

Question

Which 2 antigens are most commonly involved in neonatal isoerythrolysis?

- Pa and Ab
- Aa and Ua
- Qa and Pa
- Aa and Qa

Explanation - The correct answer is **Aa and Qa**. For whatever reason, these A and Q systems of antigens are highly immunogenic, and almost all cases of neonatal isoerythrolysis are due to incompatibility between these antigen groups. Antigens De, Ua, Pa, and Ab are very rarely associated with causing neonatal isoerythrolysis.

Question

Which of these is the most useful indicator of whether anemia in a horse is regenerative or not?

- Degree of anisocytosis
- Bone marrow examination
- Reticulocyte count
- Mean cell volume

Explanation - The correct answer is bone marrow examination. In horses, reticulocyte counts are not useful because **horses don't release reticulocytes into circulation**. Red blood cell indices such as mean corpuscular volume and anisocytosis may be altered in a regenerative response, but the only accurate way to gauge response to anemia in a horse is with bone marrow examination or serial CBCs taken daily for many days.

Question

Which of the drugs below is used to treat horses with atrial fibrillation?

- Atenolol
- Atropine
- Lidocaine
- Quinidine
- Furosemide

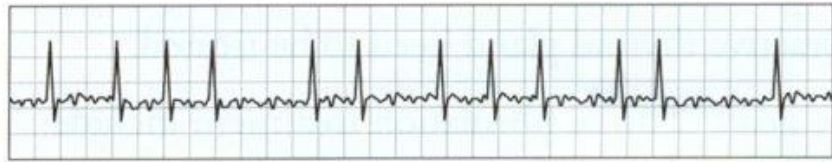
Explanation - **Oral quinidine** can be used for therapy. It is a class IA **sodium channel blocker** that has vagolytic properties which prolong the refractory period of the myocardium. This is not a perfect solution, as it does not work in all cases and can be associated with side effects including oral ulcers, hypotension, and allergic reactions. For these reasons, other treatments such as **electrical cardioversion** and alternative drugs such as flecainide are sometimes tried. When evaluating an ECG strip for atrial fibrillation, look for irregular R-

R intervals and the classic fibrillation wave of the base line.

Lidocaine is a sodium channel blocker used primarily for ventricular arrhythmias. Furosemide is a loop diuretic used to treat congestive heart failure rather than a rhythm abnormality. Atropine is an anticholinergic used primarily for supraventricular bradyarrhythmias.



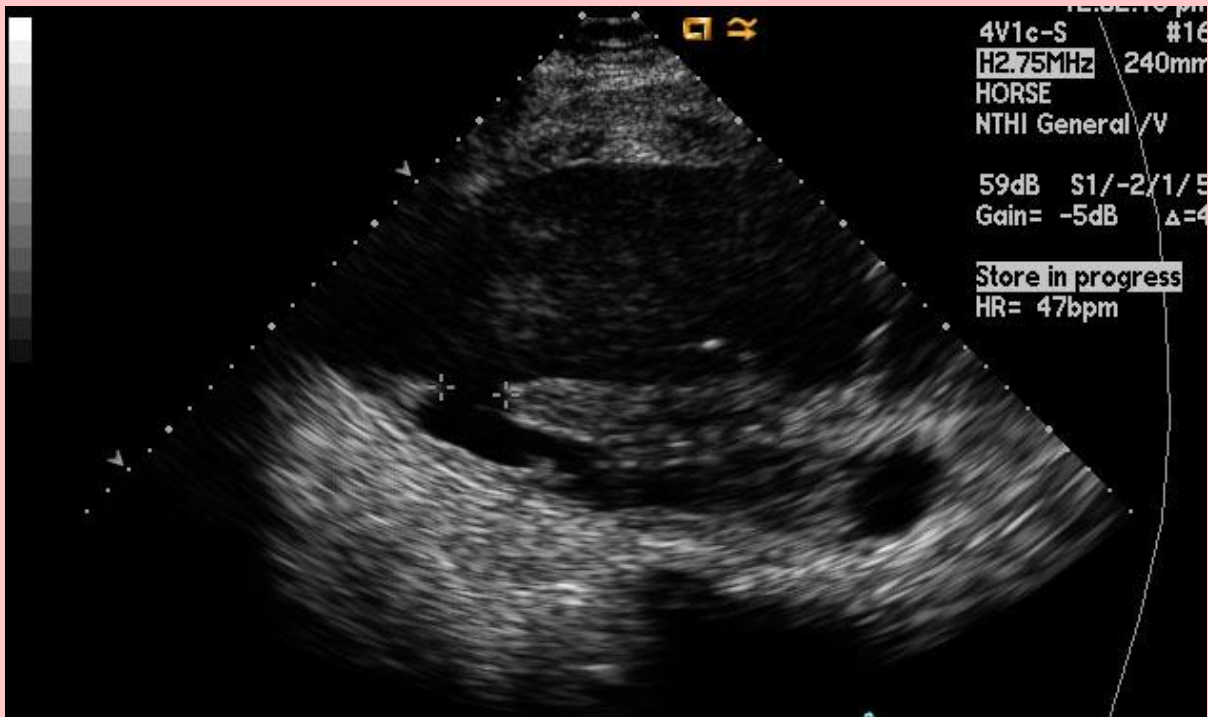
ECG tracing of a normal heart rhythm.



In atrial fibrillation, the tracing shows tiny, irregular "fibrillation" waves between heartbeats. The rhythm is irregular and erratic.

Question

The owner of a weanling colt has asked for a pre-purchase examination to be performed on her 4 month old colt. The colt appears in good health based on physical examination with the only abnormality noted being a holosystolic murmur heard best on the right side of the thorax. What is your diagnosis based on auscultation and echocardiographic findings (see image; long-axis view from left side)?



