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Computed tomographic anatomy of the thoracic region of the cat

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ABSTRACT

The purpose of this study was to identify anatomic structures of computed tomography images of the cat thoracic region for use by veterinary radiologists, clinicians and surgeons. The thoraxes of four cats were scanned using high-resolution imaging with a slice thickness of 15 mm. Each cat was then euthanized and placed in a freezer at -18 °C. Frozen cats were sectioned as close as possible to the C.T. slices. Each C.T. image was studied and compared with its corresponding anatomic section to assist in the accurate identification of specific structures. Thoracic skeleton of the cat was used as reference model. Finally, relevant structures and landmarks were identified and labelled in the C.T. images.

Key words: cat, thorax, tomography, anatomy

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Introduction

Computed tomography (C.T.) currently enjoys a prominent role in the diagnosis and evaluation of many human diseases. Recent papers have also described the use of C.T. as a paraclinical survey in veterinary medicine (MOORE et al., 1991; BURK, 1992b; PLUMMER et al., 1992; HUDSON et al., 1994; TIDWELL et al., 1994). Before any tool can become an effective diagnostic modality, normal species - specific data must be characterized. Publication of clinically relevant C.T. anatomy of the cat is basic to effective utilization of this modality in veterinary medicine (SMALLWOOD and GEORGE ،، 1993). Therefore, this study was performed to identify anatomic structures of C.T. images of the cat thoracic region for use by veterinary radiologists, clinicians and surgeons.

Materials and methods

Five mature female mixed breed (Domestic short hair) cats with average weights of 3.2-4 kg. were used in this study. After physical examination, one of the animals was fixed by fixative solution (formalin 200 ml, glycerine 50 ml, detol 50 gr., thymol 50 gr., potassium acetate 50 gr., alcohol up to 1000 ml) injected in arterial system through carotid artery. The other animals were restrained in customized restraining frames and anesthetized by intramuscular injection of 22 mg./kg. ketamine. The cats were then supported in sternal recumbency and the thorax was scanned by high-resolution imaging using a general diagnostic C.T. system (Toshiba xvid, 120kV, 200 mA., 4 second) with a slice thickness of 15 mm. Tomograms were made almost perpendicular to the longitudinal axis of the thorax. Thereafter, the cats were euthanized and were placed, together with their frames, in a freezer at -18 şC. Each frozen cat was sectioned with cuts as closely as possible to the C.T. slices. The cuts were studied twice, first freshly and then after being fixed in 10% formalin. C.T. images were compared with the first cat and anatomical slices. Thoracic skeleton of the cat was used as reference model. Finally, relevant structures and landmarks were identified and labelled in C.T. images.

Results and discussion

Fig. 2-9 are C.T. images that have been addressed in Fig. 1.

Computed Tomograghy (C.T.) is a new technology that has been used in veterinary medicine only recently. During the recent years a few papers have been published in this field, almost all of them have been related to diagnosis of special diseases (VOORHOUT et al., 1998; MOORE et al., 1991; BURK, 1992b; PLUMMER et al., 1992; HUDSON et al., 1994; TIDWELL et al., 1994; KANEPS et al., 1995). In all of these cases a normal C.T. image is necessary for identifying anatomic structures of animal, but relatively few papers on normal C.T. anatomy are available. HATHCOCK et al. (1995) supplied an anatomical atlas of the llama head for both soft and hard tissues. BURK (1992a) identified those structures that are generally visualized in C.T. images of the nasal cavity of the German shepherd dog that could be useful for analysis of nasal cavity lesions. In other surveys SMALLWOOD and GEORGE II (1992; 1993) published a comprehensive atlas of C.T. anatomy of the dog to be used by veterinarians. The fact that C.T. anatomy can be used not

