CHAPTER 1

Cardiology

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1.1 A 39-year-old man has orthopnoea, palpitations, and haemoptysis. On auscultation, there is a loud first heart sound and a low-pitched, mid-diastolic rumbling murmur at the apex.

Which is the most likely cause of his murmur?

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

1.2 A 17-year-old woman has dyspnoea and reduced exercise tolerance. On examination, she has jugular venous distension with a prominent V wave, painful hepatosplenomegaly, and mild peripheral oedema. On auscultation, there is a high-pitched pansystolic murmur in the fourth intercostal space in the parasternal region. The intensity of the murmur increases during inspiration and decreases on standing.

Which is the most likely cause of her murmur?

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

1.3 A 34-year-old woman has chest discomfort, palpitations, and feels light-headed. She had a similar episode 2 months ago. Her past medical history includes anxiety and asthma. On examination, her pulse rate is 182 bpm and BP is 128/74 mmHg. An ECG shows no P waves and a QRS interval of 90 ms.

Which is the next most appropriate management step?

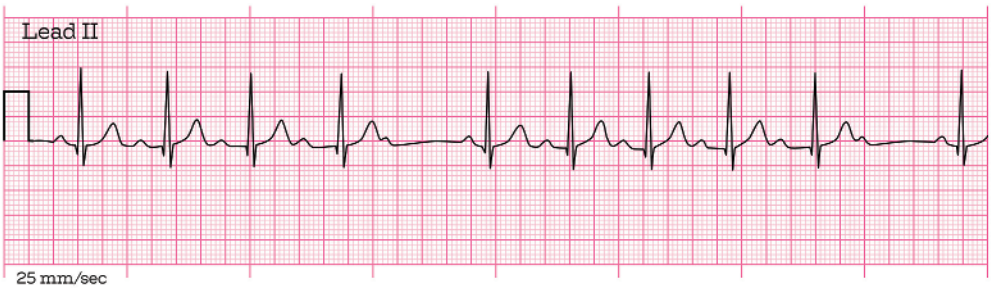
A. Metoprolol
B. Diltiazem
C. Verapamil
D. Carotid sinus massage
E. Adenosine

1.4 A 17-year-old man has palpitations for 2 months. He has not been concerned about these as he has been taking exams at college and felt it was anxiety related. His parents have asked for a review as they are worried. An ECG was performed, which shows a PR interval of 80 ms, a QRS complex of 130 ms, and a slurred delta wave.

Which is the most likely diagnosis?

A. Hypertrophic cardiomyopathy
B. Ebstein's anomaly
C. Long QT syndrome
D. Wolff–Parkinson–White syndrome
E. Atrioventricular nodal re-entry tachycardia

1.5 A 52-year-old woman has a feeling that she is going to faint, which has been persistent for 3 months. She has no loss of consciousness. She has never collapsed. She has intermittent nausea. She denies chest pain, dyspnoea, or diaphoresis. An ECG is performed, a section of which is shown (see image).

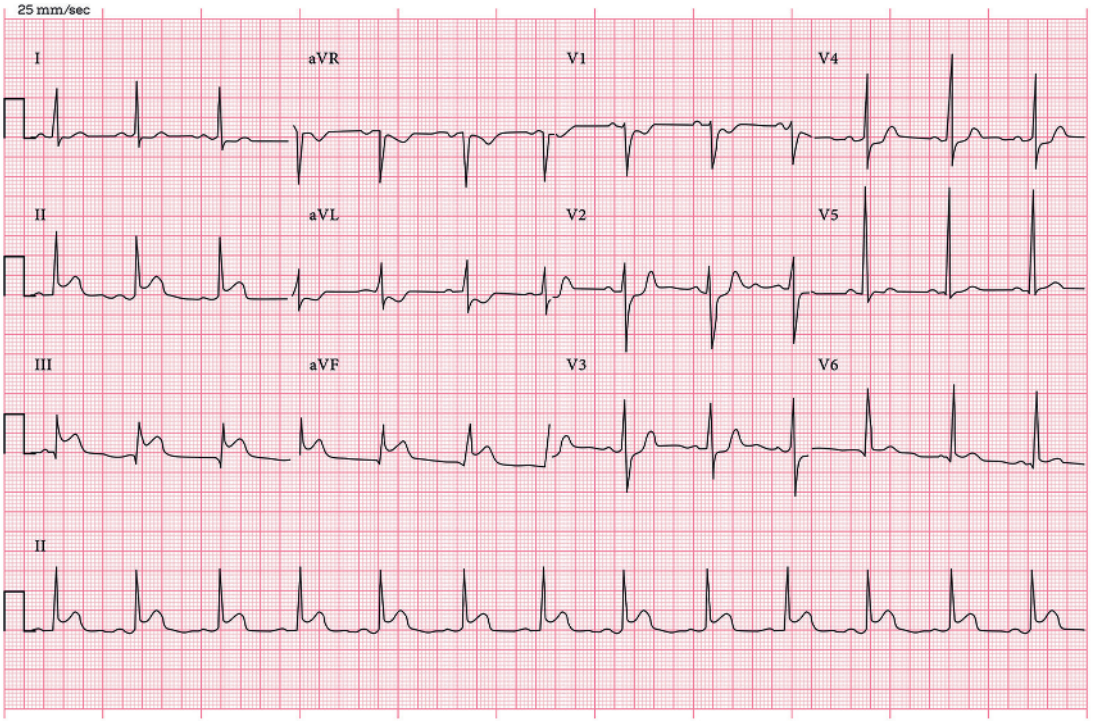


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Which is the most likely diagnosis?

A. First-degree AV block
B. Mobitz type 1 AV block
C. Mobitz type 2 AV block
D. Complete AV block
E. Tachy-brady syndrome

1.6 A 68-year-old man has felt unwell for the past 2 hours. He has nausea, diaphoresis, and left-sided neck pain. His wife has taken him to the Emergency Department. His past medical history includes type 2 diabetes mellitus, hypertension, and hypercholesterolaemia. He smokes 15 cigarettes daily. An ECG is performed (see image).

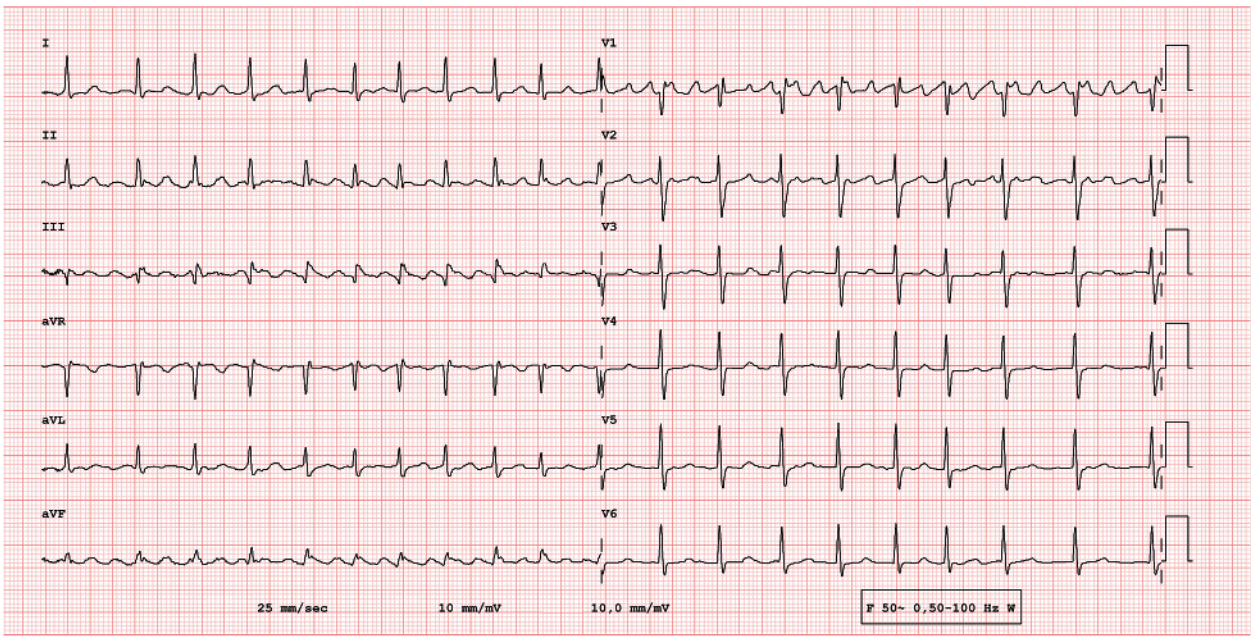


Source: alfa md / Adobe Stock Photos.

Which is the most appropriate definitive management?

A. Primary percutaneous coronary intervention
B. Ticagrelor
C. Aspirin
D. Clopidogrel
E. Tirofiban

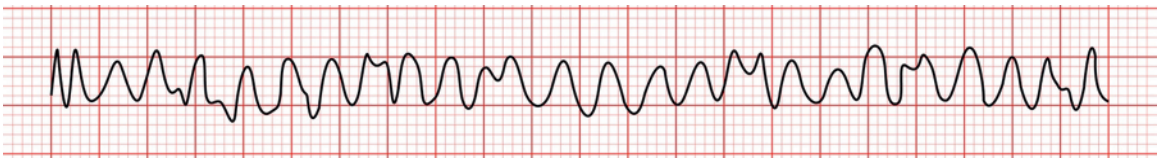
1.7 A 52-year-old woman has palpitations, dyspnoea, and fatigue for 2 months. She has been feeling more light-headed and consulted her GP. She denies chest pain. An ECG was performed (see image).



Source: christian cantarelli / Adobe Stock Photos.

Which is the most likely diagnosis?
A. Supraventricular tachycardia
B. Wide complex tachycardia
C. Left bundle branch block
D. Sinus arrhythmia with premature ventricular ectopics
E. Atrial flutter

1.8 A 70-year-old man is found collapsed on the floor by a nurse. He is currently being treated for a pulmonary embolism in hospital. He is not breathing and has no pulse. The resuscitation team are called, and chest compressions are commenced. An ECG is performed (see image). Chest compressions are resumed.



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Which is the most appropriate next step in management?
A. DC shock 200 J biphasic
B. IV amiodarone
C. IV adrenaline
D. IV atropine
E. Continue CPR 30:2, then continue chest compressions for 2 minutes

1.9 A 68-year-old man is found making incomprehensible sounds by a nurse on the Surgical Ward. He returned from theatre 1 hour ago following a laparotomy. His pulse rate is 145 bpm and BP is 58/36 mmHg. He suddenly becomes unresponsive and there is no palpable pulse. The nurse calls for help, commences CPR and the 'Cardiac Arrest Call' is made. The ECG monitor shows a widened QRS complex only.

Which is the most appropriate immediate management?
A. DC shock 200 J
B. Amiodarone 300 mg IV
C. Adrenaline 1 mg IV
D. 0.9% sodium chloride fluid bolus IV
E. Lidocaine 100 mg IV

1.10 A 29-year-old man has central chest pain and a fever for 2 days. The pain worsens with movement and is relieved with sitting forwards. He has recently recovered from an upper respiratory tract infection. His pulse rate is 80 bpm and BP is 125/76 mmHg. An ECG shows diffuse, concave-upwards ST-segment elevation and PR-segment depressions. His troponin T is 13 ng/L.

