

## Coronary Heart Disease

The questions signed by \* are hard: read their explanation. ● Past Years ● TBL ● Others

This file belongs to the PULSE Cardiology question book: the explanations of the multiple choice answers and the model answers of the essay questions, in the words of the handout.

## Answer Key | Multiple Choice Questions

| Question no. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|--------------|---|---|---|---|---|---|---|---|---|----|----|----|
| Answer       | c | c | c | a | d | c | a | a | b | d  | a  | c  |

| Question no. | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|--------------|----|----|----|----|----|----|----|----|----|----|----|----|
| Answer       | d  | c  | c  | a  | b  | d  | d  | a  | b  | b  | d  | c  |

| Question no. | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
|--------------|----|----|----|----|----|----|----|----|----|----|----|----|
| Answer       | b  | c  | d  | c  | a  | c  | b  | d  | a  | a  | c  | d  |

| Question no. | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
|--------------|----|----|----|----|----|----|----|----|----|----|----|----|
| Answer       | c  | b  | b  | d  | a  | d  | c  | c  | d  | b  | a  | c  |

| Question no. | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56  | 57  | 58 | 59 | 60      |
|--------------|----|----|----|----|----|----|----|-----|-----|----|----|---------|
| Answer       | c  | b  | a  | b  | d  | c  | b  | a+b | b+d | a  | a  | a+b+c+d |

| Question no. | 61  | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 |
|--------------|-----|----|----|----|----|----|----|----|----|----|----|----|
| Answer       | b+c | d  | c  | b  | a  | c  | a  | c  | d  | b  | c  | d  |

| Question no. | 73 | 74 | 75 | 76 | 77 | 78 |
|--------------|----|----|----|----|----|----|
| Answer       | c  | a  | a  | c  | b  | a  |

## ► Second | Questions with a Note

| Question no. | 1 | 2 | 3 | 4       |
|--------------|---|---|---|---------|
| Answer       | a | a | b | a+b+c+d |

## ► Why this answer?

- 1** *After assessment of cardiovascular risk in an asymptomatic patient with coronary heart disease, if the...*  
**(c) Referral for invasive testing.**  
Invasive coronary angiography is recommended in patients with positive stress test, while CT coronary angiography is a good negative test in patients less likely to have coronary artery disease. So a high-risk patient goes on to invasive testing; retesting later and non-invasive testing suit lower risk, and folic acid has no role.
- 2** *Which of the following is NOT one of the criteria of typical chest pain?*  
**(c) Pain provocation by deep inspiration**  
Typical angina is constricting chest discomfort, brought on by exertion or emotion, and relieved within minutes by rest or nitroglycerin. Pain made worse by deep breathing is pleuritic pain and points to a non-ischemic cause. A duration of about 15 minutes is still consistent with angina, which is short-lived (minutes, not seconds or hours), so it does not exclude typical pain.
- 3** *Nitrates are anti-anginal drugs. Which of the following is a common side effect?*  
**(c) Headache.**  
Headache is a common side effect of nitrates that could be managed with paracetamol. Nitrates are vasodilators, so they lower rather than raise blood pressure.
- 4** *Which of the following is an absolute contraindication of thrombolytic therapy in patients with acute...*  
**(a) Aortic dissection**  
Aortic dissection is an absolute contraindication for fibrinolysis. Refractory hypertension is only relative, menses are excluded from bleeding disorders, and ischaemic stroke counts only within the preceding 6 months.
- 5** *How much exercise each week is advised to help prevent heart disease?*  
**(d) 150 minutes on average**  
Physical exercise is one of the lifestyle measures. The advised amount is at least 150 minutes of moderate-intensity exercise every week.
- 6** *Which is not considered a life-threatening cause of chest pain?*  
**(c) Acute myocarditis**  
The chest pains that can kill within hours are acute coronary syndrome (unstable angina included), pulmonary embolism, aortic dissection and tension pneumothorax. Myocarditis is a cause of acute chest pain but is not one of these emergencies.
- 7** *Which of the following should NOT be used routinely in primary prevention of IHD?*  
**(a) Daily Aspirin.**  
Aspirin for life is given to patients who already have chronic stable angina, not routinely to people without heart disease, because of its bleeding risk. Exercise, smoking cessation and weight reduction are the routine lifestyle measures.
- 8** *Which of the following drugs is contraindicated in patients with acute myocardial infarction?*  
**(a) Verapamil.**  
Non DHP CCBs such as verapamil decrease contractility and must be avoided in heart failure with reduced systolic function as they worsen heart failure; acute infarction often damages the pump, so verapamil is avoided. Ticagrelor and rosuvastatin are emergency drugs of ACS and beta-blockers are continued for life after it.
- 9** *In a patient with acute chest pain that lasts for 30 minutes, with ECG showing ST depression in lateral...*  
**(b) Non ST elevation MI**  
No ST segment elevation with positive cardiac enzymes is NSTEMI. STEMI needs ST elevation, and unstable angina has negative enzymes.
- 10** *In a patient with chronic coronary stable [sic] who is still symptomatic on metoprolol and short-acting...*  
**(d) Isosorbide mononitrate**  
He is already on 1st line therapy (short acting nitrate and beta blocker), so the next step is 2nd line therapy: long-acting nitrates such as isosorbide mononitrate. His heart rate of 55 is already within the target 50-60, so verapamil and ivabradine add little, and sildenafil must not be given with nitrates.