- Patent ductus arteriosus (PDA)
- Ventricular septal defect (VSD)
- Truncus arteriosus
- Atrial septal defect (ASD)

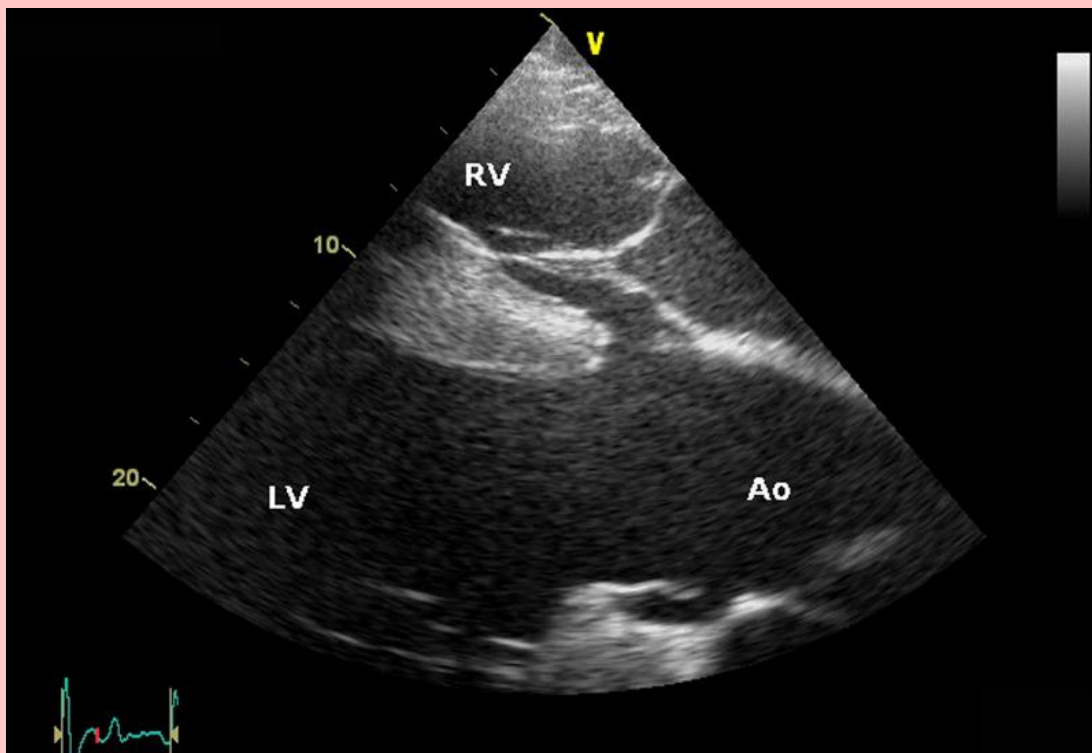
Explanation - The image demonstrates a VSD or a hole in the interventricular septum (identified by two markers). This is one of the more common congenital defects of the heart in horses.

The murmur occurs as blood is shunted from the left side of the heart to the right during systole. Some horses can perform normally with a VSD while others, with large defects, can demonstrate heart failure. In this case, it was an incidental finding, as the horse was bright and alert at the time of exam. The remainder of the answers (ASD, PDA, and truncus arteriosus) can occur but are less common and would appear differently on echocardiography.

It is unlikely but possible that you will be asked to interpret an echocardiogram on your board exam. If you are, this is likely to be one of the diseases you could be shown.

Question

A 2-year old Standardbred gelding presents for a prepurchase exam. On auscultation you hear a loud grade IV/VI systolic murmur on the right thorax. An echocardiogram is performed, which is shown below. The cardiac chambers are labeled LV (left ventricle), RV (right ventricle), Ao (Aorta). What is your diagnosis?



- Tricuspid valve endocarditis
- Subaortic stenosis
- Ventricular septal defect
- Patent ductus arteriosus
- Unremarkable echocardiogram

Explanation - The correct answer is ventricular septal defect. There is echo dropout immediately below the aortic valve and extending into the right ventricle. The auscultatory findings also fit with a VSD as the murmur is typically louder on the right. A PDA would cause a continuous heart murmur. There is no narrowing in the LV outflow tract so subaortic stenosis is not evident. There is no evidence of a vegetation or mass on the tricuspid valve so endocarditis is not correct.

Question

The two tracings show a horse (top) and a cow (lower) ECG with irregular QT intervals and absence of P waves. What cardiac disorder is this indicative of?



- Ventricular fibrillation
- Ventricular tachycardia
- Pericarditis
- Atrial Fibrillation
- Myocarditis

Explanation - These changes are typical of atrial fibrillation. Note that the horse tracing (top) also shows fibrillation waves.

Question

During a routine physical exam of a 15 day old female Arabian foal, a holosystolic murmur can be clearly heard. The murmur is graded as being 4/6. This murmur is heard bilaterally, and the point of maximum intensity is on the right side. What is the most likely diagnosis?

- Bacterial endocarditis
- Ventricular septal defect
- Tetralogy of Fallot
- Patent ductus arteriosus

Explanation - The correct answer is ventricular septal defect. This is the most commonly occurring congenital defect, and the physical exam findings are consistent with this diagnosis.

PDA will create a characteristic **continuous machinery murmur**. This will be audible throughout systole and diastole. Additionally, the point of maximum intensity is usually on the **left side between the 3rd and 4th** intercostal space.

When listening to a tetralogy of Fallot, one can expect a loud holosystolic murmur on the left 4th-6th intercostal space. This congenital anomaly is rather rare and will automatically be lower on your differential list. Just to review, the tetralogy of Fallot consists of an overriding aorta, ventricular septal defect, pulmonic stenosis, and right ventricular hypertrophy.

Bacterial endocarditis is an acquired infection of older horses and will not present as an incidental murmur in a foal.

Question

For neonatal isoerythrolysis to occur, which of these pairs must mate?

