

Complete cardiac and bronchial avulsion in a dog: Post-mortem computed tomography and forensic necropsy analysis



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ABSTRACT

The aim of this case report was to describe non-contrast tomography findings of a cardiovascular trauma followed by a forensic necropsy in a dog. A female dog was struck by a vehicle, suffered a sudden death and was sent to a veterinary hospital. PMCT images were acquired on a 16-slice multidetector scanner and the forensic necropsy was performed afterwards. Thoracic images revealed aorta avulsion, heart dislocation, complete right bronchial rupture, pneumothorax, pleural effusion, subcutaneous emphysema, multiple rib and spine processes fractures, and a diaphragmatic rupture. Abdominal images showed free abdominal fluid, and laceration of the abdominal muscles leading to evisceration of small bowel. Forensic necropsy findings corroborated the hypothesis of cardiac and bronchial avulsion. Even though no contrast media was administered in this case, it was possible to establish the cause of death based solely on the PMCT images. Further studies in this field should be conducted to evaluate the capabilities of PMCT in improving post-mortem diagnosis or even replacing it when necessary.

1. Introduction

Cardiac and bronchial avulsions are very rare conditions in animals and humans. They are mainly related to blunt chest trauma [1–4]. Vehicle accidents are one of the main causes of death in dogs, with the thorax being the first region of injuries caused by this sort of trauma [5,6]. In humans, about one third of blunt traumatic fatalities is associated with thoracic aortic injuries, increasing the risk of injuries to the thorax and the abdominal cavity [7].

Post-mortem Computed Tomography (PMCT) has a high sensitivity for identifying trauma injuries, being a valuable additional technique to forensic science [8]. However, there are still few descriptions of post-mortem images in veterinary medicine, especially obtained by PMCT [8–14]. The aim of this case report was to describe PMCT findings of a cardiovascular trauma followed by a forensic necropsy in a dog.

2. Case

A female dog died after being struck by a vehicle and was sent to a private veterinary hospital. Since it was not equipped with a computed tomography imaging system, the cadaver was transported to a school of

veterinary medicine, where a PMCT was performed.

PMCT images were acquired, with the body placed in dorsal recumbency, using a 16-slice multidetector scanner MX800 (Philips, Cleveland, OH, USA). The scan parameters were 120 kVp, 350 mAs, slice thickness ranged from 1 mm (head and parenchyma) to 2 mm (abdomen and mediastinum), and slice interval ranged from 0.5 mm (head and parenchyma) to 1 mm (abdomen and mediastinum). A veterinary radiologist analyzed the images and a veterinary pathologist performed the forensic necropsy in the private hospital.

Thoracic images revealed aorta avulsion, heart dislocation, complete right bronchial rupture, pneumothorax, pleural effusion, subcutaneous emphysema, and diaphragmatic rupture (Fig. 1). Multiple rib and spine processes fractures were observed in the CT images, especially with the 3D volume reconstruction (Fig. 2). Abdominal images showed free abdominal fluid, and laceration of the abdominal muscles leading to evisceration of small bowel (Fig. 3).

All necropsy findings were consistent with the PMCT images. The heart was dislocated to the right side of the thorax due to a complete avulsion of all great cardiac vessels (Fig. 4). Both the radiologist and the pathologist agreed that hemorrhagic shock was the cause of death of this dog.

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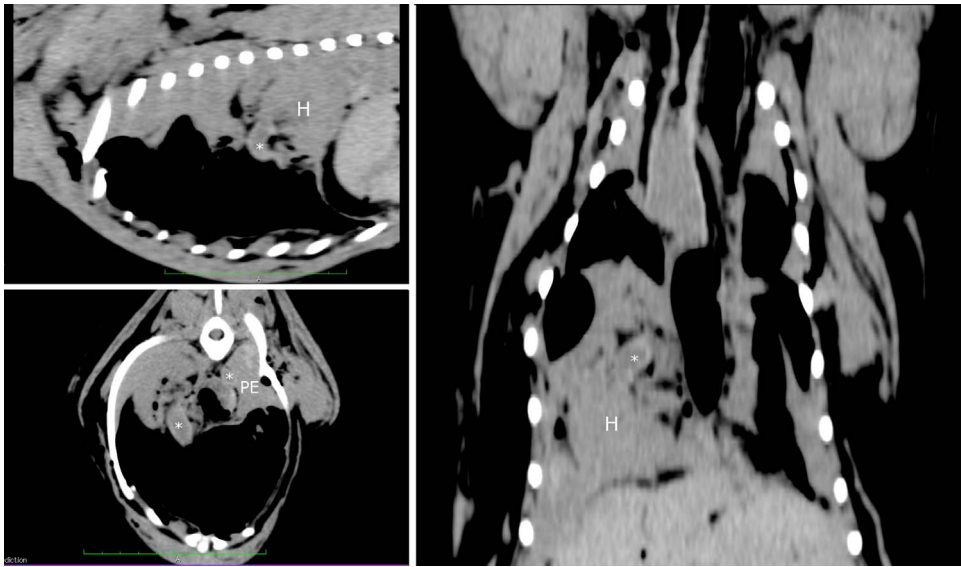


Fig. 1. PMCT MPR images show complete aortic rupture (*) with dorsocaudal heart displacement (H) and pleural effusion (PE).