- 11** Which of the following is an indication of immediate coronary intervention in a patient with acute coronary...  
**(a) Cardiogenic shock.**  
 Cardiogenic shock is hemodynamic instability, which puts the patient in the very high-risk group: PCI within less than 2 hours (immediate). Fixed ST depression is not a dynamic change, and diabetes or hypertension are not criteria for immediate PCI.
- 12** In a 75-year-old male patient with passed-time acute inferior myocardial infarction, after 48 hours of the...  
**(c) Alteplase**  
 Fibrinolytic therapy such as alteplase can be given only in the first 12 hours of chest pain, so at 48 hours it must be avoided. After 48 hours PCI should still be done if the patient presents with electrical complications such as complete heart block, and a temporary pacemaker treats the block.
- 13** In a 58-year-old male patient presented with non-ST elevation myocardial infarction with recurrent attacks...  
**(d) Coronary intervention**  
 Recurrent ventricular tachycardia is electrical instability, so this NSTEMI patient is very high risk and needs PCI within less than 2 hours. Streptokinase is fibrinolytic therapy for STEMI only, and short self-limiting runs do not need DC shock.
- 14** A 65-year-old male patient has persistent anginal attacks despite taking bisoprolol and long-acting...  
**(c) Trimetazidine**  
 Avoid combining nicorandil with nitrates, and with a heart rate of 55 the rate-lowering drugs verapamil and ivabradine are not suitable. Trimetazidine changes the heart fuel from fatty acids to glucose without slowing the heart, so it is the right add-on.
- 15** What is the next step of management if you suspect a patient of having coronary artery disease after...  
**(c) Stress ECG**  
 Once life-threatening causes are excluded, suspected coronary disease needs a stress test to unmask exercise induced ischemic heart disease, and stress ECG is one of them. Chewed aspirin, morphine and emergency referral belong to acute coronary syndrome.
- 16** Ticagrelor is one of the emergency treatments of acute myocardial infarction. Which of the following is a...  
**(a) Patients on oral anti-coagulation**  
 Ticagrelor is contraindicated in patients on oral anticoagulants, advanced liver disease, and previous intracranial hemorrhage. Stroke in general, hypertension and diabetes are not in this list.
- 17** In patients with suspected chronic stable angina and normal resting ECG and echocardiography, which of the...  
**(b) Stress myocardial perfusion imaging**  
 Resting ECG and echocardiography are usually normal in between attacks, so a stress test is needed, and stress myocardial perfusion imaging is one of them. A resting cardiac MRI does not unmask ischemia, and cardiac enzymes belong to acute coronary syndrome.
- 18** Which of the following should NOT be used routinely in primary prevention of IHD?  
**(d) Aspirin (81 mg) daily.**  
 Aspirin for life is given to patients who already have chronic stable angina, not routinely to people without heart disease, because of its bleeding risk. Smoking cessation, exercise and healthy diet are routine lifestyle measures.
- 19** Which of the following clinical characters is not suggestive of acute coronary syndrome and does not...  
**(d) Chest pain lasting for 5 minutes**  
 Anginal pain usually lasts for less than 15 minutes, while acute coronary syndrome pain lasts for more than 20 minutes, so a 5-minute pain alone is not suggestive. Fast breathing, tachycardia above 120 and systolic pressure below 90 are signs of an unstable patient who must be referred.
- 20** Ticagrelor is one of the emergency treatments of acute myocardial infarction. Which of the following is a...  
**(a) History of intracranial hemorrhage**  
 Previous intracranial hemorrhage is a contraindication for ticagrelor. Stroke in general, hypertension and diabetes are not in the list.

- 21** *Diltiazem is a first line anti-anginal drug. Which of the following is a contraindication?*  
**(b) Ejection fraction 35%.**  
 Diltiazem is a non DHP CCB; avoid non DHP CCBs in heart failure with reduced systolic function as they worsen heart failure, so an ejection fraction of 35% is a contraindication. In coronary spasm it is the beta blocker that is avoided, and Ca-channel blockers improve diastolic filling in HOCM.
- 22** *In patients with suspected chronic stable angina and normal resting ECG and echocardiography, which of the...*  
**(b) Dobutamine echocardiography.**  
 Resting ECG and echocardiography are usually normal in between attacks, so a stress test is needed, and dobutamine echocardiography is a pharmacological stress test.
- 23** *Which of the following is less likely to be anginal pain?*  
**(d) Non-exertional fleeting stitching chest pain**  
 Anginal pain could be only in the referred areas, so exertional jaw, back or epigastric pain relieved by rest can be angina. Pain lasting for seconds is less likely related to ischemic origin, so fleeting non-exertional pain is the least likely.
- 24** *The following drug could increase the heart rate in patients with chronic angina:*  
**(c) Amlodipine**  
 Beta blockers (bisoprolol), non DHP CCBs (diltiazem) and ivabradine all lower the heart rate. Amlodipine is a dihydropyridine CCB, a pure vasodilator, and can cause reflex tachycardia.
- 25** *Which of the following is not an indication of ACE inhibitors in a patient with unstable angina?*  
**(b) Recurrent chest pain**  
 After ACS, the ACE inhibitor or ARB is given for life to those with hypertension, diabetes mellitus, anterior wall STEMI and reduced left ventricular systolic function. Recurrent chest pain is not one of them.
- 26** *A 54-year-old male is presented with unstable angina. He is indicated for emergent coronary intervention if:*  
**(c) Cardiogenic shock**  
 Cardiogenic shock is hemodynamic instability, which puts the patient in the very high-risk group: PCI within less than 2 hours. A fixed T inversion is not a dynamic change, and extrasystoles are not electrical instability.
- 27** *A patient was prescribed sildenafil. Which of the following drugs must be avoided in his case?*  
**(d) Isosorbide dinitrate**  
 It is not recommended to give nitrates such as isosorbide dinitrate to a patient on sildenafil, to avoid profound hypotension and shock.
- 28** *A 54-year-old male is presented with unstable angina. He is indicated for coronary intervention if:*  
**(c) Ventricular tachycardia**  
 Ventricular tachycardia is electrical instability, which puts the patient in the very high-risk group: immediate PCI. Isolated ventricular extrasystoles and a fixed T inversion are not criteria.
- 29** *Bisoprolol is first line anti-anginal treatment in chronic coronary syndrome but must be avoided in which of...*  
**(a) Suspected coronary spasm.**  
 Avoid betablocker in variant angina as it produces coronary spasm. Heart failure with reduced systolic function is a reason to avoid non DHP CCBs, not beta blockers, and bisoprolol can be used in stable HF.
- 30** *Chest x ray could help in a patient with suspected acute coronary syndrome to rule out all the following...*  
**(c) Esophageal spasm**  
 Chest x-ray can give clues about pneumothorax, aortic dissection and pulmonary embolism and could pick up a dilated aortic root. Esophageal spasm gives no X-ray sign.
- 31** *Which of the following is a relative contraindication of thrombolytic therapy in patients with acute...*  
**(b) Severe hypertension**  
 Refractory hypertension (systolic blood pressure >180 mmHg) is a relative contraindication for fibrinolysis. Aortic dissection, haemorrhagic stroke and ischaemic stroke in the preceding 6 months are absolute contraindications.

