

QUESTIONS

1. Myocardial infarction

A 65-year-old man presents with central crushing chest pain for the first time. He is transferred immediately to the closest cardiac unit to undergo a primary percutaneous coronary intervention. There is thrombosis of the left circumflex artery only. Angioplasty is carried out and a drug-eluting stent is inserted. What are the most likely changes to have occurred on ECG during admission? lateral [V6-V6-aVL, lead I]

- A. ST depression in leads V1–4
- B. ST elevation in leads V1–6
- C. ST depression in leads II, III and AVF
- ☒ D. ST elevation in leads V5–6
- E. ST elevation in leads II, III and AVF

2. Heart failure (1)

A 78-year-old woman is admitted with heart failure. The underlying cause is determined to be aortic stenosis. Which sign is most likely to be present?

- A. Pleural effusion on chest x-ray
- B. Raised jugular venous pressure (JVP)
- C. Bilateral pedal oedema
- ☒ D. Bibasal crepitations
- E. Atrial fibrillation

3. Valve lesion signs

A patient is admitted with pneumonia. A murmur is heard on examination. What finding points to mitral regurgitation? pan systolic

- A. Murmur louder on inspiration x
- ☒ B. Murmur louder with patient in left lateral position ←
- C. Murmur louder over the right 2nd intercostal space midclavicular line x
- D. Corrigan's sign
- E. Narrow pulse pressure

4. CHAD2 score

A 79-year-old woman is admitted to the coronary care unit (CCU) with unstable angina. She is started on appropriate medication to reduce her cardiac risk. She is hypertensive, fasting glucose is normal and cholesterol is 5.2. She is found to be in atrial fibrillation. What is the most appropriate treatment?

- A. Aspirin and clopidogrel
- B. Digoxin
- C. Cardioversion
- D. Aspirin alone
- E. Warfarin

5. Chest pain (1)

A 55-year-old man has just arrived in accident and emergency complaining of 20 minutes of central crushing chest pain. Which feature is most indicative of myocardial infarction at this moment in time?

- A. Inverted T waves
- B. ST depression
- C. ST elevation
- D. Q waves
- E. Raised troponin

6. Shortness of breath (1)

A 66-year-old woman presents to accident and emergency with a 2-day history of shortness of breath. The patient notes becoming progressively short of breath as well as a sharp pain in the right side of the chest which is most painful when taking a deep breath. The patient also complains of mild pain in the right leg, though there is nothing significant on full cardiovascular and respiratory examination. Heart rate is 96 and respiratory rate is 12. The patient denies any weight loss or long haul flights but mentions undergoing a nasal polypectomy 3 weeks ago. The most likely diagnosis is:

- A. Muscular strain
- B. Heart failure
- C. Pneumothorax
- D. Angina
- E. Pulmonary embolism

7. Murmurs (1)

A 59-year-old man presents for a well person check. A cardiovascular, respiratory, gastrointestinal and neurological examination is performed. No significant findings are found, except during auscultation a mid systolic click followed by a late systolic murmur is heard at the apex. The patient denies any symptoms. The most likely diagnosis is: MR

- ☒ A. Barlow syndrome
- B. Austin Flint murmur
- C. Patent ductus arteriosus
- D. Graham Steell murmur
- E. Carey Coombs murmur

8. Chest pain (2)

A 60-year-old man presents to accident and emergency with a 3-day history of increasingly severe chest pain. The patient describes the pain as a sharp, tearing pain starting in the centre of his chest and radiating straight through to his back between his shoulder blades. The patient looks in pain but there is no pallor, heart rate is 95, respiratory rate is 20, temperature 37°C and blood pressure is 155/95 mmHg. The most likely diagnosis is: AD

- A. Myocardial infarction
- B. Myocardial ischaemia
- ☒ C. Aortic dissection
- D. Pulmonary embolism
- E. Pneumonia

9. Chest pain management

A 49-year-old man is rushed to accident and emergency complaining of a 20-minute history of severe, crushing chest pain. After giving the patient glyceryl trinitrate (GTN) spray, he is able to tell you he suffers from hypertension and type 2 diabetes and is allergic to aspirin. The most appropriate management is: MI

- A. Aspirin ~~X~~
- B. Morphine
- C. Heparin
- ☒ D. Clopidogrel
- E. Warfarin

10. Ventricular tachyarrhythmia

While on call you are called by a nurse to a patient on the ward complaining of light headedness and palpitations. When you arrive the patient is not conscious but has a patent airway and is breathing with oxygen saturation at 97 per cent. You try to palpate a pulse but are unable to find the radial or carotid. The registrar arrives and after hearing your report of the patient decides to shock the patient who recovers. What is the patient most likely to have been suffering?

- A. Torsades de Pointes
- ☒ B. Ventricular fibrillation ✓
- C. Sustained ventricular tachycardia
- D. Non-sustained ventricular tachycardia
- E. Normal heart ventricular tachycardia

11. Jugular venous pressure

A 67-year-old man presents to accident and emergency with a 3-day history of shortness of breath. On examination you palpate the radial pulse and notice that the patient has an irregular heart beat with an overall rate of 140bpm. You request an electrocardiogram (ECG) which reveals that the patient is in atrial fibrillation. Which of the following would you expect to see when assessing the JVP?

- A. Raised JVP with normal waveform ✗
- B. Large 'v waves'
- C. Cannon 'a waves'
- ☒ D. Absent 'a waves' ✓
- E. Large 'a waves'

12. Heart failure (2)

A 78-year-old woman is admitted to your ward following a 3-day history of shortness of breath and a productive cough of white frothy sputum. On auscultation of the lungs, you hear bilateral basal coarse inspiratory crackles. You suspect that the patient is in congestive cardiac failure. You request a chest x-ray. Which of the following signs is not typically seen on chest x-ray in patients with congestive cardiac failure?

- ☒ A. Lower lobe diversion ✓
- B. Cardiomegaly ✓
- C. Pleural effusions ✓
- D. Alveolar oedema ✓
- E. Kerley B lines ✓

13. First degree heart block

A 56-year-old man presents to your clinic with symptoms of exertional chest tightness which is relieved by rest. You request an ECG which reveals that the patient has first degree heart block. Which of the following ECG abnormalities is typically seen in first degree heart block? *prolonged*

- A. PR interval >120 ms
- B. PR interval >300 ms
- C. PR interval <200 ms *✓*
- ☒ D. PR interval >200 ms
- E. PR interval <120 ms *✗*

14. Mitral stenosis

You see a 57-year-old woman who presents with worsening shortness of breath coupled with decreased exercise tolerance. She had rheumatic fever in her adolescence and suffers from essential hypertension. On examination she has signs which point to a diagnosis of mitral stenosis. Which of the following is not a clinical sign associated with mitral stenosis?

