

Advanced End of Block Exam

INTRODUCTION

You have 1 hour to complete this test. Each multiple choice question has only one correct answer. The short answer questions (SAQ's) will dictate how many marks each question is worth in brackets.

Q1

Which of the following arrhythmias is caused most commonly by a macro re-entry circuit forming around the tricuspid valve

- A. Atrial flutter
- B. Atrial fibrillation
- C. AV nodal re-entry tachycardia
- D. Wandering atrial pacemaker
- E. Sick sinus syndrome

Explanation

Atrial flutter is caused by a macro re-entry circuit most commonly found around the tricuspid valve annulus. Atrial fibrillation is caused by multiple ectopic foci within the atrium all firing simultaneously, AVNRT is caused by a re-entry circuit in the AV node, wandering atrial pacemaker occurs when the pacemaker site of the heart persistently changes within the atrium and sick sinus syndrome is a disorder of the sinoatrial node caused by impaired pacemaker function and impulse transmission producing a constellation of abnormal rhythms. These can be both tachyarrhythmias and bradyarrhythmias.

Q2

The rhythm strip below is taken from a well patient in cardiology clinic. What is the diagnosis?



- A. Atrial fibrillation
- B. Focal atrial tachycardia
- C. Atrial bigeminy
- D. Wandering atrial pacemaker
- E. Multifocal atrial tachycardia

Explanation

This ECG shows a repeating pattern of one sinus p-wave followed by a premature atrial contraction (PAC). We can see that these are ectopic because the p-wave morphology is inverted. Also following the PAC there is a short compensatory pause before the next sinus beat. There is no tachycardia, meaning that B and E are incorrect, also for WAP and MAT there needs to be at least 3 different p-wave morphologies and in this ECG there are only 2. The rhythm is not irregularly irregular and there are p-waves present meaning it is not atrial fibrillation

Q3

A 68 year old male has been admitted to the general surgical ward as an emergency due to an acute abdomen. This was very sudden onset, he had been previously fit and well and was passing stools regularly with no blood. His ECG is shown below which appears similar to one taken 6 months ago during a GP appointment. His drug history includes simvastatin, bisoprolol and ramipril. VBG analysis shows acidosis with a raised lactate of 5.5 (normal <2). What is the most likely cause of his abdominal pain



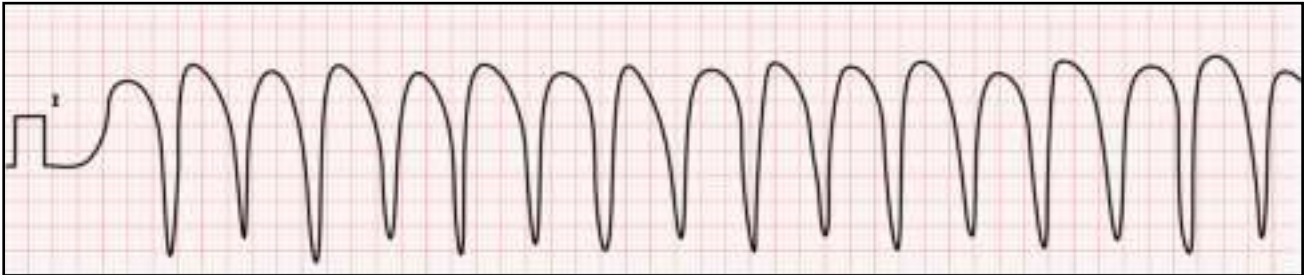
- A. Gastritis
- B. Bowel obstruction
- C. New onset inflammatory bowel disease
- D. Ischaemic colitis
- E. Non-GI related abdominal pain

Explanation

The ECG shows atrial fibrillation which has not been treated with any anticoagulation. This means that blood clots may have formed within the atrium due to stagnation of blood. The sudden onset of symptoms and high lactate suggest an ischaemic presentation. Given that he is a likely vasculopath (he takes a background statin), ischaemic colitis is the most likely answer.

Q4

A 61 year old female patient collapses in the emergency department. Her BP is unrecordable but there is a faint carotid pulse palpable. Her O2 sats are 96% and temp is 36.1. She has a PMH of ischaemic heart disease, diabetes and vasculitis. Her ECG trace is shown below. What's the most appropriate immediate management step?