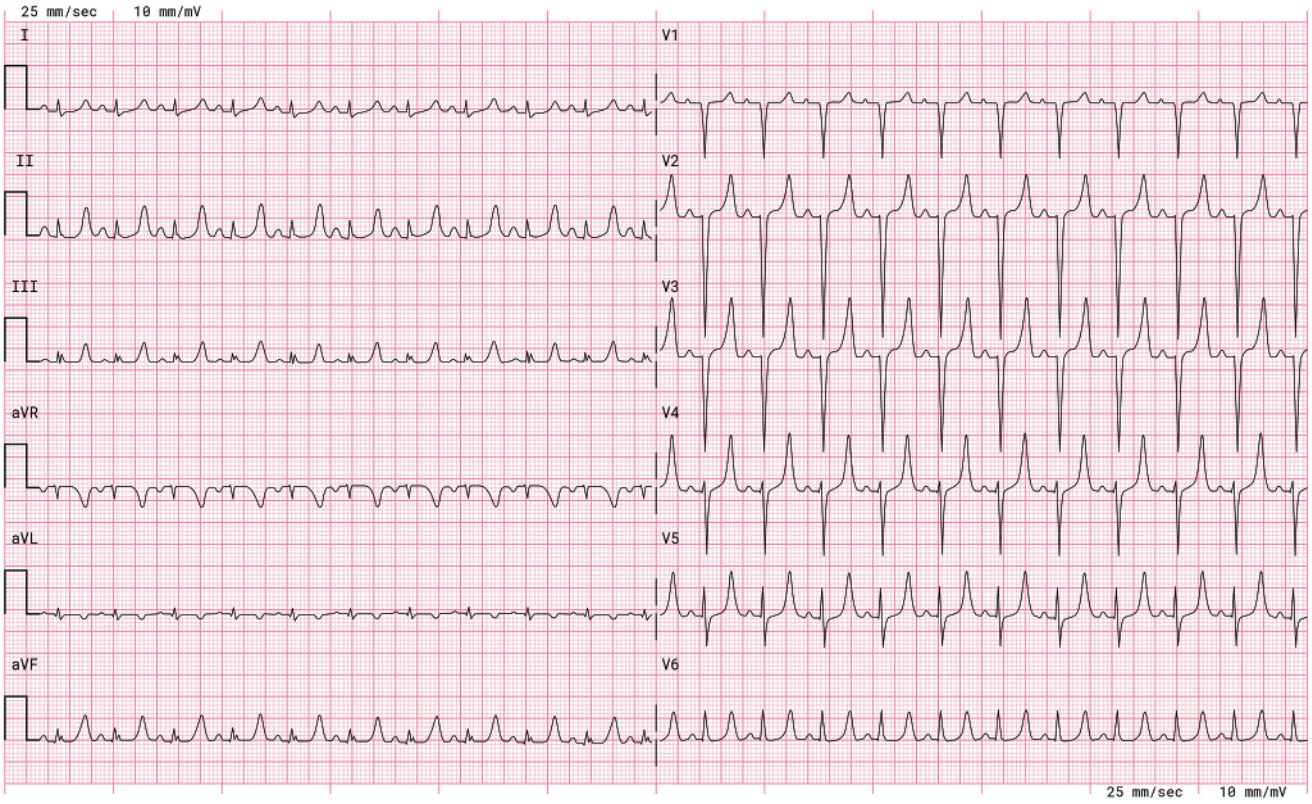
Which is the most likely diagnosis?
A. Tietze syndrome
B. Boerhaave syndrome
C. Sick sinus syndrome
D. Acute myocarditis
E. Acute pericarditis

1.11 A 72-year-old woman is commenced on treatment for symptomatic left ventricular failure in hospital. Three days into treatment, she develops constipation, fatigue, muscle weakness, and tingling in her fingers. An ECG shows low amplitude T waves and prominent U waves.

Which medication is the most likely cause?

A. Amiloride
B. Ramipril
C. Digoxin
D. Furosemide
E. Spironolactone

1.12 A 36-year-old woman has generalised muscle weakness, fatigue, weight loss, and abdominal pain for 2 weeks. She also has knee joint pains, worse on palpation, and hyperpigmented skin. She has no past medical history. Her pulse rate is 74 bpm and BP is 104/62 mmHg. Routine bloods are requested, and an ECG is performed (see image). She is referred to the Medical Admissions Unit.



Source: alfa md / Adobe Stock Photos.

Which is the most appropriate next step in management?

A. DC cardioversion
B. Calcium gluconate
C. Adenosine
D. Metoprolol
E. Amiodarone

1.13 A 26-year-old man has recently had an ECG. He is a final-year medical student, and his peer is practising his ECG skills on him for clinical examinations. He has no cardiac symptoms. The ECG tracing shows widened QRS complexes, an RSR′ pattern in V1, and a widened, slurred S wave in V6.

Which is the most likely conduction defect?

A. Long-QT syndrome
B. Right bundle branch block
C. Left bundle branch block
D. Bifascicular block
E. Sick sinus syndrome

1.14 A 23-year-old woman has tall stature, long arm span, and joint laxity which has resulted in recurrent dislocations. She has pes planus and pectus carinatum. She is estranged from her father but remembers that he had chest problems where his lungs would frequently collapse. On auscultation, there is an early diastolic decrescendo murmur audible along the left sternal border, and a mid-diastolic, low-pitched rumbling murmur heard best at the apex when she leans forwards and exhales.

Which is the most likely heart valve disease (valvulopathy)?

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

1.15 A 68-year-old man has worsening pleuritic chest pain, fever, dyspnoea, and malaise. He had a myocardial infarction 1 week ago. On auscultation, he has a pericardial friction rub with normal heart sounds. His JVP is not raised. His pulse rate is 112 bpm and BP is 105/65 mmHg.

Which is the most likely diagnosis?

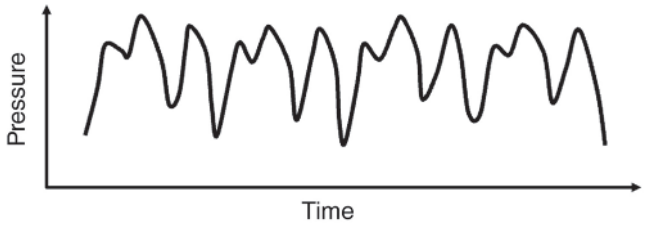
A. Dressler's syndrome
B. Endocarditis
C. Pulmonary embolism
D. Cardiac tamponade
E. Acute left ventricular failure

1.16 A 77-year-old woman has dyspnoea, palpitations, and chest discomfort. Her pulse is irregularly irregular. An ECG tracing shows no P waves and an irregular ventricular rate. A recent echocardiogram shows mild aortic stenosis and an ejection fraction of 60%. She has ischaemic heart disease and type 2 diabetes mellitus. She takes ramipril, amlodipine, bisoprolol, and metformin. She has no peripheral oedema.

What is her CHA_2DS_2-VASc score?

A. 3
B. 4
C. 5
D. 6
E. 7

1.17 A 59-year-old man has progressive exertional dyspnoea, peripheral oedema, and bilateral pleural effusions. He has engorged neck veins and his JVP is 14 cm H_2O. He has a positive Kussmaul's sign. Right atrial pressure tracing demonstrates sharp and deep *x* and *y* descents (see image). He had an orthotopic heart transplant 25 years ago for hypertrophic cardiomyopathy.



Which is the most likely diagnosis?

A. Left ventricular failure
B. Cardiac tamponade
C. Mitral stenosis
D. Constrictive pericarditis
E. Ventricular septal defect

1.18 A 66-year-old woman has dizziness and light-headedness for 3 months. She also has intermittent palpitations. She has mild dyspnoea on exertion but no chest pain. Her BP is 118/74 mmHg. She takes losartan, nicardipine, atenolol, bendroflumethiazide, and glyceryl trinitrate (when required). An ECG was performed, a section of which is shown (see image).



Source: alfa md / Adobe Stock Photos.

Which medication should be stopped?

A. Losartan
B. Nicardipine
C. Atenolol
D. Bendroflumethiazide
E. Glyceryl trinitrate

1.19 A 64-year-old man has sudden onset, prolonged, non-pleuritic chest pain. In the Emergency Department, an ECG shows sinus rhythm with ST elevation in leads II, III, aVF, V5 and V6, and ST depression in V1–3 with tall, broad R waves.

Which is the most likely diagnosis?
A. Anterior ST-elevation myocardial infarction
B. Inferior ST-elevation myocardial infarction
C. Anterolateral non-ST elevation myocardial infarction
D. Inferoposterolateral ST-elevation myocardial infarction
E. Posterior ST-elevation myocardial infarction

1.20 A 50-year-old woman has confirmed heart failure with reduced ejection fraction (40%). She had a myocardial infarction 1 month ago.

Which medication will result in a sustained survival benefit?
A. Metformin
B. Atenolol
C. Propranolol
D. Amlodipine
E. Ramipril

1.21 A 76-year-old man has atrial fibrillation and is risk assessed for major bleeding with anticoagulation. He has no bleeding history. He takes valsartan, amlodipine and bisoprolol. His haemoglobin is 118 g/L and eGFR is 75 mL/min/1.73 m^2.

What is his ORBIT score?
A. 1
B. 2
C. 3
D. 4
E. 5

1.22 A 61-year-old woman is seen in the anticoagulation clinic. Her INR is 3.0. She underwent an aortic valve replacement 6 years ago for severe aortic stenosis. Her pulse rate is 72 bpm, and regular. She has normal heart sounds with an audible S2 click.

Which is the most appropriate management?
A. Change warfarin to apixaban
B. Change warfarin to aspirin
C. Change warfarin to clopidogrel
D. Continue warfarin
E. Stop warfarin

1.23 A 59-year-old man has a persistent home BP reading of 148/92 mmHg. He has tried improving his diet and exercising more but his average home readings have not changed. He has no past medical history and takes no medication.

Which is the most appropriate first-line treatment?
A. Losartan
B. Nifedipine
C. Enalapril
D. Bisoprolol
E. Indapamide

1.24 A 68-year-old woman has dyspnoea at rest. On examination, there are bilateral coarse crepitations throughout the chest. She has bilateral pitting oedema to the knees. An echocardiogram shows an ejection fraction of 35%.

Which is the most appropriate next step in management?

A. Lisinopril
B. Irbesartan
C. Carvedilol
D. Felodipine
E. Furosemide

1.25 A 72-year-old man has central chest pain which is worsened by exercise and relieved by rest. It sometimes radiates into the neck and shoulders when he walks long distances. The pain eases within 5 minutes when he rests. His pulse rate is 75 bpm and BP is 135/84 mmHg. He takes ramipril, aspirin, metformin, and glyceryl trinitrate (when required).

Which is the most appropriate first-line treatment?

A. Bisoprolol
B. Verapamil
C. Isosorbide mononitrate
D. Nicorandil
E. Ivabradine

1.26 A 45-year-old woman has dizziness, light-headedness, and fatigue. She has no chest pain or dyspnoea. The symptoms are worse after a hot shower and when she gets out of bed. She has fibromyalgia and takes pregabalin. Her pulse rate is 72 bpm when sitting and 76 when standing. Her BP is 118/72 mmHg when sitting and 106/61 mmHg when standing. An ECG shows sinus rhythm.

Which is the most likely diagnosis?