- 32 Regarding lifestyle recommendations of ischemic heart disease patients, all of the following are recommended...  
**(d) Hormone replacement is recommended for all menopausal women.**  
Hormone replacement therapy does not protect the heart and is not given for that purpose. Exercise, weight loss in obese patients and aspirin in selected patients are sound advice; the handout lists physical exercise and weight reduction.
- 33 Fibrinolytic therapy is indicated in:  
**(a) ST elevation myocardial infarction**  
Fibrinolytic therapy is only for STEMI. It has no role in unstable angina, NSTEMI or coronary spasm.
- 34 A 57-year-old man has increasing chest pain for the past 3 days. The pain is progressively persistent (even...  
**(a) Emergency transfer to hospital.**  
Pain of increasing intensity, frequency and duration that occurs at rest and is not relieved by sublingual nitrates is acute coronary syndrome. He needs emergency transfer to hospital, not more tablets or an X-ray.
- 35 Which is the first-line treatment for primary prevention of ASCVD in diabetics?  
**(c) Statin therapy.**  
In diabetic patients the first drug to prevent atherosclerotic disease is a statin, which inhibits cholesterol synthesis. Aspirin is not routine in patients without established disease.
- 36 In patients with ischemic heart disease receiving the maximal doses of atorvastatin and ezetimibe, what is...  
**(d) Alirocumab**  
After the maximal dose of statin with ezetimibe, the next step is a PCSK9 inhibitor such as alirocumab. Rosuvastatin is just another statin and adds little to maximal atorvastatin.
- 37 Ticagrelor should be avoided in acute coronary syndrome patients who have history of:  
**(c) Intracranial hemorrhage**  
Previous intracranial hemorrhage is a contraindication for ticagrelor. Venous thrombosis, ischemic stroke and hemoptysis are not in the list.
- 38 Patients with functional mitral regurg, acute chest pain and normal troponin mostly have the following ECG:  
**(b) ST depression**  
Acute chest pain with normal troponin is unstable angina, which has no ST segment elevation. Its ischemic ECG change is ST segment depression or T wave inversion.
- 39 The modifiable risk factor that is associated with coronary artery disease is:  
**(b) Obesity**  
Central obesity is a risk factor of coronary atherosclerosis that the patient can change. Age, gender and heredity cannot be changed.
- 40 Cardiogenic shock is characterized by:  
**(d) a and b**  
Cardiogenic shock presents with tachycardia and hypotension. It is pump failure, so filling pressures and the central venous pressure rise; its pulmonary edema is not hypertensive.
- 41 The following drug should be avoided in patients on nitrates therapy:  
**(a) Sildenafil**  
It is not recommended to give nitrates to a patient on sildenafil, to avoid profound hypotension and shock.
- 42 Which of the following anticoagulants should be avoided in acute coronary syndrome patients undergoing...  
**(d) Fondaparinux**  
Fondaparinux is not used if the patient is to undergo PCI (risk of catheter thrombosis).
- 43 Which of the following should NOT be used routinely in primary prevention of ischemic heart disease?  
**(c) Aspirin (81 mg) daily**  
Aspirin for life is given to patients who already have chronic stable angina, not routinely to people without heart disease, because of its bleeding risk. Smoking cessation, exercise and diet with lipid lowering in dyslipidemia are routine.

- 44 *Right ventricular infarction could occur in setting of acute inferior wall myocardial infarction. Which of...*  
**(c) Nitroglycerine**  
Nitrates decrease preload by venodilatation; the infarcted right ventricle depends on its filling, so nitroglycerine can cause severe hypotension and must be avoided, while IV fluids support it.
- 45 *The best time window for thrombolytic therapy in patients with acute myocardial infarction is:*  
**(d) Within 12 hours from the onset of chest pain**  
Fibrinolytic therapy can be given in the first 12 hours of chest pain. The 24 and 48 hour figures belong to primary PCI.
- 46 *Which of the following is characteristic of STEMI (ST-Elevation Myocardial Infarction)?*  
**(b) Prolonged chest pain with ST-segment elevation on ECG**  
STEMI has ST segment elevation with positive cardiac enzymes, and ACS pain lasts for more than 20 minutes. Normal ECG, normal troponin and quick relief do not fit.
- 47 *Which is a characteristic feature of unstable angina in contrast to NSTEMI?*  
**(a) Normal troponin levels**  
Unstable angina and NSTEMI both have no ST segment elevation; the difference is the cardiac enzymes: negative in unstable angina, positive in NSTEMI.
- 48 *What is the recommended target for LDL cholesterol in patients with Acute Coronary Syndrome (ACS)?*  
**(c) <55 mg/dL**  
Target LDL for patients with acute coronary syndrome must be below 55 mg/dl with the maximum tolerated dose of statins with or without ezetimibe and PCSK9 inhibitors.
- 49 *Which of the following is a common symptom in patients with Chronic Coronary Syndrome?*  
**(c) Exertional chest pain (angina)**  
Anginal chest pain is brought on by exertion and relieved by rest. Pain at rest points to acute coronary syndrome.
- 50 *In patients with STEMI, which of the following is the preferred method of reperfusion therapy?*  
**(b) Primary percutaneous coronary intervention (PCI)**  
Primary PCI is the preferred line of treatment in the 1st 24 hours after STEMI. Fibrinolytic therapy is given only if Cath lab is not available.
- 51 *In patients with ACS and elevated LDL cholesterol, which of the following medications would most likely be...*  
**(a) Statins**  
A loading dose of statin is given in ACS to reach the target LDL below 55 mg/dl. Aspirin, ACE inhibitors and CCBs do not lower LDL.
- 52 *Which of the following clinical manifestations is common in patients with Chronic Coronary Syndrome?*  
**(b) Chronic exertional angina**  
Chronic coronary syndrome presents with exertional anginal pain that usually lasts for less than 15 minutes. Hours-long pain, rest dyspnea and sudden heart attack belong to acute coronary syndrome.
- 53 *Which of the following could be a manifestation of chronic stable angina?*  
**(d) Exertional syncope**  
Faintness is one of the angina equivalents, so exertional syncope can be a manifestation of stable angina. Exertional leg pain points to peripheral artery disease, and ankle edema or headache are not angina equivalents.
- 54 *The following anti-ischemic drug must be avoided in heart failure with reduced systolic function:*  
**(c) Diltiazem**  
Avoid non DHP CCBs such as diltiazem in heart failure with reduced systolic function as they worsen heart failure.
- 55 *If the patient is presented to a PCI non-capable center, the time window of thrombolytic therapy is:*  
**(b) 12 hours**  
Fibrinolytic therapy can be given in the first 12 hours of chest pain if Cath lab is not available, then immediate transfer to a PCI capable center.