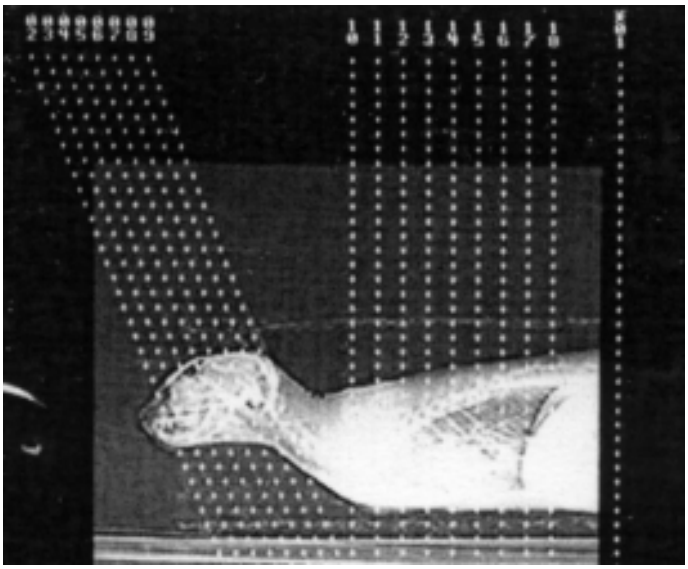


Fig. 1. Lateral view of the cat C.T. slices

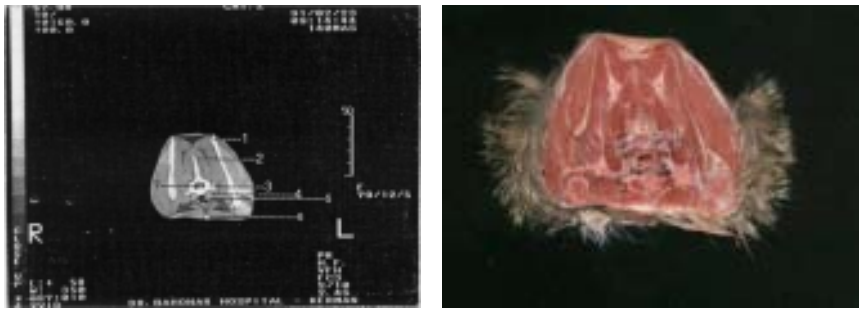


Fig. 2. C.T. slice N° 10 and corresponding frozen cut through the 7th cervical vertebra. 1 scapula; 2 spinous process; 3 transverse process; 4 oesophagus; 5 trachea; 6 sternum; 7 spinal cord.

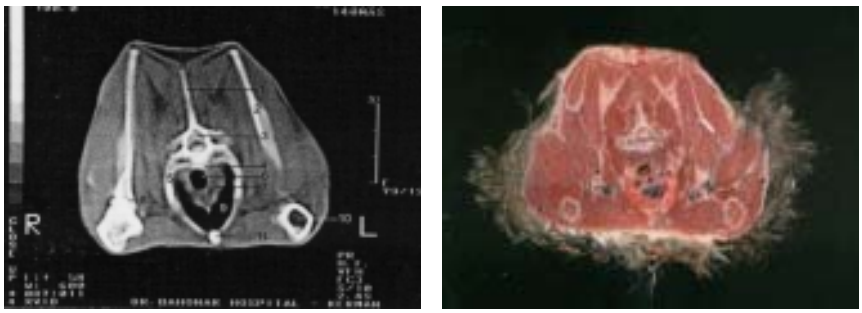


Fig. 3. C.T. slice N° 11 and corresponding frozen cut through the 2nd thoracic vertebra. 1 spinous process; 2 scapula; 3 spinal cord; 4 body of vertebra; 5 rib; 6 trachea; 7 oesophagus; 8 shoulder joint; 9 lung; 10 bone marrow; 11 sternum.

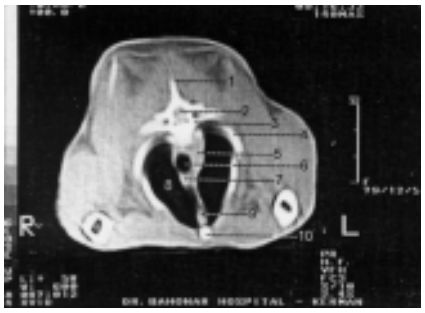


Fig. 4. C.T. slice Nº 12 through the 4th thoracic vertebra. 1 spinous process; 2 spinal cord; 3 transverse process; 4 rib; 5 oesophagus; 6 trachea; 7 cranial vena cava; 8 lung; 9 thymus; 10 sternum.