- A. Malar flush *✓*
- B. Atrial fibrillation *✓*
- ☒ C. Pan-systolic murmur which radiates to axilla *✗*
- D. Tapping, undisplaced apex beat
- E. Right ventricular heave

15. Hypertension (1)

A 48-year-old woman has been diagnosed with essential hypertension and was commenced on treatment three months ago. She presents to you with a dry cough which has not been getting better despite taking cough linctus and antibiotics. You assess the patient's medication history. Which of the following antihypertensive medications is responsible for the patient's symptoms?

- A. Amlodipine
- ☒ B. Lisinopril *ACEI*
- C. Bendroflumethiazide
- D. Frusemide
- E. Atenolol

16. Palpitations

A 62-year-old male presents with palpitations, which are shown on ECG to be atrial fibrillation with a ventricular rate of approximately 130/minute. He has mild central chest discomfort but is not acutely distressed. He first noticed these about 3 hours before coming to hospital. As far as is known this is his first episode of this kind. Which of the following would you prefer as first-line therapy?

- A. Anticoagulate with heparin and start digoxin at standard daily dose ~~x~~
- ☒ B. Attempt DC cardioversion
- C. Administer bisoprolol and verapamil, and give warfarin ^{BB} ^{CCB} Rate + anticoagulant $\Rightarrow$ permanent
- D. Attempt cardioversion with IV flecainide
- E. Wait to see if there is spontaneous reversion to sinus rhythm

17. Murmurs (2)

A 76-year-old male is brought to accident and emergency after collapsing at home. He has recovered within minutes and is fully alert and orientated. He says this is the first such episode that he has experienced, but describes some increasing shortness of breath in the previous six months and brief periods of central chest pain, often at the same time. On examination, blood pressure is 115/88 mmHg and there are a few rales at both bases. On ECG there are borderline criteria for left ventricular hypertrophy. Which of the following might you expect to find on auscultation? ^{AS}

- A. Mid-diastolic murmur ^{MS} best heard at the apex
- ☒ B. Crescendo systolic murmur best heard at the right sternal edge
- C. Diastolic murmur ^{AR} best heard at the left sternal edge
- D. Pan-systolic murmur ^{MR} best heard at the apex
- E. Pan-systolic murmur ^{TR} best heard at the left sternal edge

18. Postmyocardial infarction (1)

A 63-year-old male was admitted to accident and emergency 2 days after discharge following an apparently uncomplicated MI. He complained of rapidly worsening shortness of breath over the previous 48 hours but no further chest pain. He was tachypnoeic and had a regular pulse of 110/minute, which proved to be sinus tachycardia. The jugular venous pressure was raised and a pan-systolic murmur ^{TR} was noted, maximal at the left sternal edge. Which of the following is the most likely diagnosis?

- A. Mitral incompetence
- ☒ B. Ventricular septal defect
- C. Aortic stenosis
- D. Dressler's syndrome
- E. Further myocardial infarction

19. Hypertension (2)

A 57-year-old male is admitted complaining of headaches and blurring of vision. His blood pressure is found to be 240/150 mmHg and he has bilateral papilloedema, but is fully orientated and coherent. He had been known to be hypertensive for about five years and his blood pressure control had been good on three drugs. However, he had decided to stop all medication two months before this event. Which of the following would be your preferred parenteral medication at this point?

- A. Glyceryl trinitrate
- B. Hydralazine
- C. Labetalol
- ☒ D. Sodium nitroprusside
- E. Phentolamine

20. Mid-systolic murmur

A 16-year-old male is referred for assessment of hypertension. On average, his blood pressure is 165/85 mmHg, with radiofemoral delay. There is a mid-systolic^{AS} murmur maximal at the aortic area, and radiating to the back. Clinical findings and the ECG are compatible with left ventricular hypertrophy. What is the most likely underlying pathology?

- A. Hypertrophic obstructive cardiomyopathy
- B. Congenital aortic stenosis
- ☒ C. Coarctation of the aorta
- D. Patent ductus arteriosus
- E. Atrial septal defect

21. Ventral septal defect

A 16-year-old boy is diagnosed with a small ventricular septal defect^{VSD}, having been screened by echocardiography because of a family history of hypertrophic^{HOCM} obstructive cardiomyopathy. He is entirely asymptomatic, plays several sports regularly and has no growth retardation. The echocardiogram also confirms a small left to right shunt, with pulmonary to systemic flow ratio only just above one. Which of the following is the most likely to be a significant complication of his condition?

- A. Pulmonary hypertension
- B. Heart failure
- C. Dysrhythmias
- ☒ D. Endocarditis
- E. Shunt reversal (right to left flow)

22. Microscopic haematuria

ECCT A 52-year-old woman has been treated for several years with amlodipine and lisinopril for what has been presumed to be primary hypertension. She is seen by her GP having complained of persistent left loin pain. Her BP is 150/95 mmHg. She is tender in the left loin and both kidneys appear to be enlarged. On urine dipstick testing, there is microscopic haematuria. Which of the following is likely to be the most appropriate investigation at this point?

- ☒ A. Urinary tract ultrasound
- ☐ B. Abdominal and pelvic computed tomography (CT) scan
- ☐ C. Microscopy of the urine (microbial and cytological)
- ☐ D. Renal biopsy
- ☐ E. Intravenous urogram

23. Retrosternal chest pain

A 61-year-old man presents with a 2-hour history of moderately severe retrosternal chest pain, which does not radiate and is not affected by respiration or posture. He complains of general malaise and nausea, but has not vomited. His ECG shows ST segment depression and T wave inversion in the inferior leads. Troponin levels are not elevated. He has already been given oxygen, aspirin and intravenous GTN; he is an occasional user of sublingual GTN and takes regular bisoprolol for stable angina. What would be the most appropriate next step in his management?

unstable angina / NSTEMI

- ☒ A. IV low-molecular weight heparin
- ☐ B. Thrombolysis with alteplase ✗
- ☐ C. IV nicardapine
- ☐ D. Angiography with stenting ✗
- ☐ E. Oral clopidogrel

24. Pulmonary embolism management

A 41-year-old woman is referred for assessment after suffering a second pulmonary embolus within a year. She has not been travelling recently, has not had any surgery, does not smoke and does not take the oral contraceptive pill. She is not currently on any medication as the diagnosis is retrospective and she is now asymptomatic. What should be the next step in her management?

