

## Left atrial appendage rupture due to blunt chest trauma in an Eurasian otter (*Lutra lutra*)

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### Keywords

Atrial appendage,  
Blunt trauma,  
Eurasian otter,  
Heart,  
Rupture.

### Summary

An adult male Eurasian otter, found dead on the roadside, was submitted for post-mortem examination in April 2014 at the Veterinary Pathology Unit of the Faculty of Veterinary Medicine of Teramo, as part of the RECAL [REcovery and post mortem Analysis of Eurasian otters (*Lutra lutra*) in the National Park of Cilento, Vallo di Diano and Alburni (Salerno, Italy), and surrounding areas] project. Necropsy revealed an abundant hemothorax associated with multifocal, bilateral pulmonary contusions and lacerations, and a severe hemopericardium characterised by the presence of a wide blood clot in the intact pericardial sac. Two small laceration wounds of the left auricle were found at the base, along the atrioventricular groove, and on the outer free wall. Since myocardial and endocardial tissues showed no other gross and histopathological abnormalities, a left atrial appendage rupture resulting from a blunt chest trauma was diagnosed. Blunt traumatic cardiac rupture is a rarely reported, life-threatening condition in humans. To the best of our knowledge, this is the first report on a left atrial appendage rupture due to blunt chest trauma in veterinary literature. The possible occurrence of a cardiac rupture following a blunt thoracic injury should be taken into consideration in veterinary emergency care.

## Rottura dell'appendice atriale sinistra per trauma toracico in una lontra (*Lutra lutra*)

### Parole chiave

Appendice atriale,  
Cuore,  
Lontra euroasiatica,  
Trauma.

### Riassunto

Nell'aprile del 2014 un maschio adulto di lontra, trovato morto sul ciglio della strada, è stato sottoposto a necropsia presso l'Unità di Patologia Veterinaria della Facoltà di Medicina Veterinaria di Teramo, nell'ambito del progetto RECAL [REcovery and post mortem Analysis of Eurasian otters (*Lutra lutra*) in the National Park of Cilento, Vallo di Diano and Alburni (Salerno, Italy), and surrounding areas]. L'esame ha rivelato un abbondante emotorace associato a contusioni e lacerazioni polmonari multifocali bilaterali e un grave emopericardio caratterizzato dalla presenza di un coagulo di sangue nel pericardio. Alla base dell'auricola di sinistra sono state trovate due piccole lacerazioni, lungo il solco atrioventricolare e sulla parete esterna. Poiché i tessuti del miocardio e dell'endocardio non hanno mostrato altre evidenti anomalie istopatologiche, è stata diagnosticata una rottura dell'appendice atriale sinistra causata da trauma toracico. La rottura traumatica cardiaca è segnalata raramente ma nell'uomo è potenzialmente letale. In letteratura veterinaria, per quanto di nostra conoscenza, questo è il primo rapporto su una simile rottura a causa di trauma toracico. In emergenza veterinaria si dovrebbe quindi considerare la possibilità di un trauma cardiaco in conseguenza di una brusca lesione toracica.

