Dear EHRA Member, Dear Colleague,

As you know the EHRA Accreditation Process is becoming increasingly recognised as an important step for clinical practices within Europe.

The following slides contain examples of questions from past EHRA Accreditation Exam in EP.

Correct answers are on the last slide so that you may test yourself.

"Challenge yourself to meet the European standards of excellence in arrhythmia and join a community of experts"

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1. ECG, bipolar and distal electrode unipolar recordings from the mapping catheter during atrial pacing are shown. Please tick the best statement about the site where the recordings are obtained.

a. Not appropriate for RF application since AV continuity is not present
b. Not appropriate for RF application because AV relation > 1
c. Appropriate for RF application because early ventricular activation
d. Appropriate for RF application because a negative monophasic unipolar ventriculogram
e. None of the other statements is correct

ABL Bip and ABL Uni: bipolar and distal electrode unipolar recordings from the mapping catheter. RVA = Right Ventricular Apex; RF = radiofrequency.

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2. During sustained tachycardia a single ventricular extrastimulus is delivered at the right ventricular apex. The most likely diagnosis for the recording is:

a. Rate dependent Left Bundle Branch Block
b. A change in the mechanism of the tachycardia
c. Linking causing Left Bundle Branch Block
d. His Purkinje system is a bystander of the tachycardia
e. None of the other answers is true

HRA = high right atrium; His, P M and D = His proximal. Medium and Distal. RVA = Right Ventricular Apex.
3.- Which of the following ion channelopathies does NOT represent a gain-of-function mutation?

a.- Long QT3 syndrome
b.- Short QT1 syndrome
c.- Familial atrial fibrillation with KCNQ1 mutation
d.- SCN5A mutation in Brugada Syndrome
e.- None of the other answers is true
4.- A 24 year-old male presented with a narrow QRS-complex tachycardia and underwent electrophysiological study. During recording he presented the following ECG. What is the most likely mechanism of the tachycardia?

a.- ectopic right atrial tachycardia  
b.- orthodromic AV reentrant tachycardia  
c.- slow-fast AV nodal reentrant tachycardia  
d.- left-sided accessory pathway  
e.- none of the other mentioned mechanisms is likely

HRA = high right atrium; MAP = ablation catheter in the ventricle
5.- ECG and bipolar recordings during the beginning of a train of stimulation from the coronary sinus (A1A1) are shown. The recording is most probably:

a.- suggestive of two accessory pathways
b.- suggestive of one accessory pathway and AV nodal reentrant tachycardia
c.- suggestive of one accessory pathway and one orthodromic echo beat
d.- suggestive of one accessory pathway and intraatrial reentry
e.- suggestive of one accessory pathway and nodal automaticity

P = proximal; M= Medium; D = distal CS = coronary sinus RVA = Right Ventricular Apex;
6 - A 26-year old woman has dilated cardiomyopathy, functional class II and an EF of 26%. She had long runs of non-sustained ventricular on Holter but no syncope. What would be the best treatment according to the results of the Companion and SCD-Heft trials?

a.- No changes in therapy
b.- ICD with cardiac resynchronization therapy
c.- ICD without cardiac resynchronization therapy
d.- Amiodarone
e.- Class I anti-arrhythmic drug therapy

7 - Which of the following criteria is not typical of the Mahaim-type syndrome?

a.- Wide-QRS-complex tachycardia
b.- Pre-excitation during incremental atrial pacing
c.- Decremental antegrade conduction properties
d.- Retrograde conduction via atriofascicular pathways
How is the phenomenon shown in this tracing better explained/named?

a.- Recording artifact
b.- Atrial paralysis/standstill
c.- Atrial arrest
d.- Sinoventricular conduction
e.- Atrial diffuse fibrosis leading to low amplitude on local activity recording
9. Which diagnosis is associated with one or more right accessory pathways?

a. Coronary sinus diverticulum
b. Atrial septal defect
c. Ventricular septal defect
d. Ebstein’s anomaly
e. Pulmonary stenosis
ECG and endocardial recordings during termination of ventricular pacing (V1V1) at right ventricular apex during narrow QRS complex tachycardia are shown. Please tick the correct statement about this tachycardia.

