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Echocardiography for the General Practitioner – Part 3
Case Presentations

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Introduction

Part one of the series (May 2016) introduced the general practitioner to the technique of performing a basic echocardiogram. Part two (August 2016) focused on the echocardiographic appearance of common cardiac conditions in small animal practice and making some important measurements. Building on this knowledge and the skills and principles learnt, part three briefly presents actual cases with emphasis on relevant echocardiographic findings to further demonstrate its usefulness in general practice.

Case 1

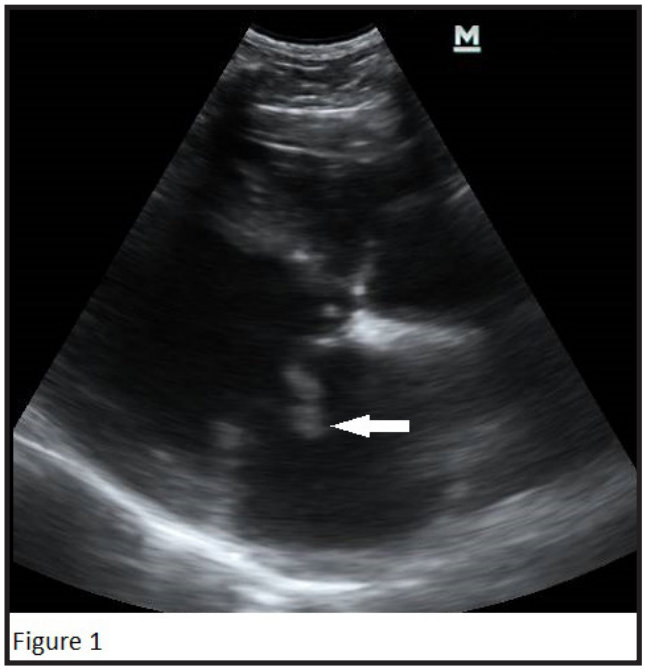

Figure 1

A male, 14-year-old Yorkshire terrier cross was presented with acute onset severe dyspnoea. It had been treated for congestive heart failure, presumably as result of myxomatous mitral valve disease (MMVD), at another veterinary clinic for an unknown time. Cardiac ultrasound revealed a very large left atrium (LA:Ao = 2.8), increased fractional shortening (53.9%) and mitral valve flail was clearly evident, indicating **chordae tendineae rupture (CTR)**. Following the mitral valve through its cycle of movement, the septal (anterior) leaflet can be seen to point backwards into the left atrium. (Figure 1, arrow). Studies have found that the ruptured chordae had been attached to the anterior mitral valve leaflet in more than 90% of cases. Ruptured chordae do not necessarily hold as poor a prognosis as previously reported. In a study published in 2007 evaluating the prevalence, survival and prognostic factors in dogs with MMVD, 16% were diagnosed with CTR of which 58% survived more than one year. The presence of acute dyspnoea, ascites and larger left atrial size were negative predictors of survival for patients with CTR.

Case 2

An eight-week-old male Staffordshire cross puppy was presented with sudden onset dyspnoea and tachypnoea. In addition there was a history of an episode of diarrhoea. Thoracic radiographs revealed substantial cardiomegaly and pulmonary oedema (Figure 2). On ultrasound the heart had the classic appearance of dilated cardiomyopathy: All four chambers of the heart were dilated with virtually no contractility of the left ventricular free wall, a

