Assessment of chest pain in primary care

Chest pain is a common presentation in primary care. One study has shown that 97% of patients with acute myocardial infarction (MI) contact their GP first in rural areas and, even in urban areas, this figure is about 67%. However, although coronary heart disease (CHD) is still the biggest killer in the UK, the majority of people presenting with chest pain in general practice do not have angina or MI and musculoskeletal pain is much more common.

The GP Curriculum and chest pain

**Primary care management**

GPs in training must learn how to manage primary contact with patients who have a cardiovascular problem and make timely, appropriate referrals on behalf of patients to specialist services, especially to rapid-access chest pain clinics.

**The knowledge base**

GPs must know the causes of chest pain (cardiac causes, e.g. ischaemic heart disease, pericarditis and aortic dissection, versus non-cardiac causes, e.g. chest wall/musculoskeletal, psychological, respiratory, gastrointestinal) and be able to treat patients presenting acutely with chest pain.

**Specific problem-solving skills**

GPs should understand the importance of risk factors in the diagnosis of cardiovascular problems and be able to demonstrate a reasoned approach to the diagnosis of cardiovascular symptoms such as chest pain, using history, examination, incremental investigations and referral. GPs should also be able to intervene urgently when patients present with a cardiovascular emergency, e.g. myocardial infarction.

Assessment and management of chest pain needs to be decisive and quick, and the main challenge is not to miss cardiac or other serious causes, such as pulmonary embolus.

In primary care, the key to appropriate management is a carefully conducted and focused history and clinical examination. Knowledge of the main features of the different causes of chest pain is important, and rarer causes always need to be considered. Careful documentation of the clinical findings – including important negative findings – is particularly crucial in those patients who are managed in primary care and are not being admitted to hospital.

This article aims to provide an overview of how to assess chest pain in general practice – and how to avoid the traps of wrongly assuming non-cardiac pain. It divides the topic into rapid assessment and management of suspected acute coronary syndromes (MI and unstable angina), assessment of patients with acute non-cardiac pain, assessment of patients with intermittent chest pain and further investigations that may be considered.

**Immediate management of acute cardiac chest pain in primary care**

When a call for assistance is made for a patient with acute chest pain, it is important that the person answering the telephone can rapidly assess the likelihood of MI. The Scottish Intercollegiate Guidelines Network recommend that five factors from the history should be considered together when assessing the likelihood of cardiac pain:

- The nature of the symptoms – central or band-like chest pain, often described as ‘crushing’ is typical of an acute coronary syndrome, particularly if it is associated with radiation to the neck, jaw or upper limbs, or is associated with other symptoms such as nausea or vomiting, sweating or breathlessness

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If an acute coronary syndrome is still suspected, then:

- MI and a normal ECG is an effective means of excluding MI. If possible, check an ECG. Presence of ST elevation suggests an acute coronary syndrome – perfusion, pulse, blood pressure, heart sounds and breath sounds (checking for pulmonary oedema).
- Past or family history of cardiovascular disease (ischaemic heart disease, stroke or peripheral vascular disease)
- Past medical history – deep vein thrombosis, immobility or long-distance travel, recent surgery, clotting tendencies, respiratory disease such as asthma or chronic obstructive pulmonary disease, cardiovascular disease, hyperlipidaemia
- Associated symptoms – such as breathlessness, fever, cough
- Provoking and relieving factors – is the pain worse on inspiration? Is it worse on movement? Is it brought on by exertion and relieved by rest?
- Past medical history – deep vein thrombosis, immobility or long-distance travel, recent surgery, clotting tendencies, respiratory disease such as asthma or chronic obstructive pulmonary disease, cardiovascular disease, hyperlipidaemia
- Family history – cardiovascular disease, clotting tendencies
- Drug history – cholesterol lowering drugs, thrombogenic medication such as the combined oral contraceptive
- Smoking history

Direct your initial examination at assessing whether the patient requires acute admission. Patient distress, breathlessness at rest, sweating, pallor, tachycardia (or bradycardia with heart rate under 40 beats per minute), and/or hypotension are reasons for immediate acute admission.

