

## Acute necrotizing pneumonia associated with barium aspiration in a cat

### *Acute necrotiserende pneumonie na bariumaspiratie bij een kat*

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## ABSTRACT

Barium sulphate is an insoluble contrast medium that is commonly used for radiography of the digestive tract. During examination, aspiration of barium might occur and cause severe complications in both humans and animals. In this report, a case of barium aspiration during gastrointestinal examination of a four-year-old, spayed, female Persian cat is described. Radiographic and pathological findings confirmed the diagnosis of barium aspiration.

## SAMENVATTING

Bariumsulfaat is een niet-oplosbare contrastvloeistof die bij radiografisch onderzoek van het spijsverteringsstelsel routinematig wordt gebruikt. Tijdens het onderzoek kan er bariumaspiratie optreden, wat ernstige complicaties kan veroorzaken bij zowel mens als dier. In deze casuïstiek wordt een geval van bariumaspiratie beschreven bij een gastro-intestinaal onderzoek van een vier jaar oude, gesteriliseerde pers. Radiografisch en pathologisch onderzoek bevestigde de diagnose van bariumaspiratie.

## INTRODUCTION

Aspiration is the inhalation of any foreign substance into the airways beyond the vocal cords. Barium sulphate is commonly used for examination of the gastrointestinal tract in humans and animals. Aspiration of the stomach contents, including the barium meal, has been reported to cause variable degrees of lung insult or death of the affected human or animal (Pracy et al., 1993; Gray et al., 1989). In general, barium sulphate is not expected to cause severe pulmonary injury, because it is an inert and non-irritant substance.

In the present case report however, a Persian cat is described that developed acute respiratory failure following aspiration of large amounts of barium and gastric acid during a gastrointestinal radiographic contrast examination.

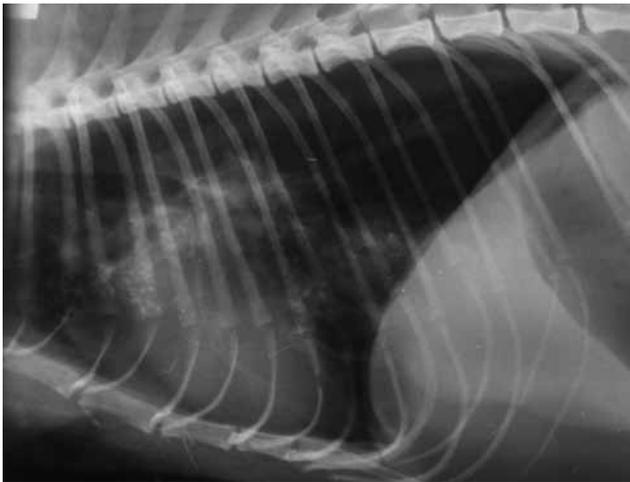
## CASE REPORT

A four-year-old, spayed, female Persian cat was presented for necropsy in adequate nutritional body

condition and mild to moderate post-mortem autolysis. Before being referred to the veterinarian, the cat had not shown any respiratory clinical signs other than a one-day history of occasional vomiting. The cat had not experienced any other abnormality before referral. Because of the vomiting, a barium swallow was performed to rule out gastrointestinal blockage. During and after radiography, the cat developed dyspnea and the general condition worsened over the next two days, despite antibiotic treatment, and eventually died.

## Radiographic findings

The owner provided two radiographic films of lateral views of the thorax and abdomen taken 48 hours after the onset of the barium swallow. They showed dense radiopaque masses in the caudal abdomen inside the gastrointestinal tract and were indicative of a barium meal. Similar material was seen scattered throughout the ventral and caudal part of both lungs (Figure 1). In addition, the lungs exhibited diffuse radio opacity, which was indicative of pulmonary edema.



