Chest pain of recent onset:

Assessment and investigation of recent onset chest pain or discomfort of suspected cardiac origin

NICE guideline

Draft for consultation, May 2009

If you wish to comment on this version of the guideline, please be aware that all the supporting information and evidence is contained in the full version.

Contents

Introduction

Chest pain or discomfort caused by angina or an acute coronary syndrome has a potentially poor prognosis, emphasising the importance of prompt and accurate diagnosis. Treatments are available to improve symptoms and prolong life, hence the need for this guideline.

This guideline covers the assessment and investigation of people with recent chest pain or discomfort of suspected cardiac origin, whether or not they present with acute pain or intermittent stable pain. It includes how to determine whether or not myocardial ischaemia is the cause of the chest pain and how to manage the chest pain during the period when people are being assessed and investigated.

There are two separate diagnostic pathways presented in the guideline. The first is for people with acute chest pain in whom an acute coronary syndrome is suspected. This includes a resting 12-lead ECG, clinical assessment and recommendations for circulating biomarker assay using the universal definition of myocardial infarction (Thygesen et al. 2007).

The second pathway is for people with intermittent stable chest pain in whom stable angina is suspected. This includes a clinical assessment, resting 12-lead ECG and recommendations for diagnostic investigations. Angina can be diagnosed based on any one of the following:

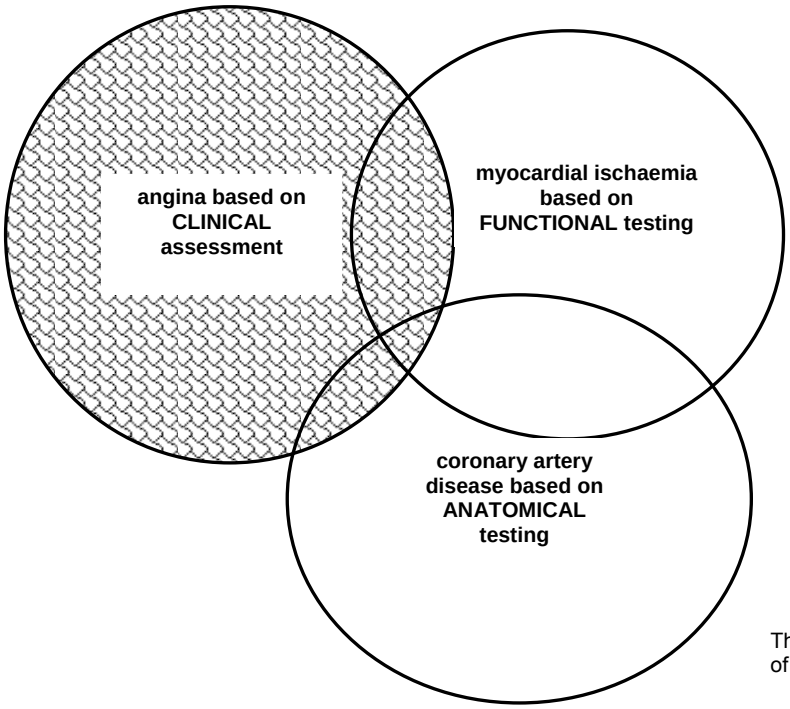
- clinical history alone (a typical history is sufficient for a diagnosis)
- clinical history plus functional testing which demonstrates myocardial ischaemia
- clinical history plus anatomical testing which demonstrates significant obstructive coronary artery disease (CAD).

It is important to note that only clinical assessment alone is necessary, and it is often sufficient, for diagnosing angina, but when there is uncertainty (with a diagnostic probability of angina of 10–90%), additional functional or anatomical testing will help confirm or exclude the diagnosis. The endpoint for

diagnosing angina in people who present with stable chest pain may be any of the above points.

This is demonstrated below in Figure 1.

Figure 1 Making a diagnosis of angina in people presenting with chest pain



The shaded area shows the scope of this guideline

This guideline does not cover the diagnosis and management of chest pain that is clearly unrelated to the heart (for example, traumatic chest wall injury, herpes zoster infection) once myocardial ischaemia has been excluded. The guideline also recognises that in people with a prior diagnosis of coronary artery disease, chest pain or discomfort is not necessarily cardiac in origin.

Note: Throughout this guideline the term chest pain is used to mean both chest pain and discomfort.

Person-centred care

This guideline offers best practice advice on the care of people who present with chest pain or discomfort of suspected cardiac origin.

Treatment and care should take into account peoples' needs and preferences. People with chest pain or discomfort of suspected cardiac origin should have the opportunity to make informed decisions about their care and treatment, in partnership with their healthcare professionals. If people do not have the capacity to make decisions, healthcare professionals should follow the Department of Health guidelines – 'Reference guide to consent for examination or treatment' (2001) (available from www.dh.gov.uk). Healthcare professionals should also follow the code of practice that accompanies the Mental Capacity Act (summary available from www.publicguardian.gov.uk).

Good communication between healthcare professionals and the person with chest pain is essential. It should be supported by evidence-based written information tailored to the person's needs. Until a diagnosis is made, it should be recognised that the person may be anxious. The options and consequences at every stage of the investigative process should be clearly explained. Investigations, treatment and care, and the information people are given about it, should be culturally appropriate. It should also be accessible to people with additional needs such as physical, sensory or learning disabilities, and to people who do not speak or read English.

If the person agrees, families and carers should have the opportunity to be involved in decisions about treatment and care.

Families and carers should also be given the information and support they need.

Key priorities for implementation

Presentation with acute chest pain

- In people with suspected acute coronary syndrome (ACS), take a detailed clinical history if a diagnosis of ST-segment elevation myocardial infarction (MI) cannot be confirmed from the resting 12-lead ECG (that is, regional ST-segment elevation, presumed new left bundle branch block [LBBB]). Document:
    - the characteristics of the pain
    - other associated symptoms
    - any history of coronary disease or other cardiovascular disease
    - any cardiovascular risk factors, and
    - details of previous investigations or treatments for similar symptoms of chest pain. **[1.2.5.2]**

- Take a resting 12-lead ECG as soon as possible. If the person is referred, ideally transmit the results to hospital before they arrive. Recording and transmission of the ECG should not delay transfer to hospital. **[1.2.4.1]**

- Do not routinely administer oxygen, but monitor arterial oxygen saturation using pulse oximetry as soon as possible, ideally before hospital admission. **[1.2.6.4]**

- Be aware that there are no major differences in ACS symptoms among different ethnic groups. **[1.2.3.1]**

- Be aware that the universal definition of a MI[1] is detection of rise and/or fall of cardiac biomarkers (preferably troponin) with at least one value above the 99th percentile of the upper reference limit, together with evidence of myocardial ischaemia with at least one of the following:
    - symptoms of ischaemia
    - ECG changes indicative of new ischaemia (new ST-T changes or new LBBB)
    - development of pathological Q wave changes in the ECG

[1] Thygesen K, Alpert JS and White HD, 2007

- imaging evidence of new loss of viable myocardium or new regional wall motion abnormality.

The clinical classification of MI includes:

Type 1: Spontaneous MI related to ischaemia due to a primary coronary event such as plaque erosion and/or rupture, fissuring or dissection.

Type 2: MI secondary to ischaemia due to either increased oxygen demand or decreased supply, such as coronary spasm, coronary embolism, anaemia, arrhythmias, hypertension, or hypotension.

Types 3, 4 and 5 refer to the diagnosis of MI in sudden cardiac death, after percutaneous coronary intervention (PCI) and after coronary artery bypass graft (CABG) respectively. **[1.2.8.1]**

Presentation with stable chest pain

- Be aware that angina can be diagnosed based on one or more of the following:
    - clinical assessment alone
    - clinical assessment combined with either obstructive coronary artery disease (CAD) found on anatomical testing, or myocardial ischaemia, found on functional testing, or
    - all three. **[1.3.1.1]**

- Before considering diagnostic investigations, estimate the likelihood of CAD (see table 1 on page 19) in people without confirmed CAD. Base the estimate on the initial clinical assessment and the ECG. **[1.3.6.1]**

- After clinical assessment and a resting 12-lead ECG, offer computed tomography (CT) calcium scoring[2]. **[1.3.8.12]**
- Following calcium scoring, if the score is:
    - zero, investigate other causes of chest pain

[2] This recommendation is for people with a low pre-test likelihood that chest pain is caused by angina (less than 30%) and an uncertain diagnosis.

    - 1–400, offer 64-slice (or above) CT coronary angiography
    - greater than 400, offer invasive coronary angiography. If this is not clinically appropriate or acceptable to the person and revascularisation is not being considered, offer non-invasive functional imaging. **[1.3.8.13]**

- Do not use exercise ECG as the primary diagnostic test for myocardial ischaemia in people without known CAD. **[1.3.11.2]**

- Offer non-invasive functional imaging (see recommendation 1.3.8.5) for myocardial ischaemia if invasive coronary angiography or 64-slice (or above) CT coronary angiography has shown CAD of uncertain functional significance. **[1.3.9.1]**

1 Guidance

The following guidance is based on the best available evidence. The full guideline ([add hyperlink]) gives details of the methods and the evidence used to develop the guidance.