- Stallion negative for Qa and mare negative for Qa
- Stallion positive for Qa and mare negative for Qa
- Stallion negative for Qa and mare positive for Qa
- Stallion positive for Qa and mare positive for Qa

Explanation - The correct answer is stallion positive for Qa and mare negative for Qa. For neonatal isoerythrolysis to occur, the mare must develop antibodies to the foal's red blood cell antigens. Aa and Qa are the two antigens most frequently implicated in this condition. For this condition to occur, the foal must inherit the Aa or Qa antigen from the stallion, and the mare must be negative for the antigen (if she was positive, meaning she has the Qa antigen on her RBCs, she would not make antibodies against it). Then, when the mare becomes exposed to the foal's red blood cell antigens, she makes antibodies. When she passes these antibodies to the foal through colostrum, an **acute hemolytic event** will occur in the foal. In most cases, the first time a mare has a foal with the antigen, she will not produce sufficient antibodies to cause severe

damage to the foal. Therefore, this condition is usually seen in **multiparous dams** or in mares that have previously had a blood transfusion that exposed them to the red blood cell antigens.

Question

A Thoroughbred racehorse has been brought to you for examination because the trainer has noted exercise intolerance. The only abnormality your exam reveals is an irregularly (randomly) irregular heart rhythm when the horse is at rest, with a heart rate of 45 beats/minute. Given this finding and the complaint of exercise intolerance, which of the following is the most likely diagnosis?

- Sinus bradycardia
- Atrial fibrillation
- Sinus arrhythmia
- Sinoatrial block
- Ventricular fibrillation

Explanation - Atrial fibrillation is most commonly associated with exercise intolerance in horses. There is no underlying rhythm to the heart beats. The ECG reveals absence of P waves and widely variant Q-Q intervals. There may or may not be a serious underlying heart disease.



Question

A horse gets into cow feed that contains the ionophore, monensin. What is your biggest concern?

- Hepatotoxicity
- Neurotoxicity
- Gastrointestinal toxicity
- Nephrotoxicity
- Cardiotoxicity

Explanation - The correct answer is cardiotoxicity. Monensin is a coccidiostat used to increase productivity in cattle. Horses are much more susceptible to toxic effects of monensin than cattle and mistakes in feeding or accidental access to cattle feed can lead to toxicity. Monensin toxicity results in **myocardial necrosis** and

development of **dilated cardiomyopathy in horses**. Clinical signs include progressive respiratory distress, heart murmur, weakness, and hypovolemic shock. Acutely, mild colic and diarrhea can occur as well but is less of a concern than the cardiovascular effects.

Question

During a routine pre-purchase exam of a 24 year old Peruvian Paso, a harsh and decrescendo holodiastolic 3/6 murmur is auscultated with a point of maximum intensity at the left base of the heart. There were no other abnormal physical exam findings. What is the most likely diagnosis best on clinical exam and prognosis of this horse?

- This horse most likely has aortic regurgitation due to degeneration of the aortic valve and should have no impact on performance
- This horse most likely has pulmonic stenosis due to turbulent flow resulting in severe stenosis, which will limit the ability to perform
- This horse most likely has aortic stenosis due to turbulent flow resulting in severe stenosis, which will limit the ability to perform
- This horse most likely has pulmonic regurgitation due to degeneration of the pulmonic valve and should have no impact on performance

Explanation - The correct answer is this horse most likely has aortic regurgitation due to degeneration of the aortic valve and should have no impact on performance. Given the location of the murmur and signalment, this should be the logical answer to choose. The thing you need to know is that aortic regurgitation in the horse is usually a degenerative change and there isn't much that can be done about it. Horses are rarely impaired by development of the murmur. In a true pre-purchase exam, you would be wise to recommend a full cardiac work-up to definitively diagnosis the source of the heart murmur. The potential buyer may decline further diagnostics, but at least you will have offered the choice and have provided the proper information to the client.

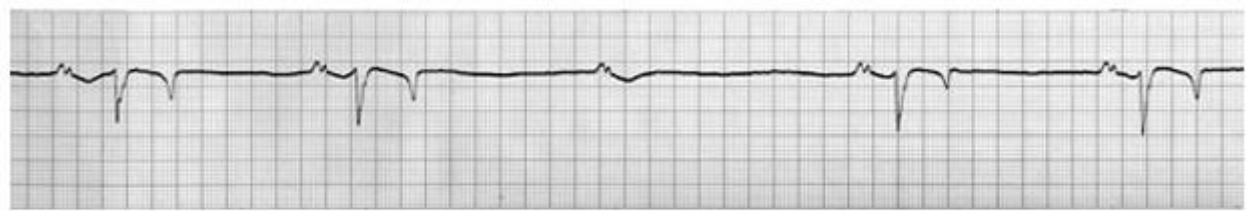
Question

In addition to a routine pre-purchase exam of a 12 year old Thoroughbred mare, an ECG was performed which showed an increase in the P-R interval followed by occasional P waves that are not followed by a QRS-T complex. What does the owner need to know about this finding?

- This is a second-degree atrioventricular block, which is commonly seen in athletic horses.
- This horse is predisposed to developing an electrical-mechanical disassociation and needs further diagnostics before purchasing
- This is a first-degree atrioventricular block and should be treated immediately with quinidine.

- This mare most likely has a ventricular septal defect and should not be purchased.

Explanation - The correct answer is this is a **second-degree atrioventricular block**, which is **commonly seen in athletic horses**. First-degree and second-degree blocks are considered variations of normal in the horse and are usually associated with **high vagal tone**. They are not predisposed to electrical-mechanical disassociation. An electrical rhythm is an ineffective method in trying to determine if there is a ventricular septal defect. If such a defect is suspected, the best way to evaluate the horse is by performing a cardiac ultrasound.