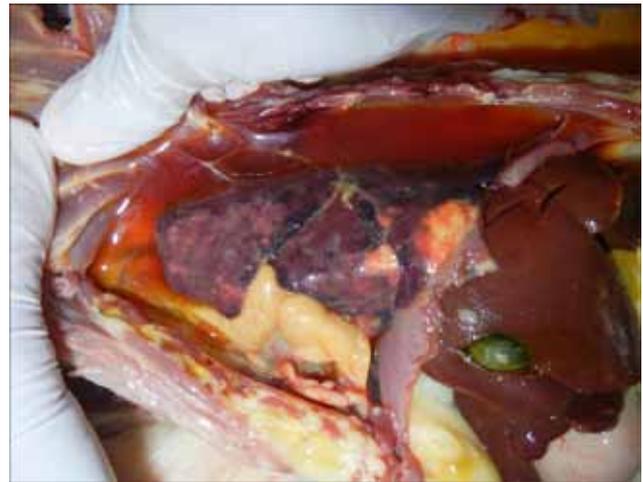
**Figure 1.** Left lateral thoracic radiograph depicts a four-year-old cat with barium aspiration during gastrointestinal examination. The radiograph shows multiple, variably sized foci of mineral opacity and an ill-defined interstitial pattern throughout the ventral lung field representing the aspirated barium in the alveoli and associated pneumonia.

### CBC and Blood chemistry

A complete blood count and serum chemistry were conducted 48 hours post barium meal and revealed mild macrocytic normochromic non-regenerative anemia and thrombocytopenia. The presence of thrombocytopenia, low normal neutrophilic count and a macrocytic normochromic non-regenerative anemia were suggestive of FeLV infection. Although the anemia was non-regenerative, the presence of schistocytosis suggested a hemolytic component to the anemia, knowing that the acute case of hemolytic or hemorrhagic anemia may also occur non-regenerative for the first two to three days. The normal total protein concentration did not support a hemorrhage component to this anemia.

### Gross findings

The mucosal membranes were yellow (icteric). The thoracic cavity contained 20 mL of serosanguinous fluid. Marked edema was present in the mediastinum. Throughout the entire lobes, both lungs, were mottled and diffusely firmer than normal, with variably sized, pinpoint to 1 cm in diameter, whitish firm foci (Figure 2). The caudal lung lobes were the most severely affected. Multifocal dark red areas were present throughout the lung lobes. Mild to moderate greenish to yellowish fibrinous material was adhered to the pleura in multiple areas. Both kidneys exhibited multiple pinpoint pale areas throughout the cortex. The mucosal surface of the stomach, intestines and urinary bladder exhibited multiple pinpoint hemorrhages. No contents was present within the stomach. No other significant findings were present.



**Figure 2.** The thoracic cavity filled with serosanguinous fluid. Scattered barium crystals throughout the lungs primarily affecting the caudal lung lobes. Multiple areas of variable sized pulmonary hemorrhages and greenish fibrinous material were present.

### Histopathological findings

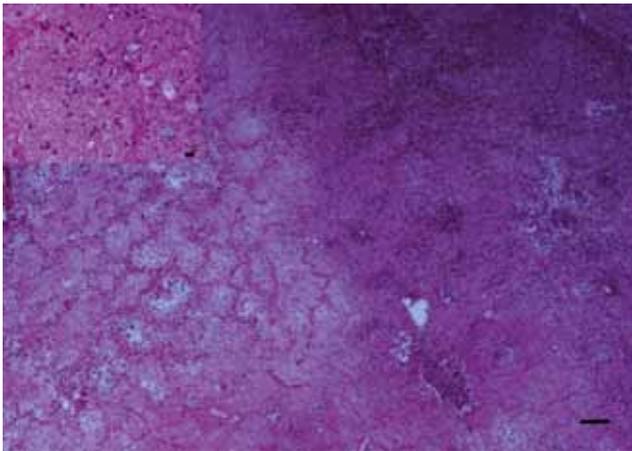
Throughout the examined tissue sections, multiple areas of the pulmonary parenchyma exhibited severe coagulative and lytic necrosis, infiltration of large numbers of neutrophils and macrophages mixed with variably sized and shaped, scattered greenish metallic crystals (barium) and massive serofibrinous material. Intracytoplasmic barium crystals were also seen within alveolar macrophages (Figure 3). The affected areas showed thickening of the interalveolar septa (interstitium) with the infiltration of large numbers of macrophages admixed with the serofibrinous material. Multifocal, mild pulmonary hemorrhages were present.