- ☐ A. Initiation of warfarin therapy
- ☐ B. ECG
- ☒ C. Thrombophilia screen
- ☐ D. Insertion of inferior vena cava filter
- ☐ E. Duplex scan of lower limb veins and pelvic ultrasound

25. Mid-diastolic murmur

A 32-year-old woman attends her GP for a routine medical examination and is noted to have a mid-diastolic murmur with an opening snap. Her blood pressure is 118/71 mmHg and the pulse is regular at 66 beats per minute. She is entirely asymptomatic and chest x-ray and ECG are normal. What would be the most appropriate investigation at this point?

- ☒ A. ECG
- B. Anti-streptolysin O titre
- C. Cardiac catheterization
- D. Thallium radionuclide scanning
- E. Colour Doppler scanning

26. Severe chest pain

A 46-year-old man develops sudden severe central chest pain after lifting heavy cases while moving house. The pain radiates to the back and both shoulders but not to either arm. His BP is 155/90 mmHg, pulse rate is 92 beats per minute and the ECG is normal. He is distressed and sweaty, but not nauseated. What would you consider the most likely diagnosis?

- A. Pneumothorax
- B. MI
- C. Pulmonary embolism
- ☒ D. Aortic dissection
- E. Musculoskeletal pain

27. Decrescendo diastolic murmur

A 49-year-old woman presents with increasing shortness of breath on exertion developing over the past three months. She has no chest pain or cough, and has noticed no ankle swelling. On examination, blood pressure is 158/61 mmHg, pulse is regular at 88 beats per minute and there are crackles at both lung bases. There is a decrescendo diastolic murmur at the left sternal edge. What is the most likely diagnosis?

- ☒ A. Aortic regurgitation
- B. Aortic stenosis
- C. Mitral regurgitation
- D. Mitral stenosis
- E. Tricuspid regurgitation

28. Supraventricular tachycardia

A 21-year-old man is on his way home from a party when he experiences the sudden onset of rapid palpitations. He feels uncomfortable but not short of breath and has no chest pain. He goes to the nearest accident and emergency department, where he is found to have a supraventricular tachycardia (SVT) at a rate of 170/minute. Carotid sinus massage produced transient reversion to sinus rhythm, after which the tachycardia resumed. What would be the next step in your management?

- ← A. Repeat carotid sinus massage
- B. IV verapamil
- C. IV propranolol
- ✓ D. IV adenosine
- E. Synchronized DC cardioversion

29. Chest pain (3)

A 44-year-old woman attends her local accident and emergency department with a history of at least six months of frequent central chest pain in the early morning or during the night. She had no chest pain on exertion. This had been a particularly severe attack, lasting over 2 hours. Her pulse rate is 84/minute in sinus rhythm, and blood pressure is 134/86 mmHg. The ECG shows anterior ST segment elevation, but troponin levels do not rise. Subsequent coronary angiography is normal. What is the most likely diagnosis?

variant

- A. MI
- B. Stable angina
- C. Unstable angina
- D. Anxiety
- ✓ E. Variant angina

30. Shortness of breath (2)

A previously fit 19-year-old man presents with unusual shortness of breath on exertion. At times, this is also associated with central chest pain. On examination there is a loud mid-systolic murmur at the left sternal edge. Heart rate and blood pressure are normal and there is no oedema. The ECG shows left axis deviation and the voltage criteria for left ventricular hypertrophy and the echocardiogram reveals a significant thickened interventricular septum, with delayed ventricular filling during diastole. There is a family history of sudden death below the age of 50. Which of the following would be your initial therapy?

ABBB

- A. Digoxin
- B. Long-acting nitrates
- ✓ C. Beta-blockers
- D. Rate-limiting calcium channel blockers
- E. Partial excision of the septum

31. Hypertension (3)

A 44-year-old woman presents with episodes of headaches, associated with anxiety, sweating and a slow pulse rate. At the time of her initial consultation, her blood pressure was 150/95 mmHg seated, but 24 hour ambulatory monitoring shows a peak of 215/130 mmHg, associated with the symptoms described above. Which of the following would be your initial diagnostic procedure?

- A. Magnetic resonance imaging (MRI) scans of the abdomen and pelvis
- B. Measurement of random plasma catecholamines
- ☒ C. Measurement of urinary metanephrines over several 24 hour periods
- D. Glucose tolerance test
- E. Pharmacological provocation using clonidine

32. Chest pain (4)

IHD
STEMI
A 56-year-old man presents to the accident and emergency department with a 2-hour history of central chest pain radiating to the left arm. He is anxious, nauseated and sweaty. His pulse rate is 120/minute in sinus rhythm and the ECG reveals ST elevation in leads II, III and aVF. The troponin level is significantly raised. This is certainly acute MI. Which is the most likely coronary vessel to be occluded?
inf. RCA

- A. Circumflex artery
- B. Left anterior descending artery
- ☒ C. Right coronary artery
- D. Left main coronary artery
- E. Posterior descending artery

33. Constrictive pericarditis

A 45-year-old woman complains of increasing shortness of breath on exertion, as well as orthopnoea, for the previous 3–4 months. She had apparently recovered from pericarditis about a year earlier. On ECG there is low voltage, especially in the limb leads, and the chest x-ray shows pericardial calcification. The presumptive diagnosis is constrictive pericarditis. Which of the following physical signs would be consistent with this?

- ☒ A. Increased jugular distention on inspiration
- B. Third heart sound
- C. Fourth heart sound
- D. Rales at both lung bases
- E. Loud first and second heart sounds

34. Visual disturbance

A 71-year-old man is being treated for congestive heart failure with a combination of drugs. He complains of nausea and anorexia, and has been puzzled by observing yellow rings around lights. His pulse rate is 53/minute and irregular and blood pressure is 128/61 mmHg. Which of the following medications is likely to be responsible for these symptoms?

