5- Which of the following cardiac lesion has the highest risk of developing infective endocarditis?

a) VSD
b) ASD
c) Mitral valve prolapse with regurgitation
d) MS

- VSD : high risk lesion for IE
- MS : intermediate risk
- ASD : Low risk

6- Which lipid pattern suggests the lowest risk for CAD?

a) Total cholesterol 215 mg /dL, HDL cholesterol 28 mg/dL
b) Total cholesterol 215 mg /dL, HDL cholesterol 43 mg/dL
c) Total cholesterol 180 mg /dL, HDL cholesterol 29 mg/dL
d) Total cholesterol 202 mg /dL, HDL cholesterol 45 mg/dL

This combination has the lowest risk, although the total cholesterol is on borderline, the high HDL cholrsterol is protective.

- Total cholesterol : N → <200, borderline : 200 – 240, high ≥ 40
- HDL : N → 40-50 in ♂ 50-60 in ♀
- LDL : < 70 ideal for peole at very high risk of heart disease, < 100 ideal for people at high risk of heart disease.

7- Which one of the following is characteristic of atrial myxome?

a) It usually originate in the right atrium
b) The clinical signs can mimic severe mitral reguraitation
c) Recurrence is frequent, even after successful surgical removal
d) Echocardiogram is diagnostic in most cases

75% of cases originate in left atrium, the clinical signs mimic MS

8- A 52-year –old woman with no prior medical history presents in the emergency department with a 3-hour episode of crushing substernal chest pain. The pain radiates to her arm and ceck, An ECG reveals St segment elevation in leads II, III and a VF, The patient has no obvious contraindication to anticoagulation. Which of the following is the most optimal treatment at this time?

a) Administration of IV fluids

b) Administration of aspirin and heparin only

c) Administration of thrombolytic therapy, heparin, and aspirin

d) Cardiac surgery to bypass the occluded vessel

NB : *if the patient is hypotensive, IV fluids may be needed.*

9- The most effective diagnostic modality in a case of subacute bacterial endocarditis is :

a) ECG

b) Transthoracic echocardiogram (TTE)

c) Transesophageal echocardiogram (TEE)

d) Cardiac catheterization

10-Which of the following therapies has been shown to increase survival in a case of post myocardial infarction patients who have emection fraction > 50%?

a) Angiotensin-Converting enzyme inhibitor

b) Beta blocker

c) Digoxin

d) Loop diurectic

- Beta blockers have been shown to improve survival after myocardial infarction (MI) by decreasing both oxygen demand and the incidence of ventricular arrhythmia.
- Angiotensin-converting enzyme (ACE) inhibitors (choice A), such as enalapril, have been shown to improve survival in post-MI patients who have ejection fractions less than 40%>

11- A 51-year –old man is brought to the emergency department for chest pain. The patient has chronic stable angina that is usually precipitated by activity and relived by rest. About 3 weeks ago, his physician prescribed sildenafil (Viagra), and he has been using the drug with success. This morning, he developed acute onset of substernal chest pain, radiating to his left arm. This pain is not relived by rest. The patient last took a sildenafil the night before. Which of the following treatments is absolutely contraindicated in this situation?

a) Captopril

b) Metoprolol

c) Nitroglycerin

d) Tissue plasminogen activator (tPA)

The co-administration of nitrates within 24 hours after taking sildenafil in absolutely contraindicated. The vasodilatory effects of nitrates are amplified when administered in the presence of sildenafil (Viagra), which can lead to refractory and live-threatening hypotension. Therefore, patients using sildenafil should be instructed to report their use on presentation to any emergency department and to never take nitrates while using the drug.

12- A 57-year-old man presents to his physician for follow-up. He has a positive family history for coronary artery diseas and he has smoked one-half pack of cigarettes per day for the past 20 years. Which of the following lipid patterns would most strongly suggest the need for pharmacologic therapy in this patient?

a) Total cholesterol 180 mg/dL, LDL cholesterol 140 mg/dL

b) Total cholesterol 230 mg/dL, LDL cholesterol 100 mg/dL

c) Total cholesterol 245 mg/dL, LDL cholesterol 165 mg/dL

d) Total cholesterol 285 mg/dL, LDL cholesterol 100 mg/dL

- A patient with 2+ risk factors and an LDL of geater than 160mg/dL nedds medical therapy.
- A total cholesterol of 180 mg/dL, LDL cholesterol of 140 mg/dL (choice a) : in this patient could be managed with a trial of dietary modification and education.
- A total cholesterol of 285 mg/dL with an LDL cholesterol of 100 mg/dL (choice d) : does not require drug therapy. The total cholesterol is elevated, but the LDL Is not, suggesting high HDL level.

13- In a patient with central chest pain at rest :

a) Relief of pain by nitrates excludes an esophageal cause

b) Features of autonomic disturbance are specific to cardiac pain

c) Intrascpular radiation suggests the possibility of aortic dissection

d) Myocardial ischemia radiates to the neck but not the jaw

Notice that autonomic disturbance may occur in severe pain from any cause.

14- Recognised causes of secondary hypertension include EXCEPT

a) Persistent ductus arteriosus

b) Coarctation of the aorta

c) Primary hyperaldosteronism

d) Acromegaly

15- As regarded to the auscultatory findings listed below, which is correct?

a) Third heart sound-opening of mitral valve

b) Varying intersity of first heart sound-atrioventricular dissociation

c) Soft first heart sound-mitral stenosis

d) Fourth heart sound-atrial fibrillation

16- In the investigation of suspected angina pectoris :

a) Physical examination is of no clinical value

b) The resting ECG is usually normal

c) Exercise-induced elevation in blood pressure indicates significant ischemia

d) A normal ECG during exercise excludes angina pectoris

Physical examination is important to exclude anemia and valvular stenosis.

17- In the treatment of patients with angina pectoris :

a) Aspirin reduces the frequency of angina attacks.

b) Glyceryl trinitrate is equally effective when swallowed as when taken sublingually

c) Calcium antagonists may cause peripheral edema

d) β blockers are more effective than other ant-anginal agents

Hypocalcaemia, not hypercalcaemia, causes prolongation of the QT interval and hence may predispose to the development of torsade de pointes

Long QT syndrome

Long QT syndrome (LQTS) is an inherited condition associated with delayed repolarization of the ventricles. It is important to recognise as it may lead to ventricular tachycardia and can therefore cause collapse/sudden death. The most common variants of LQTS (LQT1 & LQT2) are caused by defects in the alpha subunit of the slow delayed rectifier potassium channel. A normal corrected QT interval is less than 430 ms in males and 450 ms in females.

Causes of a prolonged QT interval:

Congenital	Drugs*	Other
• **Jervell-Lange-Nielsen syndrome (includes deafness and is due to an abnormal potassium channel)** • **Romano-Ward syndrome (no deafness)**	• **amiodarone, sotalol, class 1a antiarrhythmic drugs** • **tricyclic antidepressants, selective serotonin reuptake inhibitors (especially citalopram)** • **methadone** • **chloroquine** • **terfenadine**** • **erythromycin** • **haloperidol**	• **electrolyte: hypocalcaemia, hypokalaemia, hypomagnesaemia** • **acute myocardial infarction** • **myocarditis** • **hypothermia** • **subarachnoid haemorrhage**

Features

- may be picked up on routine ECG or following family screening
- Long QT1 - usually associated with exertional syncope, often swimming
- Long QT2 - often associated with syncope occurring following emotional stress, exercise or auditory stimuli
- Long QT3 - events often occur at night or at rest
- sudden cardiac death

Management

- avoid drugs which prolong the QT interval and other precipitants if appropriate (e.g. Strenuous exercise)
- beta-blockers***
- implantable cardioverter defibrillators in high risk cases

*the usual mechanism by which drugs prolong the QT interval is blockage of potassium channels. See the link for more details

**a non-sedating antihistamine and classic cause of prolonged QT in a patient, especially if also taking P450 enzyme inhibitor, e.g. Patient with a cold takes terfenadine and erythromycin at the same time

***note sotalol may exacerbate long QT syndrome

A 54-year-old man is admitted to the Emergency Department with a 15 minute history of crushing central chest pain. Which one of the following rises first following a myocardial infarction?

○	AST
○	Troponin I
○	CK
○	CK-MB
○	Myoglobin

Submit answer

A 54-year-old man is admitted to the Emergency Department with a 15 minute history of crushing central chest pain. Which one of the following rises first following a myocardial infarction?

○	AST
○	Troponin I
○	CK
○	CK-MB
○	Myoglobin

Submit answer

Myoglobin rises first following a myocardial infarction

Cardiac enzymes and protein markers

Interpretation of the various cardiac enzymes has now largely been superceded by the introduction of troponin T and I. Questions still however commonly appear in the MRCP

Key points for the exam

- myoglobin is the first to rise
- CK-MB is useful to look for reinfarction as it returns to normal after 2-3 days (troponin T remains elevated for up to 10 days)

	Begins to rise	Peak value	Returns to normal
Myoglobin	1-2 hours	6-8 hours	1-2 days
CK-MB	2-6 hours	16-20 hours	2-3 days
CK	4-8 hours	16-24 hours	3-4 days
Trop T	4-6 hours	12-24 hours	7-10 days
AST	12-24 hours	36-48 hours	3-4 days
LDH	24-48 hours	72 hours	8-10 days

Work Smart

Question 1 of 200

Which of the following antimicrobials is associated with prolongation of the QT interval?

(Please select 1 option)

○	Cefuroxime
○	Co-amoxiclav
⊙	Erythromycin Correct
○	Gentamicin
○	Isoniazid

The macrolides are associated with a prolongation of the QT interval.

Other antimicrobials associated with prolonged QT include quinine and levofloxacin.

Next question | Go to summary

Answer Statistics

Work Smart

Question 3 of 200

Which of the following infections is least likely to cause myocarditis?

(Please select 1 option)

○	Chagas disease
○	Coxsackie virus
○	Diphtheria
◉	Syphilis Correct
○	Toxoplasmosis

Quaternary syphilis involves the cardiovascular system, commonly in the form of ascending aortic aneurysm and aortic regurgitation.

Diphtheria, coxsackie virus, Chagas disease, and toxoplasmosis are all associated with myocarditis.

Next question | Go to summary

Answer Statistics

1 10%

2 10%

Work Smart

Question 4 of 200

A 52-year-old sales representative is admitted with an inferior myocardial infarction (MI). He receives thrombolysis and makes an uneventful recovery.

He is discharged on atenolol, aspirin and atorvastatin.

He enquires how long after his MI must he wait before he is able to drive?

(Please select 1 option)

○	One week
○	Two weeks
◉	Four weeks Correct
○	Three months
○	Six months

The DVLA is quite clear on this issue. He must wait at least four weeks after his MI before he is able to drive.