- 56** The following is/are absolute contraindications of thrombolytic therapy (choose all that apply):  
**(a) History of previous intracranial hemorrhage + (b) Brain malignancy**  
 The handout lists as absolute contraindications haemorrhagic stroke at any time and central nervous system neoplasms. Severe (refractory) hypertension above 180 mmHg systolic and pregnancy (within 1 week post-partum) are only relative contraindications.
- 57** The following anti-ischemic drug/s must be continued for life after acute myocardial infarction (choose all...)  
**(b) Aspirin + (d) Atorvastatin**  
 The handout says aspirin is continued at 75 mg daily for life and atorvastatin 80 mg daily for life after an acute coronary syndrome. Clopidogrel (or ticagrelor) is given with aspirin for one year only, then stopped. Long-acting nitrates such as isosorbide dinitrate are for symptoms only and are not a lifelong secondary prevention drug.
- 58** The following is the most common pathophysiology of acute coronary syndrome:  
**(a) Plaque rupture and coronary thrombosis**  
 ACS occurs on top of acute coronary ischemic event, mostly thrombosis, with plaque instability (erosion or rupture). Spasm, dissection and embolism are less common causes.
- 59** What is the best next step for such patient?  
**(a) Stress echocardiography**  
 Exertional chest pain with normal resting investigations needs a stress test to unmask exercise induced ischemic heart disease, such as stress echocardiography. Cardiac enzymes belong to acute coronary syndrome.
- 60** The following is/are symptoms of typical angina chest pain (choose all that apply):  
**(a) Exertional + (b) Retrosternal compressing + (c) Relief by rest + (d) Relief by sublingual nitrates**  
 The handout defines typical angina by three features: constricting discomfort in the chest, brought on by exertion, and relieved within 5 minutes by rest or nitroglycerin. All four options describe these features, so all apply.
- 61** Which of the following is/are first-line anti-anginal drugs (choose all that apply)?  
**(b) verapamil + (c) Short acting sublingual nitrates**  
 In the handout, first-line anti-anginal therapy is short-acting sublingual nitrates plus a beta blocker or a non-dihydropyridine calcium channel blocker such as verapamil. Long-acting nitrates are second line, and ranolazine is a later-line drug.
- 62** Despite being first line anti-anginal drug, metoprolol should be avoided in:  
**(d) Variant angina**  
 Avoid betablocker in variant angina as it produces coronary spasm. Beta-blockers are given for life after ACS.
- 63** Which of the following anti-anginal drugs acts by improving the myocardial metabolic profile?  
**(c) Trimetazidine**  
 Trimetazidine inhibits  $\beta$ -oxidation of free fatty acid and changes the heart fuel from fatty acids to glucose, reducing lactic acid production and angina. Ivabradine is a funny Na channel blocker, ranolazine blocks IKr, and nicorandil relaxes coronary smooth muscle.
- 64** The following medication/s could decrease the probability of future myocardial infarction in this patient:  
**(b) Rosuvastatin.**  
 Lipid lowering drugs such as rosuvastatin prevent the progression of disease and the development of acute coronary syndrome. Nitrates and beta blockers are anti-anginal drugs for symptom relief.
- 65** You strongly suspect chronic angina in this patient. What is the best test to confirm the diagnosis?  
**(a) Dobutamine echocardiography**  
 Resting ECG and echocardiography are usually normal in between attacks, so a stress test is needed to unmask ischemia, and dobutamine stress echocardiography is one of them. Chest X-ray, CT chest and resting cardiac MRI do not unmask ischemia.
- 66** The following medication/s could decrease the frequency of angina attacks in this patient:  
**(c) Trimetazidine**  
 Only anti-anginal drugs for symptom relief reduce the attacks, and trimetazidine is a 3rd line one. Clopidogrel, atorvastatin and ACEI-type drugs prevent progression of disease and acute coronary syndrome.

- 67** The following could be a non-coronary cause of anginal pain:  
**(a) Severe anemia**  
 Severe anaemia is a functional cause that decreases oxygen supply, so it gives true anginal pain without coronary disease. Pleuritic pain is mostly non-ischemic, and herpes zoster and rib fracture are other causes of chest pain.
- 68** The following is/are emergency medications in the ER:  
**(c) 180 mg ticagrelor**  
 Only the ticagrelor dose is right: loading dose 180 mg. The loading doses are aspirin 300 mg, clopidogrel 300 mg (600 mg if undergoing PCI) and atorvastatin 80 mg.
- 69** After successful primary percutaneous coronary intervention, the following drug/s must continue for life:  
**(d) All the above**  
 Aspirin and the statin are continued for life after ACS. This patient is diabetic and hypertensive, so the ACE inhibitor ramipril is also for life.
- 70** If the patient developed acute pulmonary edema after acute myocardial infarction, the following is a...  
**(b) Acute severe mitral regurgitation**  
 Acute severe mitral regurgitation due to infarction of the papillary muscles is a complication of MI and causes acute pulmonary edema. Pulmonary embolism gives a clear back, and tricuspid regurgitation and tamponade do not cause pulmonary edema.
- 71** If the patient did not get his LDL levels reduced with the maximal doses of rosuvastatin and ezetimibe, what...  
**(c) Alirocumab**  
 After the maximal dose of statin with ezetimibe, the next step is a PCSK9 inhibitor, and alirocumab is one. Fibrates and omega 3 mainly lower triglycerides, and olive oil is diet only.
- 72** The most specific marker for diagnosis of acute myocardial infarction is:  
**(d) Cardiac troponins**  
 The handout names cardiac troponin and CK-MB as the cardiac biomarkers. Troponins are the most specific, because they come only from heart muscle.
- 73** Acute subendocardial infarction will have the ECG finding:  
**(c) Deep symmetrical T wave inversion**  
 A subendocardial infarction does not involve the full wall, so it is a non-ST elevation infarction with ST segment depression or T wave inversion, without ST elevation or pathological Q waves.
- 74** All of the following are common arrhythmias developing from AMI except:  
**(a) Sinus arrhythmia**  
 Respiratory sinus arrhythmia is a normal variation found in healthy young adults, not a complication of infarction. Ventricular tachycardia and atrioventricular block are electrical complications of ACS, and accelerated idioventricular rhythm is common after reperfusion.
- 75** Angina due to an imbalance between O<sub>2</sub> supply and demand without atherosclerosis would most likely be seen in...  
**(a) Aortic regurgitation**  
 In aortic regurgitation the chest pain is due to drop of diastolic pressure and impaired coronary filling, so angina occurs with normal coronaries. Tamponade, pulmonary regurgitation and right heart failure do not cause this mismatch.
- 76** A 55-year-old man is admitted to the emergency ward with acute myocardial infarction. Which of the following...  
**(c) Streptokinase**  
 Streptokinase is a fibrinolytic used for reperfusion in STEMI. Clopidogrel is an antiplatelet, and heparin and warfarin are anticoagulants; none of them opens the artery.
- 77** Which of the following findings is the most specific for a diagnosis of myocardial infarction?  
**(b) Evolution of Q waves on ECG**  
 Evolution of pathological Q waves means the myocardium has actually died, so it is the most specific of these findings for infarction. Cardiac enzymes such as CK, LDH and AST also rise in muscle injury, liver disease and other conditions, and even troponin rises in many non-infarct causes of myocardial injury. Chest pain and ST elevation also occur in pericarditis, early repolarisation and other conditions.

**78** A 54-year-old male redevelops chest pain 72 hours after treatment for an anterior myocardial infarction....

**(a) CK-MB**

Troponins stay high for 1-2 weeks after an infarction, so at 72 hours they cannot show a new one. CK-MB, the other cardiac biomarker, returns to normal in 2-3 days, so a fresh rise means reinfarction.

## ► Second | Questions with a Note: why this answer?

**1** A -- years old patient with intracranial hemorrhage; the following drug is contraindicated:

**(a) Ticagrelor**

Previous intracranial hemorrhage is a contraindication for ticagrelor, so (a) is the drug the handout names.

**2** A 45-year-old patient presented with angina. He has liver cirrhosis and hematemesis. The following drug is...

**(a) Ticagrelor**

Advanced liver disease is a contraindication for ticagrelor, so (a) is the drug the handout names in this cirrhotic patient.