- A. Urgent cardiology opinion regarding percutaneous coronary intervention
- B. DC cardioversion
- C. Defibrillation
- D. Start CPR
- E. IV amiodarone 300mg

Explanation

As per the ALS guidelines this patient is in a broad complex tachycardia which has signs of haemodynamic instability (unrecordable BP). She still has a pulse and so CPR and defibrillation is not yet indicated (this would be appropriate for pulseless VT). DC cardioversion is the most appropriate step in this case. Giving IV amiodarone would have been the next most appropriate step had she not shown signs of haemodynamic instability.

Q5.

Which of the following criteria would make a diagnosis of ventricular tachycardia more likely than a diagnosis of a supra-ventricular rhythm with a superimposed bundle branch block

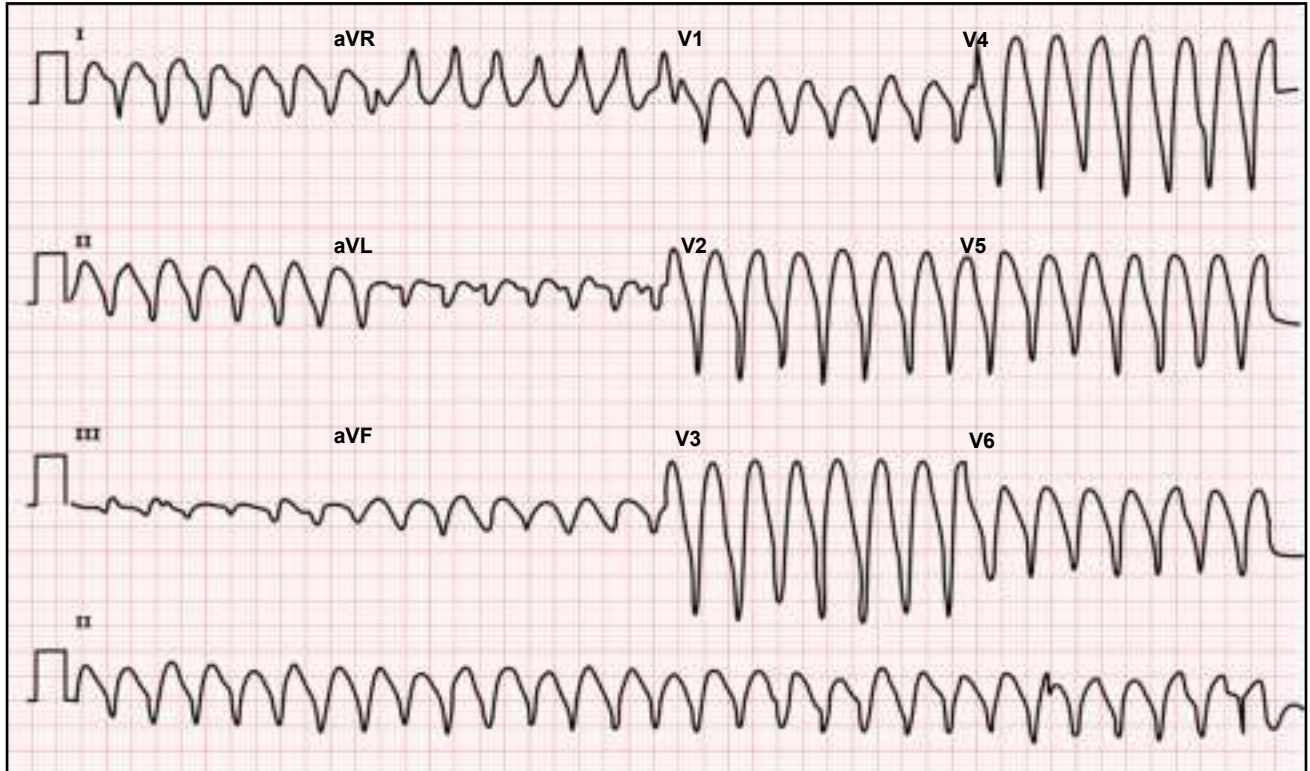
- A. Left axis deviation
- B. Inverted p-waves following each QRS complex
- C. RSr' complex in V1
- D. QRS duration of 120ms
- E. Previous bundle branch block on 12 lead ECGs

Explanation

Telling apart VT from SVT with aberrancy is difficult. An RSr' complex where the first 'bunny ear' is taller than the second is more suggestive of VT than RBBB. An extreme axis deviation rather than a left axis deviation is also a good clue. True VT will show evidence of AV dissociation meaning that each QRS should not sync with any p-waves. A QRS duration >120ms is not specific to VT and is seen as a characteristic in bundle branch block. Previous bundle branch blocks on ECG are unhelpful

Q6

A 77 year old female has recently undergone PCI for a STEMI. Whilst in CCU she begins to feel unwell and a 12 lead ECG was performed. A diagnosis of ventricular tachycardia was made. What feature is shown on this 12 lead ECG that makes a diagnosis of VT more likely than a supra-ventricular arrhythmia with aberrant conduction?



