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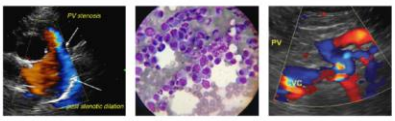

SonoPath
Clinical Sonography & Telecytology
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PATIENT
Emmy Happy Trails

SPECIES
Canine

BREED
Mix

SEX
Female Intact

AGE
1 year

WEIGHT
47lbs

INTERPRETED BY
Maggie Machen Lamy, DVM, DACVIM (Cardiology)

IMAGING PERFORMED BY
Kim Liedberg

HOSPITAL NAME
SVS Imaging WI

REFERRING VET
Dr. Klein

INVOICE
23247

DATE
3/23/22

PRESENTING CLINICAL SIGNS
History: Emmy is a shelter dog from Happy Trails. She is heartworm positive. No noted heart murmur present during PE. Assess prior to spay and adoption.
-Abnormal PE/Chem/CBC/UA Results: Normal Chem 11 and CBC.

ELECTROCARDIOGRAPHIC FINDINGS *Note: Single lead ECGs are evaluated as a rhythm strip. Morphology/MEA cannot be definitively commented on.
A single lead ECG is available; 25mm/s, 10mm/mV. The average heart rate is 80bpm (range 60-100bpm). The rhythm is sinus in origin, with a p for every QRS complex and vice versa. The P morphology is positive. The QRS is isoelectric. No ectopic beats, pauses or other dysrhythmias observed.
ECG diagnosis: Respiratory sinus arrythmia.

ECHOCARDIOGRAM FINDINGS
2D, m-mode, color flow and doppler imaging is available. Mild thickening of mitral valve with no prolapse into the left atrial lumen. No MR; normal LA dimension. No LV dilation with adequate myocardial function. The MPA and branches are minimally dilated. Concern for adult worm(s) in the distal right branch (see below); no worms seen in the RA or RV or MPA. Mild right heart prominence. Trace tricuspid regurgitation. Velocity consistent with mild pulmonary hypertension. The pulmonic and aortic valves are normal in morphology and mobility. Normal pulmonic and aortic outflow velocities with laminar flow. Mild pulmonic and aortic insufficiency. No pericardial or pleural effusion.

CARDIAC CHART

CANINE CARDIAC PARAMETERS	MR VMAX (m/s)	TR VMAX (m/s)	LA/AO (Boon method)	LA/AO (Heart Base; Swe)	FS (%)	EF (%)	EPSS (cm)
NORMAL PARAMETER	4.5-5.5	<2.7	1.3	<1.6	28-40	40-100	<0.6
PATIENT	NA	3.2	1.3	1.2	32	60	0.4
CANINE CARDIAC PARAMETERS	**HR** (BPM)	**AV VMAX** (m/s)	**PV MAX** (m/s)	**BODY WEIGHT** (kg)	**LA** 2D short axis Base view (cm)	**LVIDd** Avg; 2D and m-mode short axis (cm)	**LVIDs** Avg; 2D and m-mode short axis (cm)
NORMAL PARAMETER	50-100	0.7-1.7	0.7-1.6	BELOW	BELOW	BELOW	BELOW
PATIENT	93	1.6	1.2	21.3	2.8	4.4	3.0
*Normal chamber parameters expressed as a mean value (SD)				3	1.27 (5.3)	2.46 (2.46)	1.36 (5.5)
BODY WEIGHT DEPENDENT PARAMETERS				5	1.40 (4.5)	2.74 (5.2)	1.60 (4.7)
				10	1.50 (3.8)	3.27 (3.5)	2.06 (3.1)
				15	1.83 (2.0)	3.71 (2.4)	2.43 (2.1)
				20	2.02 (1.9)	4.14 (2.2)	2.80 (2.0)
				25	2.18 (2.4)	4.48 (2.9)	3.10 (2.5)
				30	2.33 (3.3)	4.83 (3.9)	3.39 (3.4)
				35	2.48 (4.3)	5.17 (5.0)	3.69 (4.5)
				40	2.62 (5.2)	5.48 (6.1)	3.96 (5.4)
				50	2.88 (7.1)	6.07 (8.3)	4.46 (7.4)

Note: All measurements based upon multi-modal images and methods. An average value is reported.

Adapted from June Boon, Veterinary Echocardiography, 1998
Rishniw M and Hollis NE, J Vet Intern Med 2000; 14:429-435
Hansson et al, Vet Rad and Ultrasound 2002
Bonagura et al. Echocardiography: principles of interpretation, Vet Clin North Am 15:1177, 1995

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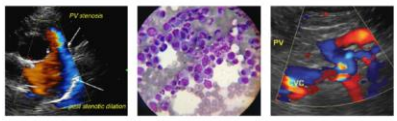

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INTERPRETATION OF THE FINDINGS & FURTHER RECOMMENDATIONS

Suspicion for an adult heartworm infestation in the distal right branch of the pulmonary artery. This is certainly not definitive in this peripheral location, as ultrasound is largely insensitive (i.e., adult worms may be easily either missed peripheral or elsewhere). Given minimal right heart enlargement, the infestation is considered relatively mild even with this finding. There is evidence of early pulmonary hypertension, which is not surprising in light of active heartworm disease. No additional issues are identified.