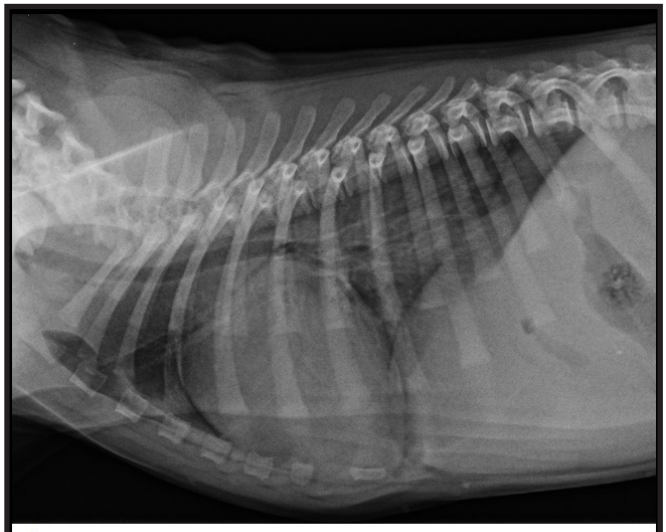

Figure 2

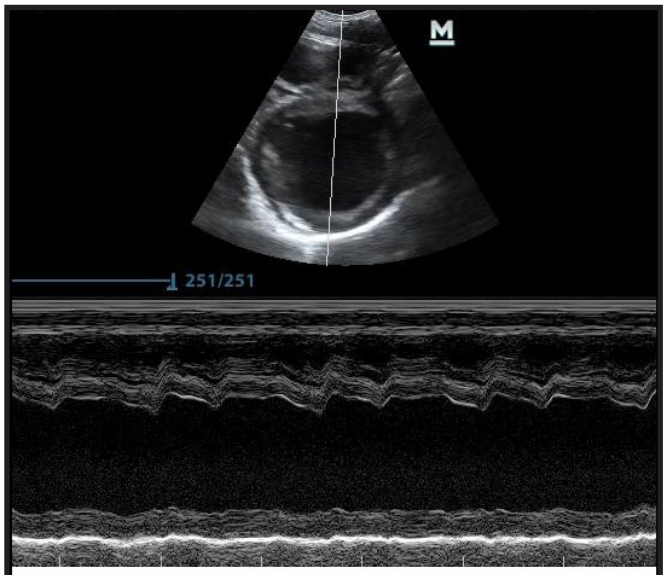

Figure 3. M-mode

fractional shortening of only 16% (Figure 3) and a LA:Ao ratio of 2.24. Spontaneous contrast ("smoke") was evident in the left atrium. A recent study hypothesised that parvo-viral myocarditis is under-recognised as a cause of cardiac damage in young dogs and probably more common than previously thought. This case was suspect for DCM developing post **parvovirus myocarditis**. Puppies infected within 2 weeks of birth are at high risk for viral myocyte invasion. Some puppies survive the acute infection and develop heart failure later. Diagnosis may be confirmed by PCR detection of canine parvovirus in tissue samples.

Case 3

A 10-year-old female domestic shorthair cat was presented with acute onset respiratory distress and collapse. It had a similar previous episode from which it had apparently rapidly recovered about one month before. Radiographs showed a pleural effusion. Straw coloured fluid with moderate protein content was aspirated. The cardiac ultrasound showed dilation of all 4 chambers, a

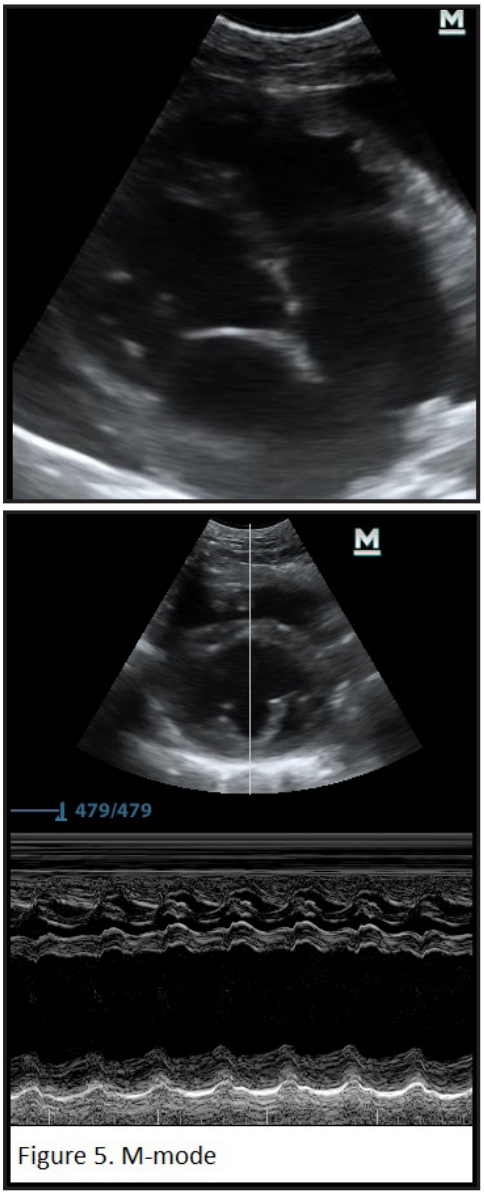

Figure 5. M-mode

LA:Ao ratio of 2.38, increased end-systolic and end-diastolic LV diameters (eccentric hypertrophy) and a fractional shortening of 15% (Figures 4 & 5). Although **dilated cardiomyopathy (DCM)** in cats is now regarded as uncommon because taurine is regularly added to cat food, this patient's heart displayed the classic characteristics of DCM. Most cases nowadays are idiopathic, but cats eating a home-cooked diet may be at increased risk for taurine deficient DCM. In some families of cats a genetic predisposition has been identified.