## Introduction

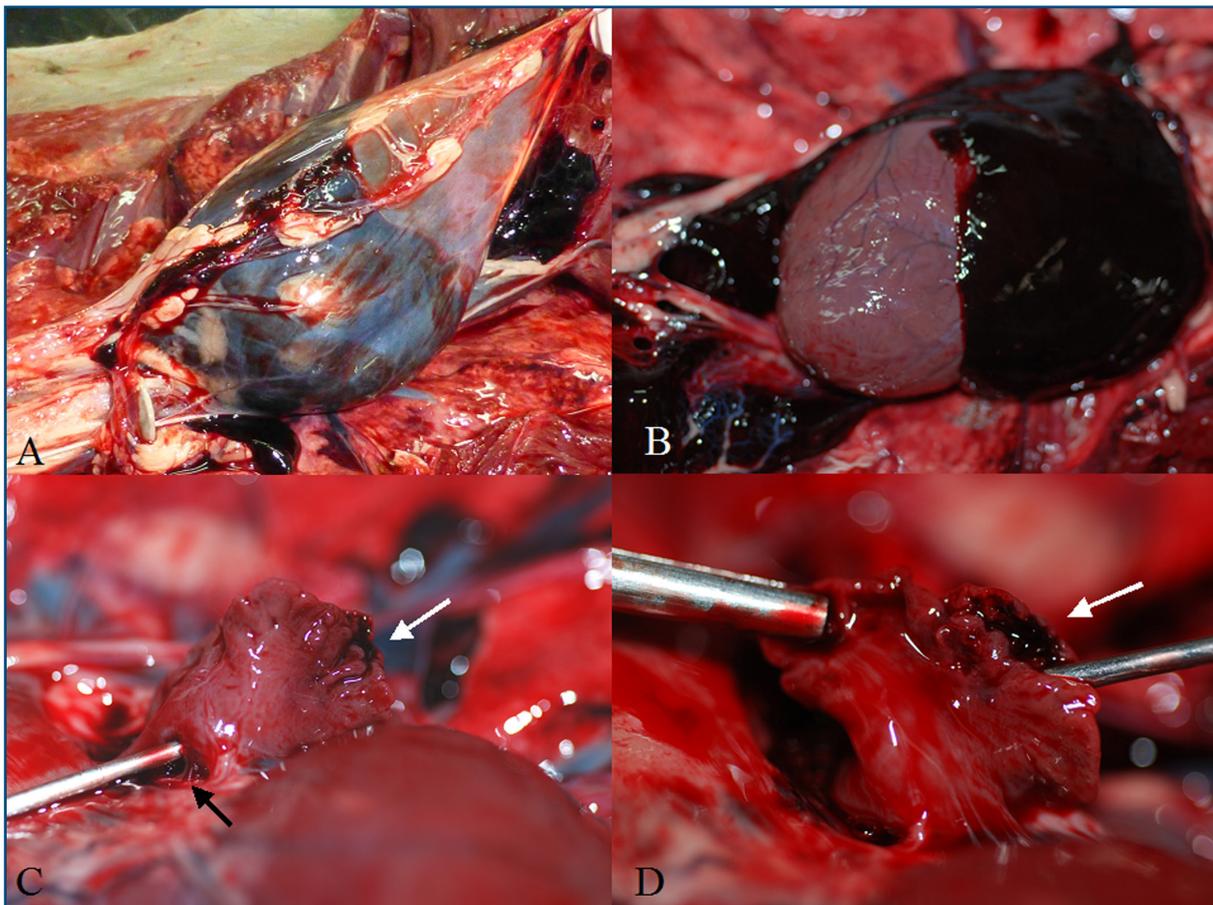
Cardiac rupture resulting from blunt trauma to the chest is a rarely reported and often overlooked condition in humans, especially when no external wound is visible. Thus, such cases are rarely diagnosed early and most patients die before surgical intervention takes place (Salam and Frauenhoffer 1996, Shalaby *et al.* 1999, Salooja *et al.* 2013). About 6%-10% of human patients who undergo blunt chest injury have cardiac rupture. The right side is most commonly affected, whereas left atrial injury accounts for 25% of cardiac rupture cases (Ryu *et al.* 2013), with left 'basal' appendage rupture being particularly rare (Tanoue *et al.* 2008). Although all heart chambers are susceptible to traumatic rupture, the atrial appendage (also known as the auricle) is most vulnerable because of its relative thinness (Salam and Frauenhoffer 1996, Salooja *et al.* 2013). In particular, the most anatomically weak region in the heart appears to be located at the atrioventricular groove, if previous heart diseases are absent (Tanoue *et al.* 2008).

To the best of our knowledge, left atrial appendage

rupture due to blunt chest trauma has not been reported in veterinary literature.

## Case description

On April 2014, an adult male Eurasian otter, found dead on the roadside in Policastro Bussentino (Latitude 40° 4' 12.37", Longitude 15° 30' 54.32") (Santa Marina, Salerno, Italy), was submitted for post-mortem examination at the Veterinary Pathology Unit, Faculty of Veterinary Medicine, University of Teramo (Italy). The animal weighed 7.1 kg and was 113 cm long from the nose to the tail tip. This case represents 1 of a series of post-mortem examinations performed, from 2009 to date, as part of the RECAL [REcovery and post mortem Analysis of Eurasian otters (*Lutra lutra*) in the National Park of Cilento, Vallo di Diano and Alburni (PNCVDA, Salerno, Italy), and surrounding areas] project established for investigating the causes of death, overall health, biometric and demographic parameters, and levels of contamination in the Eurasian otter (*Lutra lutra*) Italian population, by means of post-mortem analysis.



