Comparison of three-view thoracic radiography and computed tomography for detection of pulmonary nodules in dogs with neoplasia

Laura J. Armbrust, DVM, DACVR; David S. Biller, DVM, DACVR; Aubrey Bamford, BS; Ruthanne Chun, DVM, DACVIM; Laura D. Garrett, DVM, DACVIM; Michael W. Sanderson, DVM, MS, DACVMP

Objective—To compare the detection of pulmonary nodules by use of 3-view thoracic radiography and CT in dogs with confirmed neoplasia.

Design—Prospective case series.

Animals—33 dogs of various breeds.

Procedures—3 interpreters independently evaluated 3-view thoracic radiography images. The location and size of pulmonary nodules were recorded. Computed tomographic scans of the thorax were obtained and evaluated by a single interpreter. The location, size, margin, internal architecture, and density of pulmonary nodules were recorded. Sensitivity, specificity, positive predictive value, and negative predictive value were calculated for thoracic radiography (with CT as the gold standard).

Results—21 of 33 (64%) dogs had pulmonary nodules or masses detected on CT. Of the dogs that had positive CT findings, 17 of 21 (81%) had pulmonary nodules or masses detected on radiographs by at least 1 interpreter. Sensitivity of radiography ranged from 71% to 95%, and specificity ranged from 67% to 92%. Radiography had a positive predictive value of 83% to 94% and a negative predictive value of 65% to 89%. The 4 dogs that were negative for nodules on thoracic radiography but positive on CT were all large-breed to giant-breed dogs with osteosarcoma.

Conclusions and Clinical Relevance—CT was more sensitive than radiography for detection of pulmonary nodules. This was particularly evident in large-breed to giant-breed dogs. Thoracic CT is recommended in large-breed to giant-breed dogs with osteosarcoma if the detection of pulmonary nodules will change treatment. (*J Am Vet Med Assoc* 2012;240:1088–1094)

Pulmonary metastatic disease is common with many neoplastic diseases in dogs.[1–3] The detection of pulmonary metastases is important because it can considerably impact staging, prognosis, and treatment options. In small animals, 3-view thoracic radiography, consisting of the right and left lateral and ventrodorsal or dorsoventral views, is considered the standard for detecting pulmonary metastases.[1–5] Computed tomography has become more widely available and has an increasing role in the diagnosis of thoracic disease in small animals.[6–9] In people, CT is considered the gold standard for detection of pulmonary nodules because CT is able to detect smaller nodules with greater frequency than is survey radiography.[10] Computed tomography is recommended as a routine screening test for people with malignancies that have a high propensity to metastasize to the lungs and in those patients in which the finding of metastases would have a major impact on management.[10–12]

Abbreviation

HU Hounsfield unit

The literature mentions CT for detection of pulmonary metastatic disease in small animals[6,7,13,14]; however, reports[8,13,14] quantitatively addressing the benefit of CT, compared with thoracic radiography in dogs, for pulmonary metastases detection are few. The 2 main advantages of CT, compared with thoracic radiography, are elimination of superimposition by thoracic structures and superior contrast resolution. These allow for detection of small nodules that would otherwise go unnoticed. One of the main differences between thoracic CT performed in people and animals is the necessity of general anesthesia for animals. The requirement of anesthesia can be confounding because of the resulting poor aeration of the lung (atelectasis), which can decrease nodule conspicuity.[14,15]

The purpose of the study reported here was to compare 3-view thoracic radiography with thoracic CT for the detection of pulmonary metastatic disease in dogs with confirmed neoplastic diseases. The hypothesis was that CT would detect a larger number of pulmonary nodules than found on radiographs but that there may be variability in nodule detection on the basis of nodule size and density, patient size, and type of neoplasia.

From the Department of Clinical Sciences, College of Veterinary Medicine, Kansas State University, Manhattan, KS 66502. Dr. Chun's present address is Department of Medical Sciences, School of Veterinary Medicine, University of Wisconsin, Madison, WI 53706. Dr. Garrett's present address is Department of Veterinary Clinical Medicine, College of Veterinary Medicine, University of Illinois, Urbana, IL 61802.

Supported by Kansas State University Mentoring Fellowship for Women and Minorities in the Sciences and Engineering and Kansas State University Small Research Grant.

Address correspondence to Dr. Armbrust (armbrust@vet.ksu.edu).