Case 4

A 12-year-old male Dachshund was presented with acute collapse, dyspnoea and cyanosis. Radiographs revealed cardiomegaly (VHS = 12.5), and pulmonary oedema. Cardiac ultrasound found a very large left atrium (LA: Ao = 2.8), increased fractional shortening (52%), severe mitral regurgitation and a homogenous, echogenic mass in the pericardial sac (Figure 6). When re-scanned a few days later, the mass had disappeared. This was almost certainly a blood clot as a result of **rupture of the left atrium**, which is an uncommon complication of MMVD. The outcome of dogs with MMVD presenting with left atrial rupture may be more favourable than previously thought. A 2014 study of dogs with left atrial rupture found the median survival of all dogs was 203 days and dogs with no previous history of congestive heart failure significantly longer.

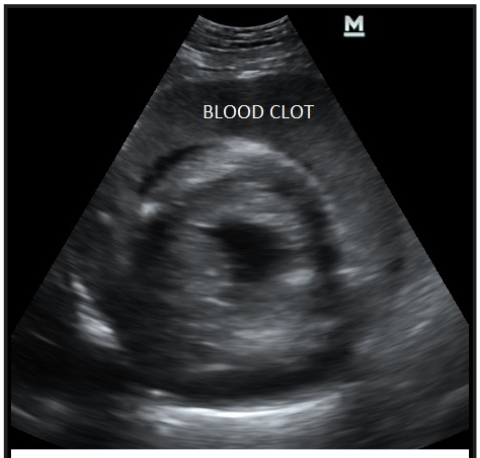

Figure 6. Right parasternal short axis

Case 5

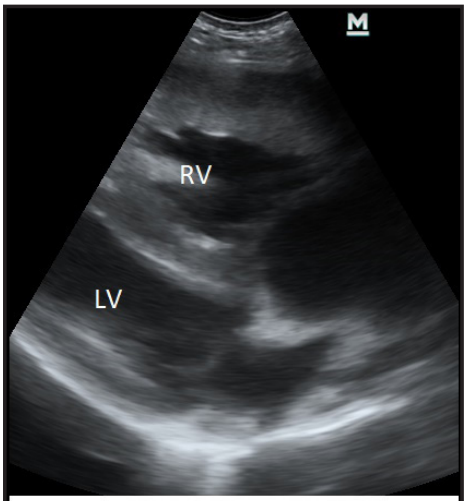

Figure 7

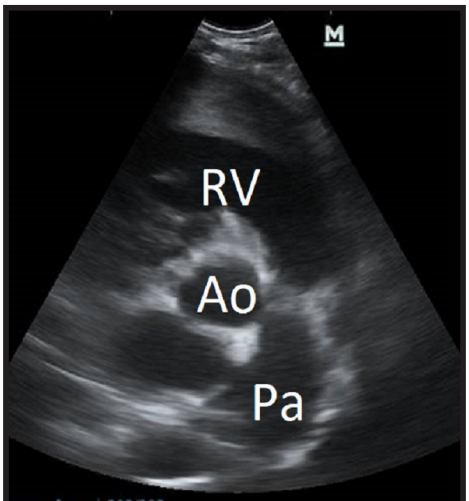

Figure 8

A four-month-old, male mixed breed dog was found to have an incidental murmur when presented for vaccinations. The murmur was systolic and loudest over the base of the heart on the left side. Cardiac ultrasound showed severe thickening of the right ventricle (RV) free wall (concentric hypertrophy) and severe RV chamber enlargement. There was systolic and diastolic septal flattening with bowing of the septum into the left ventricle indicating that systolic and diastolic pressure in the right ventricle is higher than in the left ventricle (Figure 7). On colour Doppler examination there was substantial tricuspid valve regurgitation and turbulent blood flow across the pulmonic valve. On the right parasternal short axis view of the pulmonic valve area, narrowing was evident as well as post stenotic dilation of the pulmonary artery (Figure 8). The findings were consistent with **pulmonic stenosis (PS)**, a common inherited congenital defect in which the pulmonary valve is constricted, causing obstruction of the right ventricular outflow tract (RVOT). The location of the narrowing can be valvular, supravalvular or subvalvular. Valvular PS (more common in dogs) can involve valve thickening, fusion and hypoplasia. Tricuspid valve dysplasia is associated with PS and was evident in this patient. To assess the severity of the stenosis, the peak systolic trans-stenotic pressure gradient needs to be measured with spectral flow Doppler imaging. The higher the pressure gradient, the worse the stenosis is. The treatment of choice for moderate to severe valvular PS is balloon dilation valvuloplasty. Dogs with mild PS, however have a good prognosis with survival of ≥8 years reported.