**3** Which of the following medications is used in the management of Chronic Coronary Syndrome to relieve chest...

**(b) Nitrates**

Nitrates work by coronary vasodilation and increasing coronary blood supply, and by decreasing preload and afterload. Beta blockers and non DHP CCBs act by decreasing contractility and heart rate.

**4** The following is/are emergency anti-ischemic medications in the emergency room (choose all that apply):

**(a) 300 mg aspirin + (b) 180 mg ticagrelor + (c) 80 mg atorvastatin + (d) 5 mg sublingual nitrates**

This is an anterior STEMI, and the handout's emergency treatment gives loading doses of aspirin 300 mg, ticagrelor 180 mg and atorvastatin 80 mg. Nitrates relieve ischemic pain; a 5 mg sublingual isosorbide dinitrate tablet is the usual first nitrate dose, and the blood pressure (150/90) allows it. So all four are given in the emergency room.

## Model Answers | Essay Questions

**1** Discuss the diagnostic work up of a patient with chronic stable angina.

### 1. To check for etiology / risk factors

- \* Fasting blood sugar / 2 hours post prandial / HbA1C.
- \* Lipid profile.
- \* Kidney function tests.
- \* CBC.
- \* Chest X ray could pick up rib fracture or dilated aortic root.

### 2. To confirm the diagnosis of chronic coronary syndrome

| Test                                 | Findings / use                                                                                                                                                                                                                                                                                                               |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ECG</b>                           | Usually is normal in between attacks; if performed during the attack: you could pick up ischemic ECG changes.                                                                                                                                                                                                                |
| <b>Echocardiography</b>              | Usually normal in between attacks; if performed during the attack: you could pick up ischemic wall motion abnormality with or without diastolic dysfunction or systolic dysfunction; could pick up other potential causes of chest pain: pericardial effusion could refer to pericarditis, aortic stenosis, aortic aneurysm. |
| <b>Stress test</b>                   | To unmask exercise induced ischemic heart disease (stress could be exercise or pharmacological stress using dobutamine or adenosine); stress ECG; stress echocardiography; stress myocardial perfusion imaging; stress cardiac MRI.                                                                                          |
| <b>Non-invasive coronary imaging</b> | CT coronary angiography is recommended as a good negative test in patients less likely to have coronary artery disease.                                                                                                                                                                                                      |
| <b>Invasive coronary angiography</b> | Is recommended in patients with <b>positive stress test</b> .                                                                                                                                                                                                                                                                |

## 2 Outline the indications of revascularization of non-ST elevation acute coronary syndromes.

For NSTEMI-ACS patients (NSTEMI and UA):

| Risk group                                                                       | Timing of PCI                                                                     | Criteria                                                                                 |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Very high-risk patients                                                          | PCI should be done within less than <b>2 hours</b> (immediate)                    | Hemodynamic instability; electrical instability; refractory chest pain.                  |
| High-risk patients                                                               | PCI should be done within less than <b>24 hours</b> (early invasive)              | Elevated cardiac biomarkers (troponin); dynamic changes in ST segment or T wave in ECG.  |
| Low-risk patients (other patients not having criteria of very high or high risk) | Selective PCI may be considered in patients who have one or more of the following | Prior PCI within 6 months; prior CABG; DM; CKD; LVEF <40%; early post-infarction angina. |

## 3 Is this pain life threatening? Justify your answer.

### Anginal chest pain

- \* Constricting / heavy discomfort to the chest, jaw, neck, shoulders, or arms.
- \* Symptoms brought on by **exertion**, emotion, cold weather and heavy meals.
- \* Symptoms relieved within **5 min** by **rest or nitro-glycerine (GTN)**.
- \* Anginal pain usually lasts for **less than 15 minutes**.

### Acute coronary syndrome: typical presentation

The typical presentation is continuous severe retrosternal compressing anginal pain which occurs **at rest**, lasts for **more than 20 minutes**, and **not relieved** by rest or sublingual nitrates.

**Note** The handout does not state which chest pain is life-threatening, answer incomplete.

## 4 Classify this chest pain. Justify your answer.

- ① Typical angina.

### Anginal chest pain

- ① Constricting / heavy discomfort to the chest, jaw, neck, shoulders, or arms.  
② Symptoms brought on by **exertion**, emotion, cold weather and heavy meals.  
③ Symptoms relieved within **5 min** by **rest or nitro-glycerine (GTN)**.

| Number of features | Type of chest pain     |
|--------------------|------------------------|
| All the 3 features | Typical angina         |
| Only 2 features    | Atypical angina        |
| 0-1 feature        | Non-anginal chest pain |

## 5 What is the best next step?

To confirm the diagnosis of chronic coronary syndrome:

| Test                                 | Findings / use                                                                                                                                                                                                                                                                                                               |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ECG</b>                           | Usually is normal in between attacks; if performed during the attack: you could pick up ischemic ECG changes.                                                                                                                                                                                                                |
| <b>Echocardiography</b>              | Usually normal in between attacks; if performed during the attack: you could pick up ischemic wall motion abnormality with or without diastolic dysfunction or systolic dysfunction; could pick up other potential causes of chest pain: pericardial effusion could refer to pericarditis, aortic stenosis, aortic aneurysm. |
| <b>Stress test</b>                   | To unmask exercise induced ischemic heart disease (stress could be exercise or pharmacological stress using dobutamine or adenosine): stress ECG; stress echocardiography; stress myocardial perfusion imaging; stress cardiac MRI.                                                                                          |
| <b>Non-invasive coronary imaging</b> | CT coronary angiography is recommended as a good negative test in patients less likely to have coronary artery disease.                                                                                                                                                                                                      |
| <b>Invasive coronary angiography</b> | Is recommended in patients with <b>positive stress test</b> .                                                                                                                                                                                                                                                                |

**Note** The handout does not name one best next step, answer incomplete.

## 6 Is this pain life threatening? Justify your answer.

### Typical presentation of acute coronary syndrome

The typical presentation is continuous severe retrosternal compressing anginal pain which occurs **at rest**, lasts for **more than 20 minutes**, and **not relieved** by rest or sublingual nitrates.

- \* Association: typically associated with nausea, vomiting, and sweating.

### Other presentations of acute coronary syndromes

- \* Attacks of anginal pain of increasing intensity, frequency, and duration (crescendo angina).
- \* New onset angina (de novo angina).
- \* Post infarction angina.
- \* Syncopal attacks as a complication.
- \* Acute dyspnea (acute heart failure).
- \* Cardiac arrest as a complication.

### Prognosis

The outcomes of patients with ACS showed that the 30-day mortality rate is: **1.7%** for patients with unstable angina (UA); **7.4%** for patients with NSTEMI; **11.1%** for those with STEMI.

**Note** The handout does not state which chest pain is life-threatening, answer incomplete.

## 7 What's your best next step as a primary care physician?

Surface 12-lead Electrocardiogram (ECG): should be done **as early as possible** for the suspected ACS.

