Pulmonary Alveolar Microlithiasis in a Binturong (*Arctictis binturong*): A Case Report

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INTRODUCTION

Pulmonary alveolar microlithiasis is a rare disease of unknown cause which was first described in humans in 1918 (3). It was given its present name in 1938 (9, 10). The radiographic manifestations were detailed in 1957 (10). The appearance of diffuse "sand-like" micronodular calcific densities on the chest radiograph is characteristic of this entity.

This report describes a case of pulmonary alveolar microlithiasis in an exotic animal and discusses the characteristic features of this disorder as well as the differential radiographic diagnoses.

CASE REPORT

An adult male binturong (*Arctictis binturong*) (Fig. 1) presented with clinical signs of anorexia and slight dyspnea of three days' duration. It had been in the collection for two years and had been immunized annually with inactivated canine distemper and inactivated panleukopenia vaccines. During this time it had one episode of anal sacculitis which responded to local and systemic antibiotic therapy. The animal was hospitalized and anesthetized for diagnostic evaluation. One hundred milligrams of a combination of tiletamine HCL and zolazepam[5] was employed as the anesthetic and a blood sample and chest radiographs were obtained. The chest radiographs (Fig. 2) showed diffuse, well-defined, bilateral alveolar densities throughout both lung fields. Hematologic studies revealed a leukocytosis with a lymphopenia and neutrophila and a shift to the left. The animal received systemic gentamicin[6] 5 mg/kg/24 hr during hospitalization. Four days following the initial examination the animal was again anesthetized and tracheal cultures and washings obtained. At that time the rectal temperature was 98.5° F. Chest auscultation was unremarkable. A blood sample was taken and an intradermal tuberculin test[7] was administered. This test was negative at 24, 48, and 72 hours. The tracheal culture and washing were non-diagnostic. Leukocytosis, lymphopenia, neutrophilia, and a left shift were again present (Table). The animal was continued on antibiotics for the next 14 days. The total white count was normal after 4 days of treatment. The animal was anesthetized as before and a needle biopsy of the lung was attempted after the course of antibiotic therapy was concluded. It was noted that the lung was firm and difficult to biopsy. An inadequate tissue specimen was obtained. Radiographs at this time showed no change in appearance following antibiotic therapy.

One week later the animal was anesthetized with 120 mg of tiletamine HCL and zolazepam and maintained with halothane.[8] A thoracotomy at the left fifth intercostal space was performed. The lungs contained pinpoint to 2 mm hard whitish foci distributed throughout. The pulmonary parenchyma between and surrounding these foci appeared normal. A lung biopsy 1.5 × 1.5 cm was taken from the cardiac lobe following a ligature of O chromic gut above the biopsy site. The cut surface of the lung was sealed with oxidized cellulose.[9] The binturong made an uneventful postoperative recovery. Antibiotics were continued for one week and the animal was returned to the exhibit free of clinical signs. The total white count remained normal.

The section of biopsied lung contained numerous circumscribed bony foci that were attached to the alveolar septa and often filled the alveolar spaces (Fig. 3). They consisted of bony lamellae and osteocytes arranged in concentric layers (Fig. 4). A few had spaces containing fat and bone marrow elements. Except for some minor compression of the pulmonary tissue adjacent to the microlith, there was no inflammation or other pathologic reactions associated with them.

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[5] CI-744 Parke Davis & Co., Detroit, MI 48232.
[6] Gentocin, Schering Corp., Bloomfield, NJ 07003.
[7] Tuberculin, U. S. Dept. of Agriculture.
[8] Fluothane, Ayerst Lab., Inc., New York, N. Y.
[9] Surgicel, Johnson Professional Product Co., New Brunswick, N. J.

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Fig. 1. Adult male binturong (*Arctictis binturong*).

DISCUSSION

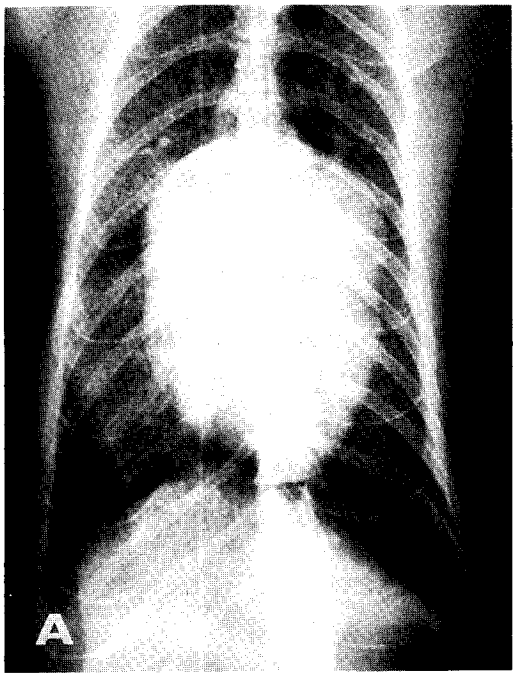
Pulmonary alveolar microlithiasis is a rare disease; only 80 human cases have been reported in the literature (10). The cause is unknown although this entity has been described in association with a variety of systemic diseases in man (2). It has been seen in snuff inhalers in Thailand (snuff contains approximately 9% calcium) (10). A familial incidence of alveolar microlithiasis has been documented, but chance occurrences are much more common. Most of the human patients are 30–50 years of age, but this entity has been encountered in premature twins. Thus, the cause of pulmonary alveolar microlithiasis remains obscure.