A. Vasovagal syncope
B. Postural orthostatic tachycardia syndrome
C. Carotid sinus syndrome
D. Orthostatic hypotension
E. Situational syncope

1.27 A 26-year-old man has a feeling that his heart flutters intermittently during the day. It lasts a few seconds. There is no associated dyspnoea, chest pain, syncope, or sweating. He takes no regular medication. He drinks alcohol occasionally, does not smoke and does not use recreational drugs. There is no history of sudden cardiac death in his family. His pulse rate is 68 bpm and regular at rest. Heart sounds are normal with no murmurs. Blood tests are unremarkable, and an ECG shows sinus rhythm.

Which is the most appropriate next investigation?

A. Echocardiogram
B. Exercise stress testing
C. Tilt table testing
D. 24-hour Holter monitoring
E. Cardiac CT scan

1.28 A 36-year-old woman has low-grade fever, fatigue, widespread myalgia, and weight loss. She underwent a tooth extraction 3 days earlier. She is otherwise fit and well. On examination, she has petechiae on the hands and feet, and oral mucosa. There are splinter haemorrhages and tender purple nodules on the finger pulps. On auscultation, there is a new regurgitant murmur.

Which is the most likely causative organism?

A. *Pseudomonas aeruginosa*
B. *Streptococcus viridans*
C. *Haemophilus influenzae*
D. *Candida albicans*
E. *Proteus mirabilis*

1.29 A 78-year-old man is admitted to hospital for a fast irregular pulse rate. He has atrial fibrillation and heart failure with reduced ejection fraction. He is commenced on digoxin. He is reviewed by his GP 1 month later and his pulse rate is 72 bpm. His digoxin level is within the normal range. An ECG was performed.

Which is the most likely ECG change?

A. Widened QRS with delta waves
B. Bradyarrhythmia with J waves
C. PR prolongation with flat T waves and U waves
D. S waves in lead I, Q waves in lead III, and inverted T waves in lead III
E. Downsloping ST depression with biphasic T waves

1.30 A 76-year-old woman has exertional dyspnoea and paroxysmal nocturnal dyspnoea. She has developed peripheral oedema up to her thighs. On examination, she is tachypnoeic and there are bibasal crepitations. She also has a raised JVP. Her pulse rate is 102 bpm and BP is 106/64 mmHg. Her NT-proBNP is 1225 ng/L. She is commenced on furosemide for symptom control.

Which is the most appropriate next step in management?

A. Emergency admission via the same day emergency care unit (SDEC)
B. Discuss with the on-call cardiology team
C. Commence sacubitril/valsartan (Entresto®)
D. Refer for specialist assessment and echocardiography to be seen within 6 weeks
E. Refer for specialist assessment and echocardiography to be seen within 2 weeks

1.31 A 58-year-old man has exertional dyspnoea, excessive fatigue, dyspnoea when bending forwards, and haemoptysis. He also has abdominal distension and weight gain. He has a holosystolic murmur when auscultating the left mid-sternal border. A chest X-ray shows an elevated cardiac apex and pruning of peripheral pulmonary vessels. An ECG shows P pulmonale, right bundle branch block, and right axis deviation.

Which definitive investigation is most likely to confirm the diagnosis?

A. Right heart catheterisation
B. Echocardiography
C. Natriuretic peptide testing
D. Cardiopulmonary exercise testing
E. Abdominal ultrasound

1.32 A 70-year-old woman is seen by her GP for a Well Woman Health Check. She is fit and well and takes no medication. On auscultation of the heart, there is an early-to-mid systolic click followed by a late systolic murmur, heard loudest at the apex. The murmur is accentuated, left ventricular volume decreases on standing, and the murmur diminishes when the patient is asked to squat.

Which is the most likely diagnosis?

A. Aortic stenosis
B. Austin Flint murmur
C. Mitral valve prolapse
D. Flow murmur
E. Mitral regurgitation

1.33 A 62-year-old man is diagnosed with essential hypertension. He has tried to control his BP with dietary modifications and increased exercise, but they have not helped. He is commenced on amlodipine and then ramipril. His BP remains elevated at 158/94 mmHg. Indapamide is then added to his drug regimen.

Which is the most likely adverse effect?

A. Hypernatraemia
B. Hypocalcaemia
C. Hyperkalaemia
D. Hypokalaemia
E. Hypoglycaemia

1.34 A 72-year-old woman attends the Emergency Department with sudden onset chest pain which radiates to the shoulder for 1 hour. Her pulse rate is 105 bpm and BP is 175/105 mmHg (right arm) and 150/85 mmHg (left arm). Heart sounds are muffled, and a diastolic murmur is present. An ECG shows sinus tachycardia. A chest X-ray shows a widened mediastinum.

Which is the most likely diagnosis?

A. Pulmonary embolism
B. Acute aortic dissection
C. Tension pneumothorax
D. Acute inferior ST-elevation myocardial infarction
E. Acute mediastinitis

1.35 A 17-year-old girl is reviewed by her GP with her parents. Her parents are concerned that she has grown little over her teen years and only recently started to develop pubic hair. She has a broad chest with widely spaced nipples. She has amenorrhoea and bilateral hearing loss. On examination, she has radiofemoral delay. Her BP is 142/88 mmHg (upper limb) and 126/64 mmHg (lower limb).

Which is the most likely diagnosis?

A. Ventricular septal defect
B. Ebstein anomaly
C. Hypoplastic left heart syndrome
D. Dilated cardiomyopathy
E. Coarctation of the aorta

1.36 A 20-year-old man has palpitations for 6 months which are worsening. He has no chest pain or dyspnoea. He has no past medical history and takes no medication. He has no significant family history. He is at university and is a keen swimmer. On examination, there is a soft, systolic ejection murmur over the left sternal edge with a wide, fixed splitting of S2. An ECG shows incomplete right bundle branch block, tall P waves, and R wave notching in leads II, III, and aVF.

Which is the most likely diagnosis?

A. Normal physiology for age
B. Cyanotic congenital heart disease
C. Ventricular septal defect
D. Atrial septal defect
E. Hypertrophic cardiomyopathy

1.37 A 64-year-old woman has been monitoring her BP at home. Her most recent reading is 196/120 mmHg. She has no visual changes and no headache. She has an emergency appointment with her GP and her clinic BP is 190/122 mmHg. Urine dipstick testing shows a trace of protein. Fundoscopy reveals bleeding in the superficial retinal layer, but no optic disc swelling.

Which is the most appropriate next step in management?

A. Urgent referral to optician
B. Same-day admission to the medical assessment unit
C. Urgent referral to cardiology
D. Commence 80 mg furosemide and review in 2 days
E. Same-day urea and electrolytes

1.38 A 44-year-old man has dyspnoea, intermittent palpitations, and dizziness for 2 hours. He attends the Emergency Department. He is normally fit and well and takes no medication. His pulse rate is 155 bpm and BP is 118/68 mmHg. An ECG shows atrioventricular nodal re-entry tachycardia. He has reduced LVEF of 35%. Vagal manoeuvres, adenosine, and verapamil fail to restore sinus rhythm. He is commenced on amiodarone which helps restore and maintain sinus rhythm.

Which is the most appropriate investigation to monitor regularly?

A. Thyroid function tests
B. Full blood count
C. Echocardiography
D. Visual fields
E. Chest X-ray

1.39 A 19-year-old woman has sudden onset syncope. She is currently being treated for a lower respiratory tract infection. She is normally fit and well. She has no family history of unexplained sudden death at younger ages or syncope attacks. Her pulse rate is 92 bpm and BP is 108/72 mmHg. An ECG shows sinus rhythm with a normal axis, QRS duration of 60 ms, and QTc interval of 600 ms.

Which antibiotic is she most likely taking?

A. Amoxicillin
B. Clarithromycin
C. Doxycycline
D. Co-amoxiclav
E. Co-trimoxazole

1.40 A 62-year-old man has intermittent central chest pain for 24 hours. In the Emergency Department, an ECG shows sinus rhythm with a rate of 86 bpm, normal axis, normal QRS complexes, ST-segment depression in lead V_4, and T wave inversion in leads V_L and V_2-V_4. Troponin T is 64 ng/L.

Which is the most likely location of the myocardial infarction?

A. Posterior
B. Lateral
C. Septal
D. Anterior
E. Inferior

1.41 A 50-year-old woman requests blood tests for a routine health check. Her cholesterol and triglycerides are 6.4 and 2.3 mmol/L, respectively. Her estimated cardiovascular risk using the QRISK3 assessment tool is 11.4%. She is a non-smoker and consumes 12 units of alcohol per week. Her BMI is 26 kg/m^2.

Which is the most appropriate management?

A. Replace saturated fats with polyunsaturated fats
B. Increase monounsaturated fats
C. Reduce alcohol consumption
D. Recommend omega-3 supplements
E. Offer statin therapy

1.42 A 59-year-old Afro-Caribbean man is diagnosed with essential hypertension following an assessment of his BP in clinic and average home BP readings. His current BP is 148/92 mmHg. Following a discussion on lifestyle advice, he would like to start drug treatment. He has well-controlled type 2 diabetes mellitus.

Which is the most appropriate antihypertensive drug treatment to commence?

A. Amlodipine
B. Ramipril
C. Candesartan
D. Indapamide
E. Bisoprolol

1.43 A 40-year-old woman has central chest pain which is worse on exertion and lasts for about 1 hour. She has had this chest pain for several years, but it has always been of short duration. She has no past medical history. She has a strong family history of heart disease. She is a smoker and does not drink alcohol. Physical examination is unremarkable. Her pulse rate is 95 bpm and BP is 148/92 mmHg. Her BMI is 36 kg/m^2. An ECG shows ST-segment depression in the lateral leads which resolved following sublingual glyceryl trinitrate. Subsequently, coronary angiography showed normal coronary arteries.

Which is the most likely diagnosis?

A. Stable angina
B. Unstable angina
C. Microvascular angina
D. Prinzmetal angina
E. Decubitus angina

1.44 A 45-year-old man has progressively worsening dyspnoea for the past year. He has no past medical history and takes no medication. On auscultation, his chest is globally clear, and there is a third heart sound present with no murmurs. A chest X-ray shows cardiomegaly with pulmonary venous hypertension. An ECG shows sinus rhythm with non-specific ST-segment changes. An echocardiogram was requested which showed severe left-ventricular systolic dysfunction with a left ventricular ejection fraction of 25%.

Which is the most likely diagnosis?

A. Dilated cardiomyopathy
B. Hypertrophic cardiomyopathy
C. Restrictive cardiomyopathy
D. Takotsubo cardiomyopathy
E. Arrhythmogenic cardiomyopathy

1.45 A 65-year-old woman has transient loss of consciousness whilst standing at the bus stop. She collapses, and bystanders notice that she started to twitch for around 30 seconds. Her face appeared very grey at the time, but soon after, she regained consciousness, and her face became flushed. She has essential hypertension and takes lisinopril. An ECG shows sinus rhythm. An echocardiogram reveals a globally hypokinetic left ventricle with a reduced left ventricular ejection fraction of 38%. On telemetry, an episode of paroxysmal atrioventricular block with a ventricular asystole of 25 seconds was documented during an attack.

Which is the most appropriate next step in management?