- A. Lisinopril
- B. Spironolactone
- ✓ C. Digoxin
- D. Furosemide
- E. Bisoprolol

35. Weight loss

A 29-year-old woman goes to see her GP complaining of fatigue and palpitations. She says she has also lost weight, though without dieting. On examination, her pulse rate is approximately 120/min and irregularly irregular. Her blood pressure is 142/89 mmHg and her body mass index is 19. There are no added cardiac sounds. The ECG confirms the diagnosis of atrial fibrillation. What would you suggest as the most useful next investigation.

- ✓ A. Thyroid function tests (TSH, free T4)
- B. ECG
- C. Chest x-ray
- D. Full blood count
- E. Fasting blood sugar

36. Postmyocardial infarction (2)

A 58-year-old man has made an excellent functional recovery after an anterior MI. He is entirely asymptomatic and there is no abnormality on physical examination. His blood pressure is 134/78 mmHg and he is undertaking a cardiac rehabilitation programme. Which of the following would you not recommend as part of his secondary prevention planning?

- A. Aspirin
- B. Lisinopril ACEI
- C. Simvastatin
- D. Bisoprolol
- ✓ E. Omega-3 fatty acids

51 → V4 LAD

37. Mitral valve prolapse complication

A 25-year-old woman with known mitral valve prolapse develops a low grade fever, malaise and night sweats within a couple of weeks of a major dental procedure. Examination reveals a pulse rate of 110/minute, which is regular, tender vasculitic lesions on the finger pulps and microscopic haematuria. Which investigation is most likely to provide a definitive diagnosis?

- A. Full blood count
- B. ECG
- C. Autoantibody screen
- ☒ D. Blood culture
- E. Coronary angiography

38. Mitral valve prolapse

An asymptomatic 31-year-old woman has been referred for cardiological assessment. After her ECG she was told that she had mitral valve prolapse and would like further information on this condition. Which of the following statements is correct?

- A. Beta-blocker therapy is indicated
- B. Angiotensin-converting enzyme (ACE) inhibitor therapy is indicated
- ☒ C. One or both leaflets of the mitral valve are pushed back into the left atrium during systole
- D. Significant mitral regurgitation will eventually develop
- E. Exercise should be restricted

39. Paroxysmal atrial fibrillation

A 69-year-old woman complains of intermittent palpitations, lasting several hours, which then stop spontaneously. She also suffers from asthma. Holter monitoring confirms paroxysmal atrial fibrillation. Which of the following statements is correct regarding the management of this patient?

- A. Digoxin effectively prevents recurrence of the arrhythmia
- B. Anticoagulation is not necessary
- C. Sotalol may be effective
- D. Amiodarone should be avoided
- ☒ E. Flecainide orally may be an effective as-needed treatment to abort an attack

40. Hypertension management

A 57-year-old man is reviewed in a hypertension clinic, where it is found that his blood pressure is 165/105 mmHg despite standard doses of amlodipine, perindopril, doxazosin and bendroflumethiazide. Electrolytes and physical examination have been, and remain, normal. Which of the following would be your next stage in his management?

- ☒ A. Arrange for his medication to be given under direct observation
- ☐ B. Add spironolactone to his medication
- ☐ C. Arrange urinary catecholamine assays
- ☐ D. Request an adrenal CT scan
- ☐ E. Add verapamil to his medication

ANSWERS

Myocardial infarction

- 1 D** Time equates to muscle. Judging from the urgency, this male presented with an ST elevation MI (STEMI) which is an indication for urgent primary percutaneous coronary intervention (PCI). Compare this to a non-ST elevation MI (NSTEMI) which indicates ischaemia rather than infarction and PCI should be carried out within 48 hours (answers A and C). The angiogram shows that the left circumflex artery is occluded, resulting in a lateral infarct. This area is represented by leads V5–6 (**D**). V1–4 represents the territory of the left anterior descending artery. If the entire left mainstem had been occluded, changes would have shown throughout leads V1–6 (**B**).

Leads II, III and aVF (**C** and **E**) point to an inferior infarct and involvement of the right anterior descending artery (see Figure 1.1 below).

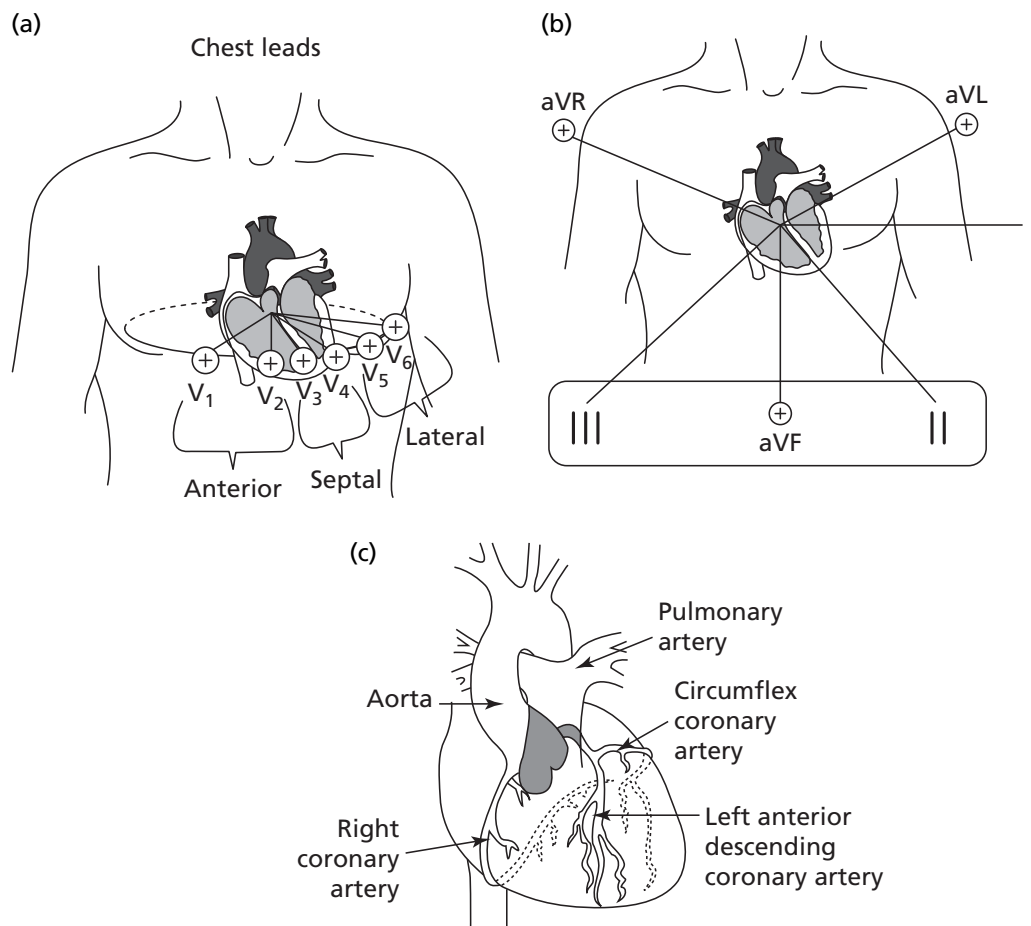


Fig. 1.1 (a,b) Chest leads. (c) Anatomy of coronary arteries (from Koppel and Naparus (2008) *Thinking Medicine: Structure your knowledge for success in medical exams*, Cavaye, with permission).

