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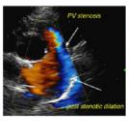
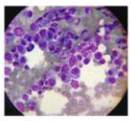
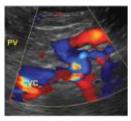

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PATIENT

Apollo Ruff Life Dog Rescue

SPECIES

Canine

BREED

Collie Mix

SEX

Male Neutered

AGE

8 years

WEIGHT

48lbs

INTERPRETED BY

Maggie Machen Lamy, DVM, DACVIM (Cardiology)

IMAGING PERFORMED BY

Sarah Pender, CVT

HOSPITAL NAME

SVS Imaging QC

REFERRING VET

Dr. Tammell

INVOICE

24774

DATE

6/14/22

PRESENTING CLINICAL SIGNS

History: Presented for a cough. Heartworm positive, treated with slow-kill (moxi-doxy) method.

RADIOGRAPHIC FINDINGS *NOTE: Images submitted for supplemental cardiac information only.

Severe right-sided cardiomegaly with PA enlargement. Diffuse heavy bronchointerstitial lung pattern. No obvious evidence of CHF.

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, 20mm/mV. The average heart rate is 70bpm (range 35-100bpm). The rhythm is sinus in origin, with a p for every QRS complex and vice versa. The P and QRS morphologies are positive. No ectopic beats, pauses or other dysrhythmias observed.
ECG diagnosis: Profound respiratory sinus arrythmia.

ECHOCARDIOGRAM FINDINGS

2D, m-mode, color flow and doppler imaging is available. Mild diffuse thickening of mitral valve with no prolapse into the left atrial lumen. Mild to moderate eccentric mitral regurgitation, mild left atrial enlargement. Normal MR velocity. Normal LV diameter with adequate myocardial function. Suspect adult worms seen in pulmonary artery and branches (see below). The MPA and branches are remarkedly dilated. Large soft tissue lesion is seen in the distal right branch with concern for adult worms near the bifurcation. Mild pulmonic insufficiency. Mild thickening of the pulmonic valve. Moderate TR. Velocity consistent with severe pulmonary hypertension. Mild right atrial enlargement and mild ventricular dilation with evidence of mild hypertrophy. The aortic valve is normal in morphology and mobility. Normal pulmonic and aortic outflow velocities with laminar flow. No aortic insufficiency. No pericardial or pleural effusion noted.

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	4.7	4.5	NM	1.7	50	92	0.7
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	104	1.0	0.7	21.8	3.5	3.6	1.8
*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)
Note: All measurements based upon multi-modal images and methods. An average value is reported.				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)

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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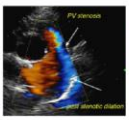
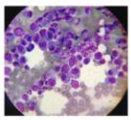
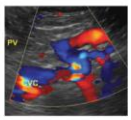

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INTERPRETATION OF THE FINDINGS & FURTHER RECOMMENDATIONS

Adult heartworm infestation is suspected with worms likely visualized in the pulmonary artery. The MPA is massively dilated and the TR velocity consistent with severe pulmonary hypertension. Of great concern, there is a large soft tissue lesion seen in the distal right pulmonary artery branch. This is atypical, although this tends to be where worms will congregate. Rule outs for this finding include a worm embolus (suspected) versus a blood clot versus other soft tissue lesion. Severe pulmonary hypertension has developed secondary to the infestation, putting the patient at high risk for clinical signs. There is also mild left heart disease, which is relatively insignificant at this time; however, follow up is advised. Finally a respiratory sinus arrhythmia is seen on the ECG, which is likely secondary to high vagal tone.