a.- Atrial fusion is evident thus suggests an atrial reentrant mechanism
b.- Atrioventricular reentry using a right free wall accessory pathway is likely
c.- This is not typical for entrained atrial tachycardia
d.- The long post-pacing interval is not typical for AV nodal reentrant tachycardia
e.- The prolongation in VA interval during pacing is not typical for AV nodal reentrant tachycardia
A patient with a dual chamber (AV) ICD complained of short bursts of palpitations 6 months after implantation. All measured parameters were within normal limits. Stored data from the device reported frequent episodes of atrial arrhythmia in clusters. An on line recording during handgrip in the outpatient clinic is shown. Please select the most appropriate diagnosis and therapy:

a.- Exercise induced atrial arrhythmias. Beta blockers should be considered to control AV response
b.- Exercise induced atrial arrhythmias. Amiodarone should be considered to reduce episodes
c.- External interference from mechanical movement and muscular electrical activity not related to insulation defects. Physical activity should be reduced.
d.- Atrial "electrical noise": probably a position related insulation defect is unmasked. Sensitivity should be programmed to a higher level (reduce sensing of atrial signals)
e.- Atrial "electrical noise": probably a position related insulation defect is unmasked. Progression is expected. Program to VVI or lead replacement should be considered

Recordings from top to bottom: precordial lead, atrial electrograms and ventricular electrograms
A tachycardia with a narrow QRS complex is initiated by two consecutive atrial premature beats. The second atrial premature beat initiates the tachycardia. Some QRS alternans of the QRS complexes is observed at the beginning of the tachycardia. The most likely diagnosis is:

a.- Atrial tachycardia
b.- Typical AV nodal reentrant tachycardia.
c.- Circus movement tachycardia using retrogradely an accessory AV pathway.
d.- Fascicular tachycardia initiated by atrial premature beats.
e.- Alternating bundle branch block.
Irregular tachycardia with narrow and wide QRS complexes: what is the most likely diagnosis?

a.- Atrial fibrillation, non-sustained ventricular tachycardia, and right bundle branch block aberrant conduction

b.- Atrial flutter with aberrant conduction over the left and right bundle branches.

c.- Atrial fibrillation with right and left bundle branch block aberrant conduction

d.- Atrial flutter and non-sustained ventricular tachycardia.

e.- Atrial fibrillation with pacing-induced left bundle branch-like QRS complexes.
14 Stored electrograms of an ICD recorded during antitachycardia pacing. The most likely diagnosis is:

a. Atrial artifacts and supraventricular tachycardia, since the ventricular electrogram recording shows far field atrial activation with AV 1:1 relationship.
b. Atrial artifacts (the short AA intervals are not in the "physiological" range) and ventricular tachycardia
c. Atrial fibrillation and changing AV conduction
d. Atrial fibrillation and ventricular tachycardia
e. None of the other choices
A 16 year old athlete presented with an episode of exercise induced wide QRS complex tachycardia (Figure 1). Figure 2 shows the 12-lead ECG in sinus rhythm. Figure 3 shows the result of signal-averaged ECG examination. Following infusion of 0.7mg/kg ajmaline, the ST segment did not show any change in the precordial leads. What is the most likely diagnosis?

a.- Idiopathic right ventricular tachycardia.
b.- Brugada syndrome.
c.- Arrhythmogenic right ventricular dysplasia.
d.- Catecholaminergic ventricular tachycardia.
e.- Supraventricular tachycardia with aberrancy or pre-excitation
Figure 2
Figure 3
Rhythm strip recorded before the interruption of narrow QRS complex tachycardia by carotid sinus massage and apnea maneuvers. The most likely mechanism is:

a.- Orthodromic AV reentry mediated by an accessory pathway
b.- AV nodal reentrant tachycardia
c.- Atrial tachycardia due to microreentry
d.- Atrial tachycardia due to automaticity
e.- There are no diagnostic clues in this ECG
Some supraventricular tachycardias are difficult to classify due to early retrograde activation during tachycardia (short VA-interval). Differential diagnosis is atrial tachycardia with long AV interval, typical AV nodal reentrant tachycardia or paraseptal orthodromic AV reentrant tachycardia. Which maneuver is of little value to differentiate between AV nodal reentrant tachycardia and AV reentrant tachycardia?

