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Case Report

Cardiac laceration following non-penetrating chest trauma in dog and cat

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ABSTRACT

Cardiac laceration with non-penetrating chest trauma is reported as a common cause of death in human following rapid deceleration in high-speed vehicular accident. In contrast, in veterinary medicine, traumatic rupture of heart and great-vessel structures appears to be an uncommon cause of death. Here we report three cases of cardiac laceration following non-penetrating chest trauma in a one cat and two dogs. In two of these cases, necropsy revealed a rupture of the heart associated with fractures of the ribs and lung contusion; only one case did not exhibit any external chest injury but revealed pericardial tear associated with hemothorax following rupture of the right auricle of the heart. However, in all three presented cases, the thoracic location of the injuries allowed to conclude that the cause of the cardiac rupture was due to a direct impact of the chest wall with a high speed object and consequent transmission of the kinetic force and compression of the heart between left and right thorax. These case reports underline the importance of a systematic and complete macroscopic evaluation of the heart in all cases of death following non-penetrating chest trauma in dog and cat such as in human. They also highlight how, in clinical and forensic practice, the cardiac injury following blunt chest trauma should be ruled out even in the cases of absence of external chest injury.

1. Introduction

Cardiac laceration with non-penetrating chest trauma (NCT) is reported as a common cause of death in human following rapid deceleration in high-speed vehicular accident [1–3]. According to Getz et al. [4], the involved mechanisms of the cardiac injury may be summarized as following: 1) direct blow to the anterior chest wall; 2) indirect injury with subsequent increased preload of the hearth; 3) compression of the heart between the sternum and vertebral bodies; 4) acceleration/deceleration of the heart; 5) blast forces; 6) penetrating injury due to the fractures of the ribs. In veterinary medicine, traumatic rupture of heart and great-vessel structures appears to be more rare than human and, to the authors knowledge, only rarely reported in literature [5]. Here we report the first case of cardiac rupture following NCT in a cat. Moreover, we present unusual cases of cardiac rupture with NCT in two dogs.

2. Case report

Case 1

A 7-year-old, mixed, cat was found dead on the roadside and a complete necropsy was performed to find out the cause of death of the animal. The forensic examination was conducted in the necropsy room of the Department of Veterinary Medicine of the University of Naples “Federico II” following a standard necropsy protocol previously described by Piegari et al. [6]. The macroscopic examination revealed multifocal hemorrhages of the myocardium associated with a myocardial laceration of 0,5 cm on the lateral-inferior portion of the right ventricle (Fig. 1A); a total of 100 cc of clotted blood in the pericardial cavity but no tear of the pericardium was also observed. In addition, we found subcutaneous hemorrhages on the right thoracic region, fractures of the third and fourth rib and a contusion on the cranial lobe of the right lung. Representative samples of the heart were collected for the histopathologic examination; tissue was fixed in 10% neutral buffered formalin, paraffin embedded, sectioned at 4 μm and stained with Hematoxylin and Eosin (HE). Histologically, we

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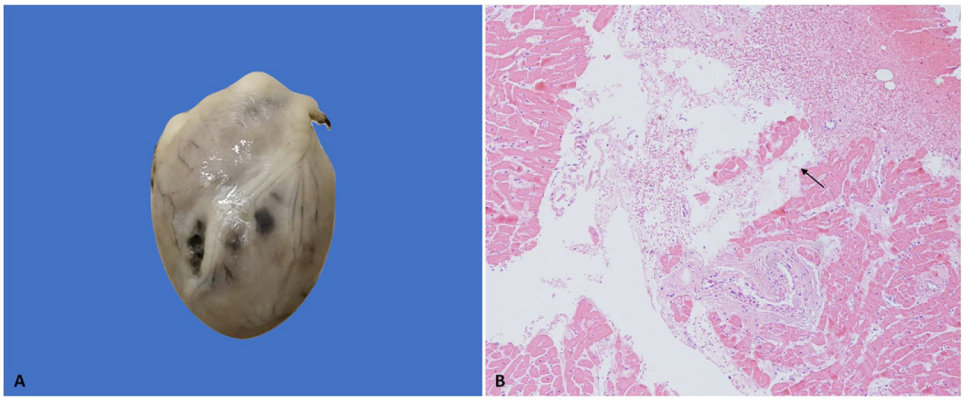

Fig. 1. Cat. (A) cardiac laceration; tear on the lateral-inferior portion of right ventricle near inter-ventricular septum. (B) Histopathological section from margin of tear; hemorrhagic laceration of the heart (arrow); H&E stain (original magnification 20×).

observed a hemorrhagic laceration of the heart associated with plurifocal hemorrhages between the myocardial fibres (Fig. 1B). Based on histological and macroscopic data, a definitive diagnosis of cardiac rupture was made. Finally, cardiac tamponade was considered as cause of death.