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. Recommend baseline lab work to screen for this development, presenting as hemoglobinuria, anemia, etc. **A CBC and urinalysis are recommended.**

This patient is symptomatic with a cough noted in the history. This is likely secondary to heartworm disease. The best we can do is treat the HW disease more aggressively (extraction, Immiticide) and utilize supportive care. Sildenafil/Pimobendan and steroid therapy can be used given the patient has respiratory signs. Continued monitoring is advised, as development of effusion in the abdomen or chest warrants diuretic therapy.
Given the complexity of this case, highly recommend immediate referral for Specialty care if possible.
Any patient with visible worms and clinical signs should consider extraction (if available) to quickly decrease load and give the greatest chance for long term recovery. The procedure does carry risk, and if available should be discussed with a local Cardiologist ASAP. Likely stabilization is recommended prior to proceeding.

Once the majority of the worm burden is removed if possible and the patient stabilized, highly recommend utilizing the split protocol using Immiticide. Strict exercise restriction and administration of monthly heartworm preventative, such as Heartguard should also be continued. Starting now through the end of therapy (6-8-week post-last immiticide injection), exercise restriction is paramount, including cage rest with leash walks only as a worm embolus can be a life-threatening complication of the disease. Following treatment, the patient should be re-tested for heartworm disease 6 months after completing the full course of therapy.

Once heartworm negative, a recheck echocardiogram and chest radiographs are recommended in 6 months to assess for any chronic damage to the heart muscle, lungs or tricuspid valve.

PLAN

Consider referral to a Multispecialty Center for a Cardiologist evaluation and treatment. If declined, screening for signs of caval syndrome including hemoglobinuria, RBC sheering/anemia, etc. as discussed; if present and referral is not an option consider euthanasia. Institute Sildenafil therapy (1-2mg/kg PO q8h), Pimobendan (0.2-0.3mg/kg PO q12h), anti-inflammatory steroids if needed for respiratory symptoms. Only utilize Lasix/Spironolactone if effusions are identified in the future. Consider immiticide therapy once stabilized, extraction performed, etc.

IMAGES

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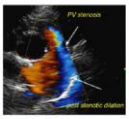
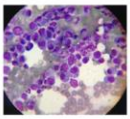
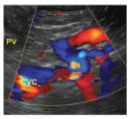

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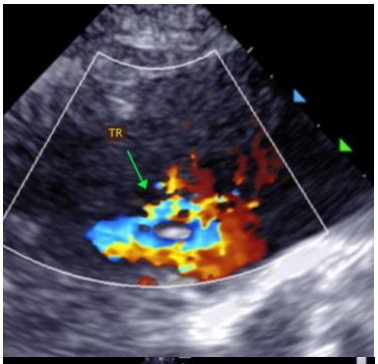

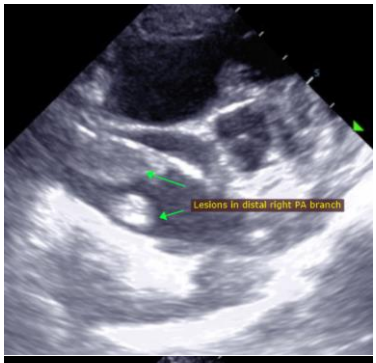

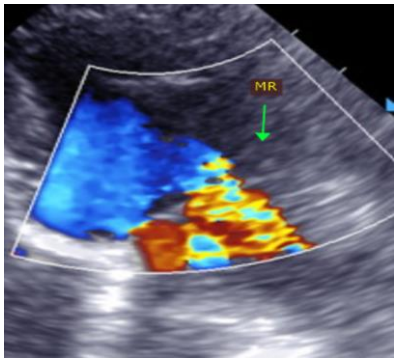

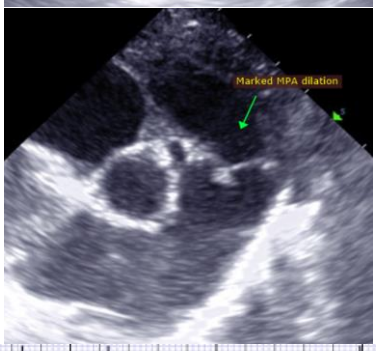

The information and recommendations provided are based on the images presented by the referring veterinarian. No evaluation can be communicated regarding pathology that was not visible in the image/video clips provided.

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