1.1 Recommendations for information to assist people in decision-making and support them through uncertainty

1.1.1.1 Discuss the person's (and where appropriate their family's or carer/advocate's) thoughts and concerns about their condition and care. Explore any misinformation.

1.1.1.2 Offer a clear explanation of the possible causes of the person's symptoms, including the uncertainties.

1.1.1.3 Clearly explain the options and consequences at every stage of the investigative process, making joint decisions with the person and taking account of the person's preferences. The healthcare professional should:

- encourage the person to ask questions
- provide repeated opportunities for discussion
- explain test results and the need for any further investigations.

1.1.1.4 Provide information about any proposed investigations using everyday, jargon-free language. Include:

- their purpose and benefits
- duration
- level of discomfort and invasiveness
- risk of adverse events.

1.1.1.5 Consider and address any factors such as physical or learning difficulties, sight or hearing problems and difficulties with speaking

English, which may affect the person's understanding of the information offered.

1.1.1.6 Offer information and education after diagnosis as recommended in the relevant disease management guidelines.

1.1.1.7 Recognise and address any anxiety the person may have when the cause of their chest pain is unknown.

1.1.1.8 When a person's chest pain is of non-cardiac origin, explain this clearly and refer the person for further investigation if appropriate.

1.1.1.9 Provide individual advice to people about seeking medical attention if they have further chest pain.

1.2 Recommendations for people presenting with acute chest pain

Assessment

1.2.1 Initial assessment and referral to hospital

1.2.1.1 Check immediately whether people have current chest pain. If they are pain free, check when their last episode of pain was.

1.2.1.2 Determine if chest pain or discomfort is of cardiac origin. Consider:

- the history of the chest pain
- the presence of cardiovascular risk factors
- the history of ischaemic heart disease and any previous treatment
- previous investigations for chest pain.

1.2.1.3 Initially assess people for any of the following symptoms and signs, which may indicate an acute coronary syndrome (ACS):

- pain or discomfort in the chest or radiating areas (for example, the arms, back or jaw) lasting longer than 15 minutes

- chest pain associated with nausea and vomiting, excessive sweating, breathlessness, or particularly a combination of these
- chest pain associated with haemodynamic instability
- new onset chest pain or discomfort, or abrupt deterioration in previously stable angina, with chest pain or discomfort occurring frequently and with little or no exertion, and often with episodes lasting longer than 15 minutes.

1.2.1.4 Do not use the person's response to glyceryl trinitrate (GTN) to make a diagnosis.

1.2.1.5 Refer people to hospital as an emergency ('blue-light' ambulance) if an ACS is suspected (see recommendation 1.2.1.3) and:

- they currently have chest pain or discomfort, or
- they are currently pain free, but had chest pain in the last 12 hours, and a resting 12-lead ECG is abnormal or not available.

1.2.1.6 Refer people urgently for same day assessment in hospital if an ACS is suspected (see recommendation 1.2.1.3) and:

- they had chest pain or discomfort in the last 12 hours, but are now pain free with a normal ECG, and there are no reasons for emergency referral

or

- the last episode of pain was 12–72 hours ago, and there are no reasons for emergency referral.

Use clinical judgement to decide on the urgency of referral.

1.2.1.7 Refer people for assessment in hospital if an ACS is suspected (see recommendation 1.2.1.3) and:

- the pain has resolved, and
- there are signs of complications such as pulmonary oedema.

Use clinical judgement to decide whether referral should be as an emergency or urgently for same day assessment.

1.2.1.8 If ACS is not suspected after initial assessment, consider other causes of chest pain. If chest pain may still be of cardiac origin refer to the recommendations on stable chest pain in this guideline (see section 1.3).

1.2.1.9 If recent ACS is suspected in people whose last episode of chest pain or discomfort was more than 72 hours ago and who have no complications such as pulmonary oedema:

- carry out a detailed clinical assessment
- confirm the diagnosis by resting 12-lead ECG and blood troponin level
- take into account the length of time since the suspected ACS when interpreting the troponin level.

Use clinical judgement to decide whether referral is necessary and how urgent this should be.

1.2.1.10 Refer people to hospital as an emergency ('blue-light' ambulance) if they have recent (confirmed or suspected) ACS and develop further chest pain or discomfort.

1.2.1.11 Follow the ACS guideline[3] or local protocols for ST-segment elevation MI for people who are pain free and have a confirmed diagnosis of ACS.

1.2.2 Gender differences in symptoms of acute chest pain

1.2.2.1 Be aware that not all people with an ACS present with central chest pain as the predominant feature. The presenting symptom may be back, jaw or throat pain, breathlessness, nausea and/or vomiting,

[3] The NICE clinical guideline 'Acute coronary syndromes: the management of unstable angina and non ST elevation myocardial infarction' is in development. The consultation period is 3 July–28 August 2009.

indigestion and palpitations. Such presentations are slightly more common in women.

1.2.3 Ethnic differences in symptoms of acute chest pain

1.2.3.1 Be aware that there are no major differences in ACS symptoms among different ethnic groups.

1.2.4 Resting 12-lead ECG

1.2.4.1 Take a resting 12-lead ECG as soon as possible. If the person is referred, ideally transmit the results to hospital before they arrive. Recording and transmission of the ECG should not delay transfer to hospital.

1.2.4.2 Follow local protocols for people with a resting 12-lead ECG showing regional ST-segment elevation or presumed new LBBB consistent with an acute ST-segment elevation MI.

1.2.4.3 Follow the ACS guideline[4] for people with a resting 12-lead ECG showing regional ST-segment depression or deep T wave inversion suggestive of a non ST-segment elevation MI or unstable angina, until a firm diagnosis is made.

1.2.4.4 Even in the absence of ST-segment changes, have an increased suspicion of ACS if there are other changes on the resting 12-lead ECG, specifically Q waves and T wave changes.

1.2.4.5 Do not exclude an ACS when the person has a normal resting 12-lead ECG.

1.2.4.6 If a diagnosis of ACS is in doubt, consider:

- taking serial resting 12-lead ECGs
- reviewing previous resting 12-lead ECGs
- recording additional ECG leads.

[4] The NICE clinical guideline 'Acute coronary syndromes: the management of unstable angina and non ST elevation myocardial infarction' is in development. The consultation period is 3 July–28 August 2009.

Note that the results may not be conclusive.

1.2.4.7 Consider automated interpretation of the resting 12-lead ECG as an adjunctive tool, but do not use as the sole method of interpretation.

1.2.4.8 If clinical assessment (as described in recommendation 1.2.1.9), including a resting 12-lead ECG makes a diagnosis of ACS less likely, consider other life-threatening conditions such as pulmonary embolism, aortic dissection or pneumonia.

1.2.5 Early assessment in hospital

1.2.5.1 Carry out a physical examination of all people with suspected ACS to determine:

- haemodynamic status
- signs of complications
- signs of non-coronary causes of acute chest pain, such as aortic dissection.

1.2.5.2 In people with suspected ACS, take a detailed clinical history if a diagnosis of ST-segment elevation MI cannot be confirmed from the resting 12-lead ECG (that is, regional ST-segment elevation, presumed new LBBB). Document:

- the characteristics of the pain
- other associated symptoms
- any history of coronary disease or other cardiovascular disease
- any cardiovascular risk factors, and
- details of previous investigations or treatments for similar symptoms of chest pain.

1.2.6 Early management

1.2.6.1 As soon as possible:

- manage pain

- give aspirin
- check oxygen saturation
- take a resting 12-lead ECG.

These should be done in the order appropriate to the circumstances, but do not delay transfer to hospital.

A blood sample for troponin measurement should be taken after arrival in hospital. Refer to recommendations 1.2.6.2–1.2.6.8 for more detail.

1.2.6.2 Offer prompt and effective pain relief. This may be achieved with GTN, but opiates such as morphine may be required, particularly if an acute MI is suspected.

1.2.6.3 Monitor people with acute chest pain, using clinical judgement to decide how often this should be done, until a firm diagnosis is made. Include:

- exacerbations of pain and/or other symptoms
- pulse and blood pressure
- heart rhythm
- oxygen saturation by pulse oximetry
- repeated resting 12-lead ECGs
- checking pain relief is effective.

1.2.6.4 Do not routinely administer oxygen, but monitor oxygen saturation using pulse oximetry as soon as possible, ideally before hospital admission.

1.2.6.5 Offer supplemental oxygen to people with oxygen saturation (SaO2) of less than 94% who are not at risk of hypercapnic respiratory failure. Aim for SaO2 of 94–98%.

1.2.6.6 In people with chronic obstructive pulmonary disease (COPD) who are at risk of hypercapnic respiratory failure, offer supplemental

oxygen as necessary to achieve a target SaO2 of 88–92% until blood gas analysis is available.

1.2.6.7 Offer a single loading dose of aspirin 300 mg to people with suspected ACS as soon as possible, until further assessment can be carried out.

1.2.6.8 Manage other therapeutic interventions using appropriate guidance (ACS guideline[5] or local protocols for ST-segment elevation MI), if ACS is suspected.

Investigations and diagnosis

1.2.7 Use of biochemical markers

1.2.7.1 Take a blood sample for troponin I or T measurement on initial assessment in hospital. These are the preferred biochemical markers to diagnose acute MI.