- A. RSr' complex in V1
- B. Negative concordance
- C. Positive concordance
- D. AV dissociation
- E. Absent p-waves

Explanation

Negative concordance in the chest leads is where all of the QRS complexes are negative. This is very suggestive of true VT. Positive concordance is also suggestive of VT but there is no evidence of it on this trace. AV dissociation is the hallmark of true VT but there are no visible p-waves on this trace, so this can't accurately be assessed. By the same logic, there is no RSr' complex within V1 on this trace. Absence of p-waves can also occur in supra ventricular arrhythmias and so is not helpful.

Q7

Which of the following would cause QTc prolongation

- A. Hyperkalaemia
- B. Hypercalcaemia
- C. Use of IV lidocaine (Na⁺ channel blocker)
- D. Use of IV magnesium
- E. Use of amitriptyline

Explanation

Hyperkalaemia does not prolong QT but hypokalaemia does. Similarly hypocalcaemia prolongs QTc interval but hypercalcaemia shortens it. Lidocaine is an anti arrhythmic which shortens the QTc duration, and IV magnesium is used as treatment for arrhythmias caused by prolonged QTc durations. Amitriptyline is a tricyclic antidepressant which typically can prolong QTc intervals. Other examples of drugs that do this are some antiarrhythmics e.g. amiodarone, and antiemetics e.g. ondansetron and levomepromazine

Q8

Which of the following statements is the most correct regarding the cardiac trace below



- F. This is 2nd degree Mobitz type I heart block
- G. This is 2nd degree Mobitz type II heart block
- H. There is no evidence of heart block
- I. This is a second degree heart block with 2:1 conduction
- J. This is 3rd degree heart block

Explanation

This ECG shows second degree heart block with 2:1 AV conduction, meaning that there are 2 p-waves for every QRS. We are unable to determine if this is Mobitz type I or II because there are not enough beats preceding the dropped QRS to demonstrate if there is progressive PR prolongation or not. There is definitely evidence of some of the p-waves conducting through to the ventricles meaning that it can't be 3rd degree heart block and so the most true statement is that this is a second degree heart block. This needs monitored further and it will likely spontaneously change to either Mobitz type 1 or type 2 patterns.

Q9

A 25 year old male patient with known atrial fibrillation is due to undergo an ablation procedure to correct his arrhythmia. Just prior to the procedure he begins to develop a tachyarrhythmia. His trace is shown below. What is the most likely explanation for the trace below?



- K. Pre-excited atrial fibrillation
- L. Atrial fibrillation + bundle branch block
- M. New onset polymorphic ventricular tachycardia
- N. New onset monomorphic ventricular tachycardia
- O. Pre-excited AV nodal re-entry tachycardia

Explanation

This is a very difficult question. The ECG shows a broad complex tachycardia and all of the options can result in broad complex tachycardias. Pre-excited AF (AF + wolff-parkinson-white syndrome) is the most likely given the irregularly irregular nature of the complexes, the subtle changes in QRS morphology with each beat, and the fact that the axis remains stable (i.e. the height of the QRS complexes is not changing). AF + BBB would produce a similarly irregularly broad trace but the QRS morphology would be more uniform. New onset polymorphic VT is a differential but the QRS height remains stable meaning the axis is not changing. The rhythm is irregular and so monomorphic VT and pre-excited AV nodal re-entry tachycardia can be ruled out.

Q10

An 89 year old patient with terminal cancer is found unresponsive in her bed. There was ongoing debate as to whether CPR would be appropriate and no DNACPR decision had been made. A cardiac monitor was attached and no central pulse could be felt. Which of the following is the best description for the ECG shown below?