The location of the changes tells you which part of the heart is affected as shown in the diagrams. These depict:

- 1 the position of the chest leads and the parts of the heart they investigate;
- 2 the position of the limb leads and the parts of the heart they investigate;
- 3 the anatomy of the coronary arteries.

Putting all of these together will allow you to pinpoint the location of the lesion.

Leads	Area	Supplied by
V1–2	Anterior	LCA: Diagonal branch of LAD
V3–4	Septal	LCA: Septal branch of LAD
V5–6	Lateral	LCA: Left circumflex artery
V1–6	Anterolateral	LCA: Left main stem disease
II, III, aVF	Inferior	RCA: Posterior descending branch

Heart failure

- 2 D** Aortic stenosis will first result in left ventricular failure as a result of increased ventricular pressure as the ventricle tries to pump blood across a narrowed valve. Initially the pressure load will cause a backlog of blood into the lungs, resulting in pulmonary oedema – the first sign of which will be bibasal crepitations (D) before enough fluid accumulates as pleural effusions visible on chest x-ray (A). Earlier signs of pulmonary oedema include upper lobe blood diversion and Kerley B lines as fluid infiltrates the interstitium. If the backlog continues back into the right heart, eventually signs of right-sided heart failure will be evident including raised JVP (B) and bilateral pedal oedema (C). Atrial fibrillation (E) may coexist with aortic stenosis, however it is more commonly associated as a result of mitral stenosis as the enlarged atrium disrupts the normal electrical pathways.

Valve lesion signs

- 3 B** A murmur heard loudest on inspiration (A) points to a right-sided valve lesion. The right intercostal space midclavicular line (C) is the anatomical landmark for the aortic valve. The mitral area is over the apex. A murmur louder with the patient in the left lateral position (B) (as opposed to leaning forward) is associated with mitral lesions. If heard, you should determine whether the murmur radiates to the axilla. Corrigan's sign (D) (visibly exaggerated pulsating carotids) is one of the many signs of a hyperdynamic circulation associated with aortic regurgitation (including de Mussets, Traubes, Quinkes, Duroziez and a whole host of others). A narrow pulse pressure (E) is a sign of aortic stenosis.

CHAD2 score

- 4 E** Ideally this patient should be started on antihypertensives, a beta blocker and a statin. There is no indication for hypoglycaemics at present. There is no indication that this is acute atrial fibrillation and she does not seem to be compromised in a female of this age, cardioversion (C) is unlikely to be successful. She should be rate-controlled but the beta blockade is more appropriate in light of her ischaemic heart disease. Whether to start anticoagulation (A) is a decision that has to be tailor-made for each individual patient. The CHAD2 score is a quick and dirty but very useful way of predicting risk of subsequent stroke as a result of atrial fibrillation and helps guide the prescription of prophylactic antiplatelets or anticoagulants. Other factors, such as ease of taking and monitoring warfarin, risk of falls and important risk factors, such as vascular disease, should be taken into account.

C	Congestive heart failure	1
H	Hypertension: blood pressure consistently above 140/90 mmHg (or treated hypertension on medication)	1
A	Age ≥ 75 years	1
D	Diabetes mellitus	1
S2	Previous stroke or TIA	2

A score of 0 is low risk (2 per cent of patients/year will have a stroke without treatment), aspirin is considered adequate. A score of 1 is moderate risk (3 per cent annual stroke risk) and either warfarin or aspirin (D) is indicated according to the individual. A score of two or above (≥ 2 per cent annual stroke risk) is classified as high risk and warfarin (E) should be started unless there are clear contraindications. A patient with a full-house of risk factors (scores 6) has an almost 20 per cent chance of stroke/year.

Chest pain

- 5 C** Acute coronary syndrome is a spectrum of cardiac ischaemia-infarction determined by the presence of two out of three factors: chest pain, ECG changes and cardiac enzyme rise. Depending on these results, patients will fall into one of the following categories: unstable angina, NSTEMI or STEMI. Inverted T waves (A) and ST depression (B) are signs of ischaemia. ST elevation, Q waves and raised troponin are indicative of infarction. Initially, 'ST elevation' or 'non ST elevation' ECG changes are used to stratify each patient's risk as the results of blood tests for troponin levels (E) (which should be carried out 12 hours after the pain started) are not known and Q waves have not had time to develop. ST elevation (C) is a very good predictor of imminent infarction (positive troponin). However, if this patient is treated quickly enough with thrombolysis or primary PCI, infarction can be avoided. A patient with STEMI who goes on to have

negative troponin is termed to have had an 'aborted MI'. Q waves (D) (indicating full-thickness MI) take time to develop, so 'Q wave' or 'non Q wave' MI is a diagnosis given on discharge.

ECG: ST elevation			
Troponin	+	STEMI	NSTEMI
	–	Aborted MI	Unstable angina

Shortness of breath

- 6 E** This patient is most likely suffering from a pulmonary embolism (E), defined as an occlusion of the pulmonary vasculature by a thrombus causing an area of lung that is ventilated but not perfused. Patients most often complain of shortness of breath, pleuritic chest pain and haemoptysis. Clinical signs can include a pleural rub, coarse crackles and atrial fibrillation. In massive pulmonary embolism there can be a raised JVP, respiratory rate, heart rate and hypotension. The Geneva scoring system (see below) is useful for predicting the risk of a pulmonary embolism: a score of ≤ 3 (mild), 4–10 (moderate) and ≥ 11 (high). Muscular strain (A) typically occurs on movement and is not associated with shortness of breath or leg pain and there is usually an indicator of injury or a preceding stressor. Heart failure (B) is unlikely due to the acute presentation of symptoms which tend to occur more insidiously and can be associated with bilateral leg oedema, murmurs, orthopnoea or hepatomegaly, among others. A pneumothorax (C) can present with a similar pleuritic chest pain that occurs in an embolism, however, there is no association with limb pain and a respiratory examination is likely to reveal hyper-resonance. Angina (D) is typically described as a dull or crushing chest pain in the centre of the chest, patients have risk factors such as diabetes, hyperlipidaemia, obesity, smoking and hypertension.