Similarly, patients undergoing surgical revascularisation must also wait four weeks.

If he was admitted with angina and underwent percutaneous transluminal coronary angioplasty (PTCA) then he should wait one week.

Reference:

1. Gov.uk. Medical conditions, disabilities and driving.

Work Smart

Question 6 of 200

Which of the following is currently recommended as the drug of choice in treating refractory ventricular fibrillation or pulseless ventricular tachycardia?

(Please select 1 option)

◉	Adenosine Incorrect answer selected
○	Amiodarone This is the correct answer
○	Bretylium
○	Lidocaine
○	Magnesium

300 mg of amiodarone made up to 20 ml with 5% dextrose given as an intravenous bolus is the drug of choice.

100 mg of lidocaine may be given intravenously when amiodarone is unavailable.

Historically 5 mg/Kg of bretylium was given, but it is no longer recommended.

Next question | Go to summary

Answer Statistics

Work Smart

Question 7 of 200

Deficiency of which one of the following trace elements is implicated as a cause of cardiomyopathy?

(Please select 1 option)

○	Chromium
◉	Copper ✗ Incorrect answer selected
○	Manganese
○	Selenium ✓ This is the correct answer
○	Zinc

Selenium deficiency is one of the reversible causes of dilated cardiomyopathy.

Next question | Go to summary

Answer Statistics

A 71-year-old man who had rheumatic fever as a child is admitted to the cardiology ward with suspected infective endocarditis. This is confirmed by blood cultures and echocardiography. Which one of the following is most likely to be represent a need for surgical intervention?

- A septic embolism in the right kidney
- Persistent pyrexia after 48 hours of antibiotics
- Lengthening of the PR interval on ECG
- Pre-existing left ventricular impairment
- *Streptococcus viridans* isolated on blood cultures

A septic embolism in the right kidney	21%
Persistent pyrexia after 48 hours of antibiotics	9%
Lengthening of the PR interval on ECG	50%
Pre-existing left ventricular impairment	13%
Streptococcus viridans isolated on blood cultures	6%

Infective endocarditis - indications for surgery:

- severe valvular incompetence
- aortic abscess (often indicated by a lengthening PR interval)
- infections resistant to antibiotics/fungal infections
- cardiac failure refractory to standard medical treatment
- recurrent emboli after antibiotic therapy

Important for me Less important

Lengthening of the PR interval is likely to represent an aortic root abscess which will require surgical intervention.

A 65-year-old patient with chronic kidney disease is found to have a deficiency of antithrombin III after he presented to emergency department with left leg pain and swelling.

A doppler-ultrasound scan of the leg confirms deep venous thrombosis (DVT). The patient is started on dabigatran.

What is the mechanism of action of dabigatran?

- Activates anti-thrombin III
- P2Y12 inhibitor
- Glycoprotein IIb/IIIa inhibitor
- Direct thrombin inhibitor
- Direct factor X activator

P2Y12 inhibitor 6%

Glycoprotein IIb/IIIa inhibitor 15%

Direct thrombin inhibitor 52%

Direct factor X activator 15%

Dabigatran is a direct thrombin inhibitor

Important for me Less important

Below is a table of the drugs and their mechanisms of actions (MOA):

Drug name	MOA
Heparin	activates anti-thrombin III
Clopidogrel	P2Y12 inhibitor
Abciximab	glycoprotein IIb/IIIa inhibitor
Dabigatran	direct thrombin inhibitor
Rivaroxaban	direct factor X inhibitor

A 32-year-old physiotherapist presents with a 2-week history of increasing shortness of breath and leg swelling. Previously well, she gave birth 8 weeks ago by planned Caesarean section and is breast-feeding. Over the last 4 weeks she became progressively breathless, and developed a dry cough and swollen ankles. She smoked in her teenage years. On examination, she is afebrile with a pulse of 108 bpm and irregular. Her blood pressure is 85/53 mmHg and her respirations at rest are 16 breaths/min, which increased to 24 on light exercise. Jugular venous pressure is elevated at 5 cm and she has pitting oedema of both lower limbs to mid-shin. A pan-systolic murmur, loudest at the apex, and a third heart sound can be heard. Percussion note is dull at the right base and is associated with decreased air entry. Coarse crackles are present at the left base. Her liver is mildly tender and enlarged 3 cm below the right costal margin. Chest X-ray shows a pleural effusion at the right base, a blunted left costophrenic angle, alveolar shadowing at both bases and large pulmonary vessels. Atrial fibrillation with an occasional ectopic beat is evident on ECG.

Investigations:

Hb	112 g/l
WCC	12.5 × 10^9/l
PLT	246 × 10^9/l
Na^+	132 mmol/l
K^+	3.8 mmol/l
Creatinine	84 mol/l
Urea	4.5 mmol/l
Bilirubin	20 μ mol/l
Albumin	36 g/l
ALT	106 U/l
ALP	121 U/l
CRP	34 mg/l
TSH	1.23 mU/l
Free T_4	18.2 nmol/l
MCV	84.3 fl

What is the most likely diagnosis?

A	Atypical pneumonia
B	Pulmonary embolus
C	Peripartum cardiomyopathy
D	Subacute bacterial endocarditis
E	Primary pulmonary hypertension

2311

Submit

Previous Question | Skip Question

Calculator

Normal Values

A 32-year-old physiotherapist presents with a 2-week history of increasing shortness of breath and leg swelling. Previously well, she gave birth 8 weeks ago by planned Caesarean section and is breast-feeding. Over the last 4 weeks she became progressively breathless, and developed a dry cough and swollen ankles. She smoked in her teenage years. On examination, she is afebrile with a pulse of 108 bpm and irregular. Her blood pressure is 85/53 mmHg and her respirations at rest are 16 breaths/min, which increased to 24 on light exercise. Jugular venous pressure is elevated at 5 cm and she has pitting oedema of both lower limbs to mid-shin. A pan-systolic murmur, loudest at the apex, and a third heart sound can be heard. Percussion note is dull at the right base and is associated with decreased air entry. Coarse crackles are present at the left base. Her liver is mildly tender and enlarged 3 cm below the right costal margin. Chest X-ray shows a pleural effusion at the right base, a blunted left costophrenic angle, alveolar shadowing at both bases and large pulmonary vessels. Atrial fibrillation with an occasional ectopic beat is evident on ECG.

Investigations:

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ALP	121 U/l
CRP	34 mg/l
TSH	1.23 mU/l
Free T_4	18.2 nmol/l
MCV	84.3 fl

What is the most likely diagnosis?

Your answer was correct

A Atypical pneumonia

B Pulmonary embolus

C Peripartum cardiomyopathy

D Subacute bacterial endocarditis

E Primary pulmonary hypertension

Explanation

C Peripartum cardiomyopathy

Peripartum cardiomyopathy is an idiopathic condition occurring in the last month of pregnancy or in the first five months postpartum. It presents with heart failure secondary to left ventricular systolic dysfunction. The clinical vignette describes a patient with significant heart failure, and this is the most likely underlying diagnosis. Heart failure should be managed with β-blockade and diuretics, and ACE inhibitors can be considered postpartum. In many cases cardiac function recovers, but if it remains poor then heart transplant should be considered.

A Atypical pneumonia

The chest findings reported here could be confused with an atypical pneumonia, but the bilateral nature and the systemic features in keeping with heart failure make this less likely.

B Pulmonary embolus

The risk of pulmonary embolism increases in pregnancy and should be considered in peripartum individuals with dyspnoea. A large pulmonary embolism would lead to features of right-sided heart failure, including a raised JVP and peripheral oedema. However, typically with a pulmonary embolism there would be limited chest findings.

D Subacute bacterial endocarditis

This diagnosis should be considered in all patients with a new pan-systolic murmur. However, there are no additional features to suggest this diagnosis. The pan-systolic murmur present here is likely caused by mitral regurgitation secondary to left ventricular dilatation rather than endocarditis. However, in both cases an echocardiogram would be the next investigative option.

E Primary pulmonary hypertension

This condition normally presents over a longer time-frame than indicated in this case. Furthermore, the primary features are of dyspnoea with right-sided heart failure signs and symptoms developing. Examination of the chest is usually normal, as left ventricular function is often preserved.

A 60-year-old man on long-term haemodialysis presents with chest pain and a troponin of 1.2 (<0.1 μg/l). He is due to dialyse next the following morning. There is T-wave inversion in the lateral leads which was not present on a 12-lead ECG from 2 months earlier. He does not have pulmonary oedema. The pain is only partially relieved by a small dose of IV diamorphine.

Which would be the most appropriate acute cardiovascular management for this man?

A	Aspirin and iv nitrates
B	Aspirin, iv nitrates and abciximab
C	Clopidogrel, aspirin, iv nitrates, iv furosemide and sc LMW heparin 1 mg/kg bd
D	Clopidogrel, aspirin, iv nitrates and fondaparinux
E	Reassure that patient that the raised troponin level is due to his renal failure

2336

A 60-year-old man on long-term haemodialysis presents with chest pain and a troponin of 1.2 (<0.1 μg/l). He is due to dialyse next the following morning. There is T-wave inversion in the lateral leads which was not present on a 12-lead ECG from 2 months earlier. He does not have pulmonary oedema. The pain is only partially relieved by a small dose of IV diamorphine.

Which would be the most appropriate acute cardiovascular management for this man?

Your answer was incorrect

A	Aspirin and iv nitrates
B	Aspirin, iv nitrates and abciximab
C	Clopidogrel, aspirin, iv nitrates, iv furosemide and sc LMW heparin 1 mg/kg bd
D	Clopidogrel, aspirin, iv nitrates and fondaparinux
E	Reassure that patient that the raised troponin level is due to his renal failure

Explanation

This man is on long-term haemodialysis, and his new ECG changes raise the possibility of an NSTEMI. The longer patients are on dialysis the less likely they will be passing urine. Furosemide would not off-load the patient unless he was passing urine. In any respect, he is not in failure. Nitrates are useful for pain in this case but do not impact on overall prognosis. NICE guidelines with respect to the management of acute coronary syndromes have included use of fondaparinux as opposed to heparin. Whilst fondaparinux accumulates in patients with moderate to severe renal impairment, it is eliminated by dialysis, as such it would be a possible choice here. Abciximab is contraindicated in patients receiving dialysis due to limited availability of clinical data.