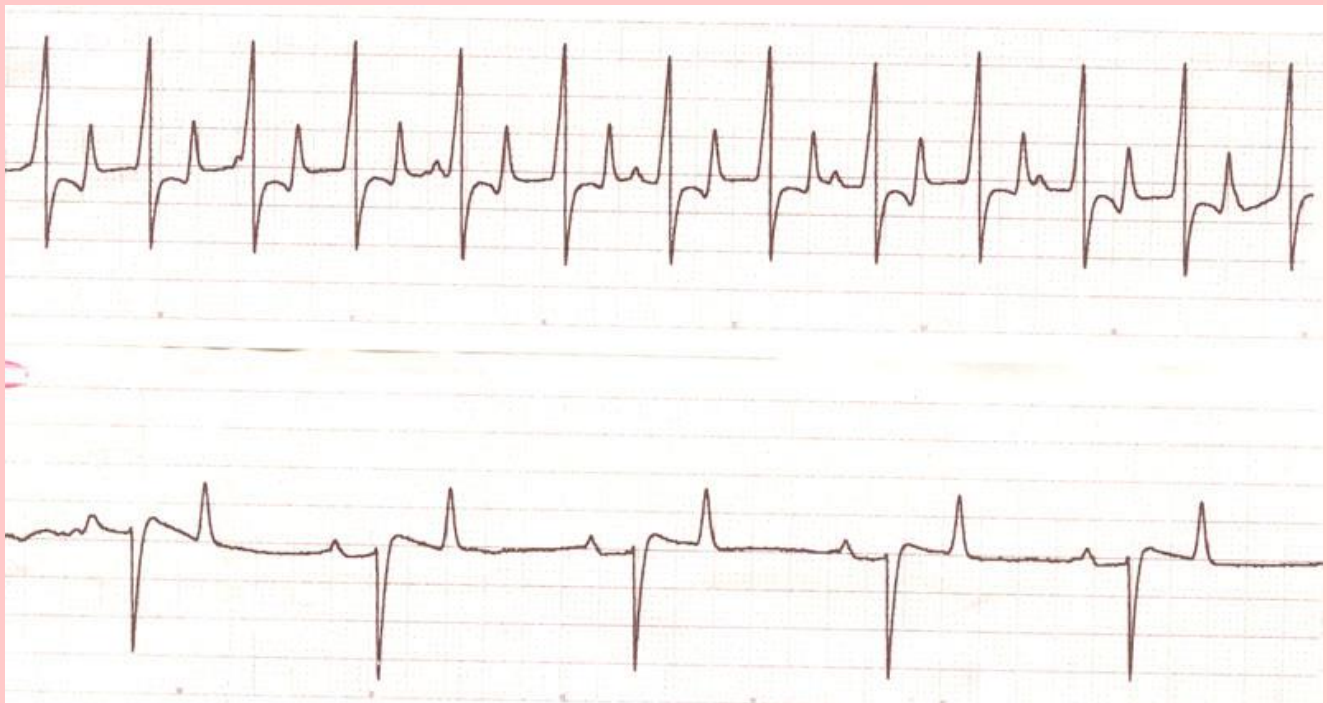


Example of a normal resting ECG. The missing segment of the third beat is a common finding in normal horses and is called a 2nd degree AV block.



Question

A 6 year old Saddlebred is presented for lethargy, anorexia and fever. Upon physical exam, you determine that the heart rate is approximately 90 beats/min. You quickly perform an ECG using the base-apex lead (see top image). What is the arrhythmia that you observe on the ECG (also consider what medication you would use to treat this arrhythmia)? (The bottom ECG strip is a normal rhythm for reference.)



- Atrial fibrillation
- Ventricular bigeminy
- Ventricular fibrillation
- Ventricular tachycardia

Explanation - The rhythm noted is **ventricular tachycardia**. You can tell that the horse has tachycardia when you compare the rate to the lower strip (~40 beats/min). Characteristics of ventricular tachycardia include **QRS complexes that are wide, bizarre, and have no association with P-waves**. However, you may see underlying P-waves occasionally within the rhythm (top strip) as the small positive deflections. The cause of the ventricular tachycardia in this horse was **vegetative endocarditis**; administration of **lidocaine** abolished the arrhythmia.

Question

Consumption of an ionophore in a horse classically results in _____.

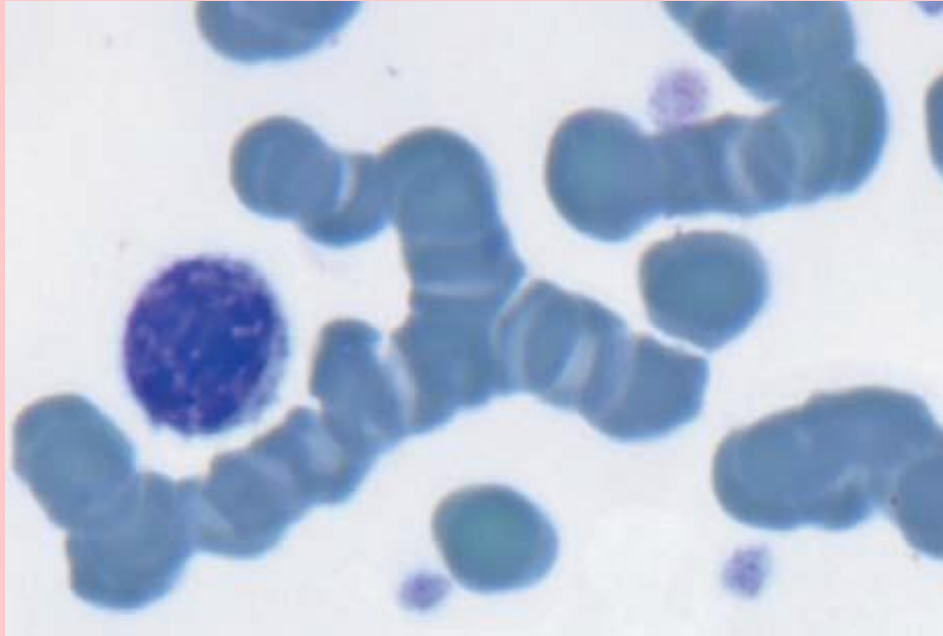
- Gastrointestinal ulceration
- Myelosuppression
- Nephrotoxicity
- Myocardial toxicity

Explanation - The correct answer is myocardial toxicity. Although the clinical signs associated with ionophore toxicity are wide, the main postmortem finding is myocardial necrosis. Ionophore toxicity usually occurs accidentally when livestock feeds containing ionophores get mixed up with that of a horse. The main ionophore that results in toxicity is **monensin**. Horses are very susceptible to monensin toxicity.