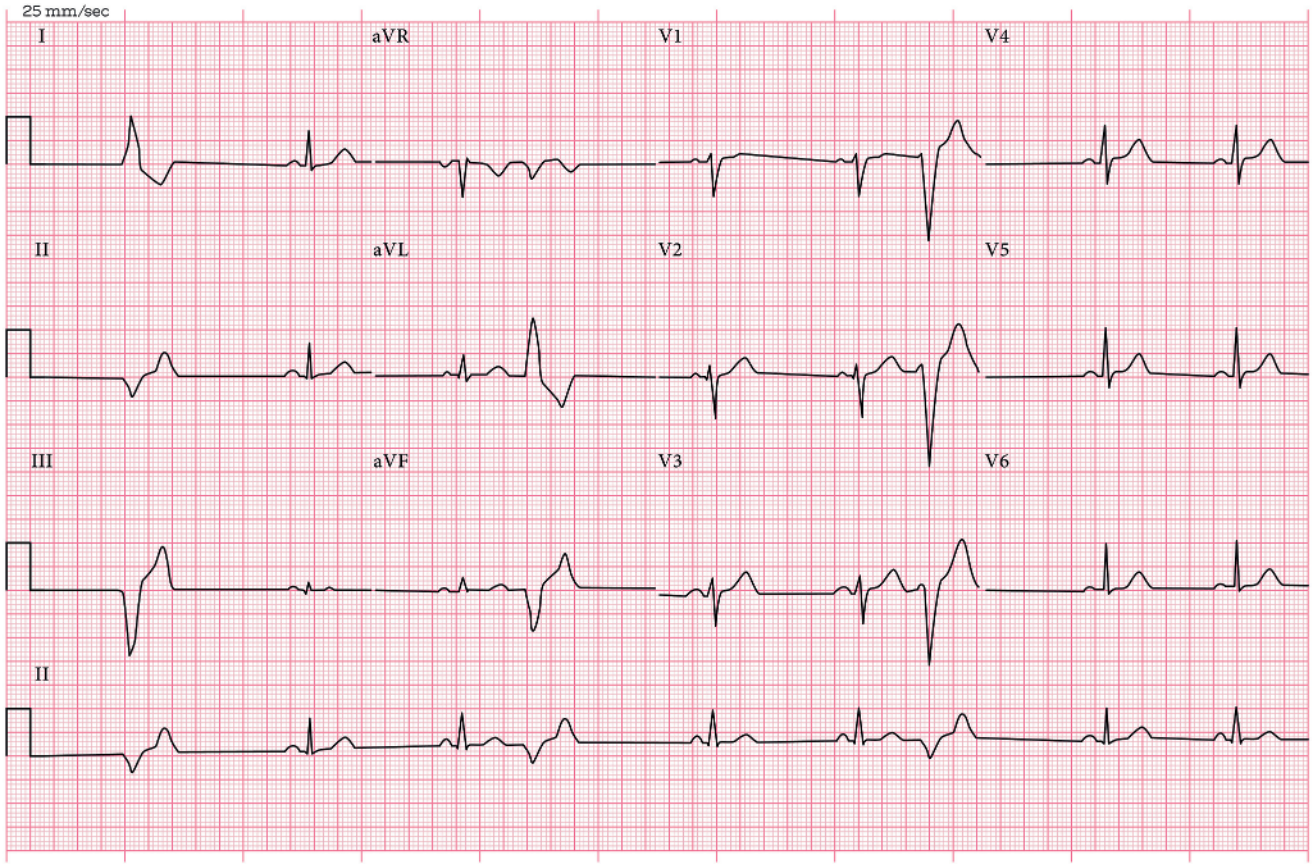
A. Interictal electroencephalogram
B. Radiofrequency ablation
C. Cardioversion
D. Cardiac resynchronisation therapy with defibrillator
E. Coronary angioplasty

1.46 A 38-year-old woman is 8 weeks pregnant. She has essential hypertension and takes ramipril. Her BP is 130/80 mmHg. A urine dipstick test shows no protein. She is referred for consultant-led care at booking for specialist input.

Which is the most appropriate management?

A. Stop ramipril and commence low-dose aspirin
B. Stop ramipril and change to losartan
C. Stop ramipril and change to methyldopa
D. Stop ramipril and change to labetalol
E. Continue ramipril until reviewed in the consultant-led clinic

1.47 A 52-year-old man feels as if his heart is 'skipping beats'. He describes a strange sensation in the centre of his chest which feels like somersaults. They are worse at rest and disappear with exercise. He has no dyspnoea, syncope, diaphoresis, or chest pain. Physical examination is unremarkable. An ECG was performed (see image).



Source: alfa md / Adobe Stock Photos.

What is shown in this ECG trace?

A. Sinus arrhythmia
B. Left bundle branch block
C. Ventricular extrasystoles
D. Right atrial hypertrophy
E. Left ventricular hypertrophy

1.48 A 49-year-old woman is commenced on ramipril for essential hypertension. She develops a cough 1 year later. It is now impacting on her sleep. She has no dyspnoea, weight loss, night sweats, or haemoptysis. Blood tests and a chest X-ray are normal.

Which is the most appropriate next step in management?

A. Consider switching to an alternative angiotensin-converting enzyme inhibitor
B. Consider switching to an angiotensin-II receptor blocker
C. Consider switching to a calcium channel blocker
D. Continue ramipril and offer zopiclone at night
E. Continue ramipril and offer codeine linctus when required

1.49 A 64-year-old man is commenced on ticagrelor for the secondary prevention of atherothrombotic events after a myocardial infarction.

Which is the principal mechanism of action of ticagrelor?

A. $P2Y_{12}$ receptor antagonist that prevents ADP-mediated $P2Y_{12}$ dependent platelet activation
B. Irreversibly inhibits cyclo-oxygenase and blocks thromboxane production
C. Inhibits phosphodiesterase III leading to increased cAMP in platelets
D. Blocks fibrinogen binding to glycoprotein IIb/IIIa receptors on platelets
E. Binds to antithrombin and blocks conversion of fibrinogen to fibrin

1.50 A 65-year-old woman has sudden-onset chest pain which started 2 hours ago. She describes it as central, crushing in nature, and radiating to the left arm. She has dyspnoea and diaphoresis. She has essential hypertension and dyslipidaemia. Her pulse rate is 105 bpm, BP is 164/92 mmHg, respiratory rate is 25 breaths per minute, and oxygen saturation is 94% on room air. An ECG shows ST elevation in leads II, III, and aVF.

Which is the most likely artery to be occluded in this patient?

A. Left anterior descending artery
B. Left circumflex artery
C. Right coronary artery
D. Left main coronary artery
E. Posterior descending artery

ANSWERS

1.1 *D – Mitral stenosis*

The most likely cause of this man's murmur is mitral stenosis, given his symptoms of orthopnoea, palpitations, and haemoptysis, along with a loud first heart sound and a low-pitched, mid-diastolic rumbling murmur at the apex. These are classic findings of mitral stenosis due to restricted mitral valve opening and raised left atrial pressure.

Other options are less likely:

- **Aortic regurgitation** causes an early diastolic murmur, best heard at the left sternal edge in expiration.
- **Aortic stenosis** presents with an ejection systolic murmur radiating to the carotids.
- **Mitral regurgitation** causes a pansystolic murmur radiating to the axilla.
- **Tricuspid regurgitation** is also pansystolic but louder on inspiration and best heard at the lower left sternal edge.

1.2 *E – Tricuspid regurgitation*

The most likely cause of this woman's murmur is tricuspid regurgitation. She presents with signs of right sided heart failure including jugular venous distension with prominent V waves, painful (pulsatile) hepatosplenomegaly, and peripheral oedema, along with a high pitched pansystolic murmur heard best at the fourth intercostal space along the left sternal border. The murmur increases in intensity with inspiration and decreases on standing, which is characteristic of tricuspid regurgitation due to increased venous return during inspiration.

1.3 *D – Carotid sinus massage*

The most appropriate next step is carotid sinus massage. This 34-year-old woman presents with a narrow complex tachycardia (QRS 90 ms), absent P waves, and a very high pulse rate (182 bpm), which is highly suggestive of paroxysmal supraventricular tachycardia (SVT). She is haemodynamically stable, and according to current guidance, vagal manoeuvres are first line.

Other options are less appropriate:

- **Metoprolol** is a beta-blocker that can be used for rate control in certain arrhythmias, but not first line in acute SVT and may worsen bronchospasm in asthmatic patients.
- **Diltiazem** is a rate-limiting calcium channel blocker sometimes used in atrial fibrillation; not first line for acute SVT and can depress myocardial contractility.
- **Verapamil** can treat SVT but is contraindicated in asthma and in some cases of accessory pathway conduction; also not preferred as a first-line agent.
- **Adenosine** slows cardiac conduction, primarily through the AV node, helping to reset sinus rhythm, but it is second-line and best avoided in patients with asthma.

1.4 *D – Wolff–Parkinson–White syndrome*

The most likely diagnosis is Wolff–Parkinson–White (WPW) syndrome. This 17-year-old man's ECG shows classic features of WPW: a short PR interval (<120 ms), slurred delta wave (early ventricular depolarisation), and a broad QRS complex (>120 ms). WPW is caused by an accessory pathway (Bundle of Kent) allowing pre-excitation of the ventricles. It often presents with palpitations and may be mistaken for anxiety in young people.

Other options are less likely:

- **Hypertrophic cardiomyopathy** can cause palpitations or syncope but does not produce delta waves or a short PR interval on ECG.
- **Ebstein's anomaly** is a congenital abnormality affecting the tricuspid valve, which is apically displaced. It can be associated with WPW, but alone it does not explain the ECG findings unless WPW is also present.
- **Long QT syndrome** involves a prolonged QT interval, not a short PR or delta wave.
- **Atrioventricular nodal re-entry tachycardia (AVNRT)** is a common cause of SVT but does not show delta waves or a short PR interval on resting ECG.

1.5 *B – Mobitz type 1 AV block*

The ECG shows a characteristic pattern of progressive prolongation of the PR interval followed by a non-conducted (dropped) QRS complex, after which the cycle repeats. This is diagnostic of Mobitz type 1 atrioventricular (AV) block, also known as Wenckebach phenomenon. It typically arises from a conduction delay within the AV node and is often benign, sometimes related to increased vagal tone or certain medications. The patient's symptoms of a persistent sensation of near-fainting without actual syncope are consistent with intermittent AV nodal delay. The absence of more concerning features such as chest pain, dyspnoea, syncope, or evidence of haemodynamic compromise further supports this diagnosis.

Other options are less likely:

- **First-degree AV block**
  - PR interval is prolonged but remains constant throughout the ECG.
  - No QRS complexes are dropped, which is inconsistent with the pattern seen here.
- **Mobitz type 2 AV block**
  - Characterised by sudden dropped beats without prior PR prolongation.
  - Indicates a more serious conduction abnormality, typically below the AV node.
  - The progressive PR prolongation in this ECG rules this out.
- **Complete AV block**
  - There is no association between P waves and QRS complexes (AV dissociation).
  - The ECG here shows grouped beating with a predictable relationship between P waves and QRS complexes.
- **Tachybrady syndrome**
  - Involves alternating periods of bradycardia and tachyarrhythmia due to sinus node dysfunction.
  - This ECG shows a regularly irregular rhythm due to AV nodal block, not variable sinus node activity.