Next Question

Previous Question | Tag Question

Feedback | End Session

Difficulty: Easy

Peer Responses %

Session Progress

Responses Correct:	2
Responses Incorrect:	1
Responses Total:	3
Responses - % Correct:	67%

7. Which of the following is a CORRECT order of blood flow through the heart?

1 - right atrium
2 - left atrium
3 - right ventricle
4 - left ventricle
5 - vena cava
6 - pulmonary artery
7 - pulmonary vein
8 - tricuspid AV valve
9 - bicuspid (mitral) AV valve
10 - pulmonary valve
11 - aortic valve
12 - aorta

A. 5, 1, 9, 3, 10, 6, 7, 2, 8, 4, 11, 12
B. 5, 1, 8, 3, 10, 7, 6, 2, 9, 4, 11, 12
C. 5, 1, 8, 3, 10, 6, 7, 2, 9, 4, 11, 12
D. 5, 1, 8, 3, 11, 6, 7, 2, 9, 4, 10, 12

8. What type of arrhythmia does this image represent?

A. First-degree heart block
B. Third degree heart block (complete AV block)
C. Premature ventricular contraction
D. Ventricular fibrillation

9. Which of the following is NOT a part of the specialized conduction system of the heart?

A. Cells of the SA node.
B. Cells of the AV node.
C. Working myocardial cells.
D. His bundle.
E. Purkinje fibers.

10. Which of the following is INCORRECT concerning cardiac muscle?

A. Cardiac cells are smaller than skeletal muscle cells.
B. Electrical communication between cardiac cells is maintained via gap junctions which are specialized portions of the intercalated discs.
C. Mechanical attachment of cardiac cells is at the intercalated disc.
D. The spread of excitation through the heart muscle is 3-dimensional.
E. Transverse tubules are larger in skeletal muscle than in heart muscle allowing more diffusion of Ca2+ into the interior of the cell.

11. Which of the following is usually the dominant pacemaker and fires the fastest?

A. SA node.
B. AV node
C. His bundle.
D. Purkinje fibers.

12. Which of the following is NOT true of the parasympathetic control of the heart?

A. It affects muscarinic receptors.
B. It decreases heart rate via the SA node.
C. It decreases conduction velocity via the AV node.
D. It can be blocked by beta blockers, e.g. propranolol.

13. Which of the following is a TRUE statement concerning pacemaker potential?

A. Specialized cells depolarize during phase 4, but ventricular and atrial muscle cells do not.
B. Specialized cells depolarize during phase 3, but ventricular and atrial muscle cells do not.
C. Specialized cells repolarize during phase 4, but ventricular and atrial muscle cells do not.
D. Specialized cells repolarize during phase 3, but ventricular and atrial muscle cells do not.
E. None are correct

14. Which of the following is INCORRECT concerning the voltage clamp technique?

A. The voltage clamp technique is used to record action potentials from heart cells

B. It is useful to measure effects of antiarrhythmic agents on specific ion channels.

C. The voltage clamp can be used to set the Vm either for a segment of the cell membrane or the entire cell.

D. It allows the investigator to measure both the magnitude and time course of the ionic current generated by ions moving through channels.

15. Which of the following is the property of a cardiac cell to initiate and fire an action potential on its own without external stimulation?

A. Selectivity

B. Spontaneity.

C. Automaticity.

D. Conductance.

16. Which of the following does NOT show rapid initial depolarization at the start of an action potential?

A. SA node.

B. Atrial muscle.

C. Purkinje fibers.

D. Ventricular muscle.

E. Bundle of His.

17. Sodium enters the cell during the upstroke of the action potential. What is the major mechanism for removing Na from the cell?

A. It passively diffuses out of the cell.

B. It is extruded via an ATP-dependent Na-K pump.
C. It is extruded via an ATP-dependent Na-Ca pump.
D. It is extruded via an ATP-independent Na-K pump.
E. It is extruded via an ATP-independent Na-Ca pump.

18. If sodium channels are open, membrane potential is +110 mV, and the equilibrium potential is +68 mV, how will sodium ions respond?
A. They will move into the cell.
B. They will move out of the cell.
C. They will not move.
D. The conductance will drop to zero.

19. Which of the following is NOT true of an inward ionic current?
A. It is negative.
B. It reduces the polarity of the cell.
C. It makes the membrane potential more negative.
D. It can be caused by Na ions moving into the cell
E. It can be caused by anions moving out of the cell.

20. If you reduced the outward current in a heart cell, what would be the result?
A. Increase the rate of repolarization.
B. Prolong the action potential.
C. Increase the rate of depolarization.

21. Which of the following is INCORRECT concerning diastolic depolarization at the SA node?
A. It results from a decrease in IK.
B. Results from the activation of If carried mainly by Na ions.
C. Its rate is decreased by sympathetic stimulation.
D. Activating IKACh decreases its rate.
E. Its rate is decreased by decreasing ICa

22. If the heart rate increases, which of the following would be a result?
A. ERP would increase while APD would decrease.
B. ERP would decrease while APD would increase.
C. Both ERP and APD would increase.

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EXPERT CONSENSUS DECISION PATHWAY

2020 ACC Expert Consensus Decision Pathway on Management of Bleeding in Patients on Oral Anticoagulants

A Report of the American College of Cardiology Solution Set Oversight Committee

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PREFACE

The American College of Cardiology (ACC) has a long history of developing documents (e.g., decision pathways, health policy statements, appropriate use criteria) to provide members with guidance on both clinical and nonclinical topics relevant to cardiovascular (CV) care. In most circumstances, these documents have been created to complement clinical practice guidelines and to inform clinicians about areas where evidence may be new and evolving or where sufficient data may be more limited. In spite of this, numerous care gaps continue to exist, highlighting the need for more streamlined and efficient

processes to implement best practices in service to improved patient care.

Central to the ACC's strategic plan is the generation of "actionable knowledge"—a concept that places emphasis on making clinical information easier to consume, share, integrate, and update. To this end, the ACC has evolved from developing isolated documents to the development of integrated "solution sets." Solution sets are groups of closely related activities, policy, mobile applications, decision support, and other tools necessary to transform care and/or improve heart health. Solution sets address key questions facing care teams and attempt to provide practical guidance to be applied at the point of care. They use both established and emerging methods to disseminate information for CV conditions and their related management. The success of solution sets rests firmly on their ability to have a measurable impact on the delivery of care. Because solution sets reflect current evidence and ongoing gaps in care, the associated tools will be refined over time to best match member needs.

Expert consensus decision pathways (ECDPs) represent a key component of solution sets. The methodology for ECDPs is grounded in assembling a group of clinical experts to develop content that addresses key questions facing our members across a range of high-value clinical topics (1). This content is used to inform the development of various tools that accelerate real time use of clinical policy at the point of care. They are not intended to provide a single correct answer; rather, they encourage clinicians to ask questions and consider important factors as they define a treatment plan for their patients. Whenever appropriate, ECDPs seek to provide unified articulation of clinical practice guidelines, appropriate use criteria, and other related ACC clinical policy. In some cases, covered topics will be addressed in subsequent clinical practice guidelines as the evidence base evolves. In other cases, these will serve as standalone policy.

Ty J. Gluckman, MD, FACC
Chair, ACC Solution Set Oversight Committee

1. INTRODUCTION

Anticoagulation is the cornerstone of treatment for thrombosis and thromboembolic complications of a variety of disorders. The incidence of the common indications for anticoagulation such as atrial fibrillation (AF) (2) has continued to rise because of an aging population; rising age-adjusted incidence due to higher burdens of chronic illness; and advances in early detection, prevention, and treatment (3,4). It is estimated that over 6 million patients in the United States are treated with anticoagulants (5) and are thus at increased risk of bleeding, with substantially increased morbidity and mortality. Secular trends in anticoagulation use have demonstrated a relatively rapid adoption of direct-acting oral anticoagulants (DOACs) for the most common indications for anticoagulation. There has been particularly rapid adoption of DOACs in venous thromboembolism (VTE) and AF in the absence of mechanical valves or mitral stenosis. Systematic reviews have demonstrated favorable risk-benefit profiles for DOACs when compared with vitamin K antagonists (VKAs) in the management of AF and when compared with low-molecular-weight heparin followed by a VKA in the treatment and prevention of VTE (6,7). Additionally, the emergence of reversal agents (8) may also further increase the proportionate use of DOACs and influence the management of bleeding that complicates anticoagulant use (9).

This ECDP focuses on the management of bleeding in patients being treated with DOACs and VKAs for any indication. The role and management of antiplatelet agents is considered in the treatment algorithms. Bleeding classification has been simplified and is categorized as major or nonmajor (10). The former includes bleeding that is associated with hemodynamic compromise, occurs in an anatomically critical site, requires transfusion (≥2 units of packed red blood cells [RBCs]), or results in a hemoglobin drop ≥2 g/dL (10). All other bleeding is categorized as nonmajor. The recommendations provided by this ECDP include guidance for temporary or permanent interruption of therapy, general approaches to bleeding management, decision support for treatment with a reversal agent, and indications and timing for reinstituting anticoagulant treatment. The primary goal of this ECDP is to guide the management of acute bleeding in patients treated with oral anticoagulants (OACs) and to supplement the "2017 ACC Expert Consensus Decision Pathway for Periprocedural Management of Anticoagulation in Patients With Nonvalvular Atrial Fibrillation" (11), which addresses the management of patients undergoing planned surgical or interventional procedures.

Given the emergence of new OACs for use in the prevention of VTE as well as the introduction of new reversal strategies for factor Xa (FXa) inhibitors, it was determined that an update of the original ECDP, published in 2017, was needed to include guidance for use of those therapeutic options in addition to those previously included (12).

Of important note, the boxes within the ECDP algorithms were delegated certain colors to align with specific guidance found throughout each of the figures.

- Pink = considerations for major bleeds
- Yellow = considerations for nonmajor bleeds
- Blue = considerations for administering reversal/hemostatic agents
- Purple = considerations for timing of reinitiation of anticoagulation

- Orange = considerations for delaying the restart of anticoagulation
- Green = considerations for restarting anticoagulation

2. METHODS

This ECDP was informed by the scientific evidence presented and expert opinions considered during the Anticoagulation Consortium Roundtable, and by subsequent review and deliberation on available evidence by the writing committee. Although the Roundtable provided valuable insight into the practical issues and gaps in care, this ECDP is a separate and independent activity aimed specifically at addressing the questions raised during the meeting. The work of the writing committee was supported exclusively by the ACC without commercial support. Writing committee members volunteered their time to this effort. Committee conference calls were confidential and attended only by committee members and ACC staff. Following reconciliation of all comments, this ECDP was approved for publication by the governing bodies of the ACC. The guidance in this ECDP is designed to address the clinical problem of bleeding management of patients treated with anticoagulants and will consider both DOACs and VKAs used for any indication. The ECDP considered the severity of the bleed (major versus nonmajor), acute medical and surgical management, the need for reversal, the appropriateness and time of restarting anticoagulation, and the impact of pertinent comorbidities and concomitant drug therapy. At each step in the ECDP algorithms, patient-specific factors should be considered.