1.2.7.2 Take a second blood sample for troponin I or T measurement 10–12 hours after the onset of symptoms even if the pain has resolved.

1.2.7.3 Do not use biochemical markers such as naturetic peptides and high sensitivity C-reactive protein (hsCRP) to diagnose ACS.

1.2.7.4 Do not use biochemical markers of myocardial ischaemia (such as ischaemia-modified albumin) as opposed to necrosis, when assessing people with acute chest pain.

1.2.7.5 Do not interpret troponin measurements in isolation. Take into account the clinical presentation and ECG findings.

1.2.8 Making a diagnosis

1.2.8.1 Be aware that the universal definition of an MI[6] is detection of rise and/or fall of cardiac biomarkers (preferably troponin) with at least

[5] The NICE clinical guideline 'Acute coronary syndromes: the management of unstable angina and non ST elevation myocardial infarction' is in development. The consultation period is 3 July–28 August 2009.
[6] Thygesen K, Alpert JS and White HD, 2007.

one value above the 99th percentile of the upper reference limit, together with evidence of myocardial ischaemia with at least one of the following:

- symptoms of ischaemia
- ECG changes indicative of new ischaemia (new ST-T changes or new LBBB)
- development of pathological Q wave changes in the ECG
- imaging evidence of new loss of viable myocardium or new regional wall motion abnormality.

The clinical classification of MI includes:

- Type 1: spontaneous MI related to ischaemia due to a primary coronary event such as plaque erosion and/or rupture, fissuring or dissection.
- Type 2: MI secondary to ischaemia due to either increased oxygen demand or decreased supply, such as coronary spasm, coronary embolism, anaemia, arrhythmias, hypertension, or hypotension.

Types 3, 4 and 5 refer to the diagnosis of MI in sudden cardiac death, after percutaneous coronary intervention (PCI) and after coronary artery bypass graft (CABG) respectively.

1.2.8.2 When a raised troponin level is detected, immediately reassess to exclude other reasons for raised troponin (for example, myocarditis or pulmonary embolism) and confirm the diagnosis of ACS.

1.2.8.3 When a raised troponin level is detected in people with suspected ACS, treat using appropriate guidance (ACS guideline[7] or local protocols for ST-segment elevation MI).

[7] The NICE clinical guideline 'Acute coronary syndromes: the management of unstable angina and non ST elevation myocardial infarction' is in development. The consultation period is 3 July–28 August 2009.

1.2.8.4 People with chest pain who do not have raised troponin levels (determined from appropriately-timed samples) and no acute ECG changes are unlikely to have acute MI. Reassess these people at an early stage to determine whether their chest pain is likely to be of cardiac origin, and to plan future investigation and management.

After reassessment, if cardiac ischaemia is suspected, refer to the recommendations on stable chest pain in this guideline (see section 1.3).

1.2.8.5 Consider a chest X-ray to help exclude complications of ACS such as pulmonary oedema, or other diagnoses such as pneumothorax or pneumonia.

1.2.8.6 Do not routinely offer chest computed tomography (CT) as part of the initial assessment in the emergency department. Only consider chest CT to rule out diagnoses other than ACS, such as pulmonary embolism or aortic dissection.

1.3 Recommendations for people presenting with stable chest pain

When people present with stable chest pain of suspected cardiac origin, healthcare professionals should consider a diagnosis of angina caused by myocardial ischaemia. Angina can be diagnosed based on:

- the clinical history alone (a typical history is sufficient for a diagnosis)
- the clinical history and functional testing which demonstrates myocardial ischaemia
- the clinical history combined with anatomical testing which demonstrates significant obstructive CAD.

The endpoint for diagnosing angina in people who present with stable chest pain may be any of these individually or in combination.

In addition, tests in asymptomatic people may find the presence of obstructive CAD and/or myocardial ischaemia, but in the absence of chest pain or discomfort these people are not diagnosed with angina.

Table 1 shows the likelihood of coronary artery disease by presentation, age, sex and the presence of risk factors.

Table 1 Diagnosis of angina: typicality, age, sex, risk factors and presence of coronary artery disease (CAD).

	Non-specific chest pain				Atypical angina				Typical angina			
	Men		Women		Men		Women		Men		Women	
Age (years)	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi
35	3	35	1	19	8	59	2	39	30	88	10	78
45	9	47	2	22	21	70	5	43	51	92	20	79
55	23	59	4	25	45	79	10	47	80	95	38	82
65	49	69	9	29	71	86	20	51	93	97	56	84

Values are per cent with CAD[8]

Hi = High risk = smoking, hypertensive, diabetic

Lo = Low risk = none of these three. If there are resting ECG ST-T changes or Q waves, the likelihood of CAD is higher in each cell of the table.

The shaded areas are those with a very low likelihood of CAD (< 10%) or very high likelihood of CAD (> 90%)

N.B. These results are likely to overestimate CAD in primary care populations

1.3.1 Clinical assessment

1.3.1.1 Be aware that angina can be diagnosed based on one or more of the following:

- clinical assessment alone
- clinical assessment combined with either obstructive CAD found on anatomical testing, or myocardial ischaemia, found on functional testing, or
- all three.

[8] Adapted from Gibbons RJ et al. (2002) American College of Cardiology/American Heart Association 2002 guideline update for the management of patients with chronic stable angina: a report of the American College of Cardiology/American Heart Association Task Force on practice guidelines.

1.3.2 History, risk factors and physical examination

1.3.2.1 Take a detailed clinical history documenting:

- the age and sex of the person
- the characteristics of the pain, including its location, radiation, severity, duration and frequency, and factors that provoke and relieve the pain
- any associated symptoms
- any history of angina, MI, coronary revascularisation, or other cardiovascular disease
- any coronary risk factors.

1.3.2.2 Be aware that the following factors make a diagnosis of angina more likely:

- increasing age
- male
- typical angina symptoms (see recommendation 1.3.2.5)
- cardiovascular risk factors including:
  - a history of smoking
  - diabetes
  - hypertension
  - hyperlipidaemia
  - family history of premature CAD
  - history of established coronary heart disease, for example previous MI, coronary revascularisation
  - other cardiovascular disease.

1.3.2.3 Carry out a physical examination in all people with a history of chest pain or discomfort to:

- identify risk factors for cardiovascular disease
- identify signs of other cardiovascular disease
- exclude non-coronary causes of angina (for example, severe aortic stenosis, cardiomyopathy)

- exclude other causes of chest pain or discomfort.

1.3.2.4 Be aware that a diagnosis of angina is less likely when the pain is:

- continuous or very prolonged
- unrelated to activity
- brought on by breathing in
- associated with symptoms such as dizziness, palpitations, tingling or dysphagia.

1.3.2.5 Be aware that:

- typical angina symptoms are:
  - constricting discomfort in the front of the chest, or in the neck, shoulders, jaw, or arms
  - precipitated by physical exertion or psychological stress
  - relieved by rest or GTN within about 5 minutes
- atypical angina symptoms are two of the three features above
- non-anginal chest pain symptoms are fewer than two of the features above.

1.3.3 Gender differences in symptoms of stable angina

1.3.3.1 Be aware that central chest pain is not always the main symptom in people with stable angina. The diagnostic pathway is determined by the likelihood of CAD, which itself is influenced by gender and age. However, the actual differences in presenting symptoms between men and women are small.

1.3.4 Ethnic differences in symptoms of stable angina

1.3.4.1 Be aware that there are no major differences in symptoms of stable angina among different ethnic groups.

1.3.5 Resting 12-lead ECG

1.3.5.1 Take a resting 12-lead ECG as soon as possible.

1.3.5.2 Be aware that a normal resting 12-lead ECG does not rule out a diagnosis of stable angina.

1.3.5.3 Be aware that a number of changes on a resting 12-lead ECG are consistent with CAD and may indicate previous infarction. These include:

- pathological Q waves in particular
- LBBB
- ST-segment and T wave abnormalities (for example, flattening or inversion).

Consider these changes along with the person's clinical history and risk factors.

1.3.6 Making a diagnosis based on clinical assessment

1.3.6.1 Before considering diagnostic investigations, estimate the likelihood of CAD (see table 1) in people without confirmed CAD. Base the estimate on the initial clinical assessment and the ECG.

1.3.6.2 If angina is very likely based on clinical assessment (greater than 90%, see table 1), treat for angina.

1.3.6.3 Follow local protocols for angina[9] for people who are diagnosed with angina on the basis of clinical assessment and a resting 12-lead ECG. No further diagnostic investigations for angina are needed.

1.3.6.4 Do not carry out further diagnostic investigations to exclude angina in people who are diagnosed with non-cardiac chest pain based on clinical assessment and a resting 12-lead ECG.

1.3.6.5 Do not carry out a chest X-ray to help diagnose angina. Consider carrying out a chest X-ray if other conditions such as lung cancer or pulmonary oedema are suspected.

[9] NICE is developing a clinical guideline on stable angina. Publication is expected in July 2011.

1.3.6.6 If angina is very unlikely based on clinical assessment (less than 10%, see table 1), consider other diagnoses.

1.3.6.7 If a cardiac cause for chest pain has been ruled out, but people have risk factors for cardiovascular disease, follow the appropriate guidance, for example 'Lipid modification' (NICE clinical guideline 67), 'Hypertension' (NICE clinical guideline 34).