Measurement	Score
≥ 65 years	1
Previous DVT or PE	3
Surgery or fracture ≤ 4 weeks	2
Malignancy	2
Unilateral leg pain	3
Unilateral oedema	4
Haemoptysis	2
Heart rate: 75–94	3
Heart rate: >95	5

Murmurs

- 7 A** This patient is suffering from a mitral valve prolapse (Barlow syndrome, click murmur syndrome) (A). A mid-systolic click followed by a late systolic murmur is heard at the apex as the thickened mitral valve leaflet is displaced into the left atrium during systole. An Austin Flint murmur (B) produces a low pitched, mid-diastolic rumble at the apex. Classically, mitral valve displacement as well as aortic turbulence due to regurgitation qualifies as an Austin Flint murmur. A patent ductus arteriosus (C) produces a constant machinery murmur. A Graham Steell murmur (D) is typically heard best at the left sternal edge, second intercostals space during inspiration. A high pitched early diastolic murmur is heard associated with pulmonary hypertension. A Carey Coombs murmur (E) is a short, mid-diastolic rumble heard best at the apex due to turbulent blood flow over a thickened mitral valve, most often due to rheumatic fever.

Chest pain

- 8 C** All of the answer options can present as central chest pain, however the patient describes a very typical description of an aortic dissection (C), usually a severe, tearing pain that radiates toward the back though this can be to the jaw depending on the location of the dissection. An MI (A) is typically described as severe, crushing chest pain with an acute onset, this patient has been suffering from a 3-day history of chest pain which makes an infarction unlikely. Although myocardial ischaemia (B), i.e. angina, can occur for a longer period of time they tend not radiate to the back but more toward the jaw, arms or epigastrium, and again are described as crushing in nature rather than tearing. A pulmonary embolism (D) typically presents with pleuritic chest pain, cough and haemoptysis which are not present in this patient, or preceding risk factors such as long haul travel or surgery. Pneumonia (E) is associated with fever and productive coughing.

Chest pain management

- 9 D** NICE guideline protocols state that in a patient with suspected MI, pain relief in the form of GTN spray or morphine should be administered. Since the patient has had an adequate response to GTN spray, further pain relief in the form of morphine (B) is unnecessary. In patients who are not allergic, 300mg of aspirin is recommended and ideally should be given in the ambulance. However, if the patient is allergic to aspirin (A) it should not be given since an anaphylactic reaction would compromise the patient's airway and does not overrule the harm from a possible MI. Although heparin (C) and warfarin (E) would provide good anticoagulant cover, they are slower to act and current guidance advises clopidogrel monotherapy (D) in those patients allergic to aspirin.

Ventricular tachyarrhythmia

- 10 B** This patient is suffering from a life-threatening ventricular tachyarrhythmia of which there are two types, sustained ventricular tachycardia and ventricular fibrillation. In ventricular fibrillation (B) the patient is pulseless and cardioversion is required. A sustained ventricular tachycardia (C) is usually recognized by cannon 'a' waves on JVP and broad QRS complexes if an ECG is available. If stable, patients can be cardioverted with amiodarone, if unstable, electrocardioversion is required. Torsades de pointes (A) presents with irregular QRS complexes and prolonged QT interval, a non-sustained ventricular tachycardia (D) is defined by more than five consecutive heart beats within 30 seconds, while a normal heart ventricular tachycardia (E) is a benign tachyarrhythmia. Answers (A), (D) and (E) are not shockable rhythms.

Jugular venous pressure

- 11 D** The JVP provides clinicians with information regarding right atrial pressures and filling. It mainly consists of five wave forms:

- 1 a wave – representing atrial systole;
- 2 c wave – representing closure of the tricuspid valve (this wave is not usually visible);
- 3 x descent – representing a fall in atrial pressure during ventricular systole;
- 4 v wave – representing atrial filling against a closed tricuspid valve;
- 5 y descent – representing the opening of the tricuspid valve.

In atrial fibrillation, the 'a waves' are absent (D) due to dysfunctional atrial systole. A raised JVP with normal waveform pattern (A) is usually seen in fluid overload and right heart failure. Large v waves (B) are usually seen in patients with tricuspid regurgitation. Cannon 'a waves' (C) are seen in patients with complete heart block, single chamber ventricular pacing, ventricular arrhythmias and ventricular ectopics. Large 'a waves' (E) can be seen in pulmonary hypertension and pulmonary stenosis.

Heart failure

- 12 A** Cardiomegaly (B), bilateral pleural effusions (C), alveolar oedema (D) and Kerley B lines (E) (representing interstitial oedema) are all features that can be seen in a chest x-ray in patients with congestive cardiac failure. Upper lobe diversion is usually seen on chest x-ray and not lower lobe diversion (A).

First degree heart block

- 13 D** The PR interval is usually measured from the start of the P-wave to the start of the QRS and the normal range lies within 0.12–0.2s (i.e. 120–200 ms). In

first degree heart block, the PR interval is prolonged, greater than 0.2s (200ms) (D). Shortened PR interval (i.e <120s or <0.12s) (E) results from fast AV conduction, usually down an accessory pathway seen in Wolff-Parkinson-White syndrome.

Mitral stenosis

- 14 C** Malar flush (A), atrial fibrillation (B), a tapping apex beat (D) and right ventricular heave (E), which occurs secondary to pulmonary hypertension, are all clinical signs associated with mitral stenosis. On auscultation of the praecordium, a mid-diastolic murmur ($\pm$ opening snap, representing a mobile valve) is heard rather than a pan-systolic murmur (C) which is usually heard in mitral regurgitation, tricuspid regurgitation and ventricular septal defects.