**Figure 1.** **A.** Intact pericardial sac with a severe hemopericardium. **B.** Presence of a wide blood clot surrounding the heart base and atria. **C.** Laceration wounds located at the base, along the atrioventricular groove (black arrow), and on the outer free wall (white arrow) of the left auricle. **D.** Higher magnification of the left atrial appendage rupture on the outer free wall (white arrow).

At necropsy, the examination of the external surface and subcutis of the carcass did not reveal macroscopical lesions. On the other hand, a wide haemorrhage involving the ventral paratracheal connective tissue extended from the entrance of the thoracic cavity to the laryngotracheal junction. Evaluation of the thoracic cavity also revealed an abundant hemothorax associated with multifocal, bilateral pulmonary contusions and lacerations, as well as a severe hemopericardium characterised by the presence of a wide blood clot into the intact pericardial sac (Figure 1 A, B). After careful inspection of the heart, 2 small laceration wounds of the left auricle about 0.3 cm - 0.4 cm in size were found at the base, along the atrioventricular groove (Figure 1C), and on the outer free wall (Figure 1 C, D). The heart showed no other gross abnormalities, as far as both myocardial and endocardial tissues were concerned. Other macroscopical findings included a non-displaced, transverse fifth left rib fracture with no pleural laceration and a very mild haemorrhage in the surrounding tissues, as well as a moderate hemoperitoneum associated with multifocal hepatic lacerations.

The heart and representative tissues of all other major organs were fixed in 10% neutral buffered formalin, embedded in paraffin, cut in 5 µm-thick sections, stained with haematoxylin-eosin (H&E), and examined by light microscopy. Histopathologic examination did not reveal significant microscopical lesions in the heart tissues, nor in any of the other organs that were examined.

On the basis of the absence of gross and histopathological, myocardial, or endocardial lesions, a left atrial appendage rupture resulting from a blunt trauma to the chest was diagnosed.

## Discussion

Review studies concerning dogs and cats indicate that practitioners generally overlook traumatic thoracic injuries, although they are serious and potentially life-threatening conditions (Salci *et al.* 2010). However, avulsion of the mitral valve from the annulus fibrosus, as well as lesions consistent

with a subaortic paramembranous ventricular septal defect with blood shunting from the left ventricle to the right atrium (Gerbode defect), have been described in association with blunt chest trauma in dogs (Miller *et al.* 2004, Hezzell *et al.* 2011).

Common causes of blunt thoracic injuries in animals include being hit by a car, falling from a height (high-rise syndrome), fights, and human-animal interactions (Salci *et al.* 2010).

Mechanisms of cardiac rupture by blunt trauma include direct contusion, compression of the chest that crushes the heart between the sternum and vertebral column, rapidly increased hydrostatic venous pressure transferred from the abdomen or lower extremities to the heart, acceleration/deceleration force, and direct penetration by the sternum or rib fractures (Leavitt *et al.* 1987, Tanoue *et al.* 2008, Ryu *et al.* 2013, Salooja *et al.* 2013).

In the present case, although a car accident could be hypothesised, the exact cause of the otter death remains undetermined. Notwithstanding this, the localisation of the heart tears and the presence of pulmonary contusions/lacerations with minimal injury to the chest wall were consistent with the major involvement of a deceleration force in the pathogenesis of these lesions (Salooja *et al.* 2013). The lack of other gross and microscopical abnormalities in the otter heart also excluded the presence of previous cardiac diseases that may have predisposed the heart to rupture. In this respect, left atrial rupture may occur as a consequence of chronic mitral valve insufficiency, especially in dogs (Reineke *et al.* 2008).

To the best of our knowledge, this is the first report on a left atrial appendage rupture due to blunt chest trauma in veterinary literature. The possible occurrence of a cardiac rupture following a blunt thoracic trauma should be taken into consideration in veterinary emergency care.

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