1.3.6.8 Consider alternative causes of chest pain (such as gastrointestinal or musculoskeletal pain) in people who are unlikely to have angina or if diagnostic investigations exclude CAD.

1.3.6.9 Do not routinely offer aspirin if the person's chest pain is unlikely to be angina.

1.3.6.10 Carry out further investigations if there is no firm diagnosis of angina, based on clinical assessment and a resting 12-lead ECG, and offer aspirin.

1.3.7 Diagnostic testing

1.3.7.1 Include the estimate of the likelihood of angina (see recommendation 1.3.6.1) in all requests for diagnostic investigations and in the person's notes.

1.3.7.2 Offer information about the risks of diagnostic testing, including any radiation exposure.

1.3.8 First-line diagnostic investigations

For people with a high pre-test likelihood that chest pain is caused by angina (more than 60%) and an uncertain diagnosis

1.3.8.1 Offer invasive coronary angiography after clinical assessment and a resting 12-lead ECG if:

- coronary revascularisation is being considered, and
- it is clinically appropriate and acceptable to the person.

1.3.8.2 Consider either 64-slice (or above) CT coronary angiography or non-invasive functional imaging after clinical assessment and a resting 12-lead ECG if:

- coronary revascularisation is not being considered, or
- invasive coronary angiography is not clinically appropriate or acceptable to the person.

1.3.8.3 Follow local protocols for angina[10] while waiting for the results of investigations if the pre-test likelihood of angina is greater than 60%.

1.3.8.4 Exclude CAD as the cause of symptoms and investigate other causes if no significant CAD is found during invasive coronary angiography or 64-slice (or above) CT coronary angiography.

For people with a moderate pre-test likelihood that chest pain is caused by angina (30–60%) and an uncertain diagnosis

1.3.8.5 After clinical assessment and a resting 12-lead ECG, offer non-invasive functional imaging for myocardial ischaemia. Use:

- myocardial perfusion scintigraphy with single photon emission computed tomography (MPS with SPECT)
- stress echocardiography
- first-pass contrast-enhanced magnetic resonance (MR) perfusion, or
- MR imaging for stress-induced wall motion abnormalities.

The choice of imaging method should take account of locally available technology and expertise, and the person and their preferences, including any contraindications.

1.3.8.6 MPS using SPECT is recommended for the diagnosis of suspected CAD in the following circumstances[11].

[10] NICE is developing a clinical guideline on stable angina. Publication is expected in July 2011.

- As the initial diagnostic tool for people with suspected CAD for whom stress electrocardiography poses particular problems of poor sensitivity or difficulties in interpretation, including women, patients with cardiac conduction defects (for example, left bundle branch block), and people with diabetes, and for people for whom treadmill exercise is difficult or impossible.
- As part of an investigational strategy for the diagnosis of suspected CAD in people with lower likelihood of CAD and of future cardiac events. The likelihood of CAD will be based on the assessment of a number of risk factors including age, gender, ethnic group, family history, associated comorbidities, clinical presentation, physical examination, and results from other investigations (for example, blood cholesterol levels or resting electrocardiogram).

1.3.8.7 Use adenosine or dipyridamole as stress agents for MPS with SPECT and first-pass contrast-enhanced MR perfusion.

1.3.8.8 Use exercise or dobutamine for stress echocardiography or MR imaging for stress-induced wall motion abnormalities.

1.3.8.9 Confirm a diagnosis of angina if reversible ischaemia is found during non-invasive functional imaging. Follow local guidelines for angina[12] .

1.3.8.10 When reversible myocardial ischaemia is not found during non-invasive functional imaging, consider other causes for chest pain.

1.3.8.11 Offer invasive coronary angiography when the results of non-invasive functional imaging are inconclusive (see recommendation 1.3.8.1).

[11] This recommendation is taken from NICE technology appraisal 73 (www.nice.org.uk/TA73)
[12] NICE is developing a clinical guideline on stable angina. Publication is expected in July 2011.

For people with a low pre-test likelihood that chest pain is caused by angina (less than 30%) and an uncertain diagnosis

1.3.8.12 After clinical assessment and a resting 12-lead ECG, offer CT calcium scoring.

1.3.8.13 Following calcium scoring, if the score is:

- zero, investigate other causes of chest pain
- 1–400, offer 64-slice (or above) CT coronary angiography
- greater than 400, offer invasive coronary angiography. If this is not clinically appropriate or acceptable to the person and revascularisation is not being considered, offer non-invasive functional imaging. See recommendation 1.3.8.5 about the choice of method.

For people with confirmed CAD (for example, previous MI, revascularisation, previous angiography)

1.3.8.14 Offer non-invasive functional testing to people with confirmed CAD when there is uncertainty about whether chest pain is caused by myocardial ischaemia. An exercise ECG may be used instead of functional imaging.

1.3.9 Further investigations

1.3.9.1 Offer non-invasive functional imaging (see recommendation 1.3.8.5) for myocardial ischaemia if invasive coronary angiography or 64-slice (or above) CT coronary angiography has shown CAD of uncertain functional significance.

1.3.10 If uncertainty remains following further investigations

1.3.10.1 Consider investigating other causes of angina, such as cardiomyopathy or small vessel disease in people with typical angina-like chest pain who, on initial assessment, either have:

- an extremely low likelihood of CAD, or
- investigation excludes flow-limiting disease in the epicardial coronary arteries.

1.3.10.2 Consider alternative causes for chest pain when diagnostic investigations exclude angina as the cause of the pain.

1.3.11 Investigations that are generally not helpful in the diagnosis of stable angina

1.3.11.1 Do not use MR coronary angiography for diagnosing CAD.

1.3.11.2 Do not use exercise ECG as the primary diagnostic test for myocardial ischaemia in people without known CAD.

2 Notes on the scope of the guidance

NICE guidelines are developed in accordance with a scope that defines what the guideline will and will not cover. The scope of this guideline is available from www.nice.org.uk/nicemedia/pdf/ACPScope.pdf

The guideline covers adults who have recent onset chest pain or discomfort of suspected cardiac origin, with or without a prior history and/or diagnosis of cardiovascular disease. It includes those presenting with either acute or stable chest pain.

The guideline addresses assessment and investigation irrespective of setting including:

- assessment at initial presentation
- early, initial pharmacological interventions such as oxygen, antiplatelet therapy and pain relief before a cause is known
- choice and timing of investigations
- education and information provision, in particular involving patients in decisions
- where relevant and where associated with chest pain or discomfort, the special needs of people from different groups are considered.

The guideline does not cover the management, including prognostic investigations, and symptom control once the cause of chest pain or discomfort is known. It does not address non-ischaemic chest pain (for example, traumatic chest injury) or pain which is known to be related to another condition, or when there are no cardiac symptoms.

How this guideline was developed

NICE commissioned the National Clinical Guidelines Centre for Acute and Chronic Conditions to develop this guideline. The Centre established a guideline development group (see appendix A), which reviewed the evidence and developed the recommendations. An independent guideline review panel oversaw the development of the guideline (see appendix B).

There is more information about how NICE clinical guidelines are developed on the NICE website (www.nice.org.uk/guidelinesprocess). A booklet, 'How NICE clinical guidelines are developed: an overview for stakeholders, the public and the NHS' (fourth edition, published 2009), is available from NICE publications (phone 0845 003 7783 or email publications@nice.org.uk and quote reference N1739).

3 Implementation

NICE has developed tools to help organisations implement this guidance (see www.nice.org.uk/CGXX).

4 Research recommendations

The Guideline Development Group has made the following recommendations for research, based on its review of evidence, to improve NICE guidance and patient care in the future. The Guideline Development Group's full set of research recommendations is detailed in the full guideline (see section 5).

Acute chest pain

4.1 Cost-effectiveness of multislice CT coronary angiography for ruling out obstructive CAD in people with troponin-negative acute coronary syndromes

Research question

Is multislice CT coronary angiography a cost-effective first-line test for ruling out obstructive CAD in people with suspected troponin-negative acute coronary syndromes?

Research recommendation

Investigation of the cost-effectiveness of multislice CT coronary angiography as a first-line test for ruling out obstructive CAD in people with suspected troponin-negative acute coronary syndromes.

Why this is important

Current European Society of Cardiology guidelines state that in troponin-negative acute coronary syndromes, with no ST-segment change on the ECG, 'a stress test is recommended… in patients with significant ischaemia during the stress test, coronary angiography and subsequent revascularisation should be considered'. Yet stress testing has relatively low sensitivity and specificity for diagnosing CAD in this group of people, ensuring that a significant proportion of at-risk people are missed while others with normal coronary arteries are subjected to an unnecessary invasive coronary angiogram. Multislice CT coronary angiography is highly sensitive and provides a potentially useful means for early rule-out of CAD in troponin-negative acute coronary disease. We need to know whether it is cost effective compared with exercise ECG as a first test in the diagnostic work up of this group.

4.2 Novel cardiac biomarkers in people with acute chest pain

What is the effectiveness and cost effectiveness of new, high sensitivity troponin methods in low, medium, and high risk people with acute chest pain?

Research recommendation

Evaluation of new, high sensitivity troponin assay methods in low, medium and high risk groups with acute chest pain.

