



# Radiographic cardiac size in cats and dogs with heartworm disease compared with reference values using the vertebral heart scale method: 53 cases

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## KEYWORDS

Heartworm;  
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**Abstract Objectives:** To measure the size of the heart, caudal vena cava and right pulmonary artery (cats) or right caudal lobar artery (dogs) using the vertebral scale method in heartworm-infected cats and dogs and compare the results with reference values.

**Background:** The vertebral heart scale (VHS) method is an objective measure of heart size relative to body size.

**Animals:** Thoracic radiographs from heartworm-infected cats ( $n = 28$ ) and dogs ( $n = 25$ ).

**Materials and methods:** Standardized measurements using a previously published method were made using lateral, dorsoventral and/or ventrodorsal thoracic radiographs.

**Results:** On lateral radiographs, the mean VHS for the heartworm-infected group was significantly larger than the reference value for both cats and dogs (cats  $p = 0.009$ , dogs  $p < 0.001$ ). On lateral radiographs of both infected cats and dogs, there was a significant correlation between mean diameter of the caudal vena cava and VHS (cats  $p = 0.002$ ,  $r = 0.59$ ; dogs  $p = 0.012$ ,  $r = 0.53$ ). The mean ratio of the width of the right pulmonary artery (cats) or right caudal lobar artery (dogs) to the width of rib 9 was higher than reference values for each species.

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**Conclusions:** Heartworm-infected cats and dogs often have an enlarged cardiac silhouette on thoracic radiographs. The VHS method, measurement of the caudal vena cava expressed in vertebral lengths, and the calculation of the ratio of the right pulmonary or caudal lobar artery width to rib 9 width are all useful tools to monitor the natural history of the disease and aid in staging for therapy of heartworm disease.

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## Introduction

Determination of heart size is important in evaluating patients with heart disease. The vertebral heart scale method allows objective assessment of radiographic heart size relative to body size using standardized measurements on lateral, dorsoventral and ventrodorsal thoracic radiographs.<sup>1</sup> Although radiographic changes with heartworm disease vary between species, thoracic radiography is a valuable tool for diagnosis and case monitoring in feline and canine heartworm disease.<sup>2</sup> Radiographic changes associated with feline heartworm disease include enlargement, blunting and tortuosity of the peripheral pulmonary arteries, especially on the right side; cardiomegaly and right ventricular enlargement; and patchy focal or diffuse pulmonary parenchymal changes.<sup>3</sup> One study measured the mean ratio of the width of the right pulmonary artery (at the caudal border with rib 9) to the width of rib 9, and values of over 1.6 were reported in association with feline heartworm disease.<sup>4</sup> These alterations may occur less consistently in the course of feline disease, if at all, and absence of radiographic abnormalities does not exclude a diagnosis of heartworm disease.<sup>4</sup>

In contrast, canine chest radiographs can more readily be used to establish a diagnosis of heartworm disease, or support this diagnosis when other laboratory tests are positive. Radiographic changes in canine heartworm disease vary with the duration and severity of the infection, and typical radiographic changes include right ventricular and rarely right atrial enlargement; main pulmonary artery enlargement and peripheral pulmonary arterial abnormalities; and pulmonary parenchymal changes such as interstitial fibrosis and alveolar or interstitial infiltrate.<sup>2</sup> Objective assessment of cardiac and pulmonary artery size is particularly suited to case staging and ongoing management for both species. Values greater than 1.0 for the ratio of the width of the right caudal lobar artery at the caudal border with rib 9 to the width of rib 9 (RCLA:rib 9) are considered abnormal.<sup>5</sup>

The aims of the present study were: (1) measure radiographic heart size using the vertebral scale method in a group of cats and a group of dogs known to be infected with heartworms, and compare the results with reference values; (2) calculate the ratio of the right pulmonary artery (RPA – cat) or caudal lobar artery (RCLA – dog) diameter (mm) to width of rib 9 (mm) in each heartworm-infected group; and (3) determine if there is any correlation between heart size and RPA/RCLA:rib; between caudal vena caval size and RPA/RCLA:rib 9; and between heart size and caudal vena caval size.

## Animals, materials and methods

### Group 1 – cats

#### Radiography

Thoracic radiographs from 28 cats diagnosed with heartworm disease were measured. All cases were sourced from the North Carolina State University College of Veterinary Medicine and standard diagnostic procedures (lateral and DV or VD thoracic radiographs; serum *Dirofilaria immitis* antibody and antigen testing; and echocardiography) to confirm the diagnosis of heartworm disease were used. Cats were of various ages (range 1–19 years) and breeds (with the most common breed being DSH;  $n = 17$ ). For each cat, both recumbent lateral and DV/VD views were available, and radiographs were taken on the same day. All cats were conscious while being radiographed, and were positioned accurately. Radiographs were taken at full inspiration if possible, and a source to image distance of 100 cm was used. Not all measurements could be made accurately on all radiographs, as the cardiac silhouette was sometimes obscured by pleural effusion, so some measurement means are reported from a subset of the total group. DV/VD radiographs were not labelled specifically as DV or VD views.

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