Case 2

A 13-year-old, mixed, dog was found dead on the roadside and a complete necropsy was performed to find out the cause of death. During the forensic examination we observed: myocardial and pericardial injury associated with 450 cc of clotted blood in the thoracic cavity. Large vertical tear of 3 cm was identified on the upper third of the pericardium (Fig. 2A) and, within the pericardial sac, only a little fragment of the right ventricle of 3 × 2 cm size was found (Fig. 2B); fragments of the heart were also identified in the chest cavity mixed with the clotted blood. In addition, we observed: contusion on the caudal lobe of the left lung, subcutaneous hemorrhages on the left thoracic region, fractures of the skull as well as fractures of the second, third and fifth right rib. Based on the macroscopic examination, "hypovolemic shock", due to severe cardiac rupture, was considered as cause of death.

Case 3

A 2-year-old, mixed, dog was found dead on the roadside and a complete necropsy was performed to find out the cause of death of the animal. The macroscopic examination did not reveal any external chest injuries. However, in the thoracic cavity, we observed pericardial tear associated with a laceration of size 0.6 cm × 0.4 cm over the right auricle of the heart (Fig. 3B); a total of 150 cc of clotted blood in the thoracic cavity was also observed (Fig. 3A). In addition, we found multifocal hemorrhages of the lung and a focal peri-aortic hemorrhage of size 1.4 × 2.0 cm. Representative samples of the heart and aorta were collected for the histopathological examination; tissues were fixed in 10% neutral buffered formalin, paraffin embedded, sectioned at 4 micron and stained with Hematoxylin and Eosin (HE). Histologically, the heart showed a haemorrhagic laceration of the right auricle associated with plurifocal petechial hemorrhagic infiltrating between the myocardial fibres (Fig. 3C). A peri-aortic hemorrhage without laceration of the vessel was also observed (Fig. 3D). Based on histological and macroscopic data, a definitive diagnosis of cardiac rupture was made. Finally, "hypovolemic shock", due to right auricle and lung rupture, was considered as cause of death.

3. Discussion

Myocardial rupture is an injury frequently found at the autopsy following fatal accident due to blunt chest trauma in human [1,2,3]. In contrast, in veterinary medicine, thoracic injuries commonly associated with non-penetrating trauma are: pneumothorax, pulmonary contusion, pulmonary laceration, hemothorax, ribs fractures, rhythm disturbances of the heart and cardiac contusion [7–9]; In dog, cardiac laceration following NCT is only rarely reported in literature [5]. Furthermore, to the authors knowledge, this is the first report of cardiac laceration with NCT in a cat. Similarly, studies conducted on canine models of blunt chest

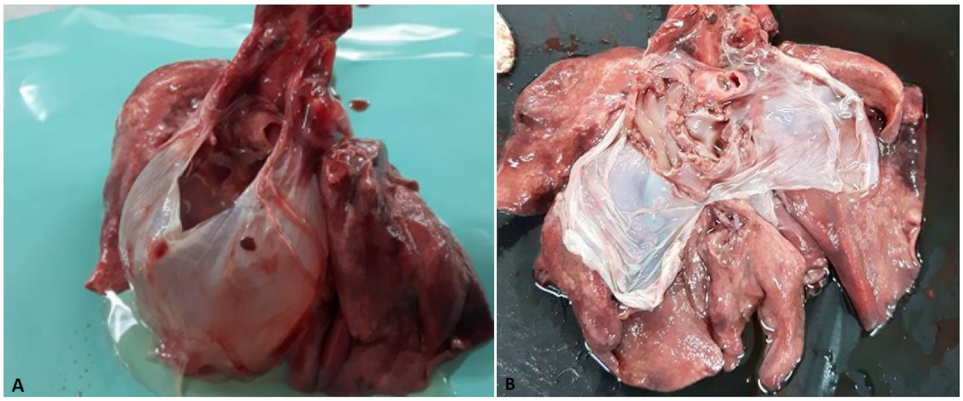

Fig. 2. Dog. macroscopic examination: (A) pericardium filled with water shows a large vertical tear on its upper third (B) little fragment of the right ventricle within the pericardial sac.

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