The ACC and the Solution Set Oversight Committee (SSOC) recognize the importance of avoiding real or perceived relationships with industry (RWI) or other entities that may affect clinical policy. The ACC maintains a database that tracks all relevant relationships for ACC members and persons who participate in ACC activities, including those involved in the development of ECDPs. ECDPs follow ACC RWI Policy in determining what constitutes a relevant relationship, with additional vetting by the SSOC.

ECDP writing groups must be chaired or co-chaired by an individual with no relevant RWI. While vice chairs and writing group members may have relevant RWI, this must constitute less than 50% of the writing group. Relevant disclosures for the writing group, external reviewers, and SSOC members can be found in Appendix 1. To ensure complete transparency, a full list of disclosure information, including relationships not pertinent to this document, is available in an online appendix. Participants are discouraged from acquiring relevant RWI throughout the writing process.

3. ASSUMPTIONS AND DEFINITIONS

Several specific assumptions and definitions were considered by the writing committee during the development of this ECDP.

3.1. General Clinical Assumptions

1. The ECDP considers acute bleeding in patients being treated with either DOACs or VKAs.
2. In the setting of bleeding with hemodynamic compromise, standard resuscitative measures should always be performed promptly.
3. All indications for anticoagulation were considered, including AF, VTE treatment and prevention, prosthetic cardiac valves, history of prior thromboembolism, intracardiac thrombus, and the presence of a mechanical circulatory support device (e.g., a left ventricular assist device).
4. The recommendations for restarting and withholding anticoagulant therapy refer to both DOACs and VKAs.
5. The ECDP algorithms assume that the provider will seek input from the appropriate specialists when indicated and involve the patient and/or family in shared decision making when possible.

3.2. Definitions

Definitions of terms used throughout the ECDP are listed here.

ABO: The three basic blood groups.

DOAC: Any direct-acting oral anticoagulant (e.g., apixaban, betrixaban, dabigatran, edoxaban, rivaroxaban).

OAC: Any oral anticoagulant, including DOACs and VKAs.

Reversal/hemostatic agents: Repletion strategies such as prothrombin complex concentrates (PCCs), plasma, vitamin K, and specific reversal agents for DOACs (e.g., idarucizumab for dabigatran, andexanet alfa for apixaban or rivaroxaban).

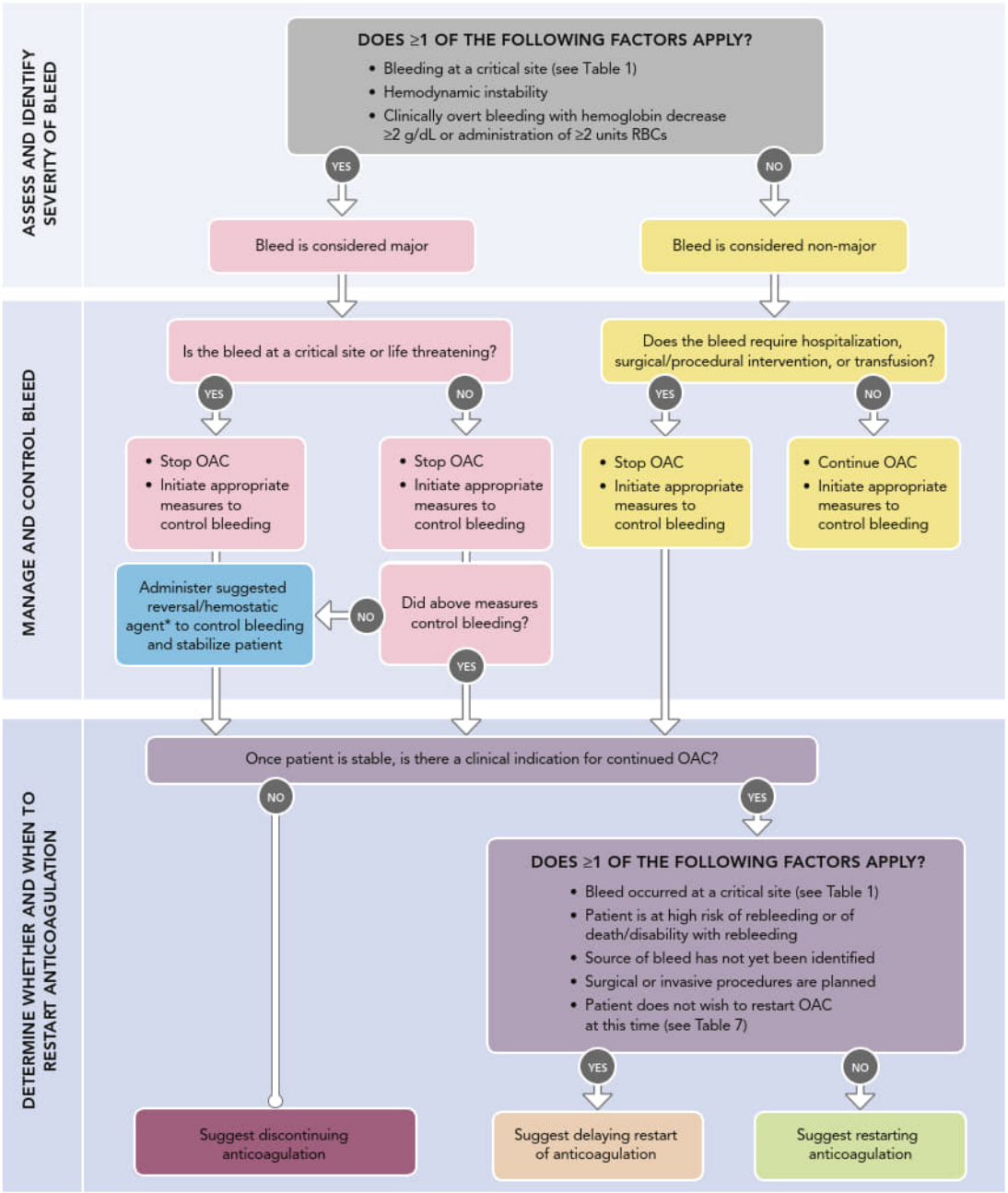
VKAs: Vitamin K antagonists (e.g., warfarin and other coumarins)

Note: The definitions of major and nonmajor bleeds were modified on the basis of the International Society on Thrombosis and Hemostasis definitions and criteria (10).

4. PATHWAY SUMMARY GRAPHIC

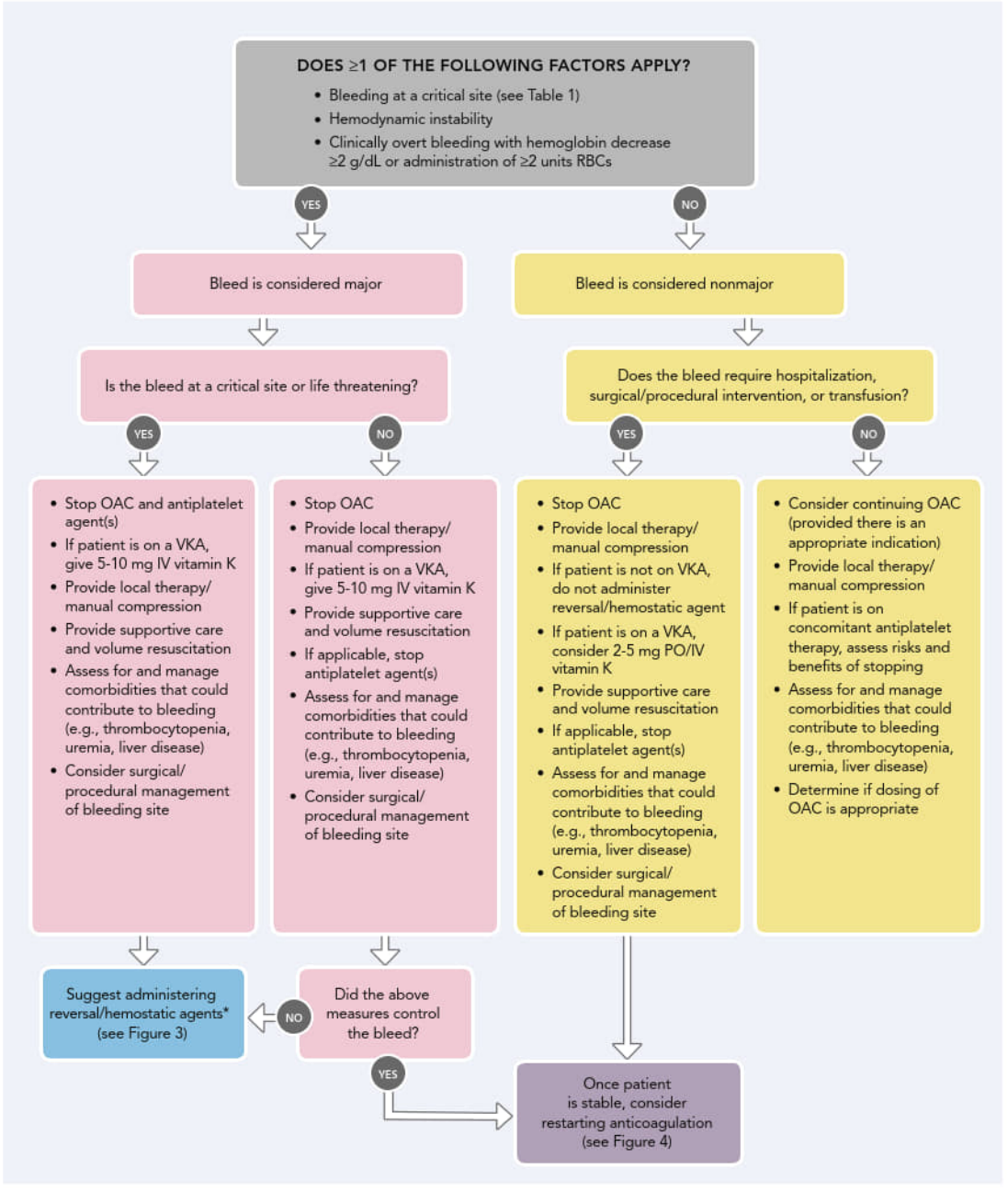
Figure 1 provides an overview of what is covered in this ECDP. See each section for more detailed considerations and guidance.

FIGURE 1 Summary Graphic



DOAC = direct-acting oral anticoagulant; OAC = oral anticoagulant, including DOACs and VKAs; PCC = prothrombin complex concentrate; RBC = red blood cell; VKA = vitamin K antagonist *Reversal/hemostatic agents include repletion strategies such as PCCs, plasma, vitamin K, and specific reversal agents for DOACs (e.g., idarucizumab for dabigatran; andexanet alfa for apixaban or rivaroxaban).