### Emergency treatment

- ① Opioids only in severe intolerable pain: e.g., morphine IV.
- ② Immediate loading doses of antiplatelet drugs:
  - Aspirin: an initial daily dose of **300 mg**, followed by a daily dose of 75 mg for life.
  - P2Y12 inhibitors: ticagrelor, loading dose of **180 mg** followed by 90 mg twice daily for one year; or clopidogrel, 300 mg (600 mg if undergoing percutaneous coronary intervention (PCI)) loading dose, then 75 mg daily for one year.
  - Ticagrelor is preferred unless unavailable or contraindicated (patients in oral anticoagulants, advanced liver disease, and previous intracranial hemorrhage).

- ③ Loading dose of statin therapy:
- 80 mg atorvastatin followed by daily dose of 80 mg for life;
  - OR 40 mg rosuvastatin followed by daily dose of 40 mg for life.
  - Target LDL for patients with acute coronary syndrome must be below **55 mg/dl** with the maximum tolerated dose of statins with or without ezetimibe and PCSK9 inhibitors.
- ④ Intravenous nitroglycerin at 5-20 µg/min may help to control ischemic pain with close monitoring of blood pressure. Dose can be increased according to the blood pressure.
- ⑤ Anticoagulants: one of the following:
- Unfractionated heparin.
  - Low molecular weight heparin.
  - Fondaparinux (fondaparinux is **not used if the patient is to undergo PCI** (risk of catheter thrombosis)).

**Note** The handout has no primary-care plan or referral step, answer incomplete.

## 8 Enumerate causes of life-threatening chest pain.

Differential diagnosis of acute chest pain:

|                 | Cause                | Clue in ABCDE approach                            |
|-----------------|----------------------|---------------------------------------------------|
| Cardiac causes  | Pericarditis         | Pericardial rub                                   |
|                 | Myocarditis          | Pericardial rub                                   |
|                 | Pulmonary embolism   | Tachycardia, desaturation, and clear back         |
| Chest causes    | Tension pneumothorax | Diminished air entry on one side                  |
|                 | Pleuritis            | Diminished air entry on one side if with effusion |
| Vascular causes | Aortic dissection    | Unequal pulse and BP                              |

  

|                   | Cause                   | Clue in ABCDE approach        |
|-------------------|-------------------------|-------------------------------|
| GIT causes        | Cholecystitis           | Epigastric tenderness         |
|                   | Pancreatitis            | Epigastric tenderness         |
|                   | Esophageal spasm        |                               |
| Chest wall causes | Myositis                | Tenderness                    |
|                   | Chest wall trauma       | Tenderness and visible injury |
|                   | Herpes zoster infection | Rash on the skin              |

**Note** The handout does not mark which causes are life-threatening, answer incomplete.

## 9 Outline the risk factors of chronic stable angina.

Risk factors of coronary atherosclerosis:

- \* Old age.
- \* Male gender.
- \* Sedentary life.
- \* Diabetes mellitus.
- \* Hypertension.
- \* Dyslipidemia.
- \* Smoking.
- \* Central obesity.

## 10 Enumerate the three lines of treatment of anginal pain for chest pain relief.

Anti-anginal drugs for symptom relief:

## 1st line therapy

### ① Short acting nitrates

- Sublingual nitroglycerine or nitroglycerine spray.
- Used during the attack of angina or shortly before exertion.
- It is not recommended to give nitrates to patient on sildenafil to avoid profound hypotension and shock.
- Nitrates work by: coronary vasodilation and increasing coronary blood supply; decreasing the O<sub>2</sub> demand by decreasing preload (venodilatation) and afterload (vasodilatation).

### ② Beta blockers or calcium channel blockers (non-dihydropyridines)

- Both groups decrease contractility and heart rate with subsequent reduction in myocardial oxygen demand.
- Target heart rate: **50-60 beat/min.**
- Selective B<sub>1</sub> blockers are useful: carvedilol, bisoprolol, metoprolol.
- Non DHP CCBs: verapamil and diltiazem.
- Avoid betablocker in variant angina as it produces coronary spasm.
- Avoid non DHP CCBs in heart failure with reduced systolic function as they worsen heart failure.

## 2nd line therapy: Long-acting nitrates

- \* Oral and transdermal patches are available.
- \* It is important to leave **8 hours** nitrates free period to avoid nitrates tolerance.
- \* Headache is a common side effect that could be managed with paracetamol.

## 3rd line therapy

| Drug                 | Mechanism & notes                                                                                                                                                                                                                                                                        |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Nicorandil</b>    | It relaxes coronary vascular smooth muscle by stimulating guanylyl cyclase and increasing cyclic GMP (cGMP) levels; also, it results in activation of K <sup>+</sup> channels and hyperpolarization; avoid combining nicorandil with nitrates.                                           |
| <b>Trimetazidine</b> | It is a cytoprotective drug that inhibits $\beta$ -oxidation of free fatty acid and increases the metabolic rate of glucose; therefore, it changes the heart fuel from fatty acids to glucose with subsequent reduction in lactic acid production and angina.                            |
| <b>Ranolazine</b>    | It blocks IKr, the rapid portion of the delayed rectifier potassium current, and prolongs the QTc interval in a dose-dependent fashion; ranolazine exerts its therapeutic effects without negative chronotropic, dromotropic, or inotropic actions neither at rest, nor during exercise. |
| <b>Ivabradine</b>    | Funny Na channel blocker; possible alternative to beta-blockers (or rate-limiting calcium antagonists) for rate control if contra-indicated or not tolerated; may cause visual disturbance (phosphenes) due to retinal side-effects; it has cytochrome P450 3A4 drug interactions.       |

## 11 Enumerate the indications of revascularization in patients with chronic angina.

Revascularization with PCI (percutaneous coronary intervention) or CABG (coronary artery bypass graft) in the following indications:

- ① Coronary stenosis **> 90 %** in one or more coronary arteries.
- ② Coronary stenosis **(50-90%)** with one of the following:
  - Refractory angina.
  - Systolic dysfunction.
  - Positive noninvasive stress test.
  - Significant ischemia with invasive hemodynamic assessment.

## 12 Classify acute coronary syndrome and mention the characteristics of each group.

### DEFINITION

Acute coronary syndrome (ACS) refers to a spectrum of clinical presentations that occur on top of acute coronary ischemic event (mostly thrombosis).

| Type                                                    | ST segment in ECG       | Cardiac enzymes |
|---------------------------------------------------------|-------------------------|-----------------|
| ST-segment elevation myocardial infarction (STEMI)      | ST segment elevation    | Positive        |
| Non-ST segment elevation myocardial infarction (NSTEMI) | No ST segment elevation | Positive        |
| Unstable angina                                         | No ST segment elevation | Negative        |

## 13 List the investigations of a patient with suspected acute coronary syndromes and possible key findings.

### 1. Surface 12-lead Electrocardiogram (ECG)

Should be done as early as possible for the suspected ACS. It may show any of the following (changes must be present in **2 or more** contiguous leads):

- \* ST elevation ( $\geq 1$  mm) - pathological Q waves (if STEMI).
- \* ST segment depression.
- \* T wave inverted or biphasic.
- \* The presence of normal ECG does **NOT exclude ACS** if typical clinical picture is present and at this time follow up ECG, full investigation and monitoring should be done.
- \* Electrical complications e.g., atrioventricular block, supraventricular arrhythmias (including atrial fibrillation), ventricular tachyarrhythmias (ventricular tachycardia and ventricular fibrillation).