1.6 *C – Primary percutaneous coronary intervention*

The clinical presentation is consistent with an acute coronary syndrome, and the ECG shows ST-segment elevation in the inferior leads (II, III, and aVF), confirming an ST-elevation myocardial infarction (STEMI). The most appropriate definitive management for a STEMI within 12 hours of symptom onset is urgent reperfusion therapy, with primary percutaneous coronary intervention (PCI) as the preferred strategy. This patient presented within 2 hours and is already in hospital, making PCI the most appropriate and time-critical intervention to restore coronary perfusion and minimise myocardial damage.

Other options are less appropriate:

- **Aspirin** is essential and should be given early in suspected myocardial infarction, but it does not address the underlying coronary occlusion.
- **Ticagrelor** is used as part of dual antiplatelet therapy alongside aspirin, but it supports rather than replaces reperfusion.
- **Clopidogrel** is an alternative to ticagrelor if contraindicated, but it is not the initial definitive step in STEMI management.
- **Tirofiban** is a glycoprotein IIb/IIIa inhibitor used selectively during PCI in high-risk patients, not an initial or routine treatment.

1.7 *E – Atrial flutter*

The ECG shows a regular rhythm with a sawtooth pattern of flutter waves, best seen in the inferior leads, and absent distinct P waves, which is characteristic of atrial flutter. The ventricular rate appears regular and may suggest a fixed conduction ratio (e.g. 2:1), which is common in atrial flutter. The patient's symptoms of palpitations, breathlessness, fatigue, and light-headedness are consistent with a sustained atrial tachyarrhythmia.

Other options are less likely:

- **Supraventricular tachycardia** is usually paroxysmal, with a sudden onset and offset, and the ECG typically shows a narrow complex tachycardia without visible flutter waves.
- **Wide complex tachycardia** refers to a tachycardia with a QRS duration >120 ms, which is not seen here, as the QRS complexes are narrow.
- **Left bundle branch block** would present with a widened QRS and specific morphological changes, not with flutter waves.
- **Sinus arrhythmia with premature ventricular ectopics** would show an irregular rhythm and intermittent broad complexes due to ectopics, not the regular sawtooth pattern seen in this ECG.

1.8 *A – DC shock 200 J biphasic*

The ECG shows a chaotic, irregular, and rapid waveform without identifiable QRS complexes, characteristic of ventricular fibrillation (VF). VF is a shockable rhythm in cardiac arrest, requiring immediate defibrillation at 200 J biphasic to restore a perfusing rhythm. The patient is pulseless and apnoeic, consistent with cardiac arrest due to VF.

Other options are less appropriate:

- **IV amiodarone (300 mg bolus)** is used in shockable rhythms but given after the third shock once compressions have been resumed.

- **IV adrenaline** administration is indicated after the first one or two unsuccessful defibrillation attempts if VF persists but is less likely as the immediate first step compared to defibrillation.
- **IV atropine** is used for bradycardia or asystole and is less likely in VF, where it has no role in management.
- **Continue CPR 30:2**, then continue chest compressions for 2 minutes; although high-quality CPR is essential, continuing CPR alone without immediate defibrillation is less likely to be effective in terminating VF.

1.9 *C – Adrenaline 1 mg IV*

The ECG shows a widened QRS complex without a palpable pulse, consistent with pulseless electrical activity (PEA). PEA is a non-shockable cardiac arrest rhythm characterised by organised electrical activity but absent mechanical heart function, resulting in no effective circulation. The most appropriate immediate management is to continue high-quality CPR and administer intravenous adrenaline 1 mg as soon as possible to support cardiac output and improve chances of return of spontaneous circulation.

Other options are less appropriate:

- **DC shock 200 J:** Defibrillation is not indicated in PEA since it is a non-shockable rhythm and will not restore circulation.
- **Amiodarone 300 mg IV:** Antiarrhythmic drugs are reserved for shockable rhythms such as ventricular fibrillation or pulseless ventricular tachycardia, making this less likely.
- **0.9% sodium chloride fluid bolus IV:** While fluids may be important if hypovolaemia is suspected, the immediate priority during cardiac arrest is CPR and adrenaline; fluids alone will not reverse PEA.
- **Lidocaine 100 mg IV:** Like amiodarone, lidocaine is used only for shockable rhythms and is not appropriate in PEA.

1.10 *E – Acute pericarditis*

The clinical presentation of central chest pain that worsens with movement and is relieved by sitting forward, along with a recent upper respiratory tract infection, is typical of acute pericarditis. The ECG shows diffuse concave-upwards ST-segment elevation and PR-segment depression, which are classic features of pericarditis. The mildly elevated troponin T may reflect some epicardial inflammation but is consistent with pericarditis rather than myocardial infarction. The patient's pulse and blood pressure are normal, supporting a stable clinical picture.

Other diagnoses are less likely:

- **Tietze syndrome** causes chest wall pain due to costochondral inflammation but does not produce ECG changes or systemic symptoms such as fever.
- **Boerhaave syndrome** is an oesophageal rupture that causes severe chest pain and systemic illness, usually after vomiting, and would not present with typical ECG changes.
- **Sick sinus syndrome** is a cardiac conduction disorder that causes arrhythmias but is not associated with chest pain, fever, or ST elevation on the ECG.
- **Acute myocarditis** can present similarly but usually causes higher troponin levels and often shows regional abnormalities on imaging. Its ECG changes

tend to be less dramatic, with sinus tachycardia and non-specific ST and T wave changes commonly seen. Myocardial inflammation can also cause arrhythmia.

1.11 *D – Furosemide*

The patient's symptoms of constipation, fatigue, muscle weakness, and tingling in the fingers, combined with ECG findings of low amplitude T waves and prominent U waves, are classic signs of hypokalaemia. Hypokalaemia is a well-known side effect of loop diuretics such as furosemide, which increase renal potassium excretion. Therefore, furosemide is the most likely medication causing these findings.

Other medications are less likely:

- **Amiloride** is a potassium-sparing diuretic and typically causes hyperkalaemia rather than hypokalaemia.
- **Ramipril** is an ACE inhibitor that can cause hyperkalaemia by reducing aldosterone-mediated potassium excretion.
- **Digoxin** toxicity can cause various arrhythmias but is not typically associated with prominent U waves or hypokalaemia-induced ECG changes.
- **Spironolactone** is another potassium-sparing diuretic and would more commonly cause hyperkalaemia rather than hypokalaemia.

1.12 *B – Calcium gluconate*

The most appropriate next step in management is calcium gluconate. This 36-year-old woman presents with features highly suggestive of primary adrenal insufficiency (Addison's disease), including fatigue, weight loss, abdominal pain, arthralgia, hyperpigmented skin, and low blood pressure. Addison's disease often leads to hyperkalaemia due to aldosterone deficiency. The ECG changes are consistent with hyperkalaemia (e.g. peaked T waves, widened QRS). Calcium gluconate stabilises the cardiac membrane and is the first priority in emergency treatment of hyperkalaemia to prevent ventricular arrhythmias, making it the most appropriate immediate management step.

Other options are less appropriate:

- **DC cardioversion** is used in haemodynamically unstable tachyarrhythmias, not in metabolic disturbances like hyperkalaemia unless there's cardiac arrest.
- **Adenosine** is effective for paroxysmal supraventricular tachycardia (PSVT), but has no role in treating conduction abnormalities from electrolyte imbalance.
- **Metoprolol**, a beta-blocker, may worsen hypotension and bradycardia, and is not suitable for electrolyte-related ECG changes.
- **Amiodarone** is used for rhythm control in arrhythmias such as atrial fibrillation or VT but does not address the underlying hyperkalaemia causing ECG abnormalities.

1.13 *B – Right bundle branch block*

The ECG shows widened QRS complexes, an RSR′ pattern in lead V1, and a widened, slurred S wave in lead V6. These findings are characteristic of a right bundle branch block (RBBB), where conduction is delayed in the right bundle, causing the typical RSR′ pattern in V1 and broad S waves in lateral leads such as V6.

Other conduction defects are less likely:

- **Long-QT syndrome** presents with a prolonged QT interval on the ECG rather than widened QRS complexes or an RSR′ pattern.

- **Left bundle branch block (LBBB)** causes broad, notched, or slurred R waves in lateral leads and deep S waves in right precordial leads, which is different from the RSR′ pattern seen here.
- **Bifascicular block** involves a combination of RBBB plus either left anterior or posterior fascicular block (with left or right axis deviation); there is no evidence here of additional fascicular block.
- **Sick sinus syndrome** affects the sinus node causing bradycardia or pauses and is not associated with QRS widening or bundle branch block patterns on ECG.

1.14 *C – Aortic regurgitation*

The patient's tall stature, long arm span, joint laxity, and chest deformity are suggestive of a connective tissue disorder such as Marfan syndrome. The family history of recurrent lung collapse also supports this. The mid-diastolic, low-pitched rumbling murmur heard best at the apex when leaning forward and exhaling is characteristic of an Austin Flint murmur, which results from severe aortic regurgitation causing turbulent flow across the mitral valve. This functional mitral stenosis-like murmur is caused by the regurgitant jet impinging on the anterior mitral leaflet.

Other valvulopathies are less likely:

- **Mitral regurgitation** typically causes a pansystolic, blowing murmur heard best at the apex and radiating to the axilla rather than a mid-diastolic rumble.
- **Mitral stenosis** produces a mid-diastolic murmur but is less commonly associated with Marfan syndrome and does not usually occur with the described connective tissue features and family history.
- **Aortic stenosis** causes a crescendo-decrescendo systolic murmur heard best at the right upper sternal border and radiates to the carotids.
- **Tricuspid regurgitation** produces a pansystolic murmur best heard at the lower left sternal border, often increasing with inspiration, and would not cause a mid-diastolic rumble at the apex.

1.15 *A – Dressler's syndrome*

The patient presents 1 week after a myocardial infarction with worsening pleuritic chest pain, fever, dyspnoea, malaise, and a pericardial friction rub. These features are classic for Dressler's syndrome, which is a post-myocardial infarction pericarditis caused by an autoimmune reaction leading to inflammation of the pericardium. The presence of a friction rub and absence of raised JVP make pericarditis more likely than tamponade.

Other diagnoses are less likely:

- **Endocarditis** usually presents with fever and signs of infection but would typically have murmurs related to valve involvement rather than a pericardial friction rub.
- **Pulmonary embolism** can cause pleuritic chest pain and dyspnoea but is less likely to cause a pericardial rub or pulsus paradoxus and usually presents with raised JVP in severe cases.
- **Cardiac tamponade** causes pulsus paradoxus and hypotension but is characterised by raised JVP and muffled heart sounds, which are not present here.
- **Acute left ventricular failure** usually causes pulmonary oedema and raised JVP but does not cause a pericardial friction rub or pulsus paradoxus.

1.16 *D – 6*

The patient has atrial fibrillation as evidenced by an irregularly irregular pulse and absence of P waves on ECG. Her CHA_2DS_2-VASc score estimates her stroke risk and guides anticoagulation decisions. The components relevant to her are: age ≥75 years (2 points), history of ischaemic heart disease (counts as vascular disease, 1 point), diabetes mellitus (1 point), hypertensive (owing to medication, 1 point), and female sex (1 point). She does not have documented heart failure or prior stroke/TIA.

Adding these up gives a total CHA_2DS_2-VASc score of 6.