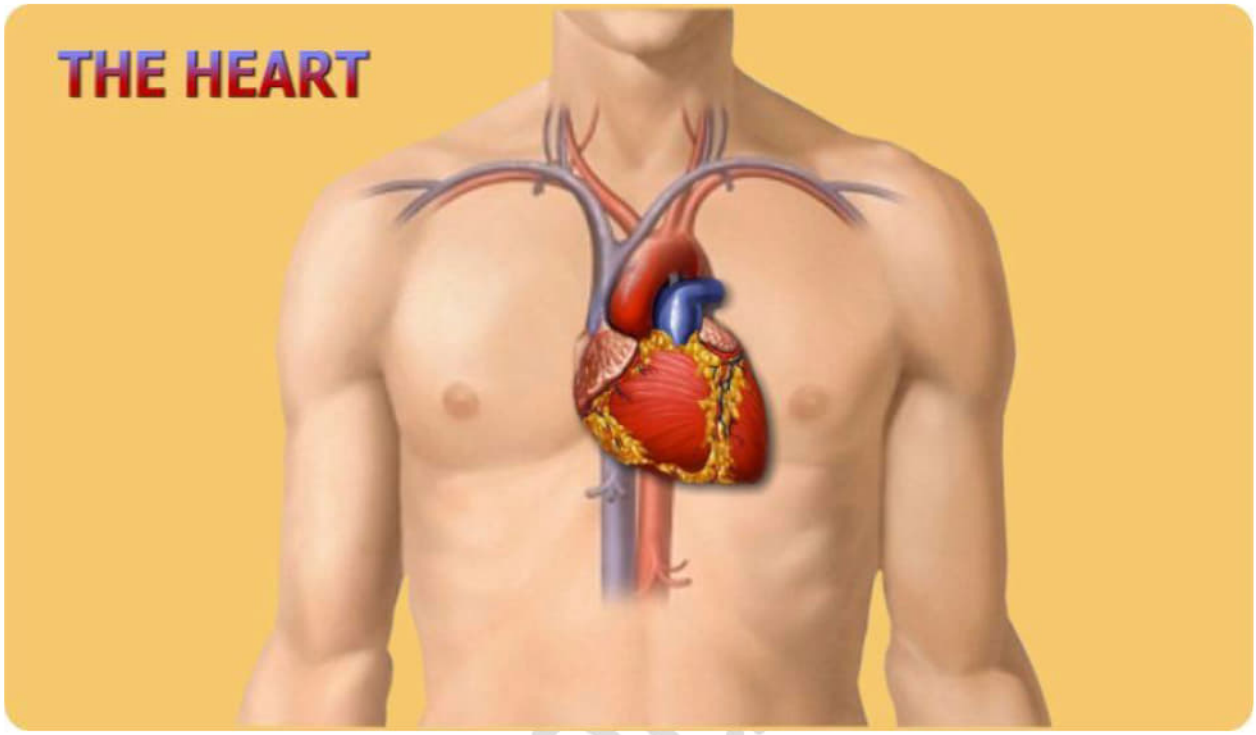
FIGURE 2 **Assessing Bleed Severity and Managing Major and Non-Major Bleeds**



DOAC = direct-acting oral anticoagulant; IV = intravenous; OAC = oral anticoagulant, including DOACs and VKAs; PCC = prothrombin complex concentrate; PO = per os "by mouth"; RBCs = red blood cells; VKA = vitamin K antagonist *Reversal/hemostatic agents include repletion strategies such as PCCs, plasma, vitamin K, and specific reversal agents for DOACs (e.g., idarucizumab for dabigatran; andexanet alfa for apixaban or rivaroxaban).

5. DESCRIPTION AND RATIONALE

The ECDP algorithms created by the writing committee include guidance on managing bleeding in patients on DOACs and VKAs, which are described in the following text. For ease of clinical use, the algorithms are also summarized in Figure 2.



1. The base of heart lies:
   a) superior b) inferior
   c) anterior d) posterior

2. In which organ sinusoids connect venule to venule?
   a) liver b) bone marrow
   c) spleen d) kidney

3. Which structure is not sensitive to pain?
   a) fibrous pericardium b) serous pericardium
   c) parietal pericardium d) visceral pericardium

4. Angeion is a Greek word which means:
   a) blood vessel b) lymph vessel
   c) cardiac vessel d) vessel

5. The average weight of heart in males is:

a) 250g
b) 300g
c) 350g
d) 400g

6. Which structure is known as epicardium:
   a) fibrous pericardium
   b) serous pericardium
   c) parietal pericardium
   d) visceral pericardium

7. The projecting ridges in the ventricular wall giving it the spongy appearance are known as:
   a) musculi pectinati
   b) sulcus terminalis
   c) crista terminalis
   d) trabeculae carneae

8. the thickness of left ventricle is_____ times the thickness of the right ventricle and_____ is the blood pressure:
   a) 3,3
   b) 3,4
   c) 3,6
   d) 4,8

9. in cross section the cavity of the right ventricle is_____ and that of the left ventricle is_____.
   a) circle, crescent
   b) crescent, circle
   c) funnel, circle
   d) circle, funnel

10. the skeleton of the heart is:
   a) bony
   b) cartilaginous
   c) fibrous
   d) heart has no skeleton

11. the connection of conduction between the myocardium of atria and that of ventricle is:
   a) S.A node
   b) A.V node
   c) A.V bundle
   d) purkinje plexus

12. it leaves the posterior end of the S.A node and passes to the posterior of the vena caval opening:
    a) anterior internodal pathway
    b) middle internodal pathway
    c) posterior internodal pathway

13. diastolic pressure is:
    A maximum pressure during ventricular diastole
    B. minimum pressure during ventricular diastole
    C. maximum pressure during atrial diastole
    D. minimum pressure during atrial diastole

14. the right bundle branch (RBB) is innervated by:
    a) right coronary artery
    b) left coronary artery
    c) both a & b
    d) conus artery

15. left bundle branch (LBB) is innervated by:
    a) right coronary artery
    b) left coronary artery
    c) both a & b
    d) conus artery

16. it directly enters the right atrium:
    a) great cardiac vein
    b) small cardiac vein
    c) middle cardiac vein
    d) anterior cardiac vein

17. Regarding the valves in veins:
    a) inferior vena cava
    b) femoral vein
    c) umbilical vein
    d) veins' diameter less than 2 mm

18. Pericardial cavity is a gap between:
    A. fibrous pericardium and serous pericardium
    B. fibrous pericardium and epicardium
    C. parietal pericardium and epicardium
    D. visceral pericardium and epicardium

19. regarding the blood supply of fibrous and parietal pericardium:
    a) internal thoracic artery
    b) descending thoracic aorta
    c) musculophrenic arteries
    d) inter coastal arteries

20. the right and left borders of heart are formed as:
    a) right atrium and left ventricle
    b) right atrium and left atrium
    c) right ventricle and left ventricle
    d)right atrium and right ventricle; left atrium and left ventricle

21. in liver and spleen capillaries are replaced by:
    a) sinusoids
    b) anastomosis of arteries
    c) shunts
    d) lymphatics

22. Tunica adventitia contains
    a) minute veins
    b) vasa vasorum
    c) lymphatics
    d) A.O.T
    e) N.O.T

23. smooth muscles are absent in the following veins:
    a) retinal veins
    b) pial veins
    c) viens of cancellous bone
    d) A.O.T
    e) N.O.T

24. capillaries are derived from the word capillus which means:
    a) thin
    b) hair
    c) connecting
    d) exchanging

25. the capillaries in_____ are of smaller diameter and that in_____ are of larger diameter.
    a) brain, intestine
    b) bone marrow, skin
    c) brain, bone marrow
    d) skin, intestine

26.the apex of heart lies at the level of____inter coastal space

a) 3rd
b) 4th
c) 5th
d) 6^{th}

27.musculi pectinati is embryologicaly derived from:

a) primitive atrium
b) sinous venosus
c) sulcus terminalis
d) crista terminalis

28.the superior vena cava is larger than inferior vena cava:

a) True
b) False

29.right atrium has____openings:

a) 2
b) 3
c) 4
d) 5

30.regarding the fetal remnants:

a) rudimentary valve of the inferior vena cava b) atrial septum
c) fossa ovalis
d) annulus ovalis

31. the right atrium lies____to the left atrium:

a) right
b) left
c) anterior
d) superior

32.the heart is placed in the:

a) chest cavity
b)thoracic cavity
c) superior mediastinum
d) middle mediastinum

33.regarding the contents of pericardium:

a) heart
b) pulmonary arteries
c) ascending aorta
d) pulmonary trunk

34.the following structures come into action when the organ is inactive:

a) sinusoids
b) capillaries

c) shunts d) arterial anastomosis

35.parasympathetic supply of heart comes from:

a) cervical portion b) thoracic portion

c) vagus nerves d) phrenic nerves

36.brachiocephalic veins are formed by:

a) superior vena cava b) inferior vena cava

c) subclavian and internal jugular veins d) azygous vein

37.The crista terminalis is inner to sulcus terminalis

a) true b) false

38.the brachiocephalic veins form:

a) superior vena cava b) inferior vena cava

c) internal jugular and subclavian veins d) azygous veins

39.find the mis-match:

a) trabeculae carneae : papilary muscle b) fossa ovalis : septum primum

c) annulus ovalis : septum secondum d) ventricles : moderator band

e) N.O.T

40.inflamation of vein is called:

a) veinitis b) phlebitis

c) aneurysm d) varicose

Answer Key

1	D	2	A	3	D

A 61-year-old patient has called 999 with a history of central crushing chest pain radiating down his left arm. He has a history of hypertension treated with atenolol and smokes 20 cigarettes per day. On examination by the paramedic crew his BP was 100/60 mmHg, with a pulse of 38/min; initial ECG is suggestive of complete heart block with ST elevation in II, III (maximally) and aVF, and ST depression in aVL. On arrival he continues to have further chest pain and his BP is now 85/60 mmHg. You notice that his JVP is elevated. His chest is clear and there is no evidence of peripheral oedema.

Investigations:

Hb	13.1 g/dl
WCC	8.2 x10^9/l
PLT	199 x10^9/l
Na^+	138 mmol/l
K^+	4.9 mmol/l
Creatinine	156 µmol/l

Which coronary artery is most likely to be affected?

Your answer was correct

A	Left anterior descending
B	Circumflex
C	Right coronary artery
D	Left main stem
E	Diagonal

Explanation

C	Right coronary artery

The presentation with initial complete heart block followed by hypotension with a raised JVP is highly suggestive of right ventricular infarction. Management includes optimising right ventricular filling pressure, and closely monitoring pressures with a pulmonary artery catheter where appropriate. Once filling is optimised, if hypotension persists, addition of inotropes may be required. He should be considered for urgent primary PCI to open the culprit artery.

