Veterinary Partners Appreciation Conference (V-PAC)

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Heartworms, Recognizing Caval Syndrome - The What?

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I. Background

A. Multiple mosquitos

B. Moderate to large number of worms
   1. Pulmonary arteries
      a. Marked decrease in blood flow allows them to fall into right ventricle
      b. Move back into pulmonary arteries unless
         1) Entwine in tricuspid valve
         2) Large mass
   2. Right heart—wrapped around tricuspid valve
      a. Acute, severe tricuspid regurgitation causes the right heart failure
         1) Jugular vein distension
         2) Hepatomegaly, maybe ascites
      b. No occlusion of tricuspid valve
      c. Volume under loaded left ventricle
      d. If large enough mass, may be pushed into the vena cava
   3. Combination of large worm burden and moderate to severe pulmonary hypertension results in this problem

C. Intravascular red cell lysis
   1. Cause uncertain
      a. Related to the shear stresses caused by flowing around the heartworms at a high velocity
      b. Red cells are more fragile in these dogs
      c. Hemoglobinemia
      d. Hemoglobinuria

II. Diagnosis

A. Clinical signs
   1. Weak, depressed, lethargic
   2. Pale mucus membranes, thread pulses, shocky
   3. Tachypnea, dyspnea in some
   4. Murmur of tricuspid regurgitation
   5. Jugular veins distended
   6. Ascites may be present

B. Laboratory findings
   1. Mirofilaremia
   2. Moderate regenerative anemia with hemoglobinemia
   3. Increases in serum AST, ALT, ALP, bilirubin, BUN
   4. Hemoglobinuria and bilirubinuria
   5. Changes due to hemolysis, acute hepatic congestion, and hypoperfusion
   6. DIC may occur
C. Thoracic radiographs—typical of severe heartworm disease
D. Echocardiogram
   1. Mass of heartworms in right atrium, right ventricle, and entwined in tricuspid valve
   2. Right ventricle is dilated
   3. Left ventricle is small

III. Treatment
A. Without treatment animals die in 12-72 hours due to necrosis of liver and renal failure (hypoperfusion)
   1. Even with treatment, mortality rate is 30-40%
   2. Complications are common and include DIC and organ failure
B. Supportive care
   1. Fluids
      a. For hypoperfusion—increase cardiac output
      b. To treat DIC
      c. To prevent hemoglobin nephropathy
      d. To reverse lactic acidosis due to decreased tissue perfusion
      e. Carefully before heartworms removed, more aggressive afterwards
   2. Other supportive care can include steroids, heparin, and antibiotics
C. Removal of heartworms imperative!
   1. No sedation if moribund
   2. Sedation if tractable
   3. Anesthesia with intensive monitoring
      a. No acepromazine—lasts too long and can get more hypotensive with it
      b. Constant blood pressure monitoring
      c. Pulse oximetry
      d. All anesthesia causes pulmonary vasoconstriction which can be a problem with oxygenation in these patients.
      e. Recommends short acting anesthetics and premeds
      f. Remember that as worms are removed, some may break apart and cause pulmonary embolism or DIC or both.
      g. Be ready for any crisis!
   4. Clip and prep right lateral neck
   5. Cut down to jugular and isolate it with blunt dissection
   6. Place umbilical tape around both ends of it
   7. Incise jugular with incision running parallel to blood flow.
   8. Instruments to remove heartworms:
      a. Long alligator forceps (20-40 cm long)—small diameter
         1) Easy to grasp worms
         2) Easy to perforate vessels
         3) Easy to tear tricuspid valve
         4) Easy to macerate heartworms
      b. Jackson forceps made for heartworm removal—cumbersome in small patients
c. Endoscopic baskets

d. Horsehair type brush (Tayma String brush)

e. Flexible alligator forceps (Ishihara alligator forceps)

f. Advance whatever instrument used slowly. Ideally fluoroscopy can be used or echocardiography. Careful as can go down the wrong vessel at the thoracic inlet.

g. Keep repeating procedure until no worms are brought out in 5-6 successive attempts (or only a few worms remain on echo).

D. Complications

1. Macerating worms causes massive antigen release resulting in:
   a. Pulmonary vasoconstriction
   b. DIC
   c. If this occurs, give anti-inflammatory doses of corticosteroids and heparin (100-500 U/kg q. 8 hrs.).

2. Monitoring
   a. Urine color, BUN, and hematocrit
   b. May need oxygen therapy in some

E. Once stable

1. Can go home
2. Send home on doxycycline or minocycline
3. Treat remaining adults with Immiticide starting in 2-4 weeks after dog goes home as takes time for right heart to return to normal.