

The pathophysiology of renal and cardiac changes in canine babesiosis

By


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DECLARATION

I declare that the thesis herewith submitted by me to the University of Pretoria the degree PhD, has not been submitted previously by me for a degree at any other university.

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ABSTRACT

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This thesis showed that dogs with natural infection with *B. canis* had both renal and cardiac dysfunction, both of which can be classified as complications of babesiosis and would thus necessitate supportive therapy.

This thesis demonstrated that RTE celluria, proteinuria, and variable enzymuria and azotaemia occur in dogs with babesiosis. However, these were all minimal changes and all could be consistent with hypoxia, reduced GFR, or reduced cardiac output. This thesis showed that dogs with naturally occurring babesiosis had significant urine met-haemoglobin with no evidence of blood met-haemoglobin. The possibility would be that the urinary met-haemoglobin was either produced in the kidney or possibly by oxidation of haemoglobin to met-haemoglobin in the bladder. It has been shown experimentally that met-haemoglobin can be toxic. The combination of reduced GFR, anaemic hypoxia, and met-haemoglobin can all act synergistically to cause renal damage. Renal haemodynamics are also much more likely to be abnormal when cardiac dysfunction is present. Reduced renal blood flow and glomerular filtration rate are evidence of redistribution of blood flow that commonly occurs in early heart failure. An important finding in this thesis was that dogs with babesiosis had lower serum sodium than control dogs but there was no difference between mild, severe, or complicated cases of babesiosis. In addition, dogs with babesiosis had a lower fractional clearance of sodium than clinically healthy control dogs, which can be interpreted as sodium retention by the kidneys. This sodium retention would also result in water retention, which will result in an expansion of the plasma volume.

In the past heart lesions in canine babesiosis were regarded as rare complications, with the majority of lesions being reported as incidental findings at post-mortem examination of complicated babesiosis cases. This thesis has demonstrated that cardiac lesions to be common in canine babesiosis.

This thesis showed that that ECG changes in babesiosis were similar to the pattern described for myocarditis and myocardial ischaemia, and together with the histopathological findings indicated that the heart suffers from the same pathological processes described in other organs in canine babesiosis, namely inflammation and hypoxia. As the clinical application of the ECG changes found in this thesis was limited, cardiovascular assessment should be based on functional monitoring rather than ECG. Using cardiac troponin as a marker of myocardial injury, this thesis showed that myocardial cell injury occurs with canine babesiosis. Cardiac troponins, especially troponin I, are sensitive markers of myocardial injury in canine babesiosis, and the magnitude of elevation of plasma troponin I concentrations appears to be proportional to the severity of the disease. ECG changes and serum cardiac troponin were correlated with histopathology. On cardiac histopathology from dogs that succumbed to babesiosis, haemorrhage, necrosis, inflammation and fibrin microthrombi in the myocardium were documented, all of which would have resulted in ECG changes and elevations in cardiac troponin. Myocardial infarction causes left ventricular failure, which will result in hypotension and an expansion of the plasma volume due to homeostatic mechanisms.

This thesis showed that dogs with babesiosis had hypoalbuminaemia, which may be because of intravascular volume dilution due to fluid retention. In disease hypoalbuminaemia can occur as a negative acute-phase protein. In the light of the cardiac changes, hyponatraemia, and hypotension, a probable cause would be fluid retention due to myocardial disease. This thesis showed that dogs with babesiosis had left ventricular lesions, which can result in systolic heart failure.

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