Hypertension

- 15 B** ACE inhibitors (e.g. lisinopril (B)) commonly cause a dry cough in some patients. If this occurs, patients are usually taken off the ACEI and started on either an ARB (e.g. irbesartan, losartan, telmisartan) or different class of antihypertensive. Amlodipine (A), bendroflumethiazide (C), frusemide (D) and atenolol (E) do not commonly cause a dry cough as a side effect.

Palpitations

- 16 B** The onset of the arrhythmia is recent, and there is a good chance of successful cardioversion (B) at this point without the need for anticoagulation. Conservative management (E) is also reasonable, though the patient is in some discomfort. 'Chemical' cardioversion (D) may be somewhat less likely to succeed than DC cardioversion but may be preferred by the patient. Digoxin (A) may eventually control resting, but not ambulant heart rate, but would probably take several days before it did so. Option (C) is certainly suitable in cases of persistent or permanent atrial fibrillation where it is decided to opt for rate control.

Murmurs

- 17 B** This is a classical presentation of aortic stenosis, with syncope following a period of increasing shortness of breath on exertion and angina, with relatively narrow pulse pressure and ECG (or echo) indications of left ventricular hypertrophy. The answer is therefore (B). (A) is the murmur of mitral stenosis (with opening snap and loud P2), (C) of aortic regurgitation, (D) of mitral regurgitation and (E) of tricuspid regurgitation. Aortic stenosis is by far the most common valvular lesion likely to be seen in general medicine.

Postmyocardial infarction (1)

- 18 B** Ventricular septal defect (B) is the most likely diagnosis and this is potentially a very serious complication which will need endovascular or surgical intervention. The murmur is not where one would expect to locate it for mitral incompetence (A), and there is also the finding of raised jugular venous pressure in this case. Aortic stenosis (C) would have quite different clinical findings, including the murmur, Dressler's syndrome (D) is a type of possibly autoimmune pericarditis and there is nothing pointing to another myocardial infarction (E).

Hypertension

- 19 D** It is generally agreed that in situations where relatively rapid blood pressure lowering is indicated, sodium nitroprusside (D) is the most effective and reliable drug. However, it can only be used safely if there are facilities for continuous intra-arterial blood pressure monitoring, since it can produce very rapid drops in blood pressure which can lead to acute cerebral, cardiac or optic hypoperfusion. GTN (A), hydralazine (B) and labetalol (C) have also been used in hypertensive emergencies but are less reliable, GTN is the drug of second choice. They may be preferred if intensive monitoring is not available. Phentolamine (E) is used in phaeochromocytoma-caused hypertensive crises. It should be noted that the evidence base for the management of hypertensive emergencies is still under review.

Mid-systolic murmur

- 20 C** Coarctation of the aorta (C) is the only diagnosis compatible with the hypertension present here. The other features are also characteristic of this condition. Bruits over the intercostal spaces with notching of the lower margins of the ribs may also be apparent.

Ventral septal defect

- 21 D** Large ventricular septal defects (VSDs) may indeed be associated with pulmonary hypertension (A), heart failure (B) and shunt reversal (E), but a small defect is unlikely to lead to these problems and, in general, VSDs are not associated with dysrhythmias (C). Endocarditis (D) is, however, a persistent hazard. Routine antibiotic prophylaxis for dental procedures is no longer recommended.

Microscopic haematuria

- 22 A** The picture strongly suggests polycystic kidney disease. The least invasive productive investigation is likely to be urinary tract ultrasound (A). The CT scan (B) is also useful, but is more costly and involves exposure to radiation

without yielding more diagnostic information in this case than high-quality ultrasound. Intravenous urogram (E) would show filling defects without defining their nature. Urine microscopy (C) will yield no additional data. Renal biopsy (D) is unjustifiable. Ultrasound screening of first-degree relatives could be discussed with them as most cases are inherited as autosomal dominant traits. Unfortunately, even excellent blood pressure control does not slow the deterioration in renal function which usually accompanies this condition, though of course it is still indicated for other reasons.

Retrosternal chest pain

- 23 A** IV low-molecular weight heparin (A) should almost always form part of the immediate management of an acute coronary syndrome, such as in this case. If the patient were not already on a beta-blocker this would also be given. At this point it would be classified as unstable angina as there is no evidence of actual tissue damage. Thrombolysis (B) probably worsens outcomes in this situation. In the absence of actual thrombus, calcium channel blockers (C) have no proven benefit and at this stage clopidogrel (E) is not indicated, although it would be if stenting (D) is carried out. If the facilities are available, that would be the next step after anticoagulation.

Pulmonary embolism management

- 24 C** As the history strongly suggests a thrombophilic trait, e.g. the presence of factor V Leiden, the correct option is a thrombophilia screen (C). This should be completed as rapidly as possible before starting warfarin (A) therapy, which would prevent a proper screen. In fact, a duplex scan (E) would probably be carried out at the same time as the screening, to exclude the presence of thrombus and of pelvic masses. An ECG (B) is irrelevant, while an inferior vena cava filter (D) may be considered later if anticoagulation is ineffective or not tolerated.

Mid-diastolic murmur

- 25 A** This is typical mitral stenosis and the correct answer is echocardiography (A). Colour Doppler scanning (E) would almost certainly follow to assess flow and pressure. Cardiac catheterization (C) may be performed prior to surgery, while thallium radionuclide scanning (D) is not relevant. The antistreptolysin O titre (B) can confirm streptococcal infection and the presumed rheumatic fever responsible for the lesion, but only around the time it occurs. It would yield no useful information years later, as would be the case here.

Severe chest pain

- 26 D** The most likely diagnosis, and the one that must be most urgently excluded, is an aortic dissection (D). The location does not indicate a pneumothorax

(A), the symptoms and ECG are against an MI (B) and the pain seems too severe for a pulmonary embolus (C), or pain of musculoskeletal origin (E). Chest x-ray may show widening of the aorta, and CT and MRI scans may be diagnostic. If confirmed, BP reduction and dampening of the aortic systolic wave by beta-blockade is indicated and urgent surgical intervention should be considered.

Decrescendo diastolic murmur

- 27 A** This is a typical clinical scenario for an aortic regurgitation (A), with early cardiac failure. Note the wide pulse pressure, and it is also usual for the pulse to be rapidly collapsing. The only lesion producing a diastolic murmur, among those listed, is of course mitral stenosis (D). No other valve abnormality (B), (C) or (E) produces a wide pulse pressure as seen here, but remember that in older people, almost always over the age of 60, similarly wide or even wider pulse pressures may be noted. This would be due to isolated systolic hypertension, i.e. systolic pressure >140 mmHg and diastolic ≤ 90 mmHg.