1.17 *D – Constrictive pericarditis*

The most likely diagnosis is constrictive pericarditis. This patient presents with classic signs of right heart failure including progressive exertional dyspnoea, elevated JVP, and a positive Kussmaul's sign (a paradoxical rise in JVP on inspiration). The right atrial pressure tracing shows prominent *x* and *y* descents, a hallmark of constrictive pericarditis due to the rapid early diastolic filling followed by abrupt cessation as the rigid pericardium limits expansion. His past history of orthotopic heart transplant raises suspicion for post-surgical pericardial changes leading to constriction, which can develop decades later.

Other options are less likely:

- **Left ventricular failure** typically presents with pulmonary congestion symptoms (e.g. orthopnoea, basal crackles), not a raised JVP with Kussmaul's sign or prominent *y* descent.
- **Cardiac tamponade** shows a blunted *y* descent due to impaired ventricular filling, not the prominent *y* seen here. The JVP may be raised, but Kussmaul's sign is typically absent.
- **Mitral stenosis** causes pulmonary hypertension and features like a diastolic murmur and malar flush, not prominent *y* descent or Kussmaul's sign.
- **Ventricular septal defect** may cause heart failure symptoms but would be unlikely to cause the pressure waveform pattern or signs described, especially in the context of a transplant recipient.

1.18 *C – Atenolol*

This patient presents with dizziness, lightheadedness, palpitations, and exertional dyspnoea, which are symptoms suggestive of intermittent bradyarrhythmia. The ECG strip shows sinus bradycardia with a sinus pause, consistent with sick sinus syndrome. The pulse rate is 48 bpm. Atenolol, a beta-blocker, suppresses sinoatrial node activity and can exacerbate this condition. In a patient already experiencing symptoms and pauses, discontinuing the beta-blocker is the most appropriate first step in management to prevent progression to more severe bradyarrhythmia or syncope.

Other options are less likely:

- **Losartan** is an angiotensin receptor blocker and does not impact sinoatrial node function or cause bradycardia.
- **Nicardipine** is a dihydropyridine calcium channel blocker that primarily causes vasodilation and does not significantly suppress heart rate.
- **Bendroflumethiazide** is a thiazide diuretic which may cause electrolyte disturbances but does not directly affect cardiac conduction.
- **Glyceryl trinitrate** is a nitrate used for angina relief and does not cause bradyarrhythmia or sinoatrial dysfunction.

1.19 *D – Inferoposterolateral ST-elevation myocardial infarction*

The ECG shows ST elevation in leads II, III, aVF (inferior leads), and V5 and V6 (lateral leads), with reciprocal ST depression in V1–3 accompanied by tall, broad R waves. This pattern is characteristic of an inferoposterolateral ST-elevation myocardial infarction, indicating infarction involving the inferior, posterior, and lateral walls of the heart.

Other diagnoses are less likely.

- An **anterior ST-elevation myocardial infarction** would show ST elevation in leads V1 to V4 without the reciprocal changes seen here.
- An **inferior ST-elevation myocardial infarction** alone would not typically have the lateral lead involvement (V5–V6) or significant posterior changes.
- An **anterolateral non-ST elevation myocardial infarction** would lack ST elevation but show ST depression or T wave inversion in those regions.
- A **posterior ST-elevation myocardial infarction** is not directly seen on standard ECG leads; instead, it presents with posterior reciprocal changes like ST depression and tall R waves in V1–V3 without ST elevation in inferior or lateral leads.

1.20 *E – Ramipril*

The patient has heart failure with reduced ejection fraction (HFrEF) following a myocardial infarction. Among the options listed, Ramipril, an ACE inhibitor, has been shown to provide a sustained survival benefit in patients with HFrEF by reducing mortality and hospitalisation through afterload reduction, inhibition of maladaptive remodelling, and neurohormonal modulation (CONSENSUS and SOLVD trials). Early post-MI mortality trials such as BHAT (propranolol) and ISIS-1 (atenolol) did show benefit, but these were in the pre-ACE inhibitor era and often before widespread reperfusion therapy.

Other options are less likely to provide this benefit.

- **Metformin** is primarily an antidiabetic medication and does not improve survival in heart failure.
- **Atenolol** is a beta-blocker but is not proven to reduce mortality in heart failure; beta-blockers with proven benefit include bisoprolol, carvedilol, and metoprolol succinate.
- **Propranolol** is a non-selective beta-blocker and is not indicated for heart failure due to lack of mortality benefit and potential adverse effects.
- **Amlodipine** is a calcium channel blocker and may improve symptoms but has not been shown to reduce mortality in heart failure patients.

1.21 *C – 3*

The patient has an ORBIT score of 3, which corresponds to an intermediate risk of major bleeding. This score is calculated based on several key clinical features:

- He is 76 years old, which gives 1 point for age ≥75 years.
- His haemoglobin is 118 g/L, which qualifies as anaemia in males (Hb <130 g/L), contributing 2 points.
- He has no prior history of bleeding, is not on antiplatelet therapy, and his eGFR is 75 mL/min/1.73 m_2, all of which score 0 points.

1.22 *D – Continue warfarin*

The most appropriate management is to continue warfarin. This patient has a mechanical aortic valve, as suggested by the history of valve replacement for aortic stenosis and the audible S2 click on auscultation. Mechanical valves require lifelong anticoagulation with warfarin to prevent thromboembolism. The target INR for most mechanical aortic valves is typically between 2.5 and 3.5, depending on the type of valve and patient-specific risk factors. As her current INR is 3.0, this lies within the therapeutic range and no adjustment to therapy is needed.

Other options are less appropriate:

- **Changing to apixaban** is not appropriate as direct oral anticoagulants (DOACs) are contraindicated in patients with mechanical heart valves. Clinical trials have shown higher rates of thromboembolic and bleeding complications in this population when DOACs are used instead of warfarin.
- **Changing to aspirin** is insufficient for thromboprophylaxis in patients with mechanical valves, as antiplatelet monotherapy does not offer adequate protection against valve thrombosis.
- **Changing to clopidogrel** is also inadequate as clopidogrel, like aspirin, is an antiplatelet agent and not an anticoagulant.
- **Stopping warfarin** would place the patient at high risk of potentially life-threatening thromboembolic complications such as valve thrombosis or stroke.

1.23 *B – Nifedipine*

The most appropriate first-line treatment is nifedipine. This patient has stage 1 hypertension (clinic BP ≥140/90 mmHg or home BP ≥135/85 mmHg) that has persisted despite lifestyle modifications. According to UK NICE guidelines (NG136), first-line pharmacological treatment for hypertension depends on age and ethnicity. For patients aged over 55 or of Black African or African-Caribbean family origin (of any age), a calcium channel blocker (such as nifedipine) is recommended first line. This man is 59 years old and does not have diabetes or chronic kidney disease, so nifedipine is appropriate.

Other options are less appropriate:

- **Losartan**, an angiotensin receptor blocker, is preferred in patients under 55 years old or those with type 2 diabetes or CKD.
- **Enalapril**, an ACE inhibitor, also falls into this category and is not first line in this age group without compelling comorbidities.
- **Bisoprolol** is not first line for hypertension in the absence of other indications such as angina or heart failure.
- **Indapamide**, a thiazide-like diuretic, is generally considered second-line in combination with a calcium channel blocker or ACE inhibitor/ARB if monotherapy is insufficient.

1.24 *E – Furosemide*

The most appropriate next step in management is furosemide. This patient presents with acute decompensated heart failure, evidenced by resting dyspnoea, widespread pulmonary crackles, and significant peripheral oedema. Although long-term management of heart failure with reduced ejection fraction (HFrEF) includes ACE inhibitors and beta-blockers, in the acute setting, symptom relief and stabilisation take priority. Loop diuretics such as furosemide are first line for relieving fluid overload and improving respiratory symptoms.

Other options are less appropriate:

- **Lisinopril**, an ACE inhibitor, improves long-term outcomes in HFrEF but should be introduced once the patient is haemodynamically stable with improved congestion and symptoms are relieved.
- **Irbesartan**, an angiotensin receptor blocker, has similar long-term benefits as ACE inhibitors but is not the priority in acute symptomatic overload.
- **Carvedilol**, a beta-blocker, improves survival in chronic HFrEF but must be started at low doses in stable patients; initiating it during decompensation can worsen symptoms.
- **Felodipine**, a dihydropyridine calcium channel blocker, is not indicated for heart failure management and may cause reflex tachycardia and fluid retention.

1.25 *A – Bisoprolol*

The most appropriate first-line treatment is bisoprolol. This patient has typical angina, characterised by exertional chest pain that is relieved by rest and sublingual GTN. First-line pharmacological therapy for stable angina in the UK includes either a beta-blocker or a calcium channel blocker, with beta-blockers like bisoprolol preferred unless contraindicated. They reduce myocardial oxygen demand by lowering heart rate and contractility, thereby reducing the frequency and severity of anginal attacks.

Other options are less appropriate:

- **Verapamil**, a rate-limiting calcium channel blocker, is effective in stable angina but should not be combined with beta-blockers due to the risk of bradycardia and heart block. It may be considered as an alternative if beta-blockers are contraindicated.
- **Isosorbide mononitrate**, a long-acting nitrate, can be used for angina symptom relief but is generally reserved for patients who remain symptomatic despite first-line therapy.
- **Nicorandil** is a potassium channel activator with nitrate-like properties and may be used as add-on therapy if symptoms are not controlled with beta-blockers or calcium channel blockers alone.
- **Ivabradine** selectively lowers heart rate and is considered in patients with stable angina who are in sinus rhythm and cannot tolerate beta-blockers or calcium channel blockers or remain symptomatic despite them. However, it is not first line.

1.26 *D – Orthostatic hypotension*

The most likely diagnosis is orthostatic hypotension. This patient reports dizziness and light-headedness that occur when rising from bed and after warm showers – both common triggers of orthostatic symptoms. Her blood pressure drops from 118/72 to 106/61 mmHg on standing. While her heart rate increases only slightly (from 72 to 76 bpm), the drop in systolic BP by ≥20 mmHg or diastolic BP by ≥10 mmHg is consistent with the definition of orthostatic hypotension. This condition is more likely in patients taking medications such as pregabalin, which can cause vasodilation and autonomic dysfunction.

Other options are less likely:

- **Vasovagal syncope** usually presents with a prodrome (e.g. nausea, pallor, sweating) followed by transient loss of consciousness, typically triggered by prolonged standing or emotional stress. This patient has no such features or syncope.

- **Postural orthostatic tachycardia syndrome (POTS)** involves a sustained increase in heart rate ≥30 bpm (≥40 bpm in those under 19) upon standing, without significant BP drop. The minimal rise in heart rate here argues against POTS.
- **Carotid sinus syndrome** generally affects older adults and is triggered by head turning, shaving, or tight collars. It results in bradycardia, hypotension, or both, typically causing syncope or presyncope, not suggested here.
- **Situational syncope** is triggered by specific actions (e.g. coughing, swallowing, urination) and is not consistent with this patient's symptom pattern.

1.27 *D – 24-hour Holter monitoring*

The most appropriate next investigation is 24-hour Holter monitoring. This patient experiences intermittent episodes of palpitations with a normal resting ECG and no red flag features such as syncope, chest pain, or family history of sudden cardiac death. Holter monitoring allows for continuous ECG recording over 24 hours or longer, increasing the likelihood of capturing transient arrhythmias that may be responsible for the symptoms. Since the palpitations are brief and sporadic, standard ECG or exercise testing is unlikely to detect them.

