Serum Cardiac Troponin I Concentration in Retired Racing Greyhounds

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Background: Cardiac troponin I (cTnI) is a polypeptide found specifically in cardiac muscle tissue that has been used as a diagnostic and prognostic indicator of cardiomyopathy. Increases in cTnI are associated with myocardial pathologic processes. However, high serum cTnI concentrations have been observed in normal Greyhounds.

Hypothesis: We hypothesized that Greyhounds have cTnI concentrations higher than non-Greyhound dogs, and that a separate reference range should be established for Greyhounds.

Methods: Analysis of serum cTnI was performed with an immunoassay system with a detection level of 0.01 ng/mL, as described previously. The Greyhound values were compared with 2 groups of Boxers with and without arrhythmogenic right ventricular cardiomyopathy (ARVC), and to a group of non-Boxer control dogs from a previous study.

Results: The mean cTnI concentration in Greyhounds was significantly higher (P < .0001) than that in non-Greyhound control dogs, although not significantly different from normal Boxers (P = .50), or Boxers with ARVC (P = .58). Greyhound serum cTnI concentrations were in the range found in Boxers with ARVC. The proposed reference range for cTnI in Greyhounds is 0.05–0.16 ng/mL.

Conclusions and Clinical Importance: Greyhounds have a reference range for serum cTnI concentrations that differs from that of other previously published reference ranges for dogs of other breeds. Until a broader database and more precise reference range can be established, caution should be exercised in interpreting serum cTnI concentrations in Greyhounds with suspected cardiac disease.

Key words: Cardiac biomarkers; Cardiac reference ranges; Cardiology; Cardiomyopathy; Cardiovascular.
The mean cTnI concentration in Greyhounds was significantly higher ($P < .005$) than that in non-Greyhound control dogs (Fig 1). The mean cTnI concentration was not significantly different between Greyhounds and normal Boxers ($P = .36$), or Greyhounds and Boxers with ARVC ($P = .48$) (Fig 1). The mean cTnI concentration in the Greyhounds was 0.10 ng/mL (median 0.08 ng/mL; range, 0.03–0.57 ng/mL). The reference range for cTnI in our population of Greyhounds calculated by 25 and 75% percentiles was 0.06–0.1 ng/mL.

There were no significant differences in cTnI concentration between male and female Greyhounds ($P = .42$), nor between the blood donor Greyhounds and those in the spay and neuter program ($P = .55$). The mean cTnI concentrations were 0.02 ng/mL (median, 0.02 ng/mL; range, <0.01–0.05 ng/mL) in non-Greyhound control dogs, 0.08 ng/mL (median, 0.085; range, 0.02–0.11 ng/mL) in normal Boxers, and 0.12 ng/mL (median, 0.13; range, 0.04–0.19 ng/mL) in Boxers with ARVC. Twelve of the 20 Greyhound cTnI concentrations (60%) were within or above the range of the Boxers with ARVC (ie 0.08–0.16 ng/mL) (Fig 1).

**Discussion**

Greyhounds have developed many adaptational physiologic traits that are different from other breeds and should give them an advantage as racing dogs. They have developed a unique musculoskeletal conformation, larger myocardial muscle mass, and higher concentrations of RBC and hemoglobin to increase their exercise efficiency. Many of these adaptations have led to differences in their hematologic and biochemical variables, some of which are only now beginning to be understood.

Reference ranges for serum cTnI concentrations have been determined for humans and dogs, but some of these studies were done by different instrumentation and reagents. Serum troponin concentrations have been evaluated in dogs with the following diseases: babesiosis, doxorubicin administration, mitral valve disease, SAS, DCM, pericardial effusion, gastric dilatation-volvulus (GDV), cardiac contusions, and ARVC in Boxers. In humans, cTnI concentrations consistent with acute myocardial infarction have been reported after high-level exertion. Although many of the Greyhounds in this study were serologically negative for *B. canis*, none had a history of chemotherapy administration, and all were healthy based on cardiac auscultation.

A limitation of this study is that only half of the Greyhounds had cardiac evaluations with ECG and blood pressure determinations. Interestingly, the female Greyhound with a serum cTnI concentration of 0.57 ng/dL, the only outlier in the group, had a normal physical examination, blood pressure, and ECG (data not shown). Because all of the Greyhounds used were retired racers, it is unlikely that persistently increased concentrations would be present because of their high-performance training. In addition, there were no significant differences in cTnI between the blood donor Greyhounds, that had lived in homes for over a year, and the Greyhounds in the spay and neuter clinic. The latter had raced more recently, but a detailed history was not available.
The cTnI concentration was above the upper limit of the reference range (0.11 ng/mL) in 5/20 Greyhounds (25%), and 12/20 Greyhounds (60%) had cTnI concentrations above the previously published reference range of 0–0.07 ng/mL. We have shown that clinically normal Greyhounds have higher cTnI concentrations than other apparently normal dogs; their serum cTnI concentration is in the range found in Boxers with ARVC. This high concentration may be because of their larger heart weight-to-body weight ratios, an adaptational mechanism for high-stress physical performance. Despite the fact that none of these dogs were in racing condition or performing at the time, breeding would favor dogs with the capacity for high-stress performance, regardless of their actual activity level.

Although unlikely the fact, the cTnI concentration in normal Greyhounds was similar to that in Boxers with ARVC could indicate that these dogs have an as yet undetermined underlying myocardial pathology. However, all Greyhounds in this study were healthy, had no arrhythmias on auscultation, and remained asymptomatic months after completing the study. Myocardial histopathology (ie, endomyocardial biopsies) would have specifically addressed this issue. However, in a study of necropsies in 230 former racing Greyhounds, only 4% had histologic evidence of myocardial pathology (eg, infarcts). Additional studies to compare serum cTnI concentrations in racing Greyhounds versus noncompeting or show Greyhounds may identify other differences in reference ranges among Greyhounds, as occur in people.

Currently, practicing veterinarians frequently obtain plain thoracic radiographs in dogs with heart murmurs. In Greyhounds, those radiographs may lead to an inaccurate interpretation of cardiomegaly, if nonbreed-specific canine reference ranges for VHS are used. Occasionally, serum cTnI concentration will be used to ascertain whether or not a dog with a heart murmur and cardiomegaly has myocardial disease. Consequently, a variable proportion of normal Greyhounds could be erroneously diagnosed as having myocardial disease based on the presence of a heart murmur, an apparently higher than normal VHS, and high serum cTnI concentration. The reference range for serum cTnI concentrations in Greyhounds differs from that of other breeds. Until a larger database can be established and a more precise reference range is widely available, caution should be exercised in interpreting serum cTnI concentrations in Greyhounds with suspected cardiac disease.

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References

Footnotes
a Interceptor, Novartis, Greensboro, NC
b Heartgard, Merial, Iselin, NJ
c Frontline, Merial Duluth, GA
d K9 Advantix, Bayer, Shawnee Mission, KS
e BD Vacutainer, Franklin Lakes, NJ
f Unicel DXI, Beckman Coulter, Fullerton, CA

Graph Pad Software, San Diego, CA