A Left anterior descending

Occlusion of the left anterior descending would be expected to cause an anterior STEMI. This would be associated with ST elevation in the precordial leads (particularly V_2–V_4), and reciprocal ST depression in the inferior leads. The more extensive the area of ischaemic myocardium (i.e. the more proximal the occlusion), the more leads will demonstrate ST elevation.

B Circumflex

In patients with a right dominant circulation (the majority of patients), the right coronary artery supplies the posterior descending artery. In this case, the circumflex artery supplies the posterolateral wall of the left ventricle, and ST changes would be those of posterior infarction (i.e. ST depression in V_1–V_3 with tall, broad R waves). If the patient has a left dominant circulation, the circumflex also supplies the posterior descending artery, and inferior ST changes will also be seen (i.e. ST elevation in II, III and aVF).

D Left main stem

Left main stem occlusion is associated with diffuse ST depression (≥1mm in ≥6 surface leads) and ST elevation in lead aVR and/or V1.

E Diagonal

An isolated diagonal occlusion would be expected to produce a lateral infarction with ST elevation in the lateral leads: I, aVL and V_5–V_6, with reciprocal depression.

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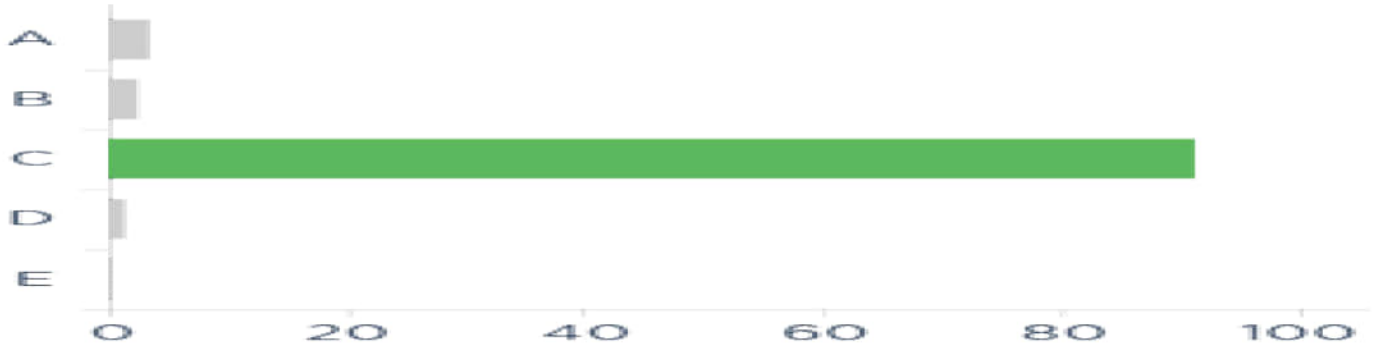
Peer Responses %



Session Progress

Responses Correct:	1
Responses Incorrect:	0
Responses Total:	1
Responses - % Correct:	100%

A 54-year-old man, who has received tissue plasminogen activator (TPA) for an anterior myocardial infarction (MI), develops sudden dyspnoea and left ventricular failure five days later.

On examination systolic murmur is heard loudest at the left sternal edge. Echocardiography with colour flow Doppler reveals a left to right shunt.

What is the diagnosis?

Your answer was correct

A	Ventricular septal defect (VSD)
B	Mitral regurgitation
C	Atrial septal defect
D	Aortic regurgitation
E	Aortic dissection

Explanation

A	Ventricular septal defect (VSD)

VSD is classically seen 5–10 days after MI. Patients present with rapid deterioration, pulmonary oedema and hypotension. There is a harsh pansystolic murmur loudest at the left sternal edge. Diagnosis is usually made with the aid of colour flow Doppler. Inotropes are used to manage severe hypotension; cautious vasodilator therapy may be employed if the systolic blood pressure is above 100 mmHg. If patients remain unstable, intra-aortic balloon pump may be considered. Surgical or specialist cardiological opinion should be requested with reference to formal surgical closure or catheter placement of an umbrella device.

B	Mitral regurgitation

Mitral regurgitation can occur due to papilllary muscle damage as a complication of an MI. The murmur is typically pansystolic and best heard at the cardiac apex, with radiation to the axillae.

C Atrial septal defect

Atrial septal defects can present as a chronic left to right shunt which results in right ventricular volume overload. It is not commonly associated with acute myocardial infarction, therefore the patient's presentation and heart sounds are consistent with an acute ventricular septal defect (VSD) secondary to ischaemia.

D Aortic regurgitation

Aortic regurgitation is not a typical complication of an acute MI. An aortic regurgitation murmur may be described as an early diastolic murmur, loudest at the right sternal edge, second intercostal space and accentuated by leaning the patient forward in held expiration.

E Aortic dissection

Aortic dissections present classically as acute central chest pain radiating to the back, described as a sharp, tearing or ripping pain. Patients exhibit acute cardiac decompensation and shock. An aortic regurgitation murmur may be detected depending upon the type of dissection.

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Difficulty: Average

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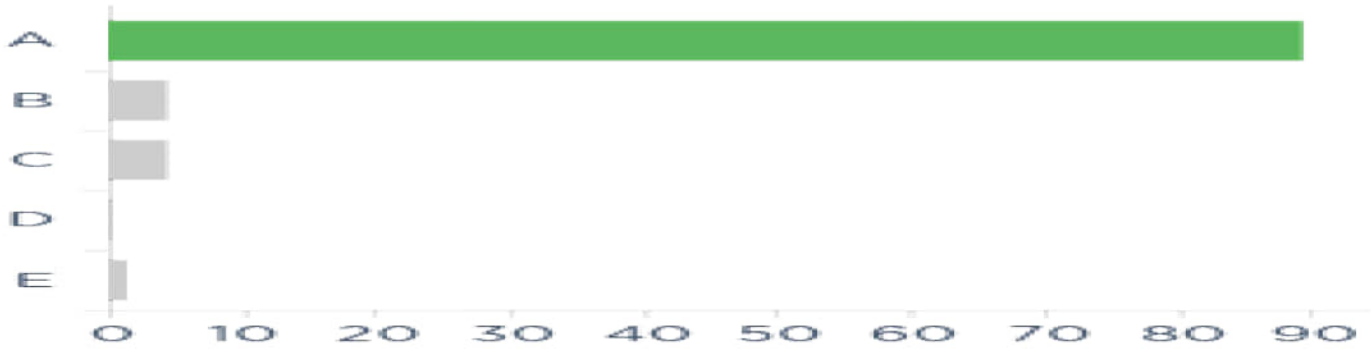


Session Progress

A 32-year-old Romanian man presents to the Emergency Department complaining of shortness of breath and tiredness. He tells you that this has been increasing over the past six months. He also complains of a chronic cough.

On examination, his body mass index (BMI) is 21 and he looks tired. His blood pressure (BP) is 110/70 mmHg and his resting pulse is 80/min. He has bilateral ankle oedema.

Investigations:

Hb	10.5 g/dl
WCC	11.6×10^9/l
PLT	201×10^9/l
Na^+	138 mmol/l
K^+	4.5 mmol/l
Creatinine	120 µmol/l
ECG	Low voltage complexes, nil else of note
ECHO	pericardial effusion
Effusion fluid	Lymphocytes ++

Which of the following is the most likely diagnosis?

Your answer was correct

A	Autoimmune pericarditis
B	Viral pericarditis
C	Restrictive cardiomyopathy
D	Tuberculous pericarditis
E	Amyloidosis

Explanation

Q1

A 45-year-old man presents with pleuritic central chest pain and flu-like symptoms to the Emergency Department. The pain started yesterday and is worse at night when he lies flat. Which one of the following ECG findings is most specific for the likely diagnosis?

- PR depression
- T wave inversion
- Short PR interval
- U waves
- ST elevation

Submit answer

Reference ranges

Score: 0%

PR depression
T wave inversion
Short PR interval
U waves
ST elevation

The most specific ECG finding in acute pericarditis is PR depression

Important for me Less important

ST elevation is seen but is not specific as it may also indicate ischaemia

Discuss Improve

Next question

Acute pericarditis

Pericarditis is one of the differentials of any patient presenting with chest pain.

Features

- chest pain: may be pleuritic. Is often relieved by sitting forwards
- other symptoms include non-productive cough, dyspnoea and flu-like symptoms
- pericardial rub
- tachypnoea
- tachycardia

Causes

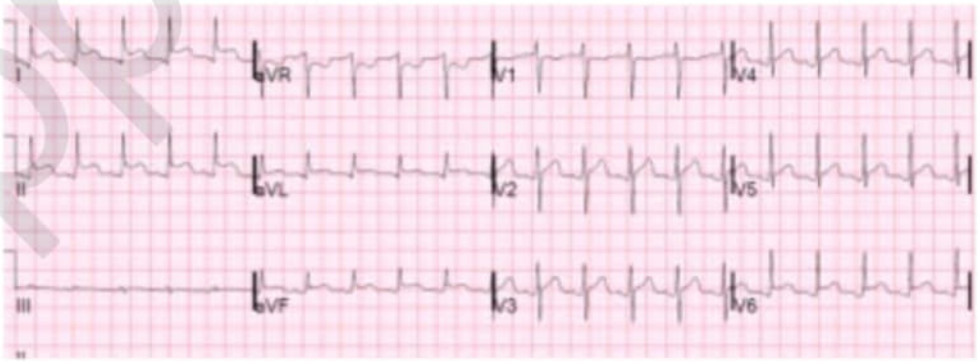
- viral infections (Coxsackie)
- tuberculosis
- uraemia (causes 'fibrinous' pericarditis)
- trauma
- post-myocardial infarction, Dressler's syndrome
- connective tissue disease
- hypothyroidism
- malignancy

Investigations

- ECG changes
  - the changes in pericarditis are often global/widespread, as opposed to the 'territories' seen in ischaemic events
  - 'saddle-shaped' ST elevation
  - PR depression: most specific ECG marker for pericarditis
- all patients with suspected acute pericarditis should have transthoracic echocardiography

Management

- treat the underlying cause
- a combination of NSAIDs and colchicine is now generally used for first-line for patients with acute idiopathic or viral pericarditis



ECG showing pericarditis. Note the widespread nature of the ST elevation and the PR depression

Next question

Q2

Which one of the following statements regarding percutaneous coronary intervention (PCI) is **incorrect**?

- Stent thrombosis usually occurs in the first month
- Restenosis is more common than stent thrombosis
- Around 95% of patients have a stent fitted during a PCI
- Renal impairment is a risk factor for restenosis
- Patients with drug-eluting stents require a shorter duration of clopidogrel therapy

Submit answer

Reference ranges

Score: **100%**

1 ✔

2 -

Restenosis is more common than stent thrombosis

Around 95% of patients have a stent fitted during a PCI

Renal impairment is a risk factor for restenosis

Patients with drug-eluting stents require a shorter duration of clopidogrel therapy

PCI - patients with drug-eluting stents require a longer duration of clopidogrel therapy

We've marked this as an important fact for you.