Case 6

A 9-year-old female Golden Retriever was presented with a history of chronic cough. As part of the work-up an echocardiogram was performed. Marked left ventricular concentric hypertrophy was noted (Figure 9). The left ventricular wall in diastole measured between 14-18mm with normal for this dog being 7-11mm. In such cases the cause of the hypertrophy should be investigated. Hypertrophic cardiomyopathy (HCM) as a primary cardiac disease in dogs is rare and can only be considered in the absence of other cardiac or systemic diseases which may lead to hypertrophy

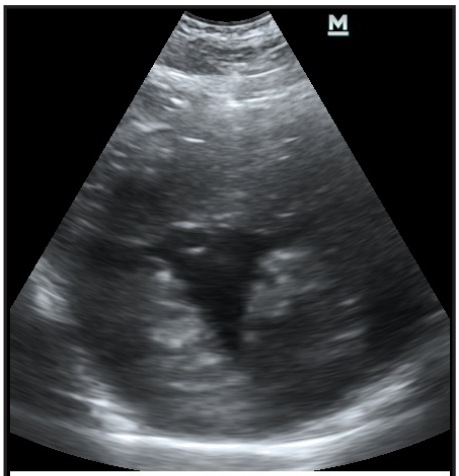

Figure 9. R parasternal short axis. LV in diastole

such as systemic hypertension, hyperthyroidism, infiltrative myocardial disease, aortic stenosis and pseudo-hypertrophy (as in hypovolemic shock, dehydration, blood loss etc.). Oscillometric blood pressure measurement was done and persistent hypertension was noted (average systolic BP 200, diastolic 109). It was presumed the left ventricular hypertrophy was secondary to **systemic hypertension**. Any disease that causes an elevation in cardiac output, systemic vascular resistance, heart rate and/or stroke volume can lead to systemic hypertension. If no underlying cause of hypertension can be found it is classified as primary. Secondary hypertension, where an underlying cause is responsible, is far more common and accounts for at least 80% of cases in dogs and cats. Diseases associated with systemic hypertension include chronic renal insufficiency, diabetes mellitus, Cushing's, hyperthyroidism and pheochromocytomas. Medications such as glucocorticoids, mineralocorticoids, phenylpropanolamine and non-steroidal anti-inflammatory drugs can also cause hypertension. Transient hypertension due to excitement, fear and anxiety needs to be ruled out.

Case 7

An eleven-year-old, male, Cocker Spaniel was presented with acute onset panting and reluctance to walk. Thoracic radiographs revealed cardiomegaly (VHS = 13). Cardiac ultrasound revealed a moderate pericardial effusion (Figure 10) and **suspected heart base tumour** (usually chemodectoma or ectopic thyroid carcinoma) adjacent to the ascending aorta, best visualised on the right parasternal short axis view, angling the transducer dorsally (Figure 11). The vast majority of cardiac neoplasms are present on the surface of the heart or great vessels and are a common cause of pericardial effusion. Brachycephalic breeds are predisposed to heart base tumours. Haemangiosarcoma of the right atrium is also common in dogs, but both are rare in cats where lymphosarcoma is mostly reported.