Question

With the given microscopic image (see image), identify all of the structures.

- Rouleaux, neutrophil, platelets
- Agglutinated red blood cells, platelets, neutrophil
- Agglutinated red blood cells, basophil, stained debris (artifact)
- Rouleaux, lymphocyte, platelets



Explanation - The correct answer is rouleaux, lymphocyte, and platelets. This is an image of an equine blood smear. The reason this is not agglutinated red blood cells is because a) rouleaux have a more uniform linear arrangement while agglutinated red blood cells are all bunched together and b) the white blood cell in this image is a lymphocyte making the other answers incorrect. A way to differentiate between rouleaux and agglutinated red blood cells diagnostically, is to mix blood with normal saline. Rouleaux blood will dissipate where agglutinated red blood cells will not.

Question

A 12 year old Quarter Horse presents for poor performance and exercise intolerance. On auscultation, an irregularly irregular rhythm with variable heart sounds is present. What atrial arrhythmia is most commonly associated with this type of presentation?

- Atrial flutter
- Atrial premature complexes
- Atrial tachycardia
- Atrial fibrillation

Explanation - The correct answer is atrial fibrillation. When attempting to exercise, the atria are unable to contribute effectively, since there is poor filling of the chambers as a result of being in atrial fibrillation. However, at rest, atrial fibrillation may not cause a significant deficit in cardiac output and the horse may appear normal. Atrial fibrillation is the most common pathologic arrhythmia in the horse while 2nd degree AV block is the most common non-pathologic arrhythmia. Treat atrial fibrillation with quinidine. Atrial fibrillation can be paroxysmal, in which it usually goes away in about 1-2 days, or it may be sustained. Furthermore,

acute atrial fibrillation (i.e. present for a week or so) is much more responsive to cardioversion than chronic atrial fibrillation (i.e. present for months to years).

Question

You perform a physical exam on a horse and note pale mucous membranes. A CBC is submitted for analysis. What would you expect to see on your CBC if this horse has hemolytic anemia that has been going on for 10 days or more?

- Macrocytic, hypochromic anemia
- Macrocytic, hyperchromic anemia
- Normocytic, normochromic anemia
- Macrocytic, normochromic anemia
- Microcytic, hypochromic anemia

Explanation - The correct answer is **normocytic, normochromic anemia**. In the horse, it is very uncommon to see morphologic changes to red blood cells, even if there is a strong regenerative response. Therefore, most types of anemia in the horse will be normocytic, normochromic.

Question

A healthy race track horse with a heart rate of 16 bpm is most likely to have what electrical rhythm finding?

- Third-degree atrioventricular block
- Ventricular premature complexes
- Atrial fibrillation
- Second-degree atrioventricular block

Explanation - The correct answer is **second-degree atrioventricular block**. First-degree and second-degree atrioventricular blocks are considered a normal finding in horses and usually result from high vagal tone. All other answer choices are abnormal findings and should be addressed accordingly. Atrial fibrillation is usually treated with quinidine. A chronic third-degree atrioventricular block can be treated by placing a pacemaker. If the onset is rapid then a catecholamine or parasympatholytic such as atropine may be used.

Question

A 3-year old Thoroughbred presents for evaluation after pulling up late in a recent race. You perform an ECG, which is shown below. What is the rhythm?



- Atrial tachycardia
- Ventricular tachycardia
- Atrial fibrillation
- Ventricular premature complexes
- Normal sinus rhythm

Explanation - The correct answer is atrial fibrillation. The baseline shows **coarse fibrillatory waves** and the rhythm is irregular. For a base-apex lead in the horse, the deep S waves of the QRS complexes are normal. The other answers are incorrect because of the presence of flutter/fibrillatory waves and irregularity of the rhythm.

Question

A 14 year old Warmblood presents for an acute onset of exercise intolerance. On physical exam, an irregularly irregular rhythm with variable heart sounds is present. The heart rate is 40 beats per minute. There are no other abnormal physical exam findings. Given this, what is the treatment of choice assuming that the findings are confirmed via an ECG?

- Quinidine
- Furosemide
- Digoxin
- Defibrillation
- Precordial thump

Explanation - The correct answer is quinidine. The physical exam findings are consistent with the most common equine arrhythmia encountered, atrial fibrillation. Ideally, you would begin oral dosing of quinidine via a nasogastric tube at 2 hour intervals until there is conversion or toxicosis. An increase in the QRS duration of greater than 25% as compared to before initiation of treatment is considered a sign of toxicity. Clinical signs of toxicosis include colic, ataxia, hypotension, diarrhea, and edema. Digoxin will not convert an atrial fibrillation to a normal rhythm. However, it is indicated as adjunctive therapy when the vagolytic effect of quinidine causes a significant acceleration in ventricular response rate, the resting heart rate is in excess of

90 beats per minute, if the horse is exhibiting a low vagal tone, or if conversion has not been achieved within 24 hours of initiating quinidine therapy. This horse is probably not in congestive heart failure given the exam findings and will not benefit from the use of diuretics. A precordial thump is ineffective, and defibrillation is only indicated during ventricular fibrillation, not atrial. Usually, there is an excellent prognosis for conversion if the horse has a heart rate of less than 60 beats per minute, atrial fibrillation of less than four months duration, and if there is a murmur less than or equal to a grade 3/6. Recently, novel therapies that have been used for atrial fibrillation in horses include amiodarone, flecainide, and transvenous electrical cardioversion. However, quinidine still remains the most commonly used drug, despite its potential toxic side effects.