Supraventricular tachycardia

- 28 D** IV adenosine (D) has a very high likelihood of success, with rapid onset and offset. It may cause very brief chest pain (which is not ischaemic) and very occasionally bronchospasm. Verapamil (B) and beta-blockers (C) may also be effective but have a longer duration of action which is unnecessary here, may cause excessive bradycardia, and are in any case less effective than adenosine. If the patient has severe haemodynamic compromise, DC cardioversion (E) could be considered but would be excessive here. Carotid sinus massage (A) is likely to remain ineffective. SVT is common in young people and may be associated with excessive nicotine, caffeine and alcohol and patients should be advised about this, although they may not take much notice!

Chest pain

- 29 E** Variant angina, sometimes called Prinzmetal's angina (E), of which this is a typical presentation. Its mechanism is controversial and even its existence has been questioned. The general view is that it is due to vasospasm in small coronary arteries and this is likely to respond to the effects of nitrates and calcium channel blockers such as verapamil. Beta-blockers are not effective and in theory could make it worse by aggravating vasoconstriction, but whether this actually happens is also controversial.

Shortness of breath

- 30 C** The diagnosis here is hypertrophic obstructive cardiomyopathy, which is associated with the risk of sudden death. The best answer is beta-blockers

(C), closely followed by rate-limiting calcium channel blockers (D). These drugs slow the heart and improve diastolic relaxation. Nitrates (B) do the opposite while digoxin (A) may increase contractility and thereby worsen the outflow obstruction. Surgery (E) may ultimately be indicated.

Hypertension

- 31 C** Although there is some debate on this issue, the general consensus is that the best answer is option (C), which is highly sensitive and specific, with levels as much as ten-fold greater than normal. Option (B) may be normal between episodes, option (D) may well be abnormal but would not be diagnostic, and option (E) is not recommended or necessary. Option (A) will be essential once the diagnosis is definite or highly probable.

Chest pain

- 32 C** The answer is right coronary artery (C). This is the artery that supplies the inferior and posterior aspects of the left ventricle. The circumflex artery (A) would affect the anterolateral territory (leads I, aVL, V5–6). The left anterior descending artery (B) supplies the septum (leads V1–V4). The left main coronary artery (D) would include the circumflex artery and left anterior descending artery territory. The posterior descending artery (E) affects a limited portion of the posterior wall, and is associated with tall R waves in V1–2.

Constrictive pericarditis

- 33 A** The answer is (A) (Kussmaul's sign). Third heart sounds (B) and fourth heart sounds (C) are associated with heart failure, but not pericardial diseases. Lung signs are less likely than 'right sided' ones, such as ascites and peripheral oedema. The first and second heart sounds are usually reduced as the pericardial wall is thickened and sound transmission is reduced.

Visual disturbance

- 34 C** These symptoms are characteristic of digoxin (C) (cardiac glycosides). The yellow-tinged vision (xanthopsia) is particular to these drugs. The slow pulse, with probable ectopics, together with the subjective symptoms, suggests toxicity and plasma digoxin should be measured, with lowering of the dosage or withdrawal of the drug, which is not considered first-line therapy in any case in the management of congestive heart failure.

Weight loss

- 35 A** This clinical picture strongly suggests thyrotoxicosis and therefore the correct answer is TFTs (A). This is probably the most common cause of

atrial fibrillation in a young person, particularly in the absence of valve disease. No doubt an ECG (B) will be carried out to exclude this but there are no physical signs to suggest an abnormality: the mitral valve is the one most likely to be associated with atrial fibrillation, probably at least in part because of stretching of the left atrium. It is certain that full blood count (D) and fasting blood sugar (E) will be carried out routinely, while a chest x-ray (C) may form part of the search for a retrosternal goitre if there is any indication of this.

Postmyocardial infarction (2)

- 36 E There is strong clinical trial evidence for the other four classes of drugs (A–D), although it is not clear how long the duration of therapy should be in each case. This benefit is applicable to normotensive patients with ‘normal’ LDL levels, although what constitutes normal in this case is controversial. Targets are likely to be reduced in the near future. One clinical trial did appear to show additional benefit for the omega-3 fatty acids (E) but this was in a population where few were receiving statins. Subsequent data have not supported their routine use.

Mitral valve prolapse complication

- 37 D The diagnosis here is subacute bacterial endocarditis, probably due to *Streptococcus viridans*. The definitive diagnosis is by blood culture (D) although echocardiography (B) will show vegetations on affected heart valves. Although the lesions described are vasculitic (as are the painless Janeway lesions and the Roth spots in the retina), in this case they are due to antigen–antibody complexes triggered by infection. The issue of routine prophylaxis for patients with valvular disease prior to dental procedures is controversial; in the UK, it is no longer recommended.

Mitral valve prolapse

- 38 C There is no indication for ACE inhibitor therapy (B), while beta-blockers (A) may be used for management of arrhythmias if these occur. Mitral regurgitation (D) is unlikely to occur, although it is a possibility. There is no need to limit exercise (E) in an asymptomatic patient. As mentioned elsewhere, endocarditis is a persistent risk, with the need for antibiotic prophylaxis a topic of current debate.

Paroxysmal atrial fibrillation

- 39 E Oral flecainide (E) is now widely recommended to avoid continuous therapy. Propafenone is used in a similar way. Digoxin (A) is not effective in this situation; sotalol (C) may be used but should be avoided because of this patient’s asthma. Amiodarone (D) is effective, but has numerous serious adverse reactions including pulmonary fibrosis, liver damage,

peripheral neuropathy and abnormal thyroid function. Anticoagulation (B) is very important to prevent strokes, although in low-risk patients aspirin may be adequate. In patients where drug therapy is ineffective or poorly tolerated, ablation therapy can have a high success rate.

Hypertension management

- 40 A** Poor adherence to therapy (A) is probably the most common cause of apparent resistance to hypertensive therapy. In cases where this occurs despite good adherence, spironolactone (B) is often highly effective, although it is not clear why. Verapamil (E) is very occasionally added to a dihydropyridine in severe hypertension. If he is already a patient of the hypertension clinic, one can presume that he has been screened for possible secondary causes (C and D), so this is very likely to be primary hypertension.