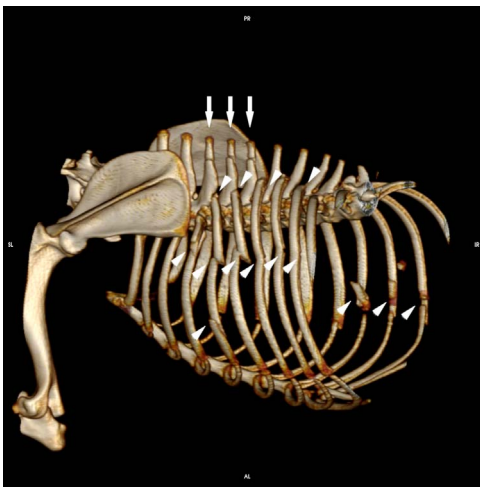


Fig. 2. Volume-rendered 3D image of the thorax showing multiple bones fractures of spinous processes (arrows) and ribs (arrowheads).

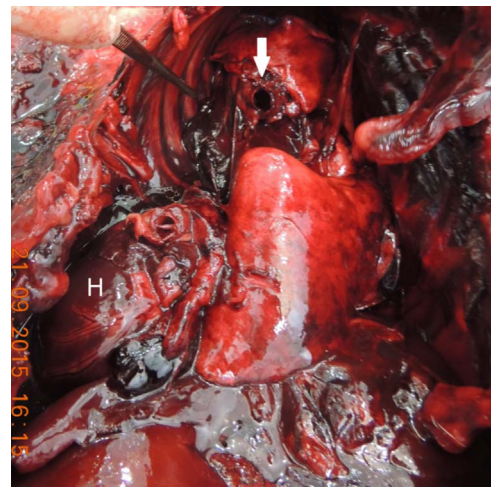


Fig. 4. Necropsy image of the thorax in correspondence to the Fig. 1. Note the heart displacement (H), the aorta rupture (arrowhead) and the bronchial avulsion (arrow).

3. Discussion

Forensic necropsy findings corroborated the hypothesis of cardiac and bronchial avulsion. Even though no contrast was administered in this case, it was possible to visualize complete aortic and bronchial

rupture, enough information to conclude that the animal had a sudden death by hemorrhage. In human forensic radiology, comparisons between PMCT or PMCTA (PMCT angiography) and conventional necropsy are well documented [15–18].

Computed tomography proved to be a very important technique to

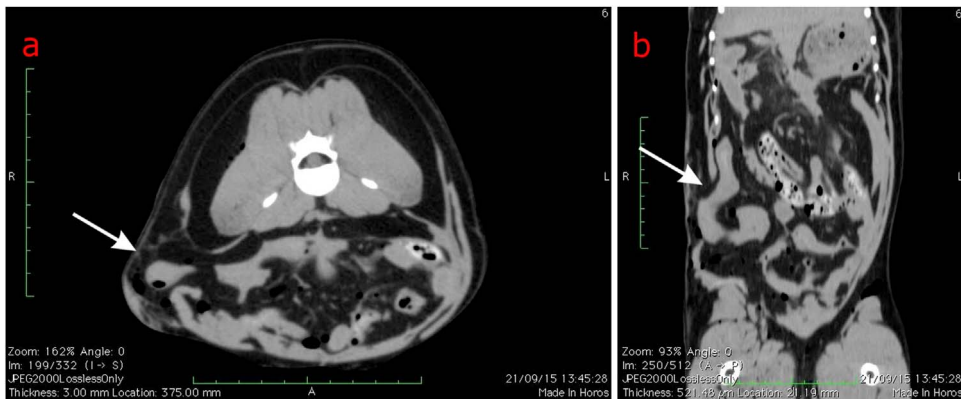


Fig. 3. Discontinuity of the muscles of the abdominal wall on the right side with displacement of an intestinal loop segment to the subcutaneous region (arrows). Transverse plane CT, soft tissue window (a); dorsal plane CT, soft tissue window (b).

assist forensic science, especially because small fractures and small amounts of gas in the vascular system or cavities are infrequently observed in conventional necropsy or even by using traditional radiography, whereas they are well documented in PMCT images [19,20]. Hence, it is a complementary tool, which should be more explored by veterinarians, mainly when a veterinary pathologist is not present to conduct the necropsy or even when there is a suspicion of zoonosis, considering the veterinary exposure to these kinds of diseases during conventional necropsy.

Although there are some reported cases of bronchial avulsion in veterinary medicine [4,21], to the best of our knowledge, there is no cardiac avulsion case reported in animals. So, this is perhaps the first complete cardiac and bronchial avulsion case reported in a dog.

The analysis of veterinary CT images requires specific knowledge of the animal's anatomy and pathology from the observers, besides know-how related to the interpretation of post-mortem images. Therefore, a new field of investigation is emerging in veterinary medicine, as it happened in human medicine.

Despite the lack of contrast media administration in this study, it was possible to establish the cause of death using PMCT images alone. Further studies in this field would be desirable to evaluate the capabilities of PMCT in improving necropsy in veterinary medicine or even replacing it when necessary.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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