Evaluation of other putative biomarkers in comparison with the diagnostic and prognostic performance of the most clinically-effective and cost-effective troponin assays.

Why this is important

Newer more sensitive troponin assays may offer advantages over previous assays in terms of diagnostic accuracy, and allow exclusion of myocardial infarction earlier than the 12 hour time frame currently required. Other proposed biomarkers need to be compared to the best available troponin assays.

4.3 Refining the use of telephone advice in patients with chest pain

Research question

In what circumstances should telephone advice be given to people calling with a symptom of chest pain? Is the appropriateness influenced by age, gender or symptoms?

Research recommendation

To develop a robust system for giving appropriate telephone advice to patients with chest pain.

Why this is important

The telephone is a common method of first contact with healthcare services, and produces a near uniform emergency response to the expression of a chest pain symptom. Such a response has considerable economic, social and human costs. Research should be conducted to clarify if such a response in all circumstances is appropriate, or if there are identifiable factors such as age, gender, or associated symptoms that may allow a modified response that would permit more appropriate use of resources.

Stable chest pain

4.4 Establishing a national registry for people who are undergoing initial assessment for stable angina

Research question and recommendations

Can a national registry of people presenting with suspected angina be established in order to permit cohort analysis of treatments, investigations and

outcomes of this group? Such a registry would provide a vital resource for a range of important research projects, including:

- Development and validation of a new score for assessing the pre-test probability of disease, addressing outstanding uncertainties in the estimation of the pre-test probability of CAD based on simple measures obtained at initial assessment (history, examination, routine bloods, resting 12-lead ECG).
- Assessment of the extent to which new circulating biomarkers add information incremental to measures made at initial assessment.
- Provision of a framework for trial recruitment without significant work up bias allowing evaluation of the diagnostic and prognostic test performance of CT-based, MR, echocardiography, and radionuclide technologies.

Why this is important

A national prospective registry of consecutive people with suspected stable angina prior to initial diagnostic testing does not currently exist in the UK or in any other country. Establishing such a registry would offer the following methodological strengths – statistical size, representative patients without work-up bias, contemporary data – which would overcome key problems in much of the existing evidence base.

Accurate assessment of pre-test likelihood of coronary disease is needed to inform the cost-effective choice of investigative technologies such as CT coronary calcium scoring for people with chest pain that may be due to cardiac ischaemia. The data on which pre-test likelihood is based date from 1979 in a US population and may not be applicable to contemporary UK populations. There remain continuing uncertainties about the initial assessment of people with suspected stable angina. For example, the contributions (if any) of simple clinical measures such as body mass index, routine blood markers such as haemoglobin or novel circulating biomarkers to estimates of the pre-test likelihood of CAD are not known and require further assessment in the whole population and in predefined subgroups including ethnic minorities.

4.5 Cost-effectiveness of multislice CT coronary angiography compared with functional testing in the diagnosis of angina

Research question

What is the clinical and cost effectiveness of multislice computed tomography coronary angiography compared to functional testing in the diagnosis of angina in a population of people with stable chest pain who have a moderate (30-60%) pre-test likelihood of CAD?

Research recommendation

Further research should be undertaken to evaluate the clinical and cost effectiveness of multislice CT coronary angiography compared with functional testing in the diagnosis of angina in a population of people with stable chest pain who have a moderate pre-test likelihood of CAD.

Why this is important

Multislice CT coronary angiography has developed rapidly in recent years. Published reviews have shown it to be highly effective in the diagnosis of anatomically significant CAD, and costing data indicates that tests can be run at a relatively low cost. However, questions remain about multislice CT coronary angiography's ability to accurately identify stenoses of functional significance (that is,. those that are sufficient to cause angina) in people with stable chest pain. This is especially true for people with a moderate pre-test likelihood for significant CAD.

Cost-effectiveness modelling to date has used the diagnosis of CAD as a short-term outcome, and as such inexpensive anatomical tests like multislice CT coronary angiography fare better than functional testing strategies such as MPS with SPECT, stress perfusion MR imaging and stress echocardiography. Since the diagnosis of angina is the true outcome of interest, health economic modelling is needed to evaluate diagnostic technologies on their ability to diagnose stable angina.

4.6 Information about presenting and explaining tests

Research question

All people presenting with chest pain will need to decide whether to accept the diagnostic and care pathways offered. How is information relating to the diagnostic pathway and the likely outcomes, risks, and benefits, with and without treatment, most effectively presented to particular groups of patients defined by age, ethnicity and gender?

Research recommendation

To establish the optimal ways of presenting information to people on the diagnostic pathway.

Why this is important

Methods of communication (both the content and delivery) will be guided by current evidence-based best practice. Controlled trials should be conducted based on well-constructed randomised controlled clinical trials comparing the effects of different methods of communication on patient comprehension. Such studies might consider a number of delivery mechanisms, including advice and discussion with a clinician or a specialist nurse as well as specific information leaflets or visual data.

Any trials should also investigate the feasibility of introducing a suggested guideline protocol to be used with all people presenting with chest pain when faced with options concerning their clinical pathway.

Only by clearly explaining and then discussing the proposed diagnostic and care pathways can the healthcare professional be reasonably certain that informed consent has been obtained and that a patient's moral, ethical and spiritual beliefs, expectations, and any misconceptions about their condition, have been taken into account. Due consideration should be given to any communications problems the person may have.

5 Other versions of this guideline

5.1 Full guideline

The full guideline, 'Chest pain of recent onset: assessment and investigation of recent onset chest pain or discomfort of suspected cardiac origin' contains details of the methods and evidence used to develop the guideline. It is published by the National Clinical Guidelines Centre for Acute and Chronic Conditions, and is available from www.rcgp.org.uk and our website (www.nice.org.uk/CGXXfullguideline). **[Note: these details will apply to the published full guideline.]**

5.2 Quick reference guide

A quick reference guide for healthcare professionals is available from www.nice.org.uk/CGXXquickrefguide

For printed copies, phone NICE publications on 0845 003 7783 or email publications@nice.org.uk (quote reference number N1XXX). **[Note: these details will apply when the guideline is published.]**

5.3 'Understanding NICE guidance'

A summary for patients and carers ('Understanding NICE guidance') is available from www.nice.org.uk/CGXXpublicinfo

For printed copies, phone NICE publications on 0845 003 7783 or email publications@nice.org.uk (quote reference number N1XXX). **[Note: these details will apply when the guideline is published.]**

We encourage NHS and voluntary sector organisations to use text from this booklet in their own information about chest pain of recent onset.

6 Related NICE guidance

Published

- Lipid modification: cardiovascular risk assessment and the modification of blood lipids for the primary and secondary prevention of cardiovascular

disease. NICE clinical guideline 67 (2008). Available from www.nice.org.uk/guidance/CG67

- Hypertension: management of hypertension in adults in primary care. NICE clinical guideline 34 (2006). Available from www.nice.org.uk/CG34
- Secondary prevention in primary and secondary care for patients following a myocardial infarction. NICE clinical guideline 48 (2007). Available from www.nice.org.uk/CG48
- Myocardial perfusion scintigraphy for the diagnosis and management of angina and myocardial infarction. NICE technology appraisal guidance 73 (2003). Available from www.nice.org.uk/TA73
- Statins for the prevention of cardiovascular events. NICE technology appraisal guidance 94 (2006). Available from www.nice.org.uk/TA94

Under development

NICE is developing the following guidance (details available from www.nice.org.uk):

- Acute coronary syndromes: the management of unstable angina and non ST elevation myocardial infarction. NICE clinical guideline. Publication expected February 2010.
- The management of stable angina. NICE clinical guideline. Publication expected July 2011.

7 Updating the guideline

NICE clinical guidelines are updated so that recommendations take into account important new information. New evidence is checked 3 years after publication, and healthcare professionals and patients are asked for their views; we use this information to decide whether all or part of a guideline needs updating. If important new evidence is published at other times, we may decide to do a more rapid update of some recommendations.