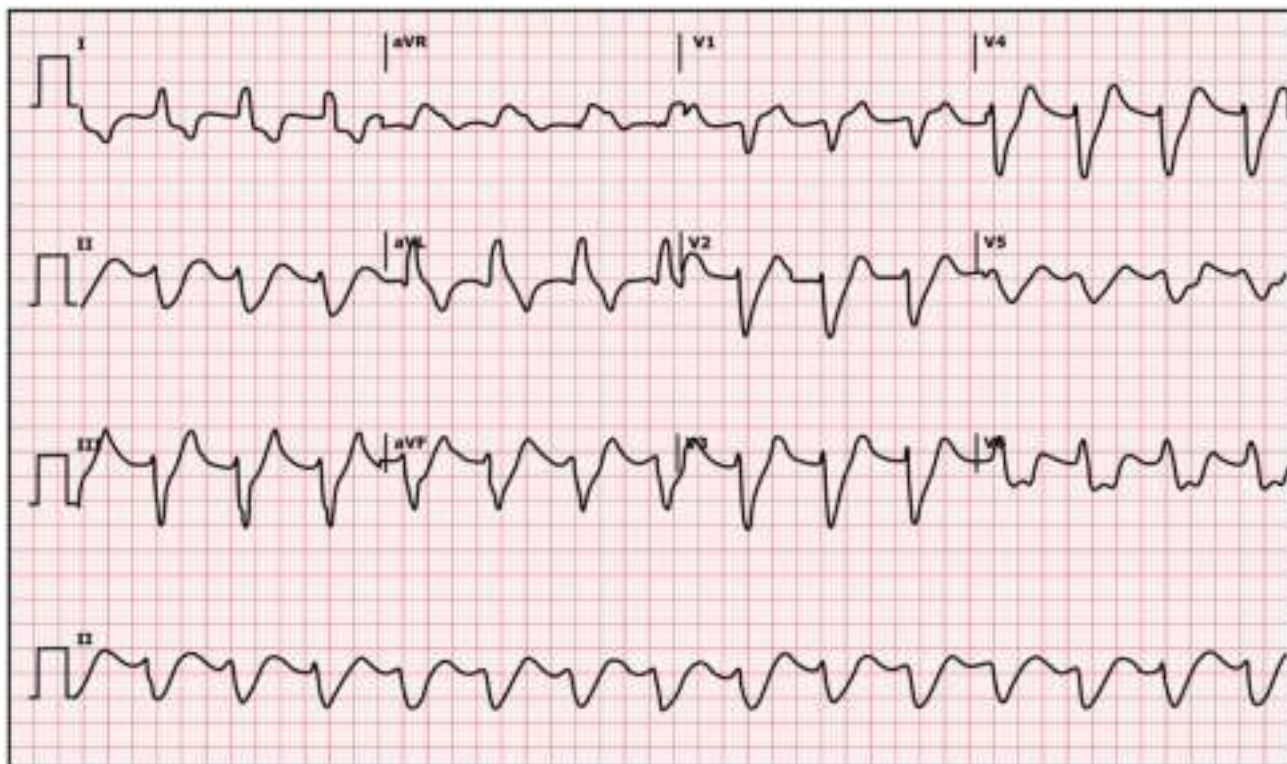
- A. Complete asystole
- B. Agonal rhythm
- C. P-wave asystole
- D. Pulseless electrical activity
- E. Ventricular fibrillation

Explanation

There is evidence of p-waves within this trace and so it is not complete asystole although there is no evidence of ventricular activity, meaning that the trace is not compatible with life. Pulseless electrical activity would be correct if there was no pulse and the rhythm was compatible with life. Agonal rhythm is a broad complex slow rhythm often seen during ongoing CPR attempts. Thus the diagnosis is p-wave asystole. Transcutaneous pacing can sometimes be used to reverse this although it is likely in this scenario that resuscitation attempts would be futile.

SAQ 1

A 45 year old female patient with diabetic nephropathy and CKD stage 4 presents with worsening shortness of breath. She has no chest pain or fevers. Her current medication includes humulin M3, ramipril, spironolactone, bisoprolol and simvastatin. Her ECG is shown below. Please interpret the ECG systematically by answering the questions below



Is electrical activity present in all leads? (1 mark) - **yes**

What's the heart rate? (1 mark) - **between 100 and 75 bpm**

Is the rhythm irregular? (1 mark) - **no**

Is the QRS complex broad? (1 mark) - **yes**

Are there any p-waves? (1 mark) - **no**

What's the relationship between p-waves and QRS complexes? (1 mark) - **Cannot determine**

What is the approximate cardiac axis in degrees (1 mark), is this within the normal range (1 mark) - **accept either -30 degrees or 0 degrees (1 mark), the axis is normal (1 mark)**

What other morphological change in the ST segments can be seen on this trace (1 mark) - **Slurring of ST segments in to T-waves (1 mark)**

What is the most appropriate next investigation to perform (1 mark) - Urea and electrolytes (also accept blood gas analysis as this will give information on electrolytes as well as acid base balance)