If the patient is reasonably well, and a non-cardiac cause of chest pain is suspected, try to find the cause of the pain. Do a full cardiovascular examination, including blood pressure in both arms, pulse rate and rhythm, jugular venous pressure and

Box 1. Important risk factors for coronary heart disease when assessing chest pain

- Hypertension
- Angina
- Diabetes
- Hyperlipidaemia
- Previous chest pains
- Past or family history of cardiovascular disease (ischaemic heart disease, stroke or peripheral vascular disease)
- Lifestyle factors: smoking, obesity, lack of exercise, poor diet, stress

- Ask about history of ischaemic heart disease – patients with prior history are more at risk of further episodes
- Ask about gender – male patients are more likely to have an acute coronary syndrome, particularly in the younger age groups
- Ask about age – risk of acute coronary syndromes increases with age, and
- Ask about the number of traditional cardiac risk factors present (particularly history of diabetes mellitus, hyperlipidaemia, smoking, and family history of cardiovascular disease – Box 1)

In all cases, if an acute coronary syndrome is suspected, arrange for immediate transfer to hospital by ambulance. In acute MI, for thrombolysis to be effective, it must be given as soon as possible after the onset of pain. Seeing the patient prior to arranging transfer introduces unnecessary delays. If possible attend the patient once the ambulance has been called to assist – there is a lot that a GP can do that an ambulance crew cannot. Try to ensure that you have access to emergency drugs and an automated defibrillator when you attend the patient.

On arrival, take a brief history. There is no single clinical symptom that indicates a diagnosis of MI, however, presence of pleuritic chest pain suggests that the diagnosis is not an acute coronary syndrome. Once you have established the likelihood of MI from the history, perform a rapid assessment of cardiovascular status – perfusion, pulse, blood pressure, heart sounds and breath sounds (checking for pulmonary oedema). If possible, check an ECG. Presence of ST elevation suggests an MI and a normal ECG is an effective means of excluding MI.

If an acute coronary syndrome is still suspected, then:

- Give the patient a 300 mg aspirin orally (unless contraindicated)
- If available, give oxygen
- Give sublingual glyceryl trinitrate to act as a coronary artery vasodilator if systolic blood pressure is over 90 mmHg and pulse is less than 100 beats per minute
- If possible, insert an intravenous cannula
- Give intravenous analgesia (diamorphine 2.5–5 mg) and repeat after 15 min as necessary
- Give an intravenous antiemetic such as metoclopramide 10 mg
- If the patient is bradycardic give atropine 300 mg intravenously and further doses if needed to a maximum of 1.2 mg
- Thrombolysis may be appropriate in general practice in places where transfer to hospital takes more than half an hour. Special training and equipment is necessary

Hospital investigations used to confirm MI include cardiac enzymes and serial ECGs. ECG changes, specifically ST elevation and bundle branch block, are indications for acute thrombolysis. Cardiac enzymes are biochemical blood assays of molecules released when the heart is damaged. Troponins T and I are the preferred markers as they rise early after MI and are the most sensitive and specific markers. They are used to confirm diagnosis of MI and also for risk stratification.

Patients with acute non-cardiac chest pain

Even if acute cardiac pain is thought unlikely, arrange to visit the patient at home, or see the patient in the surgery, the same day. Take a history from the patient. Start with open questions, even when under time pressure. Allow patients to tell their story in their own words and help them to express their worries. Ask them for possible explanations for their chest pain, which can give vital clues and may help you to address particular concerns directly without making (possibly wrong) assumptions.

Ask about:

- Site and nature of the pain – sharp, dull, central, peripheral, any radiation
- Duration – was there a trigger, for example an injury, that triggered the pain? Severe chest pain for a couple of hours is often more significant than pain that has been present for weeks
- Associated symptoms – such as breathlessness, fever, cough
- Provoking and relieving factors – is the pain worse on inspiration? Is it worse on movement? Is it brought on by exertion and relieved by rest?
- Past medical history – deep vein thrombosis, immobility or long-distance travel, recent surgery, clotting tendencies, respiratory disease such as asthma or chronic obstructive pulmonary disease, cardiovascular disease, hyperlipidaemia
- Family history – cardiovascular disease, clotting tendencies
- Drug history – cholesterol lowering drugs, thrombogenic medication such as the combined oral contraceptive
- Smoking history

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Table 1. Causes of acute chest pain