Appendix A: The Guideline Development Group

Professor Adam Timmis (Chair)
Professor of Clinical Cardiology, Barts and the London, Queen Mary's School of Medicine and Dentistry, London

Dr Jane Skinner (Clinical Adviser)
Consultant Community Cardiologist, Royal Victoria Infirmary, Newcastle Upon Tyne

Dr Philip Adams
Cardiologist Consultant, Royal Victoria Infirmary, Newcastle Upon Tyne

Dr John Ashcroft
General Practitioner, Old Station Surgery, Ilkeston, Derbyshire

Ms Liz Clark
Patient Representative

Dr Richard Coulden
Consultant Cardiothoracic Radiologist, Glenfield Hospital, Leicester

Professor Harry Hemingway
Public Health Physician Epidemiologist, University College London Medical School, London

Mrs Cathryn James
Clinical Pathways Adviser/Emergency Care Practitioner, Yorkshire Ambulance Service Headquarters, Wakefield

Ms Heather Jarman
Consultant Nurse in Emergency Care, St George's Healthcare NHS Trust, London

Dr Jason Kendall
Consultant in Emergency Medicine, Frenchay Hospital, Bristol

Mr Peter Lewis
Chief Clinical Physiologist, Prince Charles Hospital, Merthyr Tydfil, Wales

Dr Kiran Patel
Consultant Cardiologist, Lyndon, West Bromwich, West Midlands

Professor Liam Smeeth
Professor of Clinical Epidemiology, London School of Hygiene and Tropical Medicine, London

Mr John Taylor
Patient Representative

Members of the GDG from the Centre

Nancy Turnbull
Guideline Lead

Dr Angela Cooper
Senior Health Services Research Fellow

Katrina Sparrow
Health Services Research Fellow

Dr Neill Calvert
Head of Health Economics

Laura Sawyer
Health Economist

David Hill
Project Manager

Marian Cotterell
Information Scientist (until January 2009)

Co-opted GDG Members

Dr Paul Collinson
Consultant in Chemical Pathology and Head of Vascular Risk Management, St George's Hospital, London

Dr Dorothy Frizelle
Clinical Health Psychologist, Department of Clinical Psychology, University of Hull, Hull

Professor Steve Goodacre
Professor of Emergency Medicine, Medical Care Research Unit, Sheffield

Dr Marcus Hardbord
Consultant Physician and Gastroenterologist, Chelsea and Westminster Hospital, London

Ms Helen Williams
Consultant Pharmacist for Cardiovascular Disease, Southwark Health and Social Care, London

Appendix B: The Guideline Review Panel

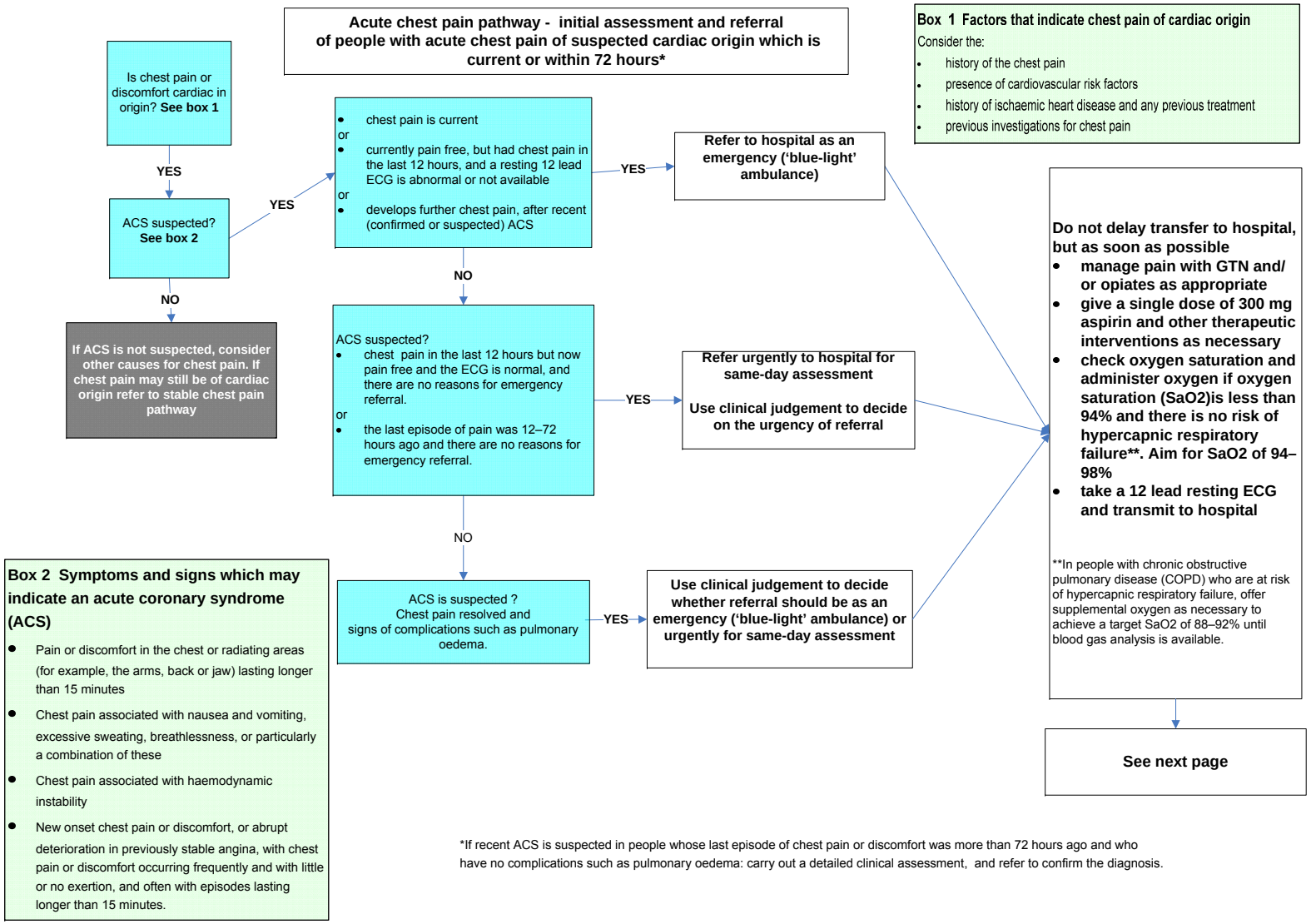
The Guideline Review Panel is an independent panel that oversees the development of the guideline and takes responsibility for monitoring adherence to NICE guideline development processes. In particular, the panel ensures that stakeholder comments have been adequately considered and responded to. The panel includes members from the following perspectives: primary care, secondary care, lay, public health and industry.

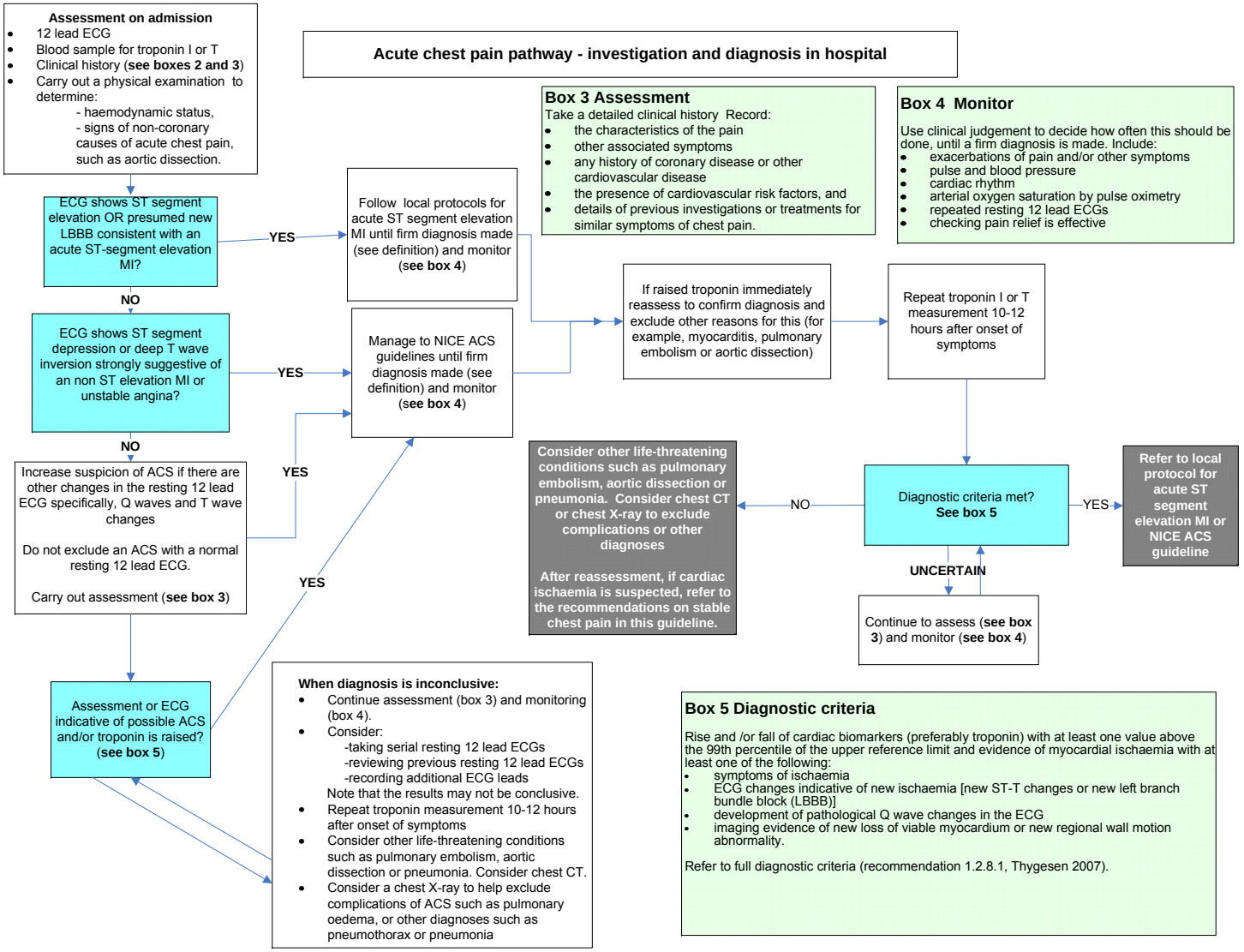
[NICE to add]

[Name; style = Unnumbered bold heading]
[job title and location; style = NICE normal]