Question

When does neonatal isoerythrolysis occur in horses?

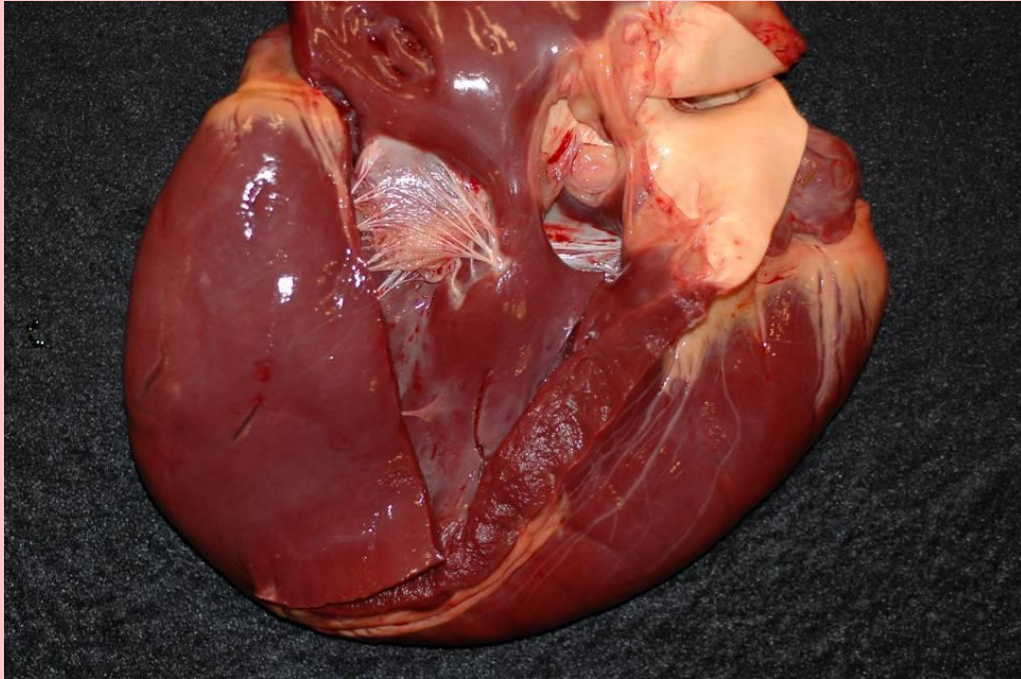
- 0-4 day old foals
- 1-4 month old foals
- In utero
- 1-4 week old foals

Explanation - The correct answer is **0-4 day** old foals. In utero, the foal is protected from the mare's antibodies due to epitheliochorial placentation (in humans, this condition occurs in utero). The foal takes in colostrum during its first 24 hours of life from the mare and develops the condition fairly acutely. Remember NI develops because the newborn foal expresses alloantigens on its red blood cells inherited from the sire that the mare does not have. If the mare becomes sensitized to the sire's specific antigen, maternal antibodies are produced and absorbed by the foal soon after birth. This subsequently results in lysis of the red blood cells. Pre-parturient blood testing between the mare and stallion may help in identifying the likelihood of this occurring.

Question

The most common congenital cardiac abnormality in the horse is depicted below, what is it?

- Ventricular septal defect
- Patent ductus arteriosus
- Tetralogy of Fallot
- Pulmonic stenosis



Explanation - The correct answer is **ventricular septal defect**. Clinically, you will hear a murmur bilaterally with the point of maximum intensity on the **right side**.

A patent ductus arteriosus will create a characteristic **continuous machinery or washing machine murmur**. This will be audible throughout systole and diastole. Additionally, the point of maximum intensity is usually on the **left side between the 3rd and 4th intercostal space**.

When listening to a tetralogy of Fallot, one can expect a **loud holosystolic murmur** on the **left 4th-6th intercostal space**. This congenital anomaly is rather rare and will automatically be lower on your differential list. Just to review, the tetralogy of Fallot consists of an overriding aorta, ventricular septal defect, pulmonic stenosis, and right ventricular hypertrophy.

Question

A first-degree atrioventricular conduction block is characterized by _____.

- An increase in the S-T interval
- A widening of the QRS complex
- An increase in the P-R interval
- A lack of P waves

Explanation - The correct answer is an increase in the P-R interval. First-degree, second-degree, and third-degree blocks are associated with delays in conduction at the level of the atrioventricular conduction system.

In a first-degree block, the impulse is still able to transmit through the atrioventricular conduction system;

however, it takes longer. Therefore, you will see an increased P-R interval.

Second-degree AV block is associated with intermittent AV block in which some but not all P waves are conducted to the ventricles.

In third-degree block, there is complete dissociation between the P waves and the QRS complexes. Frequently in third-degree block, the heart rate is slower than normal (20 beats/min) because a subservient pacemaker (i.e. in the AV node or ventricle) has to fire to cause ventricular contraction.

Question

A 36 hour foal born from a multiparous mare presents for weakness, decreased appetite, and tachycardia. On physical exam, you examine the sclera as seen in the photo. Based on the signalment and findings, what is a likely cause?



- Congenital iron toxicity
- Failure of passive transfer
- Immune mediated thrombocytopenia
- Neonatal Isoerythrolysis

Explanation - Neonatal Isoerythrolysis (NI) would be a possible cause of the icterus noted in the sclera. NI is common in multiparous mares and usually affects foals between 24-72 hours of age. NI results in hemolysis, hyperbilirubinemia, and icterus. A low packed cell volume would further support NI.

NI develops because the newborn foal expresses alloantigens on its red blood cells inherited from the sire that the mare does not have. If the mare becomes sensitized to the sire's specific antigen, maternal antibodies are produced and absorbed by the foal soon after birth. This subsequently results in lysis of the red blood cells.