### 2. Echocardiography

It should not delay revascularization in STEMI in acute setting. However, in acute setting, it is helpful in uncertain diagnosis and in patients with hemodynamic compromise. You could pick up:

- \* Evidence of new regional wall motion abnormality.
- \* Mechanical complications: mitral regurgitation - ventricular septal rupture.
- \* Other causes of chest pain e.g., aortic dissection, cardiac tamponade, pulmonary embolism.

### 3. Chest x-ray

It should not delay revascularization in STEMI in acute setting. However, in acute setting, it is helpful in uncertain diagnosis. You could pick up:

- \* Ischemic-related left-sided heart failure (pulmonary congestion).
- \* Clues about other causes of chest pain e.g., pneumothorax, aortic dissection, and pulmonary embolism.

### 4. Laboratory tests (should not delay revascularization in patients with STEMI)

- \* Elevated cardiac biomarkers (only in STEMI & NSTEMI, not in unstable angina) e.g., cardiac troponin, or CK-MB.
- \* Lipid profile should be obtained within **24 hours** of the onset of ACS.
- \* Complete blood count: to exclude anemia and check for platelets.
- \* Kidney function test: to adjust medication doses.
- \* Glycated hemoglobin (HbA1C): to check for DM and if controlled.

## 14 Discuss the treatment strategy of patients presenting with ST elevation myocardial infarction.

### Emergency treatment

- ① Opioids only in severe intolerable pain: e.g., morphine IV.

- ② Immediate loading doses of antiplatelet drugs:
  - Aspirin: an initial daily dose of **300 mg**, followed by a daily dose of 75 mg for life.
  - P2Y12 inhibitors: ticagrelor, loading dose of **180 mg** followed by 90 mg twice daily for one year; or clopidogrel, 300 mg (600 mg if undergoing percutaneous coronary intervention (PCI)) loading dose, then 75 mg daily for one year.
  - Ticagrelor is preferred unless unavailable or contraindicated (patients in oral anticoagulants, advanced liver disease, and previous intracranial hemorrhage).
- ③ Loading dose of statin therapy:
  - 80 mg atorvastatin followed by daily dose of 80 mg for life;
  - OR 40 mg rosuvastatin followed by daily dose of 40 mg for life.
  - Target LDL for patients with acute coronary syndrome must be below **55 mg/dl** with the maximum tolerated dose of statins with or without ezetimibe and PCSK9 inhibitors.
- ④ Intravenous nitroglycerin at 5-20 µg/min may help to control ischemic pain with close monitoring of blood pressure. Dose can be increased according to the blood pressure.
- ⑤ Anticoagulants: one of the following:
  - Unfractionated heparin.
  - Low molecular weight heparin.
  - Fondaparinux (fondaparinux is **not used if the patient is to undergo PCI** (risk of catheter thrombosis)).

### **Reperfusion therapy: for STEMI patients**

**Time is muscle** (reperfusion should start as early as possible).

### **Fibrinolytic therapy (only for STEMI)**

Can be given in the first **12 hours** of chest pain if Cath lab is not available. Then immediate transfer to a PCI capable center (streptokinase or better alteplase).

### **Contraindications for fibrinolysis**

#### **\* Absolute contraindications**

- Haemorrhagic stroke or stroke of unknown origin at any time.
- Ischaemic stroke in the preceding 6 months.
- Central nervous system damage, neoplasms or structural vascular lesions (e.g. arteriovenous malformation).
- Recent major trauma/surgery/head injury (within the preceding 3 weeks).
- Gastro-intestinal bleeding within the last month.
- Known bleeding disorder (excluding menses).
- Aortic dissection.

#### **\* Relative contraindications**

- Transient ischaemic attack in preceding 6 months, dementia.
- Oral anticoagulant therapy.
- Pregnancy within 1-week post-partum.
- Non-compressible punctures.
- Traumatic resuscitation.
- Refractory hypertension (systolic blood pressure >180 mmHg).
- Advanced liver disease.
- Infective endocarditis.
- Active peptic ulcer.

### Primary PCI (percutaneous coronary intervention)

- \* Is the **preferred line of treatment** in the 1st 24 hours after STEMI (could be done even within 48 hours after chest pain onset).
- \* Should be done if late presentation after 48 hours ONLY IF presented by electrical (arrhythmias) or mechanical (pulmonary edema or cardiogenic shock) complications.

### Surgery

- \* Coronary artery bypass surgery (CABG) if:
  - Multi-vessel coronary artery disease after opening of infarct-related artery with balloon dilatation.
  - Surgical repair of a mechanical complication (e.g., ventricular septal rupture).

### Other medications started in hospital after revascularization and continued for long term after discharge

- \* Angiotensin-converting enzyme (ACE) inhibitor or angiotensin receptor blockers (ARBs): for life for those with:
  - Hypertension.
  - Diabetes mellitus.
  - Anterior wall STEMI.
  - Reduced left ventricular systolic function.
- \* Beta-blockers for life with target heart rate in the ischemic patients (**50-60 bpm** at rest).
- \* Proton pump inhibitors if:
  - The patient on dual antiplatelet drugs in the first year after ACS.
  - Gastroesophageal reflux disease (GERD).
  - High risk for GIT bleeding.
  - History of peptic ulcer.
- \* Lifestyle modifications: the same as chronic angina.

- 15** Outline the emergency treatment and revascularization strategy of a patient presented with ventricular tachycardia on top of acute ST elevation myocardial infarction within the first 3 hours of the onset of chest pain.

### Ventricular tachycardia: acute management

Restoring sinus rhythm with **DC shock** regardless hemodynamics status.

### Emergency treatment

- ① Opioids only in severe intolerable pain: e.g., morphine IV.
- ② Immediate loading doses of antiplatelet drugs:
  - Aspirin: an initial daily dose of **300 mg**, followed by a daily dose of 75 mg for life.
  - P2Y12 inhibitors: ticagrelor, loading dose of **180 mg** followed by 90 mg twice daily for one year; or clopidogrel, 300 mg (600 mg if undergoing percutaneous coronary intervention (PCI)) loading dose, then 75 mg daily for one year.
  - Ticagrelor is preferred unless unavailable or contraindicated (patients in oral anticoagulants, advanced liver disease, and previous intracranial hemorrhage).
- ③ Loading dose of statin therapy:
  - 80 mg atorvastatin followed by daily dose of 80 mg for life;
  - OR 40 mg rosuvastatin followed by daily dose of 40 mg for life.
  - Target LDL for patients with acute coronary syndrome must be below **55 mg/dl** with the maximum tolerated dose of statins with or without ezetimibe and PCSK9 inhibitors.