Appendix C: The algorithms

Acute chest pain pathway parts 1 and 2: see pages 42 and 43


Acute chest pain pathway - initial assessment and referral of people with acute chest pain of suspected cardiac origin which is current or within 72 hours*
Is chest pain or discomfort cardiac in origin? See box 1
YES
ACS suspected? See box 2
YES
NO
If ACS is not suspected, consider other causes for chest pain. If chest pain may still be of cardiac origin refer to stable chest pain pathway
chest pain is current
or
currently pain free, but had chest pain in the last 12 hours, and a resting 12 lead ECG is abnormal or not available
or
develops further chest pain, after recent (confirmed or suspected) ACS
YES
Refer to hospital as an emergency ('blue-light' ambulance)
NO
ACS suspected?
chest pain in the last 12 hours but now pain free and the ECG is normal, and there are no reasons for emergency referral.
or
the last episode of pain was 12–72 hours ago and there are no reasons for emergency referral.
YES
Refer urgently to hospital for same-day assessment
Use clinical judgement to decide on the urgency of referral
NO
ACS is suspected ? Chest pain resolved and signs of complications such as pulmonary oedema.
YES
Use clinical judgement to decide whether referral should be as an emergency ('blue-light' ambulance) or urgently for same-day assessment
Box 1 Factors that indicate chest pain of cardiac origin
Consider the:
history of the chest pain
presence of cardiovascular risk factors
history of ischaemic heart disease and any previous treatment
previous investigations for chest pain
Do not delay transfer to hospital, but as soon as possible
manage pain with GTN and/ or opiates as appropriate
give a single dose of 300 mg aspirin and other therapeutic interventions as necessary
check oxygen saturation and administer oxygen if oxygen saturation (SaO2)is less than 94% and there is no risk of hypercapnic respiratory failure**. Aim for SaO2 of 94–98%
take a 12 lead resting ECG and transmit to hospital
**In people with chronic obstructive pulmonary disease (COPD) who are at risk of hypercapnic respiratory failure, offer supplemental oxygen as necessary to achieve a target SaO2 of 88–92% until blood gas analysis is available.
See next page
Box 2 Symptoms and signs which may indicate an acute coronary syndrome (ACS)
Pain or discomfort in the chest or radiating areas (for example, the arms, back or jaw) lasting longer than 15 minutes
Chest pain associated with nausea and vomiting, excessive sweating, breathlessness, or particularly a combination of these
Chest pain associated with haemodynamic instability
New onset chest pain or discomfort, or abrupt deterioration in previously stable angina, with chest pain or discomfort occurring frequently and with little or no exertion, and often with episodes lasting longer than 15 minutes.
*If recent ACS is suspected in people whose last episode of chest pain or discomfort was more than 72 hours ago and who have no complications such as pulmonary oedema: carry out a detailed clinical assessment, and refer to confirm the diagnosis.


Acute chest pain pathway - investigation and diagnosis in hospital
Assessment on admission
12 lead ECG
Blood sample for troponin I or T
Clinical history (see boxes 2 and 3)
Carry out a physical examination to determine:
- haemodynamic status,
- signs of non-coronary causes of acute chest pain, such as aortic dissection.
ECG shows ST segment elevation OR presumed new LBBB consistent with an acute ST-segment elevation MI?
YES
Follow local protocols for acute ST segment elevation MI until firm diagnosis made (see definition) and monitor (see box 4)
NO
ECG shows ST segment depression or deep T wave inversion strongly suggestive of an non ST elevation MI or unstable angina?
YES
Manage to NICE ACS guidelines until firm diagnosis made (see definition) and monitor (see box 4)
NO
Increase suspicion of ACS if there are other changes in the resting 12 lead ECG specifically, Q waves and T wave changes
Do not exclude an ACS with a normal resting 12 lead ECG.
Carry out assessment (see box 3)
YES
YES
Assessment or ECG indicative of possible ACS and/or troponin is raised? (see box 5)
When diagnosis is inconclusive:
Continue assessment (box 3) and monitoring (box 4).
Consider:
-taking serial resting 12 lead ECGs
-reviewing previous resting 12 lead ECGs
-recording additional ECG leads
Note that the results may not be conclusive.
Repeat troponin measurement 10-12 hours after onset of symptoms
Consider other life-threatening conditions such as pulmonary embolism, aortic dissection or pneumonia. Consider chest CT.
Consider a chest X-ray to help exclude complications of ACS such as pulmonary oedema, or other diagnoses such as pneumothorax or pneumonia
If raised troponin immediately reassess to confirm diagnosis and exclude other reasons for this (for example, myocarditis, pulmonary embolism or aortic dissection)
Repeat troponin I or T measurement 10-12 hours after onset of symptoms
Diagnostic criteria met? See box 5
NO
YES
Consider other life-threatening conditions such as pulmonary embolism, aortic dissection or pneumonia. Consider chest CT or chest X-ray to exclude complications or other diagnoses
After reassessment, if cardiac ischaemia is suspected, refer to the recommendations on stable chest pain in this guideline.
Refer to local protocol for acute ST segment elevation MI or NICE ACS guideline
UNCERTAIN
Continue to assess (see box 3) and monitor (see box 4)
Box 3 Assessment
Take a detailed clinical history Record:
the characteristics of the pain
other associated symptoms
any history of coronary disease or other cardiovascular disease
the presence of cardiovascular risk factors, and
details of previous investigations or treatments for similar symptoms of chest pain.
Box 4 Monitor
Use clinical judgement to decide how often this should be done, until a firm diagnosis is made. Include:
exacerbations of pain and/or other symptoms
pulse and blood pressure
cardiac rhythm
arterial oxygen saturation by pulse oximetry
repeated resting 12 lead ECGs
checking pain relief is effective
Box 5 Diagnostic criteria
Rise and /or fall of cardiac biomarkers (preferably troponin) with at least one value above the 99th percentile of the upper reference limit and evidence of myocardial ischaemia with at least one of the following:
symptoms of ischaemia
ECG changes indicative of new ischaemia [new ST-T changes or new left branch bundle block (LBBB)]
development of pathological Q wave changes in the ECG
imaging evidence of new loss of viable myocardium or new regional wall motion abnormality.
Refer to full diagnostic criteria (recommendation 1.2.8.1, Thygesen 2007).

Stable chest pain pathway parts 1–3: see pages 45–47

1. Presentation with stable chest pain

Box 1 Factors that indicate chest pain of cardiac origin

Consider

- the history of the chest pain
- presence of cardiovascular risk factors
- history of ischaemic heart disease and any previous treatment
- previous investigations for chest pain

Is chest pain or discomfort cardiac in origin? **See box 1** — YES → **Features characteristic of an ACS?** — YES → **See acute chest pain pathway**

NO

Carry out a detailed assessment and review (see boxes 2, 3 and 4)

History

Document:

- the age and gender of the person
- the characteristics of the pain including its location, radiation, severity, duration and frequency, and factors that provoke and relieve the pain
- any associated symptoms
- any history of angina, MI, coronary revascularisation, or other cardiovascular disease
- any cardiovascular risk factors

Examination

- Identify risk factors for cardiovascular disease (see recommendation 1.3.2.2)
- Identify signs of other cardiovascular disease
- Exclude non-coronary causes of angina (for example, severe aortic stenosis)
- Exclude other causes of chest pain or discomfort (for example upper GI or musculoskeletal pain)

Investigations

- Resting 12 lead ECG
- Blood tests (refer to angina management)
- Chest x-ray if indicated

If confirmed CAD → **See part 3**

If NO prior history of CAD

Based on assessment, estimate the likelihood that angina is due to ischaemic coronary disease (see table 1)

UNLIKELY (less then 10%) →

- **Consider alternative causes of chest pain (such as gastrointestinal or musculoskeletal pain).**
- **Discuss CV risk if appropriate with patient and manage.**
- **Do not carry out further investigations to exclude angina until alternative causes of chest pain have been ruled out.**
- **Do not routinely offer aspirin**

LIKELY (greater than 90%) →

- **No further diagnostic investigations**
- **Offer aspirin**
- **Treat as angina**

Uncertain →

Offer aspirin
Carry out further investigations
See part 2

Box 2 Changes on a resting 12 lead ECG consistent with CAD and may indicate previous infarction

- Pathological Q waves, in particular
- LBBB
- ST segment and T wave abnormalities (For example. flattening or inversion)

Consider these changes along with the person's clinical history and risk factors.

N.B. a normal resting 12 lead ECG does not rule out a diagnosis of angina.

Box 3 Typical angina symptoms

- Constricting discomfort across the chest, and/or in the neck, shoulders, jaw, or arms
- Precipitated by physical exertion or psychological stress
- Relieved by rest or nitroglycerin within about 5 minutes

Atypical angina is 2 of the above 3 features
Nonanginal chest pain is fewer than 2 of the above features.