Question

Measurement of blood lactate is commonly used in foals and adult horses as an overall reflection of cardiovascular status. What is the normal blood lactate in a healthy foal or horse?

- Less than 10 mmol/L
- Less than 7.5 mmol/L
- Less than 2.5 mmol/L
- Less than 5 mmol/L

Explanation - The correct answer is less than 2.5 mmol/L. It is important to remember a general reference range for all diagnostic laboratory data; lactate is commonly performed on hand-held lactometers that do not provide a reference range.

As you may recall, lactate is produced from pyruvate in anaerobic environments to keep the process of glycolysis running. When a horse/foal is **hypovolemic**, blood lactate may increase because of poor blood perfusion to the body. Several studies have investigated blood and peritoneal lactate as a means of predicting survival in **neonatal sepsis and equine colic**. It may be necessary to look up these studies if you want exact findings (different reports provide different findings), but not surprisingly, **the higher the lactate, the poorer the prognosis**.

Question

You are examining a 12-year old Arabian mare for mild to moderate weight loss and lethargy over the past 2 months. Physical examination is fairly unremarkable with a heart rate of 44 beats/min, respiratory rate of 16 breaths/min and rectal temperature of 101.2F. You perform a CBC and biochemistry profile and notice an unusual appearance of the red blood cells (see image). Based on this information, what is the cause of weight loss in this horse?



- The red blood cells exhibit anisocytosis and a cause of anemia should be investigated.
- Morula are noted in the red blood cells and an infectious agent of the red blood cells should be investigated.
- The red blood cells exhibit rouleaux formation and an alternate source of weight loss should be investigated.
- The red blood cells exhibit agglutination and an immune mediated disorder should be investigated.

Explanation - The correct answer is rouleaux formation, which is a common finding in the blood smear of healthy horses. Rouleaux formation resembles a stack of coins; this formation dissipates on dilution with saline. In comparison, agglutination would look like a cluster of grapes and can be associated with immune mediated anemia. There are no morula in this slide whereas anisocytosis is a term used to describe variation in the size of the red blood cells....

Question

You are presented with a 4-year old Thoroughbred gelding for lethargy and weight loss. Hematology reveals a hematocrit of 16% (28-42%); in order to identify if this is a regenerative anemia, what would you further examine?

- Reticulocyte Count
- Mean corpuscular volume (MCV) and mean corpuscular hemoglobin concentration (MCHC)
- Bone Marrow Aspirate
- Concentration of indirect bilirubin

Explanation - The horse does not release reticulocytes into the peripheral circulation; therefore you must look at a **bone marrow sample** to identify if the horse has a regenerative anemia. If this were the case, you would see **hypercellular bone marrow with a low myloid/erythroid ratio** (<0.5). Increased peripheral reticulocyte count and increased MCV are indicators of regeneration in other species. An increased MCV is inconsistent in horses with regenerative anemia. Therefore, the most definitive diagnostic test to determine if you have a regenerative anemia is to evaluate a bone marrow aspirate.

Question

Failure of closure of the foramen ovale within the first 48 hours of life in a healthy foal will result in _____.

- Shunting of blood from the right atrium to the left atrium
- Shunting of blood from the left ventricle to the right ventricle
- Shunting of blood from the left atrium to the right atrium
- Shunting of blood from the right ventricle to the left ventricle

Explanation - The correct answer is shunting of blood from the **left atrium to the right atrium**. The foramen ovale is a small slit that allows shunting between the right atrium and left atrium in the fetus. Once the foal is born, the lungs expand (right atrial pressure decreases) and the left atrium becomes a higher pressure system than the right. Therefore, blood is shunted from the left atrium to the right atrium.

Question

You are examining a 6-year old race horse that has been experiencing decreased performance. On auscultation you note, a slow heart rate of 16 beats per minute with an irregular rhythm consisting of occasional dropped beats. An ECG confirms the presence of a second degree atrioventricular block. Which of the following should you tell the owner?

- This conduction finding is common in racehorses and is unlikely to contribute to poor performance
- This conduction finding is a life-threatening abnormality and placement of a pacemaker is indicated
- This conduction finding is a common cause of poor performance and is not treatable; the horse should be retired
- This conduction finding is a common cause of poor performance and is usually effectively treated by quinidine
- This conduction finding likely indicates serious underlying pathology in the heart and further diagnostic tests are needed

Explanation - Second-degree atrioventricular block is commonly seen in athletic horses. First-degree and second-degree blocks are considered variations of normal in the horse and are usually associated with high vagal tone. Horses with second-degree atrioventricular block are NOT predisposed to electrical-mechanical disassociation. This is not a cause of poor performance or a concern in horses because high vagal tone is overcome by sympathetic tone during exercise.

Question

Warfarin intoxication in horses interferes with synthesis of which clotting factors?

- VIII, IX, XI, XII
- II, V, VII, X
- II, VII, IX, X
- VII, VIII, IX, X

Explanation - The correct answer is II, VII, IX, X (2-7-9-10). These are the **vitamin K-dependent coagulation factors**. Warfarin is an inhibitor of vitamin K and interferes with hepatic synthesis of these factors.

Question

Several horses are suspected to be infected with equine infectious anemia as a result of having a history of weight loss, anemia, and intermittent fevers. What is the test of choice for confirming infection?

- Immunodiffusion
- ELISA for antigen
- ELISA for antibody
- Identification of organism in white blood cells
- Paired antibody titers

Explanation - The correct answer is **immunodiffusion**. This is more commonly known as the **Coggin's test**. There are ELISA tests available but if the result is positive, you always need to confirm this with a Coggin's test, as there is the possibility of a false positive. EIA is caused by a virus that is related to the human immunodeficiency virus, and there is no way to visualize it in the blood on a smear. Treatment of EIA usually involves isolation and supportive care. The main modes of transmission are via blood-sucking flies that act as vectors and contaminated instruments.