Heartworms can cause significant damage to the lung tissue leading to pulmonary damage, pulmonary hypertension and clinical signs such as coughing, decreased ability to exercise, or difficulty breathing. Disease severity can range from an asymptomatic dog with few worms to dogs with severe respiratory signs. In the most severe cases, caval syndrome may develop due to a very high worm burden sheering blood cells as they pass through the heart. Caval syndrome is a life-threatening emergency that requires immediate surgical removal of the worms.

Given that this patient has no reported clinical signs and minimal right heart enlargement, we do have some flexibility when approaching therapy. Medical management with drugs like Sildenafil and prednisone is typically only utilized if the patient is showing respiratory signs or syncope (none noted). If extraction would be a possibility from a financial standpoint, I would consider **referral to a local cardiologist for advanced echocardiography and evaluation.** If that is not a possibility, utilizing the standard approach to heartworm treatment as dictated by the American Heartworm Society is recommended, including 30 days of doxycycline and heartguard prior to the split immiticide protocol. **Please see website and protocol for specific information, as no information is provided in the history as to what has already been done.** There is high risk for thromboembolism in any patient, however those with adult worms seen in the PA are no question at elevated risk. At this time, exercise restriction is paramount, including cage rest with leash walks only, as a worm embolus can be a life-threatening complication of the disease. This should be continued for an additional 6-8 weeks following therapy.

Modifications to this protocol are sometimes elected depending on individual circumstances which may involve fewer injections or a “slow kill” method. These are not, however, our standard recommendation as alternate treatment may not result in effective treatment of the infestation. Following treatment, retest for heartworm disease 6 months after completing the full course of therapy. Anesthesia is NOT advised prior to completing the protocol, as vasodilation can lead to increased risk for an embolus. Prognosis is guarded, as the right heart/MPA changes are often permanent and may cause clinical signs (exertional syncope/dyspnea, right-sided CHF) in the future.

During therapy, there is high risk for a worm embolus and breathing rate and effort should be monitored closely. Anti-inflammatory prednisone can be used if becomes symptomatic. Patient will be at high risk for developing clinical signs due to pulmonary hypertension with age given the inherent secondary inflammation and damage to the pulmonary vasculature and lungs, and periodic rechecks may be helpful. Monitor for exertional dyspnea or fainting episodes going forward.

Once heartworm negative, a recheck echocardiogram and chest radiographs are recommended in 6 months to reassess right heart changes.

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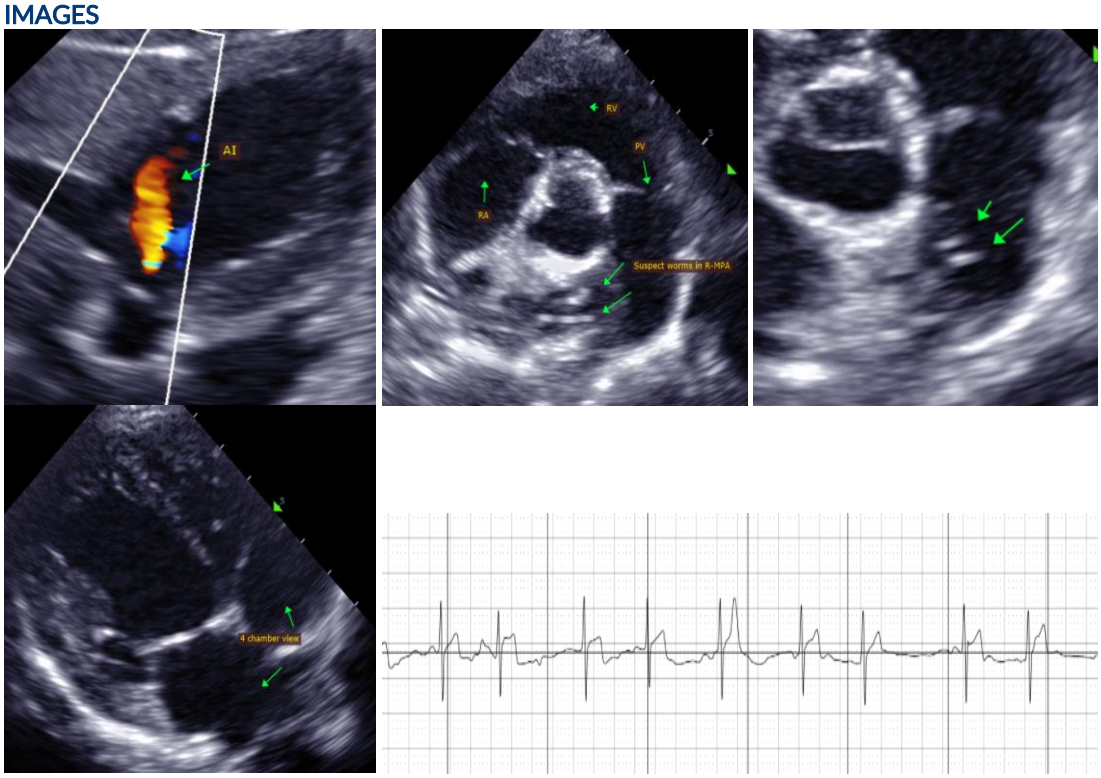

The information and recommendations provided are based on the images presented by the referring veterinarian. No evaluation can be communicated regarding pathology that was not visible in the image/video clips provided.

Thank you for this referral. If the clinical or image interpretation does not parallel your findings or if I can be of any further assistance, please contact me.

Maggie Machen Lamy, DVM
Diplomate of the American College of Veterinary Internal Medicine (Cardiology)
info@sonopath.com