- ④ Intravenous nitroglycerin at 5-20 µg/min may help to control ischemic pain with close monitoring of blood pressure. Dose can be increased according to the blood pressure.
- ⑤ Anticoagulants: one of the following:
  - Unfractionated heparin.
  - Low molecular weight heparin.
  - Fondaparinux (fondaparinux is **not used if the patient is to undergo PCI** (risk of catheter thrombosis)).

### Reperfusion therapy: for STEMI patients

**Time is muscle** (reperfusion should start as early as possible).

### Fibrinolytic therapy (only for STEMI)

Can be given in the first **12 hours** of chest pain if Cath lab is not available. Then immediate transfer to a PCI capable center (streptokinase or better alteplase).

### Primary PCI (percutaneous coronary intervention)

- \* Is the **preferred line of treatment** in the 1st 24 hours after STEMI (could be done even within 48 hours after chest pain onset).
- \* Should be done if late presentation after 48 hours **ONLY IF** presented by electrical (arrhythmias) or mechanical (pulmonary edema or cardiogenic shock) complications.

### Surgery

- \* Coronary artery bypass surgery (CABG) if:
  - Multi-vessel coronary artery disease after opening of infarct-related artery with balloon dilatation.
  - Surgical repair of a mechanical complication (e.g., ventricular septal rupture).

## 16 Enumerate the differential diagnosis of cases with chest pain.

### Differential diagnosis of acute chest pain

|                        | Cause                | Clue in ABCDE approach                            |
|------------------------|----------------------|---------------------------------------------------|
| <b>Cardiac causes</b>  | Pericarditis         | Pericardial rub                                   |
|                        | Myocarditis          | Pericardial rub                                   |
|                        | Pulmonary embolism   | Tachycardia, desaturation, and clear back         |
| <b>Chest causes</b>    | Tension pneumothorax | Diminished air entry on one side                  |
|                        | Pleuritis            | Diminished air entry on one side if with effusion |
| <b>Vascular causes</b> | Aortic dissection    | Unequal pulse and BP                              |

|                          | Cause                   | Clue in ABCDE approach        |
|--------------------------|-------------------------|-------------------------------|
| <b>GIT causes</b>        | Cholecystitis           | Epigastric tenderness         |
|                          | Pancreatitis            | Epigastric tenderness         |
|                          | Esophageal spasm        |                               |
| <b>Chest wall causes</b> | Myositis                | Tenderness                    |
|                          | Chest wall trauma       | Tenderness and visible injury |
|                          | Herpes zoster infection | Rash on the skin              |

### Cardiac pain

- \* Ischaemic heart disease: M.I.; angina pectoris.
- \* Pericardial disease: dry pericarditis; massive pericardial effusion.
- \* Massive pulmonary embolism and pulmonary infarction.
- \* Aortic dissection and aortic aneurysm.

- \* Cardiac neurosis:
  - Occurs in neurotic individuals.
  - Site: left inframammary and localized.
  - Radiation: no specific radiation (may be to left arm).
  - Character: stitching or stabbing.
  - No relation to exertion and no relief by rest.
  - Variable duration (seconds or hours).
  - Associated with local tenderness and may be other features of neurosis.
  - Normal cardiac exam.
- \* Huge cardiomegaly: may rarely cause retrosternal heaviness.
  - N.B. Huge left atrium: sawing pain (erosion of spine).
- \* Mitral valve prolapse, AS, AR.

## 17 How will you deal with cases presenting with chest pain?

### Physical examination

- \* Examination is normal in most of cases.
- \* With **ABCDE approach**, you could pick up the cause of pain (cardiac or non-cardiac) or catastrophic complications for urgent management:

| Step                                         | What you could pick up                                                                                                                                                                                                                                                                                                        |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>A - Airway</b>                            |                                                                                                                                                                                                                                                                                                                               |
| <b>B - Breathing</b>                         | Coarse crepitations and desaturation could refer to <b>acute pulmonary edema</b> which is a common complication of ACS.                                                                                                                                                                                                       |
| <b>C - Circulation</b>                       | Pulse: you could pick up tachy-arrhythmias (ventricular tachycardia) or brady-arrhythmias (complete heart block); BP: you could pick up hypertensive emergency as a cause or cardiogenic shock as a complication; ABG: you could find respiratory acidosis in acute heart failure or metabolic acidosis in cardiogenic shock. |
| <b>D - Disability</b>                        | Check for disturbed conscious level which could occur as complication (stroke or cardiogenic shock); check random blood sugar as acute MI could precipitate diabetic ketoacidosis.                                                                                                                                            |
| <b>E - Exposure and complete examination</b> | Systolic murmur of acute mitral regurge; systolic murmur of ventricular septal rupture.                                                                                                                                                                                                                                       |

### Investigations

Surface 12-lead Electrocardiogram (ECG): should be done **as early as possible** for the suspected ACS.

**Note** The handout has no stepwise plan for chest pain, answer incomplete.

## 18 What is the most likely diagnosis?

- ① Musculoskeletal (chest wall) pain.

### Differential diagnosis of acute chest pain: chest wall causes

|                          | Cause                   | Clue in ABCDE approach        |
|--------------------------|-------------------------|-------------------------------|
| <b>Chest wall causes</b> | Myositis                | Tenderness                    |
|                          | Chest wall trauma       | Tenderness and visible injury |
|                          | Herpes zoster infection | Rash on the skin              |

### Features that make angina less likely

- \* Pleuritic localized chest pain or that worse with swallowing is mostly non-ischemic pain.

**19 What is the most likely diagnosis? And what is the next step?**

- ① Panic attacks (anxiety disorder).

**Note** The handout does not cover panic attacks or the next step, answer incomplete.

**20 Enumerate non-cardiac causes of chest pain.**

Differential diagnosis of acute chest pain:

|                        | Cause                | Clue in ABCDE approach                            |
|------------------------|----------------------|---------------------------------------------------|
| <b>Chest causes</b>    | Tension pneumothorax | Diminished air entry on one side                  |
|                        | Pleuritis            | Diminished air entry on one side if with effusion |
| <b>Vascular causes</b> | Aortic dissection    | Unequal pulse and BP                              |
| <b>GIT causes</b>      | Cholecystitis        | Epigastric tenderness                             |
|                        | Pancreatitis         | Epigastric tenderness                             |
|                        | Esophageal spasm     |                                                   |

|                          | Cause                   | Clue in ABCDE approach        |
|--------------------------|-------------------------|-------------------------------|
| <b>Chest wall causes</b> | Myositis                | Tenderness                    |
|                          | Chest wall trauma       | Tenderness and visible injury |
|                          | Herpes zoster infection | Rash on the skin              |