Other options are less appropriate:

- **Echocardiogram** is not indicated as there are no signs of structural heart disease and examination is unremarkable.
- **Exercise stress testing** is used to evaluate exertional symptoms or suspected ischaemia, which are not present here.
- **Tilt table testing** is appropriate for investigating syncope or postural symptoms, which this patient does not have.
- **Cardiac CT scan** assesses coronary anatomy or structural abnormalities but is not relevant in this low-risk case with no concerning features.

1.28 *B – Streptococcus viridans*

The most likely causative organism is *Streptococcus viridans*. This patient's presentation is consistent with subacute infective endocarditis, characterised by low-grade fever, fatigue, weight loss, petechiae, splinter haemorrhages, and tender nodules (Osler nodes), along with a new regurgitant murmur. The recent tooth extraction is a classic predisposing event for infective endocarditis caused by oral flora.

Other options are less likely:

- ***Pseudomonas aeruginosa*** is more commonly associated with healthcare-associated infections and intravenous drug use, not typically following dental procedures.
- ***Haemophilus influenzae*** (part of the HACEK group) can cause endocarditis but is less common and usually presents more acutely.
- ***Candida albicans*** causes fungal endocarditis, usually in immunocompromised patients or those with prosthetic valves or indwelling catheters, which is not the case here.
- ***Proteus mirabilis*** is a urinary tract pathogen and is not commonly associated with endocarditis.

1.29 *E – Downsloping ST depression with biphasic T waves*

This patient on digoxin therapy commonly shows a characteristic 'reverse tick' or 'Salvador Dali sagging' appearance on ECG. This includes downsloping ST depression, often with flattened, inverted, or biphasic T waves, and sometimes a shortened

QT interval. These changes occur even when digoxin levels are within the therapeutic range. Mild PR interval prolongation and prominent U waves may also be seen.

Other options are less likely:

- **Widened QRS with delta waves** indicates Wolff–Parkinson–White syndrome, which is unrelated to digoxin.
- **Bradyarrhythmia with J waves** is typically associated with hypothermia or hypercalcaemia, not digoxin use.
- **PR prolongation with flat T waves and U waves** can occur with digoxin, but lacks the distinctive downsloping ST changes seen here.
- **S waves in lead I, Q waves in lead III, and inverted T waves in lead III** suggest pulmonary embolism (S1Q3T3 pattern), unrelated to digoxin effect.

1.30 *A – Emergency admission via the same-day emergency care unit (SDEC)*

This patient has clinical features of decompensated heart failure and is now haemodynamically compromised with hypotension (BP 106/64 mmHg) and tachycardia (102 bpm). According to NICE guidelines, patients who are acutely unstable or at risk of deterioration should be assessed urgently, and same-day admission is appropriate.

Other options are less appropriate:

- **Discussing with the on-call cardiology team** may be helpful, but the patient requires immediate evaluation rather than just advice.
- **Starting sacubitril/valsartan (Entresto®)** is premature before stabilisation and confirmation of heart failure subtype.
- **Referral for specialist assessment and echocardiography to be seen within 6 weeks** is unsafe, as it is intended for clinically stable patients with intermediate NT-proBNP (400–2000 ng/L).
- **Referral within 2 weeks** is intended for patients with high NT-proBNP (>2000 ng/L) or urgent clinical features, but in this case the patient requires immediate admission, making same-day assessment the safer option.

1.31 *A – Right heart catheterisation*

This patient has clinical features and investigations suggestive of pulmonary hypertension, including exertional dyspnoea, haemoptysis, signs of right heart strain (P pulmonale, right bundle branch block, right axis deviation), and a holosystolic murmur possibly indicating tricuspid regurgitation. The chest X-ray findings of pruning of peripheral pulmonary vessels further support this.

The investigation most likely to confirm the diagnosis is right heart catheterisation, which is the gold standard for diagnosing pulmonary hypertension by directly measuring pulmonary artery pressures.

Other options are less likely:

- **Echocardiography** is useful as an initial non-invasive assessment to estimate pulmonary artery pressures and assess right heart function but cannot definitively confirm the diagnosis.
- **Natriuretic peptide testing** helps assess cardiac strain but is not diagnostic of pulmonary hypertension.
- **Cardiopulmonary exercise testing** assesses functional capacity and exercise limitation but does not confirm pulmonary hypertension.
- **Abdominal ultrasound** may detect liver congestion or ascites but is not diagnostic for pulmonary hypertension.

1.32 *C – Mitral valve prolapse*

This patient's clinical findings of an early-to-mid systolic click followed by a late systolic murmur heard loudest at the apex, which becomes louder on standing and softer on squatting are characteristic of mitral valve prolapse.

Other options are less likely:

- **Aortic stenosis** typically causes a harsh, crescendo-decrescendo systolic murmur heard best at the right upper sternal border and does not have a systolic click.
- **Austin Flint murmur** is a mid-diastolic murmur associated with severe aortic regurgitation and is heard at the apex, but this patient has a systolic murmur.
- **Flow murmur** is usually a soft, early systolic murmur without clicks and often heard in younger or fit individuals without structural heart disease.
- **Mitral regurgitation** produces a holosystolic murmur heard at the apex radiating to the axilla, but it is not typically preceded by a systolic click and does not vary significantly with position.

1.33 *D – Hypokalaemia*

This patient is on a combination of antihypertensives including amlodipine, ramipril, and indapamide. Indapamide is a thiazide-like diuretic, which commonly causes hypokalaemia due to increased renal potassium excretion.

Other options are less likely:

- **Hypernatraemia** is uncommon with thiazide diuretics; they usually cause mild hyponatraemia instead.
- **Hypocalcaemia** is not typically caused by indapamide; thiazide diuretics often cause mild hypercalcaemia by reducing urinary calcium excretion.
- **Hyperkalaemia** is more commonly associated with ACE inhibitors like ramipril, but indapamide usually lowers potassium.
- **Hypoglycaemia** is not a known adverse effect of indapamide.

1.34 *B – Acute aortic dissection*

This patient presents with sudden onset chest pain radiating to the shoulder, unequal blood pressures in both arms, muffled heart sounds, a diastolic murmur, and a widened mediastinum on chest X-ray. These features are highly suggestive of acute aortic dissection.

Other options are less likely:

- **Pulmonary embolism** can cause chest pain and tachycardia but typically does not cause unequal blood pressures or a widened mediastinum.
- **Tension pneumothorax** usually presents with respiratory distress, tracheal deviation, and unilateral absent breath sounds rather than muffled heart sounds or a diastolic murmur.
- **Acute inferior ST-elevation myocardial infarction** presents with chest pain and ECG changes but does not cause unequal blood pressures or a widened mediastinum.
- **Acute mediastinitis** is rare, usually occurs post-operatively or after infection, and does not cause the described vascular signs.

1.35 *E – Coarctation of the aorta*

This patient's clinical features of short stature with delayed puberty, broad chest with widely spaced nipples, amenorrhoea, bilateral hearing loss, radiofemoral delay, and higher blood pressure in the upper limbs compared to the lower limbs are suggestive of coarctation of the aorta.

Other options are less likely:

- **Ventricular septal defect** typically presents with a pansystolic murmur and heart failure symptoms but does not cause the physical features or blood pressure discrepancy seen here.
- **Ebstein anomaly** involves tricuspid valve malformation causing right heart symptoms and cyanosis, not the systemic signs described.
- **Hypoplastic left heart syndrome** presents in infancy with severe heart failure and shock, not delayed puberty or blood pressure differences.
- **Dilated cardiomyopathy** causes heart failure and arrhythmias but does not explain the physical exam findings or blood pressure discrepancy.

1.36 *D – Atrial septal defect*

This patient's presentation with palpitations, a soft systolic ejection murmur over the left sternal edge, wide fixed splitting of the second heart sound (S2), and ECG findings of incomplete right bundle branch block, tall P waves, and R wave notching in inferior leads is characteristic of atrial septal defect (ASD).

Other options are less likely:

- **Normal physiology for age** would not explain the fixed splitting of S2 or ECG abnormalities.
- **Cyanotic congenital heart disease** typically presents with cyanosis and more severe symptoms, which are absent here.
- **Ventricular septal defect** usually causes a harsh pansystolic murmur and may present earlier with heart failure symptoms.
- **Hypertrophic cardiomyopathy** presents with a harsh systolic murmur that varies with manoeuvres and often causes symptoms like syncope, which are not described here.

1.37 *B – Same-day admission to the medical assessment unit*

This patient has a severely elevated blood pressure with signs of hypertensive retinopathy (retinal haemorrhages) but no optic disc swelling. This indicates a hypertensive emergency requiring urgent inpatient management to prevent further target organ damage.

Other options are less appropriate:

- **Urgent referral to optician** is inappropriate as this is a medical emergency needing immediate treatment, not routine eye care.
- **Urgent referral to cardiology** is not the first step without acute cardiac complications.
- **Commencing 80 mg furosemide and review in 2 days** is unsafe without hospital assessment and monitoring.
- **Same-day urea and electrolytes** alone is insufficient; urgent admission and blood pressure control are needed.

1.38 *A – Thyroid function tests*

This patient is being treated with amiodarone for atrioventricular nodal re-entry tachycardia, and because amiodarone can cause both hypo- and hyperthyroidism due to its high iodine content and effects on thyroid metabolism, regular monitoring of thyroid function tests is essential to ensure patient safety.

Other options are less appropriate:

- **Full blood count** is not routinely required for amiodarone monitoring.
- **Echocardiography** is useful for structural heart disease but not for monitoring amiodarone toxicity.
- **Visual fields** testing is not a standard monitoring requirement for amiodarone.
- **Chest X-ray** may be used if pulmonary toxicity is suspected but is not a routine monitoring test.

1.39 *B – Clarithromycin*

This patient has a markedly prolonged QTc interval of 600 ms with syncope, likely due to drug-induced QT prolongation, which is a known adverse effect of certain antibiotics such as macrolides; therefore, clarithromycin is the most likely antibiotic she is taking.

Other options are less likely:

- **Amoxicillin**, **doxycycline**, **co-amoxiclav**, and **co-trimoxazole** are not commonly associated with significant QT prolongation.

1.40 *D – Anterior*

The most likely location of the myocardial infarction is the anterior wall, based on the ECG findings of T wave inversion in leads V2–V4 and aVL, and ST-segment depression in lead V4. Leads V2–V4 correspond to the anterior portion of the heart, and these changes indicate anterior ischaemia or infarction. The T wave inversion in aVL represents reciprocal changes often seen in anterior MI.

Other options are less likely:

- **Posterior** infarction typically presents with ST depression and tall R waves in leads V1–V3, which are not described here.
- **Lateral** infarction primarily affects leads V5–V6, I, and aVL, without significant involvement of V2–V4.
- **Septal** infarction involves leads V1–V2 with ST elevation, not inversion.
- **Inferior** infarction affects leads II, III, and aVF, which show no abnormalities in this case.

1.41 *E – Offer statin therapy*

According to NICE guidelines, for this 50-year-old woman with a QRISK3 score of 11.4%, offering a statin is appropriate as part of a cardiovascular risk reduction strategy alongside lifestyle advice.

Other options are less appropriate:

- **Replace saturated fats with polyunsaturated fats** is important but considered part of general lifestyle advice rather than standalone management at this risk level.
- **Increase monounsaturated fats** is less emphasised compared to overall dietary changes focusing on reducing saturated fat.