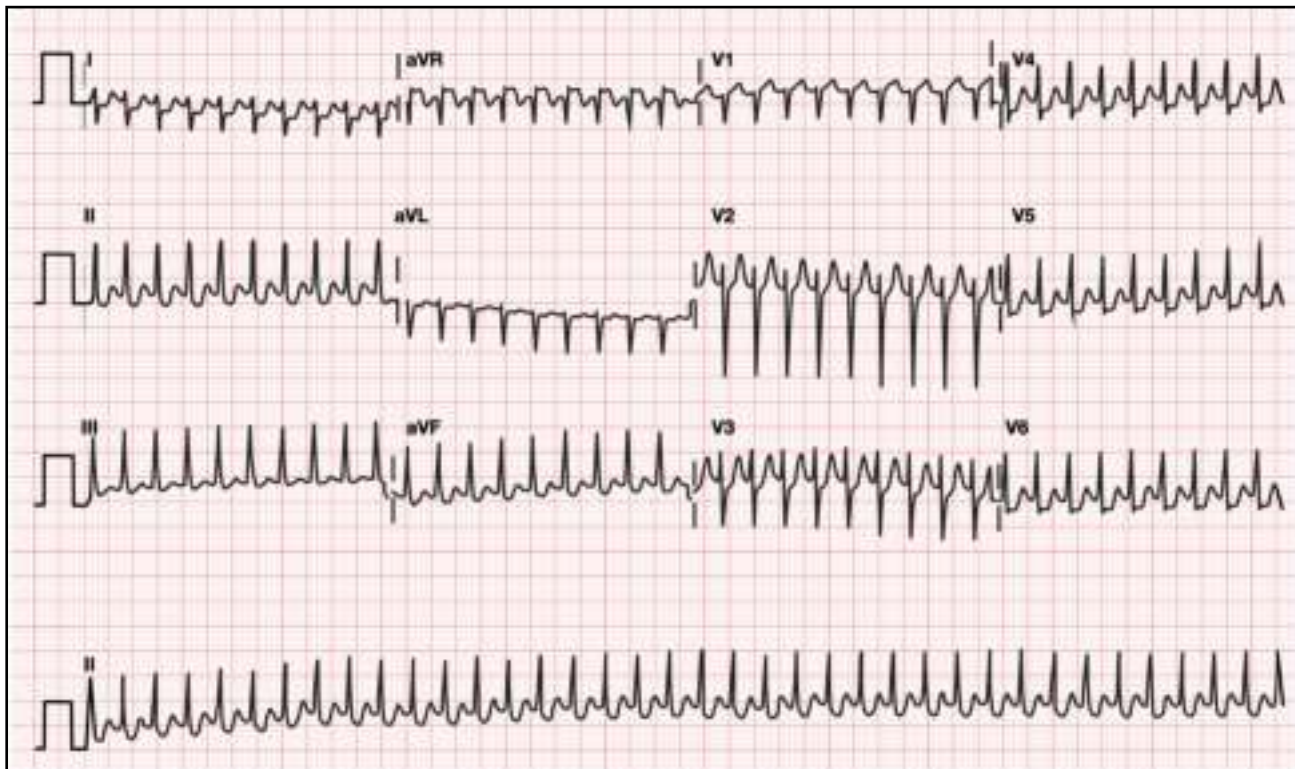
What is the most likely cause of this patient's ECG changes (1 mark) - hyperkalaemia

What initial drug treatments should be administered (3 marks) - IV calcium gluconate, IV dextrose/insulin infusion, nebulised salbutamol (don't accept calcium resonium as this acts too slowly and the effects are unpredictable)

These initial measures fail to deliver any noticeable ECG changes. What definitive management will need to be undertaken? (1 mark) - Admission to the renal unit for emergency dialysis

SAQ 2

A young 16 year old male patient is admitted to the ED following sudden onset collapse during a football tournament. He has no PMH of note and is taking no medications. His 12 lead ECG is shown below.



What umbrella heading can we use to describe the arrhythmia is shown on the trace (1 mark) -
supraventricular tachycardia or narrow complex tachycardia (1 mark for either)

Give 3 potential causes of this arrhythmia (3 marks) - AV nodal re-entry tachycardia (1 mark), AV re-entry tachycardia (1 mark), atrial flutter with 2:1 conduction (1 mark)

What is the initial treatment of this arrhythmia given that the patient is stable and still has a palpable pulse (1 mark) - trial of vagal manoeuvres

Total. /30

Pass mark 21/30