Question

You are presented with a horse that has immune-mediated hemolytic anemia. Under which of these conditions would it be contraindicated to treat the horse with corticosteroids?

- The horse is suspected to be having a drug reaction
- The horse had a positive Coomb's test and Coggin's test
- The horse is receiving antibiotics
- The horse has underlying neoplasia

Explanation - The correct answer is the horse had a positive Coomb's and Coggin's test. In this case, the probable cause of the immune-mediated hemolytic anemia is the equine infectious anemia retrovirus. It is known that corticosteroids tend to cause recrudescence of viremia and worsen anemia in infected animals. If a horse is receiving an antibiotic prior to development of immune-mediated hemolytic anemia, the drug should be discontinued, because it may be the cause of the anemia due to a drug reaction. In such an instance, a completely different class of antibiotic should be chosen in its place.

Question

You suspect equine infectious anemia is a cause of abortion in a mare. What test would confirm this diagnosis?

- Coggin's Test
- Direct Coomb's Test
- Blood smear

- Liver biopsy with immunofluorescent antibody
- Indirect Coomb's Test

Explanation - The correct answer is Coggin's test. This test is an agar immunodiffusion to detect serum antibodies against the retrovirus causing equine infectious anemia. Coomb's tests are done to diagnose immune mediated hemolytic anemias. The blood smear and liver biopsy would not show anything specific for equine infectious anemia.

Question

You suspect disseminated intravascular coagulation (DIC) in a 16-year old Arab mare presented for colic and epistaxis (see image). Which of the following parameters is NOT associated with a diagnosis of DIC?



- Decreased antithrombin III activity
- Elevation in D-dimers
- Thrombocytopenia
- Shortened activated partial thromboplastin time (aPTT)
- Prolongation of Prothrombin Time (PT)

Explanation - Disseminated intravascular coagulation is a complex disorder that can be described as widespread activation of the coagulation system, resulting in a pro-coagulant state with systemic thromboses and secondary diffuse hemorrhage throughout the body. DIC is secondary to pathologic conditions such as

sepsis, localized infections, colitis, neoplasia, trauma, hepatic or renal failure, vasculitis, and various other disorders. DIC is associated with thrombocytopenia (from platelet consumption), prolongation of coagulation times such as PT and aPTT (from consumption of coagulation factors), elevations in D dimers (from degradation of fibrin), and low antithrombin III (from consumption). Thus the correct answer to this question is shortened aPTT. These criteria for DIC apply to all species, not just horses.

Question

You are examining a 4-year old Paint gelding and notice the pictured abnormality on physical examination. Which of the following diagnostic tests would help determine if platelets are associated with this finding?



- Template Bleeding Time (TBT)
- Activated Partial Thromboplastin Time (APTT)
- Antithrombin Activity (AT)
- Prothrombin Time (PT)

Explanation - The image demonstrates petechial and ecchymotic hemorrhages. The **TBT** is a test that determines the **functional ability of platelets to plug a minute wound**. A buccal mucosal bleeding test is similar to template bleeding time. The APTT and PT determine if there are deficiencies in the coagulation factors and do not assess platelet function. Antithrombin activity is sometimes measured when disseminated intravascular coagulation (DIC) is a concern, but is not used to evaluate platelet function.

Question

Which of these statements is most accurate regarding the Coggin's test for equine infectious anemia?

- The test is effective in foals because it detects antigen
- It is most effective during an acute episode of anemia
- False negatives can occur in foals due to maternal antibody interference
- It is effective at diagnosing infection in chronic asymptomatic carriers

Explanation - The correct answer is it is **effective at diagnosing infection in chronic asymptomatic carriers**.

The Coggin's test is a test for an antibody; therefore, it carries several drawbacks/limitations. In acute episodes of equine infectious anemia (EIA), there is often not yet adequate production of antibody to detect by this test. In foals, false positives can occur due to acquisition of the antibody in colostrum. Persistently infected horses constitute the majority of cases, and because they are under constant antigenic stimulation, they maintain antibody production and can be very accurately diagnosed with the condition by the Coggin's test.

Question

A horse presents for several days of lethargy, anorexia, and bleeding from its gums. Its prothrombin time is 20 seconds, and its partial thromboplastin time is 102 seconds. Its platelet count is 48,750/uL. Its antithrombin III activity is decreased as well. What is going on in this horse?

Immune mediated thrombocytopenia

- Renal failure
- Disseminated intravascular coagulation (DIC)
- Liver failure
- Rodenticide toxicity

Explanation - The correct answer is disseminated intravascular coagulation (DIC). DIC can be defined by having elevated PT/APTT, thrombocytopenia, and positive D dimer (a type of fibrin degradation product). Another parameter to evaluate is the fibrinogen concentration. Fibrinogen may be low in other species during DIC but is not commonly observed in horses. Usually two of these findings are enough to diagnose DIC. Antithrombin III activity is often decreased.

Coagulopathies are not uncommon in horses with infections, diseases such as severe colitis, pleuropneumonia, or strangulating intestinal lesions. DIC is a more severe coagulopathy in which both thrombosis and hemorrhage are occurring.

Question

A newborn foal is examined two hours after birth. The foal has a heart rate of 100 bpm [N=100-120], and a continuous murmur loudest on the left side.

Which one of the following choices is the most likely explanation for these findings?

- Incipient septicemia
- Hypoxic ischemic encephalopathy
- Foal dysmaturity
- Normal in a neonatal foal
- Ventricular septal defect

Explanation - Normal in a neonatal foal. These findings are NORMAL in a neonatal foal. The heart rate and a finding of a continuous murmur on the left side (due to slight opening of the ductus arteriosus, which usually closes within 4-5 days) are normal in newborn foals. Persistent patent ductus arteriosus is rare in horses.