### DISCUSSION

Barium sulphate is an inert chalky insoluble substance used as a contrast medium for radiographic examination of the digestive tract (Wani and Yeola, 2008; Forbes, 1989). Barium sulphate aspiration is a well-recognized complication during contrast medium radiographic examinations of the gastrointestinal system. Immediately after aspiration, subsets of inflammatory mediators are activated causing series of events leading to pulmonary edema (Mendelson, 1946).

After a few hours, more protein-rich edema with infiltration of neutrophils take place within the alveolar spaces as well as the interstitium (Marik, 2001).

Accidental aspiration of barium sulphate causing granulomatous pneumonia has been reported in a cat (Forbes, 1989). Although the affected cat did not show any respiratory signs, these areas were not



**Figure 3.** Lung of a Persian cat. Lytic and coagulative necrosis of the pulmonary parenchyma with serofibrinous exudations, barium crystals and large numbers of inflammatory cell infiltrates. H&E.

Bar= 100  $\mu$ m. Inset shows higher magnification of the serofibrinous material admixed with barium crystals. H&E, Bar= 10  $\mu$ m.

functional. In a study by Ginai (1984), various contrast agents were experimentally evaluated in rats, in which barium sulphate provoked severe local pneumonia (Ginai, 1984).

The cat of the present case report might have been predisposed to aspiration because the cat experienced a history of vomiting, although the owner claimed that the vomiting was mild and did not frequently occur. The histopathological examination of the gastrointestinal tract did not reveal any histopathological abnormalities. It has been reported that barium aspiration causes aspiration pneumonitis (Pracy et al., 1993). Moreover, in some instances, barium aspiration might lead to death (Albeldawi and Makkar, 2012). Fruchter and Dragu (2003) stated that using barium sulphate, suspension in radiographic examination can be lethal.

It is a matter of debate whether the aspirated gastric juice is the primary cause of death or the barium itself. It has been reported that aspirated stomach contents might have been responsible for the death of a human patient who was incidentally containing barium because of the well-known injurious effect of the gastric juice on the pulmonary parenchyma and the use of barium sulphate for bronchography in the past (Whiting, 2003). However, Fruchter and Dragu (2003) stated that barium aspiration itself was the main factor in causing serious complications or even death of several human patients. Moreover, several experimental and incidental reports in animals have shown that barium aspiration may cause variable degrees of lung lesions (Forbes, 1989; Ginai, 1984). In the present case, the authors believe that the combined effect of gastric juice and barium sulphate aspiration had a substantial additive effect causing severe pulmonary lesions and its devastating consequences, and was potentially life threatening. The presence of lytic

necrosis of the pulmonary parenchyma, serofibrinous edema, pulmonary hemorrhage and abundant neutrophils support the diagnosis that these findings were caused by acidic gastric juice. On the other hand, the presence of large numbers of macrophages that were associated with barium sulphate crystals in multiple areas within the lungs support the diagnosis that these lesions were induced by barium aspiration. In experimental animal models testing the effect of combined acid/gastric food particle aspiration on lung injury, it has been found that lung injury from combined acid/gastric food particle aspiration is more severe than from either aspirated food particles or gastric juice alone (Raghavendran et al., 2011).

In this case, the aspiration of barium meals and gastric juice and its devastating consequences for the lungs as well as its potential life threatening effects are illustrated.

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