a. Para-Hisian pacing
b. Pacing the right ventricle at the tachycardia cycle length and compare the VA-interval to the VA-interval recorded during tachycardia
c. Adenosine during tachycardia
d. Adenosine during ventricular pacing
e. Stimulation to test for tachycardia reset
18 This tracing was recorded at the emergency room in an 85 year old man with aortic stenosis (valvular area 1.1 cm²). What is your diagnosis?

a.- Extreme first degree AV block with sinus arrhythmia.
b.- Junctional rhythm with retrograde P waves.
c.- Atrial fibrillation with slow ventricular rate and U waves.
d.- Atrial fibrillation with complete AV block and U waves.
e.- Junctional rhythm with sinus node captures.
The ECG shows a prolonged QT interval (QTC 470 ms). The repolarisation abnormality in the chest leads attached in the figure is suggestive for which subtype of the long QT syndrome?

a.- Long QT 1
b.- Long QT 2 Syndrome
c.- Long QT 3 Syndrome
d.- Long QT 4 Syndrome
e.- Long QT 5
Which of the following is the main ionic current responsible for spontaneous automatism in the sinus node?

a.- INa  
b.- IK1  
c.- IK  
d.- If  
e.- Ito
21- Intracardiac recordings during bipolar pacing with the roving catheter during ventricular tachycardia. The most probable diagnosis about the site of pacing is:

a. participation of that point in the circuit in a protected isthmus
b. participation of that point in the circuit in an outer not protected loop
c. protected dead-end pathway
d. not participation in the circuit but close to it
e. not participation in the circuit and far away from it
22- ECG and bipolar endocardial recordings reproducibly obtained during pacing at Right Ventricular Apex (370 ms). The most accurate diagnosis is:

a. Retrograde dual AV nodal physiology
b. His Purkinje block
c. Wenckebach VA block
d. VA accessory pathway
e. Normal VA physiology
23- This ECG
a. means a counter-clockwise circuit in the right atrium around the tricuspid annulus
b. excludes a left atrial circuit
c. is not typical for typical common flutter
d. excludes a focal mechanism
e. does not fit any of the other statements
24- During narrow QRS tachycardia a single ventricular extrastimulus (V2) is delivered at Right Ventricular Apex. Please select the correct statement about the recording.

a. atrioventricular reentry is ruled out
b. intranodal reentry is ruled out
c. atrial tachycardia is ruled out
d. atrial tachycardia and intranodal reentry are ruled out
e. none of the other statements fits the recording

His P, M and D: His Proximal, Medium and Distal; CS from 9-10 to 1-2: Coronary sinus from proximal to distal, RVA: Right Ventricular Apex
25- During pacing at Right Ventricular Apex (V1V1 600 ms) a single extrastimulus is delivered (V2) coupled at 340 ms. The most probable diagnosis is

a. - refractoriness in the right bundle branch and retrograde dual nodal pathways
b. - refractoriness in the right bundle branch
c. - refractoriness in the right bundle branch and VA accessory pathway
d. - refractoriness in the right bundle branch and normal physiology
e. - conduction gap in the His Purkinje system

His M and D: His Medium and Distal; RVA: Right Ventricular Apex
26- ECG and endocardial bipolar recordings during pacing at His catheter with different output. This finding
a.- rules out VA conduction through a paraseptal accessory pathway
b.- rules out VA conduction through a left free wall accessory pathway
c.- confirms VA conduction through a right paraseptal accessory pathway
d.- confirms retrograde intranodal conduction through dual pathways
e.- does not fit any of the other statements
HRA: High Right Atrium; His P: His Proximal; Recordings speed 200 mm/s
27- Sequential peritricuspid recordings from CS Os (ORB 1-2). After RF ablation at Cavo Tricuspid Isthmus (CTI) a line of block seems to be present at ORB 5-6. Please select the statement best fitting the recording obtained during pacing at CS Os (A1A1 600 ms)

a. intermittent clockwise conduction
b. capture at both sides of the line of block
c. fusion with an atrial premature beat
d. fast conduction through crista terminalis
e. none of the other