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| **Myocardial infarction (MI)**    | - Band like chest pain around the chest or central chest pressure/dull ache with or without radiation to the shoulders, arms (left arm more frequently than right), neck and/or jaw  
- Often associated with nausea, sweating and/or shortness of breath  
- The patient may have risk factors for CHD – smoking, diabetes, dyslipidaemia, family history and/or past history of CHD  
- Examination is often normal but patients may be hypo- or hypertensive with evidence of left ventricular failure  
- ECG – ST elevation (Figure 2) or R waves and ST depression in leads V1–V3 (posterior infarction) or new LBBB  
- If suspected admit as an acute emergency to hospital. In hospital, diagnosis is confirmed on ECG and with cardiac troponins |
| **Angina**                        | - As for MI  
- Attacks are often precipitated by exercise, cold, or meals  
- Angina is often relieved by nitrates – if it lasts for more than 20 min consider the possibility of MI and treat as for MI  
- Search for evidence of aortic stenosis (slow rising pulse, ejection systolic murmur left sternal edge radiating to the carotids)  
- A normal ECG does not exclude coronary artery disease, but an abnormal ECG between attacks identifies those at higher risk of cardiac events in the next year – consider referral for further investigation  
- Exercise tolerance test can be diagnostic in cases in which the chest pain is intermittent and short-lived (sensitivity 75%, false positive rate of 5%) |
| **Pericarditis**                  | - Sharp, constant sternal pain relieved by sitting forwards  
- May radiate to the left shoulder and/or arm or into the abdomen  
- Worse lying on the left side and on inspiration, swallowing and coughing  
- ECG – widespread, concave (saddle-shaped) ST elevation, PR segment depression—Figure 1 |
| **Dissecting thoracic aneurysm**  | - Typically presents with sudden tearing chest pain radiating to the back  
- Consider in any patient with chest pain (especially if radiates through to the back) and reduced blood pressure  
- Look for evidence of aortic regurgitation, pericardial or pleural effusion  
- Check pulses and blood pressure in both arms–a differential between the two arms suggests a dissecting thoracic aneurysm  
- If suspected admit as an emergency. In hospital, diagnosis may be suggested by widening of the mediastinum on chest X-ray and is confirmed with thoracic CT scan |

Figure 1. ECG showing changes typical of pericarditis
InnovAiT

Diagnosis | Features
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Pulmonary embolus (PE) | • PEs are relatively common and easily missed, as symptoms and signs may be very subtle. Have a high index of suspicion
• Risk factors include recent immobilization, long-distance travel, surgery and thrombogenic medication (such as the combined oral contraceptive pill)
• Typical features include breathlessness (may be acute or slower onset), sharp chest pain worse on inspiration, haemoptysis and/or syncope
• Examination is often unreliable. Tachycardia is a useful sign and patients often have a mild pyrexia. Other signs include raised jugular venous pressure and pleural rub. Check legs for evidence of deep vein thrombosis
• ECG may show right ventricular changes but may be normal apart from tachycardia
• If suspected, patients should be admitted for further investigation. A normal d-dimer has a negative predictive value of around 90%. Ventilation perfusion scan (VQ scan) is diagnostic

Respiratory causes:
Pleurisy | • Sharp, localized chest pain, worse on inspiration
• May be associated with symptoms and signs of a chest infection or other underlying lung disease, e.g. cough, pleural effusion

Pneumothorax | • Sudden onset of pleuritic chest pain or increased breathlessness with or without pallor and tachycardia
• Often occurs in tall, thin young adults or patients with chronic obstructive pulmonary disease
• Examination shows reduced chest expansion on the affected side accompanied by hyper-resonant percussion and absent or quiet breath sounds. The trachea may be deviated
• If suspected, refer for urgent chest X-ray or admit depending on clinical state. Chest X-ray is diagnostic – check for lung markings in the periphery to avoid missing small pneumothoraces

Abdominal causes:
Oesophageal spasm or oesophagitis | • Central chest pain. May be associated with acid reflux, though not always
• May be described as burning but often indistinguishable from cardiac pain
• May respond to antacids

Other intra-abdominal causes | • Gallstones may present with right sided chest pain
• Acute pancreatitis may present with central chest pain – though is usually accompanied by epigastric tenderness

