, indicates a need for an updated guideline that will help deliver best practice to the large number of people receiving treatment for acute coronary syndromes in the NHS.

Finding more information and committee details

To find NICE guidance on related topics, including guidance in development, see the NICE topic page on cardiovascular conditions.

For full details of the evidence and the guideline committee's discussions, see the evidence reviews. You can also find information about how the guideline was developed, including details of the committee.

NICE has produced tools and resources to help you put this guideline into practice. For general help and advice on putting our guidelines into practice, see resources to help you put NICE guidance into practice.

Update information

November 2020: This guideline updates:

- NICE guideline CG172 (published November 2013)

- NICE guideline CG167 (published July 2013)

- NICE technology appraisal guidance 230 (published July 2011)

- NICE guideline CG94 (published March 2010)

- NICE technology appraisal guidance 152 (published July 2008)

- NICE technology appraisal guidance 71 (published October 2003).

It incorporates unchanged NICE guideline CG130 (published October 2011).

We have reviewed the evidence on dual antiplatelet therapy, early angiography for unstable angina and non-ST-segment elevation myocardial infarction (NSTEMI), antithrombin therapy before percutaneous coronary intervention (PCI), complete revascularisation versus culprit vessel only PCI for ST-segment elevation myocardial infarction (STEMI), drug-eluting stents, combination antiplatelet and anticoagulant treatment for people with a separate indication for anticoagulation, and duration of beta-blocker treatment for people with reduced left ventricular ejection fraction after MI. We have made new recommendations. These recommendations are marked **[2020]**.

We have also made some changes without an evidence review:

- We have aligned terminology with the NICE guideline on chronic heart failure in adults.

- We have clarified advice on drug therapy for secondary prevention to indicate that dual antiplatelet therapy may not be suitable for people with a separate indication for anticoagulation.

- We have indicated when to offer a cardiology assessment to someone who has had a previous MI.

These recommendations are marked **[2007, amended 2020]**.

Minor changes since publication

December 2024: We added links to relevant technology appraisal guidance in the sections on dual antiplatelet therapy, coronary angiography with follow-on PCI, drug therapy for secondary prevention and people with reduced left ventricular ejection fraction.

December 2021: Following a surveillance review we have updated recommendation 1.3.7 to say that either glycosylated haemoglobin (HbA1c) or fasting blood glucose may be used to test for diabetes. Recommendation 1.3.3 on using both tests before discharge from hospital in people with hyperglycaemia after acute coronary syndrome has not changed.

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