CTI from ORBIT 3-4 to ORBIT 7-8. Anterior right atrial free wall from CTI 9-10 to 13-14 Right atrial roof from ORBIT 15-16 to 17-18 Posteroseptal right atrium from ORBIT 19-20 to ORBIT 23-24. Recording speed 200 mm/s
ECG and multiple recordings from the right atrium and coronary sinus are shown in both panels during pacing at distal coronary sinus (SC 1-2) at two different cycle length (400 and 340 ms) during tachycardia. The most probable mechanism of this tachycardia is:

a. triggered activity
b. automatism
c. microreentry
d. macroreentry
e. the mechanism cannot be established with these data

ORB 1-2 to 19-20: bipolar recordings from right atrium; CS from 9-10 to 1-2: Coronary Sinus from proximal to distal.
29- ECG and endocardial recordings from a multipolar catheter deployed from the coronary sinus ostium, through the inferior vena cava-tricuspid isthmus, anterior right atrial free wall, right atrial roof and posteroseptal region (from 1-2 to 23-24) are shown. Recording speed 200 mm/s. After inferior vena cava-tricuspid isthmus ablation stimulation (A1A1) is performed septal to the line of application. First panel shows pacing at the ostium of the coronary sinus and second panel shows pacing at septal inferior vena cava-tricuspid isthmus, closer to the hypothetic line of block.

The diagnosis best fitting the recordings is

a. clockwise conduction block
b. clockwise conduction
c. clockwise conduction delay
d. conflicting data
e. no diagnosis is suggested
30- ECG and endocardial recordings from a multipolar catheter deployed from the coronary sinus ostium, through the inferior vena cava-tricuspid isthmus, anterior right atrial free wall, right atrial roof and posteroseptal region (from 1-2 to 21-22) are shown during radiofrequency application at inferior vena cava-tricuspid isthmus (in between 5-6 and 7-8). Recording Speed 100 mm/s. The most probable diagnosis for this finding is
a. interruption of typical reverse flutter and initiation of intranodal reentry
b. persistence of the atrial tachycardia with modification of the activation pattern
c. interruption of isthmic flutter unmasking a different atrial tachycardia
d. conduction through inferior vena cava-tricuspid isthmus is not modified
e. coarse atrial fibrillation
ECG and bipolar endocardial recordings from a multipolar catheter at the right atrium: anterior free wall (RA FW), roof (Roof) and posterior septum (PS) and at the coronary sinus are shown (CS). Both panels show last paced beats at Low Anterior Right Atrium at different cycle length (A1A1 460 and 440 ms). Recording speed 200 mm/s. The most probable mechanism of the tachycardia is

a. right atrial microreentry
b. left atrial microreentry
c. right atrial free wall incisional tachycardia
d. lower loop (inferior vena cava) reentry
e. none of the above
A single atrial extrastimulus (A2 390 ms) over paced atrial rhythm (A1A1) at high right atrium is shown. The most probable diagnosis for this finding is:

a. superconductor AV node and His Purkinje system
b. accessory pathway with non-decremental long conduction times
c. right bundle branch recording
d. fasciculoventricular connection
e. Mahaim type AV connection

HRA: High Right Atrium; His P, M and D: His Proximal, Medium and Distal; RVA: Right Ventricular Apex
33- Stored electrograms of two different episodes in the same patient leading to ATP therapy. Both ventricular electrograms are shown. Please select the statement most probably fitting the stored episodes.

a.- both have ventricular origin  
b.- both have atrial origin  
c.- first has ventricular origin and second is atrial  
d.- first has atrial origin and second is ventricular  
e.- no diagnosis can be suspected unless atrial electrograms are provided
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