Applications of Cardiac Troponin I Evaluation in Small Animal Practice

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Cardiac Disease
Typically, veterinarians have relied on presenting complaints, physical examination and cardiac auscultation to diagnose cardiac disease. If further investigation was indicated, radiography, echocardiography and/or electrocardiography were utilized. Though beneficial, these advanced diagnostics require special equipment, expertise to interpret, and are costly. Until recently, a non-invasive, rapid, accurate, inexpensive method to identify and monitor cardiac disease in dogs and cats did not exist.

Cardiac Markers
In human medicine, several cardiac enzymes (creatine kinase isoenzymes, lactate dehydrogenase, natriuretic peptides and myoglobin) have been utilized to aid in the diagnosis of acute myocardial infarction. Unfortunately, these enzymes lack sufficient sensitivity and specificity for successful clinical application in small animal medicine.

The current gold standard laboratory test for diagnosing myocardial infarction (in humans) is cardiac troponin I (cTnI), a highly sensitive (85%) and specific (97%) marker of myocardial cell necrosis. Unlike other cardiac markers, especially BNP, the structure of cTnI is highly conserved across species, and assays validated for human cTnI have been validated for the dog.

Troponin
Cardiac muscle cell contraction is partially regulated by troponin proteins and intracellular calcium; together they moderate the interaction between myosin, tropomyosin and actin. Cardiac troponins exist in three forms: cardiac troponin C (cTnC), cardiac troponin I (cTnI), and cardiac troponin T (cTnT) with cTnI being the inhibitory component. In the absence of calcium, tropomyosin blocks myosin binding sites on actin filaments preventing bridging of thick and thin muscle filaments. With higher intracellular calcium concentrations, cTnI bound calcium causes a conformational change in tropomyosin which exposes the myosin binding sites. Normally cTnI is bound to the actin filament by cTnT, but in response to cardiac muscle cell damage, it detaches and is released into circulation. Following acute cardiac injury, cTnI levels peak on the first day, remain elevated for 7 days, and return to baseline by 3 weeks after injury. Increased concentration of cTnI has been found in dogs with dilated cardiomyopathy (DCM), mitral valve regurgitation (MVR), gastric dilatation-volvulus (GDV), myocarditis, subaortic stenosis (SAS), blunt thoracic trauma, pericardial effusion and babesiosis.

Applications of cTnI Use in Small Animal Practice

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<thead>
<tr>
<th>APPLICATION</th>
<th>CONDITION</th>
<th>EFFECT ON cTnI</th>
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<tbody>
<tr>
<td>Assessment</td>
<td>SAS</td>
<td>Increased baseline cTnI suggests underlying myocardial damage.</td>
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<td>HCM (Cats)</td>
<td>Sensitive (85%) and specific (97%) for differentiating cats with moderate to severe HCM compared to normal.</td>
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<td>Monitoring</td>
<td>Cardiotoxicity</td>
<td>Early cTnI elevations are detectable from certain medications, e.g., chemotherapeutics (Doxorubicin).</td>
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<td>DCM and MVR</td>
<td>A correlation can be made between elevated cTnI levels and left ventricular and left atrial size.</td>
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<td>Prognosis</td>
<td>GDV</td>
<td>cTnI concentration peaks at 48–72 hours post-op. Continued elevations correlate with severity of cardiac arrhythmias and outcome.</td>
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<td>HBC</td>
<td>In cases of blunt thoracic trauma such as HBC, cTnI concentrations better correlated with myocardial damage than ECG, cTnT, or creatine kinase.</td>
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(Continued)
Heska Corporation has recently introduced a new immunoassay cartridge for the iSTAT® 1 analyzer with the ability to measure cTnI in dogs and cats. Evaluating cTnI has many applications in small animal practice including:

1. Assessing severity of disease in dogs with SAS, MVD, and CM.10
2. Monitoring response to treatment of congestive heart failure.10,14
3. Assessing cardiac damage due to extra-cardiac disease (GDV and HBC).10
4. Assessing severity of disease in cats with cardiomyopathy.10

As with other products related to the iSTAT® and iSTAT® 1 analyzers, the cTnI cartridge has a proven track record in human medicine providing fast, accurate and reliable results. cTnI measurement on presentation and as follow-up ensures superior monitoring and care in all veterinary cardiac and trauma patients.

References:
2. Berkowitz, A. (4th year student), Koret School of Veterinary Medicine, The Hebrew University of Jerusalem.