Musculoskeletal causes: Chest wall pain is not a reliable sign to rule out cardiac diagnosis. Do not assume chest pain is musculoskeletal unless you have confidently ruled out other serious causes

Musculoskeletal pain | • Localized pain – worse on movement
• May be a history of injury or steroid use
• Vertebral pain may be due to vertebral collapse – particularly if the patient is elderly or on steroids. Confirm with lateral X-ray

Costochondritis | Inflammation of the costochondral junctions – tenderness over the costochondral junction and pain in the affected area on springing the chest wall

Other causes:
Shingles | • Intense, often sharp, unilateral pain
• Responds poorly to analgesia
• May be present several days before the shingles rash appears

Bornholm’s disease | • Unilateral chest and/or abdominal pain, rhinitis
• Due to a Coxsackie virus infection

Idiopathic chest pain | • No cause apparent. Common
• Affects young people more than elderly people
• Far more common in women than men

Table 1. Contd.
carotid pulse, apex beat and heart sounds. Check the lung fields for signs of infection, pleural rubs, heart failure and signs of pneumothorax. Check the skin for rashes and injuries. Palpate the chest wall for tenderness. If a musculoskeletal cause is suspected, test to see if movement of the chest wall reproduces the pain. Check for epigastric tenderness. Finally, check for swelling or tenderness of the legs. Examination may be entirely normal, particularly in patients with small pulmonary emboli, oesophageal or cardiac pain.

Management depends on suspected differential diagnosis. Table 1 lists the common differential diagnoses of acute chest pain in general practice and their key features. These can broadly be divided into cardiovascular causes, respiratory causes, musculoskeletal causes and abdominal causes. Options are immediate admission, further investigation in primary care or treatment in primary care. Have a low threshold for admission and always err on the side of caution if you are unsure of the diagnosis.

### Patients with intermittent chest pain

Intermittent chest pain is a common symptom in the UK. The main differential diagnosis is of musculoskeletal pain, oesophageal pain or angina. Angina affects around 2% of the population in UK. Incidence increases with age and it is more common among men than women. Coronary artery disease is the most common cause. Rarer causes include hypertrophic obstructive cardiomyopathy, hypoperfusion during an arrhythmia, arteritis, anaemia or thyrotoxicosis. Mortality (usually sudden death or due to MI or acute left ventricular failure) is about 0.5–4% per year. Mortality is doubled if there is co-existent left ventricular dysfunction.

Diagnosis is usually made on history:
- Episodic central-crushing or band-like chest pain, which may radiate to the jaw or neck and/or one or both arms suggests angina. Pain in the arms or neck may be the only symptom. Ask about frequency, severity, duration and timing of attacks. Oesophageal pain may be described as burning retrosternal pain, but is often indistinguishable from anginal pain.
- Angina is often precipitated by exertion, cold, emotion and/or heavy meals. Pain stops with rest or glyceryl trinitrate spray. In contrast, musculoskeletal pain is related to movement and often specific movements rather than duration or intensity of movement.
- Oesophageal pain may be relieved by antacids. Note that glyceryl trinitrate spray may relieve oesophageal pain as well as angina.
- Anginal pain may be associated with palpitations, sweating, nausea and/or breathlessness during attacks. Oesophageal pain may be associated with acid reflux.
- The patient with anginal pain often has other risk factors for cardiovascular disease (Box 1) – particularly smoking, diabetes mellitus, hyperlipidaemia or personal or family history of cardiovascular disease.

Patients with angina usually have no physical signs, although anaemia may exacerbate symptoms. Check body mass index and blood pressure. Look for murmurs (especially an ejection systolic murmur of aortic stenosis) and evidence of peripheral vascular disease and carotid bruits. If angina cannot be excluded by examination, patients need further investigation.

### Initial primary care investigation

Do not delay acute admission to investigate a patient in primary care. For patients not being admitted, useful preliminary investigations include:
- **Blood tests:** consider a full blood count to exclude anaemia and as an indicator of infection, urea and electrolytes, fasting glucose and a fasting lipid profile.
- **ECG:** for patients with intermittent chest pain, ECG is often normal between episodes of pain. Look for changes suggesting ischaemia (abnormal Q waves, ST elevation or depression, and abnormal T waves – see Figure 2), arrhythmias and evidence of left ventricular hypertrophy (Figure 3).
- **Imaging:** consider a chest X-ray to assess cardiac size or exclude pneumonia or pneumothorax.