Importance: **50**

  Discuss (3) | Improve

Next question ›

Percutaneous coronary intervention

Percutaneous coronary intervention (PCI) is a technique used to restore myocardial perfusion in patients with ischaemic heart disease, both in patients with stable angina and acute coronary syndromes. Stents are implanted in around 95% of patients - it is now rare for just balloon angioplasty to be performed

Following stent insertion migration and proliferation of smooth muscle cells and fibroblasts occur to the treated segment. The stent struts eventually become covered by endothelium. Until this happens there is an increased risk of platelet aggregation leading to thrombosis.

Two main complications may occur

- stent thrombosis: due to platelet aggregation as above. Occurs in 1-2% of patients, most commonly in the first month. Usually presents with acute myocardial infarction
- restenosis: due to excessive tissue proliferation around stent. Occurs in around 5-20% of patients, most commonly in the first 3-6 months. Usually presents with the recurrence of angina symptoms. Risk factors include diabetes, renal impairment and stents in venous bypass grafts

Types of stent

- bare-metal stent (BMS)
- drug-eluting stents (DES): stent coated with paclitaxel or rapamycin which inhibit local tissue growth. Whilst this reduces restenosis rates the stent thrombosis rates are increased as the process of stent endothelisation is slowed

Following insertion the most important factor in preventing stent thrombosis is antiplatelet therapy. Aspirin should be continued indefinitely. The length of clopidogrel treatment depends on the type of stent, reason for insertion and consultant preference

CARDIOLOGY

1) In the diagnosis of rheumatic fever, which of the following may be helpful?

Available marks are shown in brackets

1)	A generalized macular-papular rash.	[0]
2)	ASO titre of less than 1:200.	[0]
3)	Polyarthritis.	[100]
4)	*Staphylococcus aureus* grown on throat culture.	[0]
5)	Splinter haemorrhages.	[0]

Comments:
A Jones criteria require two major or one major and two minor, and evidence of recent streptococcal infection for the diagnosis of rheumatic fever.
MAJOR:
1) Pancarditis. 2) Polyarthritis 3) Erythema marginatum 4) Chorea 5) Subcutaneous nodules
- The rash is macular.
MINOR:
1) Fever 2) Polyarthralgia 3) History of RF 4) Raised ESR/CRP 5) Prolonged PR interval on ECG.

2) Cyanosis in the newborn may be caused by which of the following:

Available marks are shown in brackets

1)	Transposition of the great arteries.	[100]
2)	VSD	[0]
3)	Hyperbilirubinaemia.	[0]
4)	Coarctation of the aorta.	[0]
5)	Eisenmenger syndrome	[0]

Comments:
VSD is a left to right shunt, coarctation is a narrowing of the aortic arch and hyperbilirubinaemia is not associated with cyanosis. Eisenmenger's syndrome though a cause of cyanosis develops much later following reversal of a left to right shunt.

3) A 1-year-old infant is known to have heart disease and is noted to be cyanosed. Which of the following is the most likely diagnosis?

Available marks are shown in brackets

1)	Atrial septal defect	[0]
2)	Coarctation of the aorta	[0]
3)	Patent Ductus Arteriosus	[0]
4)	Tricuspid atresia	[100]
5)	Ventricular septal defect	[0]

Comments:
The patient is cyanosed and of the diseases described only tricuspid atresia is associated with cyanosis. Other causes are Fallot's tetralogy, single ventricle and Transposition of the great vessels. Eisenmenger's syndrome develops with the switch to right to left flow associated with deteriorating VSD etc.

4) An uncomplicated ventricular septal defect in a 5-year-old boy may be associated with which one of the following?

Available marks are shown in brackets

1)	A collapsing pulse.	[0]
2)	Wide and fixed splitting of the second heart sound.	[0]
3)	Clubbing of the fingers.	[0]
4)	A pansystolic murmur of grade 4/6 in intensity.	[100]
5)	Splenomegaly.	[0]

Comments:
A *collapsing pulse* may indicate associated aortic incompetence. The *S2 splits* normally in an uncomplicated VSD and P2 is normal. *Clubbing* is a feature of cyanotic congenital heart disease. *A holo-systolic murmur* of variable intensity is characteristic. Splenomegaly is not associated.

5) A newborn baby, one of twins born at term, is noted to be centrally cyanosed soon after birth. Which of the following is the most likely cause

Available marks are shown in brackets

1)	Ventricular septal defect	[0]
2)	Transposition of great arteries	[100]
3)	Patent ductus arteriosus	[0]
4)	Coarction of the aorta	[0]
5)	Tricuspid atresia	[0]

Comments:
VSD and PDA are left to right shunts; coarctation of the aorta is not associated with cyanosis. Tricuspid atresia and transposition of the great arteries are both cyanotic congenital heart diseases and present in the immediate newborn period. Of the 2 transposition of the great arteries is more common and hence more likely to be the cause.

6) Plethoric lung fields are a common radiological feature of:

Available marks are shown in brackets

1)	A large ventricular septal defect	[100]
2)	Fallot's tetralogy	[0]
3)	Coarctation of the aorta	[0]
4)	Epstein's anomaly	[0]
5)	Eisenmenger's complex	[0]

Comments:
Coarctation is associated with normal pulmonary blood flow and other than a large VSD the rest are associated with reduced pulmonary blood flow.

7) A 14-year-old boy presents with hypertension. Which of the following statements concerning hypertension in the young is true?

Available marks are shown in brackets

1)	Sodium nitroprusside is useful for the long-term treatment of severe cases.	[0]
2)	Headache is the usual presenting feature.	[0]
3)	It is defined as systolic blood pressure above the 99th centile for age.	[0]
4)	Abnormalities are frequently seen on DMSA scan.	[100]
5)	Aortic coarctation is the commonest secondary cause.	[0]

Comments:
Sodium nitroprusside is useful only in the short term, as cyanide levels accumulate with time.
Hypertension is usually diagnosed incidentally, and is *defined as systolic blood pressure >95th centile for age*. Secondary causes are usually due to renal abnormalities, with reflux associated scarring being the commonest renal disease. This will cause abnormalities on DMSA scan. Coarctation of the aorta is the commonest non-renal cause, with pheochromocytoma/neuroblastoma, congenital adrenal hyperplasia, Cushing Syndrome and steroid therapy being rarer causes.

8) Which one of the following is a recognized feature of abeta-lipoproteinaemia?

Available marks are shown in brackets

1)	A high serum cholesterol	[0]
2)	Palmar xanthomas	[0]
3)	Advanced atherosclerotic vascular disease	[0]
4)	Abnormal red blood cell morphology	[100]
5)	Severe mental retardation	[0]

Comments:

Acanthocytes are seen in **abetalipoproteinaemia**.
Retinitis pigmentosa is seen in abeta-lipoproteinaemia. Neurodegenerative changes are seen such as ataxia but IQ is normal.

ABETALIPOPROTEINAEMIA

Rare recessive disorder inability to produce LDL chylomicron formation is defective

Characteristic features to age 2

- Steatorrhoea, failure to thrive
- Low serum lipids, acanthocytosis

Later childhood

- Ataxia, intention tremor, nystagmus
- Athetosis, muscle weakness, dec. reflexes
- IQ normal but emotionally labile

Some develop retinitis pigmentosa

9) A baby is diagnosed with a ventricular septal defect. Which one of the following is true concerning a VSD?

Available marks are shown in brackets

1)	Is likely to cause heart failure in the first week of life.	[0]
2)	Is associated with plethoric lung fields on chest x-ray in a 10-week-old infant.	[100]
3)	Requires surgical correction in all but a small minority of cases.	[0]
4)	Requires surgical correction if central cyanosis occurs.	[0]
5)	Causes "fixed splitting" of the second heart sound.	[0]

Comments:
VSD is unlikely to present till after the first month of life and associated with pulmonary plethora. The majority of cases will resolve spontaneously. *Central cyanosis* indicates shunt reversal and pulmonary hypertension, which implies poor prognosis and response to operative repair of the VSD. The second heart sound is normally spilt.

10) In ventricular septal defect (VSD)

Available marks are shown in brackets

1)	The smallest defects tend to produce the softest murmurs	[0]
2)	Left-to-right shunting leads to increased risk of cerebral abscess	[0]
3)	There may be a diastolic murmur at the apex	[100]
4)	The systolic murmur increases in intensity as pulmonary hypertension develops	[0]
5)	There is no risk of bacterial endocarditis	[0]

Comments:
Large Defects may be associated with soft murmurs; right to left shunting cause's cerebral abscesses. Diastolic murmur occurs due to aortic incompetence (5%) or increased flow across the mitral valve and relative mtral stenosis. Although pulmonary hypertension may occur in association with increased flow across the shunt, it may indicate decreased flow across the shunt and increased pulmonary vascular resistance in which case the murmur would be softer. The risk of bacterial endocarditis is high in this lesion and even greater with haemodynamically trivial lesions.

11) Which of the following concerning congenital heart disease is correct?

Available marks are shown in brackets

1)	ASD is the commonest malformation at birth	[0]
2)	Congenital complete heart block is usually associated with Anti-Ro antibodies in the mother	[0]
3)	Ebstein's anomaly is associated with maternal exposure to lithium carbonate	[100]
4)	Hypo plastic left heart syndrome is characterized by a large, dilated left ventricle	[0]
5)	Osteogenesis imperfecta is associated with aortic stenosis	[0]

Comments:
A VSD is the commonest at 30%, ASD is 10%. Aortic regurgitation may be a feature of Osteogenesis imperfecta. Ebstein's anomaly is associated with maternal LiCO3 use if exposed in the first trimester. In the vast majority of cases of neonates with complete heart block the cause is unknown but in the minority it may be caused by autoimmune disease, particularly Anti-Ro antibodies, in the mother. LV Hypolasia occurs when the left sided chambers fail to develop and blood enters the systemic circulation from the right ventricle via the pulmonary artery and a patent ductus arteriosus.

12) In an infant, which of the following make Cardiac failure unlikely?

Available marks are shown in brackets

1)	A respiratory rate of more than 30 per minute	[0]
2)	A heart rate of more than 180 per minute	[0]
3)	An enlarged liver	[0]
4)	Ascites	[100]
5)	Excessive perspiration	[0]

Comments:
Ascites is rare in cardiac failure in infancy. Other features such as bibasal crackles, raised JVP, third heart sound, pulsus alternans are common clinical features.