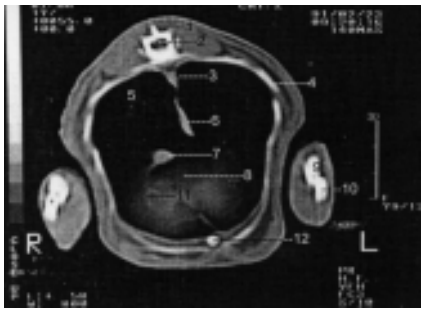
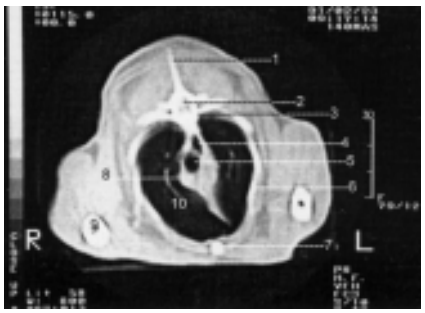


Fig. 9. C.T. slice Nº 17 through the 1st lumbar vertebra. 1 spinous process; 2 spinal cord; 3 aorta; 4 rib; 5 lung; 6 oesophagus; 7 caudal vena cava; 8 diaphragm; 9 radius; 10 ulna; 11 phrenic vessels; 12 sternum.



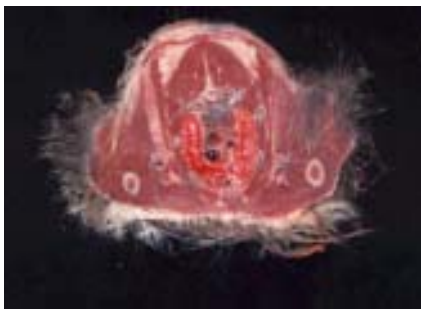


Fig. 5. C.T. slice Nº 13 and corresponding frozen cut through the 6th thoracic vertebra. 1 spinous process; 2 spinal cord; 3 transverse process; 4 oesophagus; 5 trachea; 6 rib; 7 sternum; 8 cranial vena cava; 9 humerus; 10 lung.

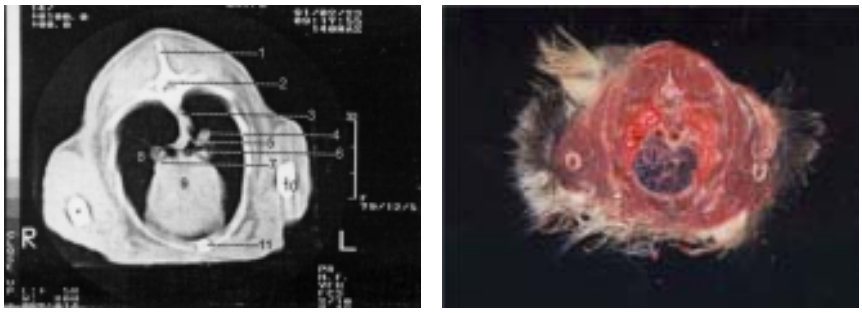


Fig. 6. C.T. slice N^{o} 14 and corresponding frozen cut through the 8th thoracic vertebra. 1 spinous process; 2 spinal cord; 3 oesophagus; 4 mediastinal lymph node; 5 left bronchus; 6 cranial vena cava; 7 right pulmonary artery; 8 lung; 9 heart; 10 humerus, 11 sternum.