Box 4 Angina is LESS likely if pain is:

- continuous or very prolonged
- unrelated to activity
- brought on by breathing in
- Associated with symptoms such as dizziness, palpitations, tingling or dysphagia

Table 1 Diagnosis: Typicality, age, sex + risk factors and CAD presence

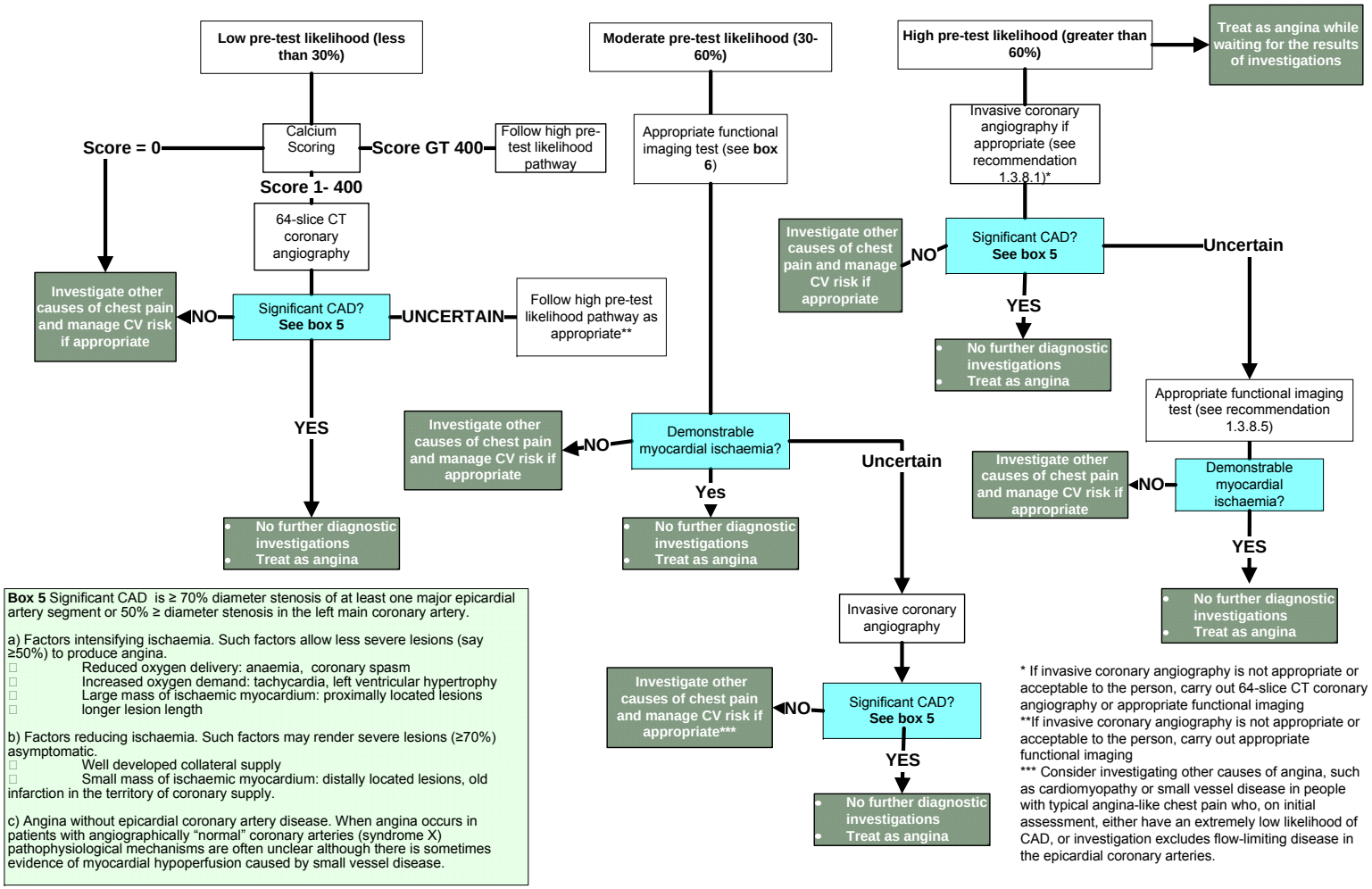
	Non-specific chest pain				Atypical angina				Typical angina			
	Men		*Women*		*Men*		*Women*		*Men*		*Women*	
Age (years)	*Lo*	*Hi*	*Lo*	*Hi*	*Lo*	*Hi*	*Lo*	*Hi*	*Lo*	*Hi*	*Lo*	*Hi*
35	3	35	1	19	8	59	2	39	30	88	10	78
45	9	47	2	22	21	70	5	43	51	92	20	79
55	23	59	4	25	45	79	10	47	80	95	38	82
65	49	69	9	29	71	86	20	51	93	97	56	84

Values are percent with CAD from Duke[40]
Hi = High risk = smoking, hypertensive diabetic
Lo = Low risk = none of these 3. If there are resting ECG ST-T changes or Q waves, the likelihood of CAD is higher in each cell of the table.

N.B. These results are likely to overestimate CAD in primary care populations

The shaded areas are those that leave the pathway as ruled in or ruled out

2. Investigations for people with no previous diagnosis of CAD and uncertain diagnosis after assessment



Box 5 Significant CAD is ≥ 70% diameter stenosis of at least one major epicardial artery segment or 50% ≥ diameter stenosis in the left main coronary artery.

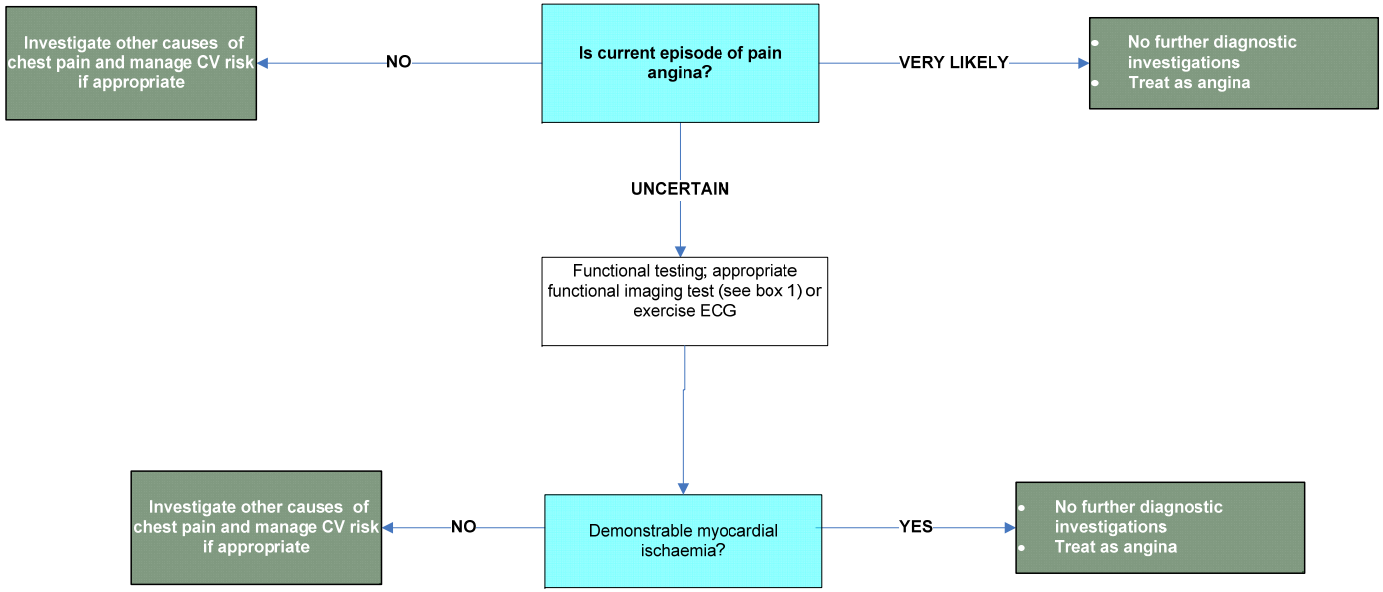
a) Factors intensifying ischaemia. Such factors allow less severe lesions (say ≥50%) to produce angina.
- Reduced oxygen delivery: anaemia, coronary spasm
- Increased oxygen demand: tachycardia, left ventricular hypertrophy
- Large mass of ischaemic myocardium: proximally located lesions
- longer lesion length

b) Factors reducing ischaemia. Such factors may render severe lesions (≥70%) asymptomatic.
- Well developed collateral supply
- Small mass of ischaemic myocardium: distally located lesions, old infarction in the territory of coronary supply.

c) Angina without epicardial coronary artery disease. When angina occurs in patients with angiographically "normal" coronary arteries (syndrome X) pathophysiological mechanisms are often unclear although there is sometimes evidence of myocardial hypoperfusion caused by small vessel disease.

* If invasive coronary angiography is not appropriate or acceptable to the person, carry out 64-slice CT coronary angiography or appropriate functional imaging
**If invasive coronary angiography is not appropriate or acceptable to the person, carry out appropriate functional imaging
*** Consider investigating other causes of angina, such as cardiomyopathy or small vessel disease in people with typical angina-like chest pain who, on initial assessment, either have an extremely low likelihood of CAD, or investigation excludes flow-limiting disease in the epicardial coronary arteries.

3. Established prior diagnosis of coronary artery disease



Box 6

Use:

- MPS with SPECT
- stress echocardiography
- first-pass contrast-enhanced MR perfusion, or
- MR imaging for stress-induced wall motion abnormalities.

The choice of imaging method should take account of locally available technology and expertise, and the person and their preferences, including any contraindications.