13) A 3-month-old girl presents with apnoea. She had been well that morning, but had become unsettled, crying inconsolably and gradually more mottled. Mother was bringing her to A and E when she stopped breating. She responded to physical stimulation. She was born at 40+3/40 weighing 3.6kg and there were no neonatal problems.

On examination she has a temperature of 36.3°C (tympanic), RR 30/min and HR of 240/min. Her pulse in thready. She has a 3 cm liver and gallop rhythm.

What is the most likely diagnosis?

Available marks are shown in brackets

1)	Acute life-threatening event	[0]
2)	Cardiac dysrhythmias	[100]
3)	Seizures	[0]
4)	Sudden infant death syndrome	[0]

Comments:
The history suggests apnoea precipitated by tachyarrhythmia. This is most likely to be a supraventricular tachycardia. This can be confirmed by ECG monitoring, and is usually successfully reverted by adenosine with digoxin maintenance therapy. An echocardiogram will exclude the rare possibility of an underlying structural defect.

14) Which one of the following would lead you to consider a murmur to be innocent in a four and a half year old child?

Available marks are shown in brackets

1)	Pansystolic timing.	[0]
2)	Association with a thrill.	[0]
3)	Marked variation of loudness with change of posture.	[100]
4)	Radiation towards the left axilla.	[0]
5)	Association with fixed splitting of the second heart sound.	[0]

Comments:
Innocent murmurs are of short duration and vary with posture. A thrill implies significant turbulence and hence valvular disease. Radiation to the axilla implies mitral incompetence and fixed splitting implies an ASD.

15) Cyanosis is a typical feature of which of the following conditions:

Available marks are shown in brackets

1)	Patent ductus arteriosus.	[0]
2)	Ventricular septal defect.	[0]
3)	Total anomalous pulmonary venous drainage.	[100]
4)	Atrial septal defect	[0]
5)	Mitral atresia.	[0]

Comments:
PDA, ASD and VSD are left to right shunts. Tricuspid atresia is typically associated with cyanosis rather than Mitral.

16) A four year old child is found to have the classical murmur of a patent ductus. He is underweight for age but otherwise well. Which of the following would you recommend for this patient?

Available marks are shown in brackets

1)	Recommend early operative closure?	[100]
2)	Review the child constantly, expecting spontaneous closure within the next five years?	[0]
3)	Recommend prophylactic penicillin until operation is performed?	[0]
4)	Delay operation until the child has reached its expected weight for age?	[0]
5)	Explain to the parents that this is of little significance and can be ignored?	[0]

Comments:
Early operative closure is recommended, in any patient in whom the defect has persisted beyond six months of age. Prophylactic antibiotics are recommended for dental and other invasive procedures.

16) A 9 year old boy presents with fever and joint pains. Initially the pain affected his right wrist, but now affects his left wrist and right ankle. He had tonsillitis 4 weeks previously treated with oral penicillin. Full term normal delivery with no neonatal complications. Immunisations up to date. There is no family or social history of note.

On examination temperature is 38.7°C, respiratory rate 15/min, heart rate 95/min. 2/6 ejection systolic murmur at the left sternal edge. His left wrist and right ankle are exquisitely tender, such that even the bedclothes cause pain. His ESR is 95 mm/hr and CRP 129 mg/l. ECG shows a PR interval of 0.15s. His ASOT is 800 IU/l.

What is the most likely diagnosis?

Available marks are shown in brackets

1)	Acute rheumatic fever	[100]
2)	Bacteraemia/sepsis	[0]
3)	Henoch-Schonlein disease	[0]
4)	Septic arthritis	[0]
5)	Urinary tract infection	[0]

Comments:
The history of sore throat followed by fever, migratory polyarthritis and heart murmur suggest Acute Rheumatic Fever. This is diagnosed using the Duckett-Jones criteria. Evidence of Streptococcal infection PLUS Major criteria: arthritis, carditis, nodules, erythema marginatum and chorea. Minor criteria: fever, arthralgia, raised acute phase reactants, prolonged PR interval.

12. it leaves the posterior end of the S.A node and passes to the posterior of the vena caval opening:
    a) anterior internodal pathway b) middle internodal pathway
    c) posterior internodal pathway

13. diastolic pressure is:
    A maximum pressure during ventricular diastole
    B. minimum pressure during ventricular diastole
    C. maximum pressure during atrial diastole
    D. minimum pressure during atrial diastole

14. the right bundle branch (RBB) is innervated by:
    a) right coronary artery b) left coronary artery
    c) both a & b d) conus artery

15. left bundle branch (LBB) is innervated by:
    a) right coronary artery b) left coronary artery
    c) both a & b d) conus artery

16. it directly enters the right atrium:
    a) great cardiac vein b) small cardiac vein
    c) middle cardiac vein d) anterior cardiac vein

17. Regarding the valves in veins:
    a) inferior vena cava b) femoral vein
    c) umbilical vein d) veins' diameter less than 2 mm

18. Pericardial cavity is a gap between:
    A. fibrous pericardium and serous pericardium
    B. fibrous pericardium and epicardium
    C. parietal pericardium and epicardium
    D. visceral pericardium and epicardium

19. regarding the blood supply of fibrous and parietal pericardium:
    a) internal thoracic artery
    b) descending thoracic aorta
    c) musculophrenic arteries
    d) inter coastal arteries

20. the right and left borders of heart are formed as:
    a) right atrium and left ventricle
    b) right atrium and left atrium
    c) right ventricle and left ventricle
    d)right atrium and right ventricle; left atrium and left ventricle

21. in liver and spleen capillaries are replaced by:
    a) sinusoids
    b) anastomosis of arteries
    c) shunts
    d) lymphatics

22. Tunica adventitia contains
    a) minute veins
    b) vasa vasorum
    c) lymphatics
    d) A.O.T
    e) N.O.T

23. smooth muscles are absent in the following veins:
    a) retinal veins
    b) pial veins
    c) viens of cancellous bone
    d) A.O.T
    e) N.O.T

24. capillaries are derived from the word capillus which means:
    a) thin
    b) hair
    c) connecting
    d) exchanging

25. the capillaries in_____ are of smaller diameter and that in_____ are of larger diameter.
    a) brain, intestine
    b) bone marrow, skin
    c) brain, bone marrow
    d) skin, intestine

26.the apex of heart lies at the level of____inter coastal space

a) 3rd b) 4th

c) 5th d) 6^{th}

27.musculi pectinati is embryologicaly derived from:

a) primitive atrium b) sinous venosus

c) sulcus terminalis d) crista terminalis

28.the superior vena cava is larger than inferior vena cava:

a) True b) False

29.right atrium has____openings:

a) 2 b) 3

c) 4 d) 5

30.regarding the fetal remnants:

a) rudimentary valve of the inferior vena cava b) atrial septum

c) fossa ovalis d) annulus ovalis

31. the right atrium lies____to the left atrium:

a) right b) left

c) anterior d) superior

32.the heart is placed in the:

a) chest cavity b)thoracic cavity

c) superior mediastinum d) middle mediastinum

33.regarding the contents of pericardium:

a) heart b) pulmonary arteries

c) ascending aorta d) pulmonary trunk

34.the following structures come into action when the organ is inactive:

a) sinusoids b) capillaries

c) shunts d) arterial anastomosis

35.parasympathetic supply of heart comes from:

a) cervical portion b) thoracic portion

c) vagus nerves d) phrenic nerves

36.brachiocephalic veins are formed by:

a) superior vena cava b) inferior vena cava

c) subclavian and internal jugular veins d) azygous vein

37.The crista terminalis is inner to sulcus terminalis

a) true b) false

38.the brachiocephalic veins form:

a) superior vena cava b) inferior vena cava

c) internal jugular and subclavian veins d) azygous veins

39.find the mis-match:

a) trabeculae carneae : papilary muscle b) fossa ovalis : septum primum

c) annulus ovalis : septum secondum d) ventricles : moderator band

e) N.O.T

40.inflamation of vein is called:

a) veinitis b) phlebitis

c) aneurysm d) varicose

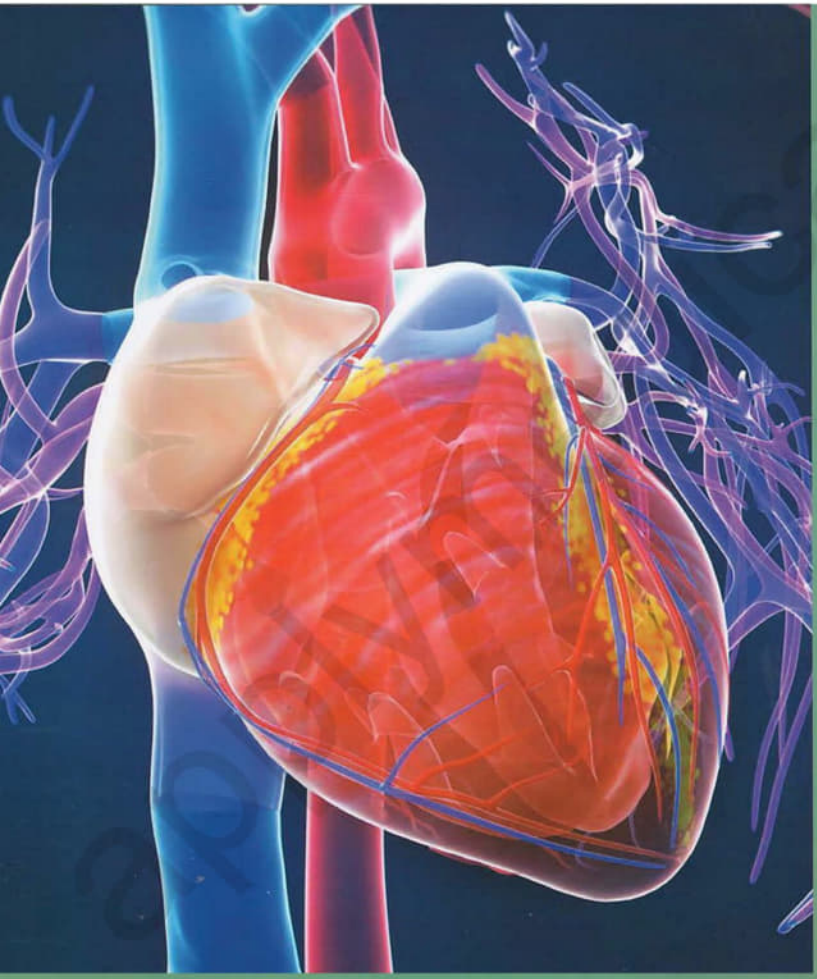
Answer Key

1	D	2	A	3	D

InCapsule | Series

SMARTER NOT HARDER

CARDIOLOGY



MOWAFY

INTERNAL MEDICINE

IRIS ASPECT