- **Reduce alcohol consumption** is not necessary here as intake is within recommended limits.
- **Recommend omega-3 supplements** are not recommended for primary prevention of cardiovascular disease.

1.42 *C – Candesartan*

According to NICE guidelines (NG136), for this 59-year-old Afro-Caribbean man with well-controlled type 2 diabetes, the most appropriate first-line antihypertensive is an angiotensin II receptor blocker (ARB), such as candesartan, as ARBs are recommended over ACE inhibitors in this population due to lower risk of adverse effects like angioedema.

Other options are less appropriate:

- **Amlodipine** is first line for Black patients *without* diabetes but is not recommended as step 1 when diabetes is present.
- **Ramipril**, an ACE inhibitor, is suitable if ARBs are not tolerated but is less preferred in Afro-Caribbean individuals due to side effect profile.
- **Indapamide** is more appropriate as an add-on therapy at step 2 or 3 rather than as initial treatment.
- **Bisoprolol** is reserved for specific conditions such as ischaemic heart disease or heart failure, not for initiating hypertension treatment.

1.43 *C – Microvascular angina*

This 40-year-old woman presents with exertional chest pain lasting about an hour, with ST-segment depression in the lateral leads that resolves following sublingual glyceryl trinitrate. Despite having multiple cardiovascular risk factors, including smoking, obesity, and a strong family history of heart disease, her coronary angiography is normal, making microvascular angina the most likely diagnosis. This condition, also known as cardiac syndrome X, is characterised by angina-like chest pain with objective evidence of myocardial ischaemia (such as transient ST depression) but with no obstructive coronary artery disease on angiography, due to dysfunction in the coronary microcirculation.

Other options are less likely:

- **Stable angina** would typically involve fixed atherosclerotic lesions visible on angiography.
- **Unstable angina** presents with worsening or unpredictable chest pain, usually at rest, and often with coronary obstruction.
- **Prinzmetal angina** often presents with *transient ST-segment elevation*, usually at rest. While in practice vasospasm can occasionally cause ST-depression or occur on exertion (e.g. cold exposure), it is relatively uncommon, and diagnosis often requires specialised invasive testing.
- **Decubitus angina** occurs when lying flat and is usually seen in advanced heart failure, which is not evident here.

1.44 *A – Dilated cardiomyopathy*

This 45-year-old man presents with progressive exertional dyspnoea over the past year, a third heart sound on auscultation, cardiomegaly and pulmonary venous hypertension on chest X-ray, and echocardiographic evidence of severe left

ventricular systolic dysfunction (LVEF 25%). These features are characteristic of dilated cardiomyopathy, the most likely diagnosis. This condition involves dilation and impaired contraction of the left or both ventricles, often presenting with signs and symptoms of congestive heart failure, including exertional breathlessness and a third heart sound. The ECG findings of sinus rhythm with non-specific ST-segment changes are also commonly seen in this condition.

Other options are less likely:

- **Hypertrophic cardiomyopathy** usually presents with preserved or increased ejection fraction and asymmetric septal hypertrophy on echocardiography. A third heart sound is uncommon, and symptoms are often exertional syncope or chest pain.
- **Restrictive cardiomyopathy** is characterised by impaired ventricular filling with relatively preserved systolic function. It often presents with diastolic heart failure and echocardiographic findings of non-dilated ventricles and biatrial enlargement.
- **Takotsubo cardiomyopathy** typically presents acutely with chest pain mimicking myocardial infarction, often triggered by emotional or physical stress, and shows transient apical ballooning on echocardiography. It is not progressive over a year.
- **Arrhythmogenic cardiomyopathy** more commonly affects the right ventricle and often presents with arrhythmias or sudden cardiac death rather than heart failure symptoms.

1.45 *D – Cardiac resynchronisation therapy with defibrillator*

This 65-year-old woman presents with a transient loss of consciousness while standing, witnessed twitching lasting around 30 seconds, pallor followed by facial flushing, and spontaneous recovery. Although the twitching might suggest a seizure, the key finding is the 25-second episode of ventricular asystole due to paroxysmal atrioventricular block, captured on telemetry. This confirms a cardiac cause of syncope, specifically a Stokes-Adams attack. The echocardiogram showing a globally hypokinetic left ventricle with a reduced ejection fraction (38%) adds further weight to the diagnosis of underlying structural heart disease. In this context, the most appropriate next step is cardiac resynchronisation therapy with defibrillator (CRT-D). This device will not only provide pacing support to prevent further episodes of bradycardia/asystole but also address the reduced LVEF and protect against sudden cardiac death due to ventricular arrhythmias.

Other options are less appropriate:

- **Interictal electroencephalogram** might be considered if epilepsy were suspected, but this case has clearly documented arrhythmic syncope with asystole, making a neurological cause less likely.
- **Radiofrequency ablation** is a treatment for tachyarrhythmias such as supraventricular tachycardia or certain types of atrial fibrillation and is not indicated in bradyarrhythmic syncope from AV block.
- **Cardioversion** is used in rhythm control for tachyarrhythmias like atrial fibrillation or flutter, not in cases of ventricular asystole.
- **Coronary angioplasty** could be considered if there were evidence of ongoing myocardial ischaemia or infarction, but the presentation here is due to conduction system disease, not acute coronary syndrome.

1.46 *D – Stop ramipril and change to labetalol*

This 38-year-old woman is 8 weeks pregnant with well-controlled essential hypertension on ramipril (BP 130/80 mmHg) and no proteinuria. Although her blood pressure is currently stable, ramipril is contraindicated in pregnancy due to its known teratogenic effects, particularly in the second and third trimesters. According to NICE CKS guidance, ACE inhibitors should be discontinued as soon as pregnancy is confirmed, regardless of current blood pressure control. The most appropriate management is to stop ramipril and switch to labetalol, which is considered first line for hypertension in pregnancy and is safe for both mother and foetus (though monitoring is required for foetal growth retardation).

Other options are less appropriate:

- **Stopping ramipril and commencing low-dose aspirin** alone is inadequate. While aspirin (75–150 mg daily) is recommended from 12 weeks' gestation in women with chronic hypertension to reduce the risk of pre-eclampsia, it does not substitute for appropriate antihypertensive treatment.
- **Changing to losartan** is unsafe, as it is also contraindicated in pregnancy and carries similar foetal risks as ACE inhibitors.
- **Changing to methyldopa** is a valid alternative if labetalol is contraindicated or not tolerated, but it is often associated with side effects such as sedation and depression.
- **Continuing ramipril until reviewed in the consultant-led clinic** is inappropriate and potentially harmful, as ACE inhibitors should be stopped immediately upon confirmation of pregnancy.

1.47 *C – Ventricular extrasystoles*

The ECG shows multiple broad QRS complexes occurring earlier than expected, not preceded by P waves and followed by a compensatory pause. These are classical features of ventricular extrasystoles (also known as premature ventricular complexes, PVCs). The morphology is consistent with ectopic ventricular origin – wide QRS complexes with discordant T wave and abnormal axis. The patient's symptoms of a 'skipping beat' or 'somersaulting' sensation, worsened at rest and disappearing with exercise, are typical of benign ventricular ectopics.

Other options are less likely:

- **Sinus arrhythmia** presents as variation in heart rate with respiration, maintaining normal narrow QRS complexes and P waves.
- **Left bundle branch block** would show a broad QRS (>120 ms) with a characteristic notched R wave in leads I, aVL, V5–V6, and deep S waves in V1–V3.
- **Right atrial hypertrophy** would present with tall, peaked P waves in inferior leads (II, III, aVF), which are not seen here.
- **Left ventricular hypertrophy** would show signs such as high voltage in precordial leads (e.g. S in V1 + R in V5/V6 >35 mm) and repolarisation abnormalities, which are not evident in this trace.

1.48 *B – Consider switching to an angiotensin-II receptor blocker*

This 49-year-old woman developed a persistent cough 1 year after starting ramipril for essential hypertension. The cough is now affecting her sleep but is not accompanied by red flag features such as dyspnoea, haemoptysis, or systemic symptoms. Her blood tests and chest X-ray are normal, making other serious causes unlikely. A persistent dry cough is a well-recognised side effect of ACE inhibitors like ramipril and

can occur months after initiation. The most appropriate next step is to switch to an angiotensin-II receptor blocker (ARB), which provides similar antihypertensive benefit without the associated cough, as ARBs do not increase bradykinin levels.

Other options are less appropriate:

- **Switching to another ACE inhibitor** is unlikely to resolve the cough, as this is typically a class effect.
- **Switching to a calcium channel blocker** may be reasonable if ARBs are contraindicated or poorly tolerated, but ARBs are usually the first alternative.
- **Continuing ramipril and offering zopiclone** only addresses the sleep disturbance and not the underlying issue, and long-term hypnotic use is not advisable.
- **Continuing ramipril and offering codeine linctus** may suppress the cough temporarily but risks side effects like constipation and sedation, and again, does not address the cause.

1.49 *A – $P2Y_{12}$ receptor antagonist that prevents ADP-mediated $P2Y_{12}$ dependent platelet activation*

This 64-year-old man has been commenced on ticagrelor for secondary prevention following a myocardial infarction. Ticagrelor is an oral antiplatelet agent used in dual antiplatelet therapy alongside aspirin to reduce the risk of further atherothrombotic events. Its principal mechanism of action is as a $P2Y_{12}$ receptor antagonist. By reversibly inhibiting the ADP-mediated activation of the $P2Y_{12}$ receptor on platelets, ticagrelor prevents platelet aggregation and thrombus formation.

Other options are less appropriate:

- **Irreversibly inhibiting cyclo-oxygenase and blocking thromboxane production** describes the mechanism of aspirin, not ticagrelor.
- **Inhibiting phosphodiesterase III** is the action of cilostazol, used more in peripheral arterial disease than in acute coronary syndrome, and milrinone used for short-term treatment of severe congestive heart failure.
- **Blocking fibrinogen binding to glycoprotein IIb/IIIa receptors** is the mechanism of GP IIb/IIIa inhibitors such as abciximab, eptifibatide, and tirofiban.
- **Binding to antithrombin and blocking fibrin formation** describes the action of heparin, an anticoagulant, not an antiplatelet agent.

1.50 *C – Right coronary artery*

This 65-year-old woman presents with sudden-onset central crushing chest pain radiating to her left arm, accompanied by dyspnoea and diaphoresis. Her vital signs show tachycardia, elevated blood pressure, mild hypoxia, and tachypnoea. The ECG demonstrates ST elevation in leads II, III, and aVF, which are the inferior leads. This pattern is most consistent with an acute inferior ST-elevation myocardial infarction (STEMI). The artery most likely to be occluded in an inferior STEMI is the right coronary artery (RCA), which typically supplies the inferior wall of the left ventricle in most individuals.

Other options are less likely:

- The **left anterior descending artery (LAD)** usually supplies the anterior wall, so occlusion here typically causes ST elevation in the anterior leads (V1–V4).

- The **left circumflex artery (LCx)** can supply the lateral wall, causing ST elevation in lateral leads (I, aVL, V5, V6), but it is less commonly the culprit in isolated inferior STEMI.
- The **left main coronary artery** occlusion would cause extensive ischaemia involving both anterior and lateral walls and is often catastrophic, with widespread ECG changes.
- The **posterior descending artery** is usually a branch of the RCA (or less commonly the LCx), so isolated occlusion here is rare, and it would cause posterior MI with ST depression in anterior leads rather than ST elevation in inferior leads.