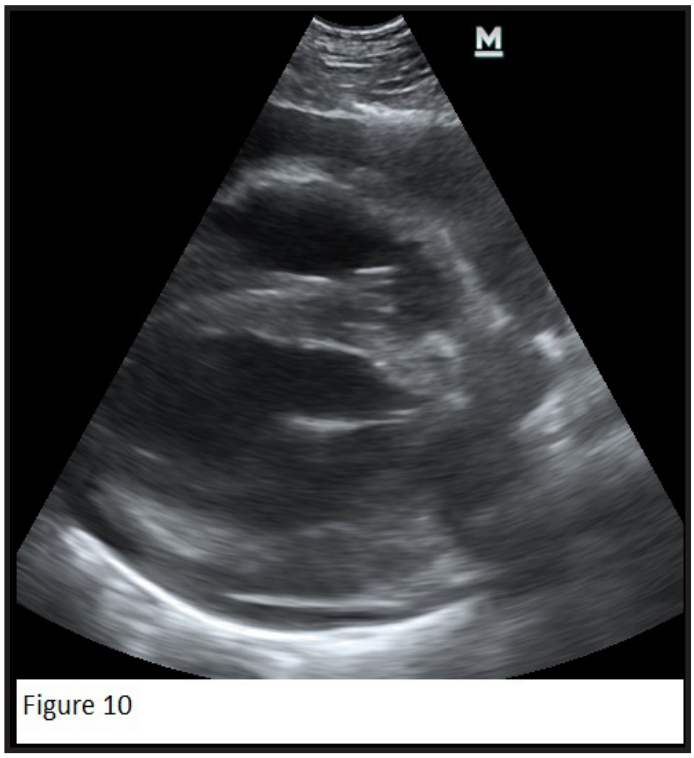

Figure 10

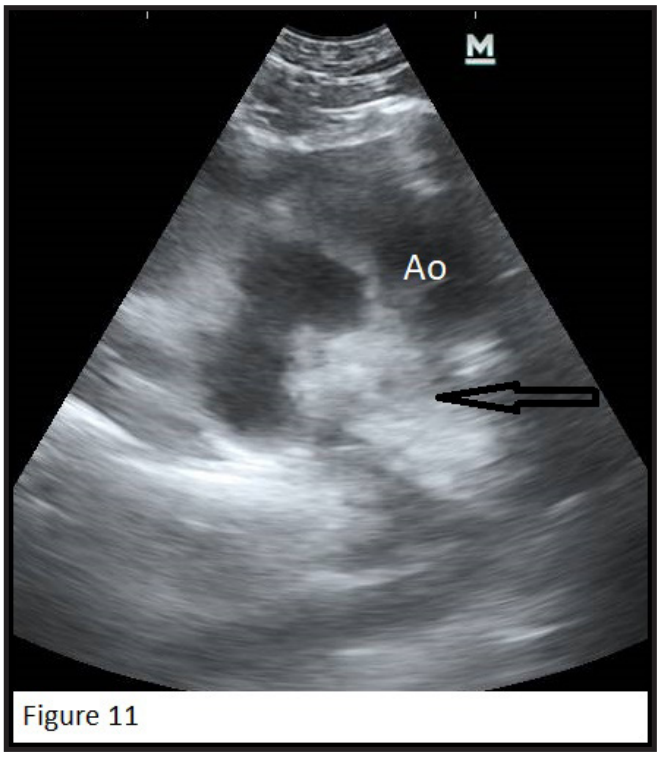

Figure 11

Case 8

A 2-year-old male Pekingese was presented with a harsh, hacking cough and dyspnoea. As part of the investigation, cardiac ultrasound was performed. An unusual structure was seen, best visible on the right parasternal long axis view. A shelf-like structure apparently dividing the left atrium into two compartments was evident (Figure 12, arrow points to the mitral valve). The appearance was **suspect for Cor Triatriatum Sinister or supra-valvular mitral stenosis**, both very rare congenital defects in dogs and often only differentiated on necropsy. Cor Triatriatum Sinister is a congenital heart defect where the connection of the common pulmonary vein to the left atrium is abnormal. There is an accessory atrial chamber that receives all or some of the pulmonary veins. The term triatriatum thus refers to three atria within one heart. The patient was referred to a specialist for further investigation, but died before that could be done and the owners elected against post mortem examination and thus a definitive diagnosis could not be made. This was unfortunate because although these conditions have been recognised in cats with rare frequency, there appears to be only one documented case of Cor Triatriatum Sinister in a French bulldog. Cor Triatriatum Dexter is more commonly documented in dogs.