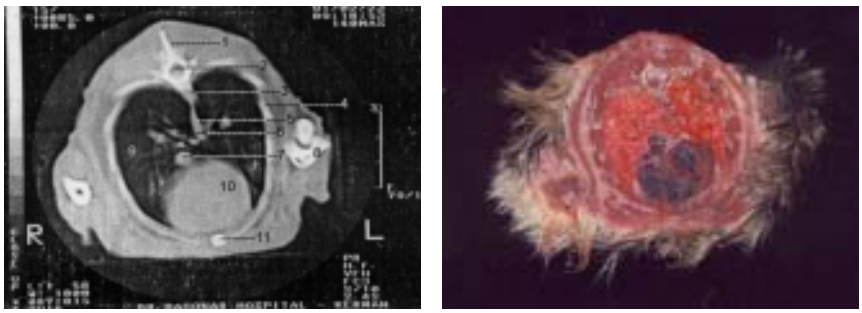


Fig. 7. C.T. slice N^{o} 15 and corresponding frozen cut through the 10th thoracic vertebra. 1 spinous process; 2 spinal cord; 3 aorta; 4 rib; 5 oesophagus; 6 lymph node; 7 caudal vena cava; 8 trochlea of humerus; 9 lung; 10 heart; 11 sternum.

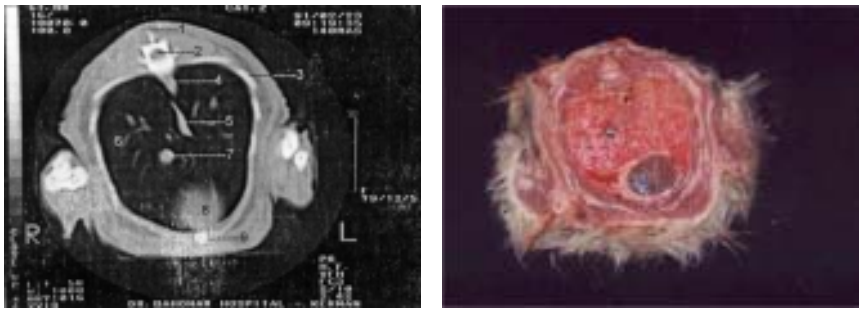


Fig. 8. C.T. slice N^{o} 16 and corresponding frozen cut through the 12th thoracic vertebra. 1 spinous process; 2 spinal cord; 3 rib; 4 aorta; 5 oesophagus; 6 lung; 7 caudal vena cava; 8 apex of the heart; 9 sternum.

only in diagnostic procedures but also in many biometric researches constitutes an immense contribution to the evaluation of breeds (REGEDON et al., 1991; ROBINA et al., 1991; ONAR et al., 2002). We were unable to find any published paper, apart from LOSONSKY et al. (1997) - survey, of normal C.T. anatomy of the cat.

In this study we identified normal anatomic structures of C.T. images of the cat thoracic region. Since one of the primary uses of C.T. is for the evaluation of space-occupying lesions, our reference can be useful in determining the origin of the lesion, as well as explaining clinical signs in some instances. This reference can also be of value to surgeons in developing an operative plan through a greater awareness of structures in the immediate area. For following studies we suggest reduction of slice thickness to obtain more detailed image information. Also, resolution might be changed for differential diagnosis.

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SAŽETAK

Svrha istraživanja bila je odrediti anatomske strukture prsnog koša mačke pomoću kompjutoriziranih tomografskih slika za potrebe veterinarskih radiologa, kliničara i kirurga. Snimljen je prsni koš četiri mačke u uvjetima visoke rezolucije i rezova debljine 15 mm. Nakon snimanja sve su mačke bile eutanazirane, a njihove lešine smrznute u istom položaju pri -18 ^{0}C. Lešine su bile izrezane na rezove što bliže C.T. presjecima. Svaki C.T. presjek bio je proučen i uspoređen s odgovarajućim anatomskim rezom radi točne identifikacije određenih struktura. Kostur prsnog koša je poslužio za topografsku orijentaciju. Odgovarajuće strukture i njihova obilježja identificirane su i označene u tomografskim presjecima.

Ključne riječi: mačka, prsni koš, tomografija, anatomija