Further investigations depend on the suspected diagnosis, duration and severity of symptoms. Some can be accessed directly by GPs, others require specialist referral. Rapid assessment chest pain services are effective, safe and often very helpful to rule out or confirm anginal pain in patients with a longer history of intermittent chest pains.

**Figure 2.** ECG changes associated with ischaemic heart disease. *British Medical Journal* 2002; 324: 1264–7 reproduced/amended with permission from the BMJ Publishing Group.
24-hour or ambulatory ECG
ECG monitoring equipment is worn for 24 h. Continuous monitoring may detect intermittent arrhythmias or ischaemia.

Exercise ECG:
ECG testing whilst the patient undergoes graded exercise on a treadmill/exercise bicycle. Local referral criteria vary. Used:
- For diagnosis of ischaemic heart disease – 75% have a positive test. There is a false positive rate of around 5%
- For assessment of exercise tolerance
- To assess response to treatment
- As a prognostic indicator
- For assessment of exercise-related arrhythmias
- As a guide to rehabilitation following acute MI
- For risk stratification in patients with obstructive cardiomyopathy
- To assess the need for further investigation

Exercise testing is usually carried out according to a standardized protocol (standard Bruce or modified Bruce protocol), that gradually increases the speed and gradient of the bicycle or treadmill. A number of parameters are assessed during the test: ECG changes, appearance of the patient, recurrence of symptoms and blood pressure and heart rate response. Exercise testing is not risk free and carries a mortality of one in 10,000. It is contraindicated if the patient is acutely systemically unwell, has had an MI within the past week or has unstable angina or acute pericarditis, myocarditis, severe heart failure, aortic stenosis or is known to have left main coronary artery stenosis. It is unsafe to perform an exercise test if a patient has an electrolyte disturbance. In addition, the trace may be impossible to interpret if the patient has left bundle branch block.

Coronary angiography
Always accessed via secondary care, coronary angiography involves passing a catheter, usually via the femoral or brachial artery, to the heart. The vast majority of patients who undergo cardiac catheterization have coronary angiography – usually in conjunction with left heart catheterization. Indications include:
- Diagnosis of coronary artery disease
- Assessment of angina uncontrolled by medication
- Assessment of suitability for coronary intervention
- Recurrence of angina following coronary angioplasty or bypass grafting
- A strongly positive exercise test
- Severity of coronary narrowing is described using percentage stenosis – >50% is usually regarded as significant
- To perform other procedures, e.g. angioplasty, valvuloplasty, cardiac biopsy

Complications include haemorrhage at the site of insertion (0.56%); arrhythmia (0.56%); MI (0.07%); stroke (0.07%) or thromboembolism elsewhere; trauma to the heart or blood vessels; infection; or even death (0.14%).

Radionucleotide imaging
Refer via secondary care. Radionucleotide imaging involves intravenous administration of a $\gamma$-emitting radionucleotide and gamma camera monitoring.
- Radionucleotide angiography: uses technetium99m-labelled red blood cells to calculate left ventricular ejection fraction and assess ventricular action
- Myocardial perfusion scintigraphy: uses thallium201 injected intravenously during exercise testing to demonstrate areas of poorly perfused myocardium

Cardiac magnetic resonance imaging (MRI) and magnetic resonance angiography
These investigations are being used increasingly in secondary care to provide detailed structural information about the heart and rapid angiographic images.

Summary
Assessment of chest pain in primary care is difficult. There is no need to admit every patient with chest pain, but caution is needed not to miss significant and serious disease.

A focused but comprehensive history and examination are vital to the diagnosis, always considering the differential diagnosis when interpreting symptoms, signs and investigation results. Actively look for risk factors for serious underlying cause. Freshen up your ECG interpretation skills if necessary. If a patient is acutely unwell with chest pain and the cause is
not clear, err on the side of caution and admit for further assessment. Rapid assessment chest pain services are effective, safe and often very helpful to rule out cardiac pain in patients with a longer history of intermittent chest pain.

REFERENCES

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