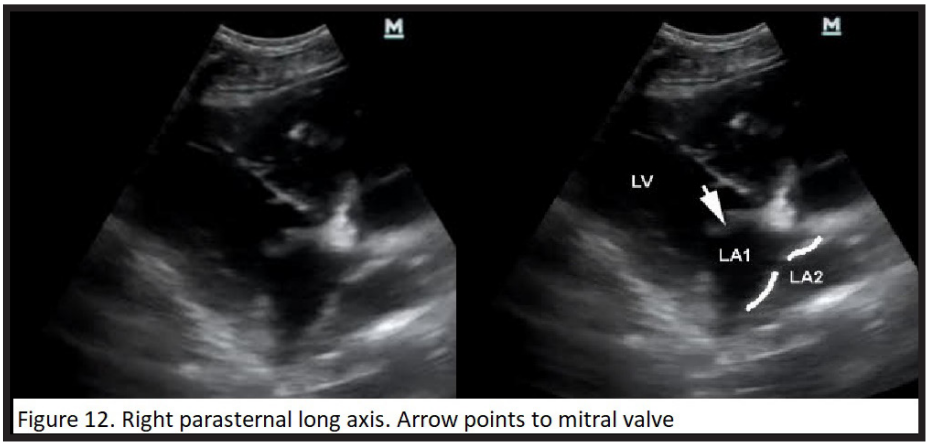

Figure 12. Right parasternal long axis. Arrow points to mitral valve

Conclusion

Just like abdominal ultrasound, the ability to perform a basic echocardiographic examination is a valuable skill to develop in order to gather important diagnostic and prognostic information. If you do not look, you will not find. *References available on request.*

MULTIPLE-CHOICE QUESTIONS

QUESTION 1
Which statement regarding dogs with advanced MMVD is INCORRECT?
a. They typically develop a dilated left atrium
b. Fractional shortening may be increased
c. A decreased LA:Ao ratio is commonly found
d. They may be at risk for rupture of the left atrium
e. They may be at risk for chordae tendinae rupture

QUESTION 2
Which statement regarding chordae tendineae rupture (CTR) is CORRECT?
a. Chordae attached to the posterior mitral leaflet most commonly rupture
b. On ultrasound the mitral leaflet points backward into the left atrium
c. CTR always carry a dismal prognosis
d. Acute dyspnoea is not a negative prognostic indicator
e. None of the above

QUESTION 3
Which statement regarding parvovirus myocarditis is FALSE?
a. Puppies infected within 2 weeks of birth are at high risk
b. Parvovirus myocarditis may be more common than previously thought
c. Some puppies will survive acute infection and develop heart failure later
d. PCR based detection of parvovirus in tissue samples can confirm the diagnosis
e. None of the above

QUESTION 4
The congenital heart defect usually regarded as MOST COMMON in dogs is:
a. Aortic stenosis
b. Pulmonic stenosis
c. Cor triatriatum dexter
d. Patent ductus arteriosis
e. Mitral valve dysplasia

QUESTION 5
Typical findings with pulmonic stenosis (PS) do NOT include:
a. Thickening of the right ventricular wall
b. A decreased pressure gradient across the pulmonic valve
c. Increased pressure in the right ventricle
d. Post stenotic dilation of the pulmonary artery
e. Septal flattening

QUESTION 6
The treatment of choice for moderate to severe PS is:
a. Pimobendan
b. Balloon valvuloplasty
c. Valve replacement
d. No treatment required
e. Euthanasia

QUESTION 7
Diseases which may induce systemic hypertension INCLUDE
a. Chronic renal disease
b. Hyperadrenocorticism
c. Diabetes Mellitus
d. Hyperthyroidism
e. All of the above

QUESTION 8
Which statement regarding Cor Triatriatum Sinister (CTS) is FALSE?
a. It has been described in humans and cats with rare frequency
b. A case has been described in a French Bulldog
c. Cor Triatriatum Dexter is more commonly described in dogs
d. The term "triatriatum" denotes three atria within a single heart
e. None of the above

QUESTION 9
Which statement regarding rupture of the left atrium is INCORRECT?
a. It results in acute development of pericardial effusion
b. The blood in the pericardium may clot
c. The prognosis is not as poor as previously thought
d. It is a common complication of MMVD
e. None of the above

QUESTION 10
Which statement regarding heart base tumours is INCORRECT?
a. Heart base tumours may cause pericardial effusion
b. Scan as far dorsally as possible to find them
c. Dolichocephalic breeds are predisposed
d. Brachycephalic breeds predisposed
e. A negative scan does not rule out a heart base tumour

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