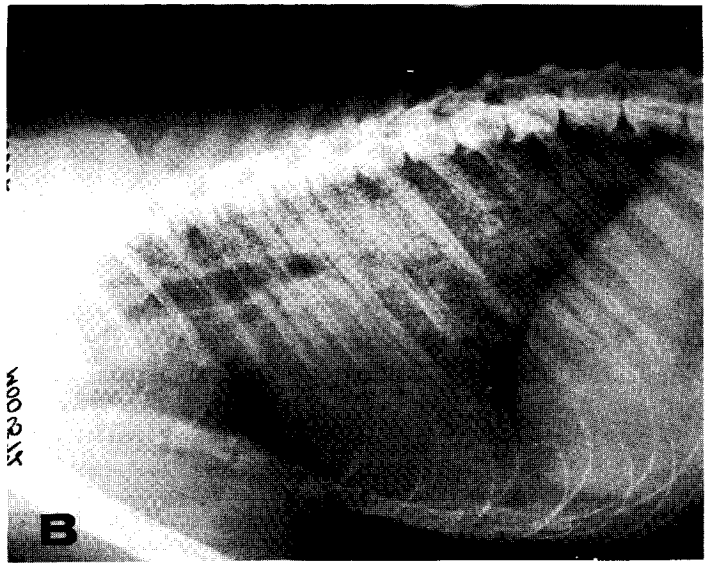
The occurrence of pulmonary alveolar microlithiasis in animals is very rare. A well-documented case in a dog with cardiac failure has been reported (6). In lower animals "pumice stone lung" describes the pathologic appearance (7). Mineralization and/or calcification has been reported in aged dogs (11, 12), guinea pigs (5), cows (8), rats on deficient diets (4), and young dogs with excessive vitamin D (1). These conditions differ markedly from the characteristic radiographic and pathologic finding in pulmonary alveolar microlithiasis.

In general, human patients are asymptomatic and have a chest radiograph obtained for some other reason. In 26 human patients 70% were initially asymptomatic (10). The natural course of the human disease varies with some patients remaining asymptomatic for as long as 30 years while others develop dyspnea on exertion and even clubbing of the fingers. Some individuals actually cough up broncholiths.

The binturong may have had a mild upper respiratory infection at the time of the radiographic examination, an infection which was limited in its course and unrelated to the microliths, since the other binturongs in adjacent displays also had mild signs of respiratory distress but had a normal chest radiograph.

Pathologically the lungs in this disease contain many tiny calculi (calcispherytes) or spherules of calcium phosphate (2, 5, 6). These dense structures are 0.01–3.0 mm in diameter and may form in the walls of the alveoli or become extruded into the alveolar spaces. Chemical





Figs. 2A, B. Dorsoventral (A) and lateral (B) chest radiographs. Bilateral diffuse alveolar densities are present. Each alveolar process is seen with great clarity and appears well-delineated from the lung parenchyma. No lymphadenopathy, cardiomegaly, nor pleural effusion is seen.

TABLE
Comparison of the Hemograms of the Binturong with Pulmonary Alveolar Microlithiasis (PAM) to Seven "Normal" Binturongs Bled during Routine Screening

	Hct	Hemoglobin	RBC	WBC	Neutrophils	Bands	Lymphocytes	Monocytes
"Normal" Binturongs	47	16.0	7.2	21,000	65% (13,700)	4% (840)	2% (220)	2% (220)
PAM Binturong initial examination	44	15.6	7.2	39,000	75% (29,300)	20% (7,800)	5% (1,950)	0
Tracheal culture	44	15.6	7.4	32,300	80% (25,400)	6% (1,940)	13% (4,200)	0
After 4 days of antibiotics	43	16.2	6.8	21,700	81% (17,600)	8% (1,740)	8% (1,740)	3% (650)
One week postoperative when returned to exhibit	40	13.9	6.6	25,200	81% (20,400)	12% (3,000)	7% (1,800)	0

analysis of these structures equals the consistency of bone. It appears that initially the remainder of the lung is unaffected, but interstitial fibrosis associated with giant cell formation may develop subsequently.

Chest radiographs characteristically show a diffuse bilateral micronodulation. These discrete calcific densities are fine and "sand-like" in appearance. Since there is very little reaction in the lung parenchyma, these microcalcifications appear as though you could "pick them out with a pair of tweezers" (10). These densities are usually spaced approximately 1.0 mm apart, but may become confluent. This has been described as a "snowstorm" or "sandstorm" appearance (10). In this circumstance the lungs may appear totally opacified. Increased linear markings and pleural thickening may be encountered as a late radiographic manifestation. The chest radiograph is almost always abnormal, but two human patients have been reported with previous normal chest radiographs.

When the radiographic manifestations are seen, they

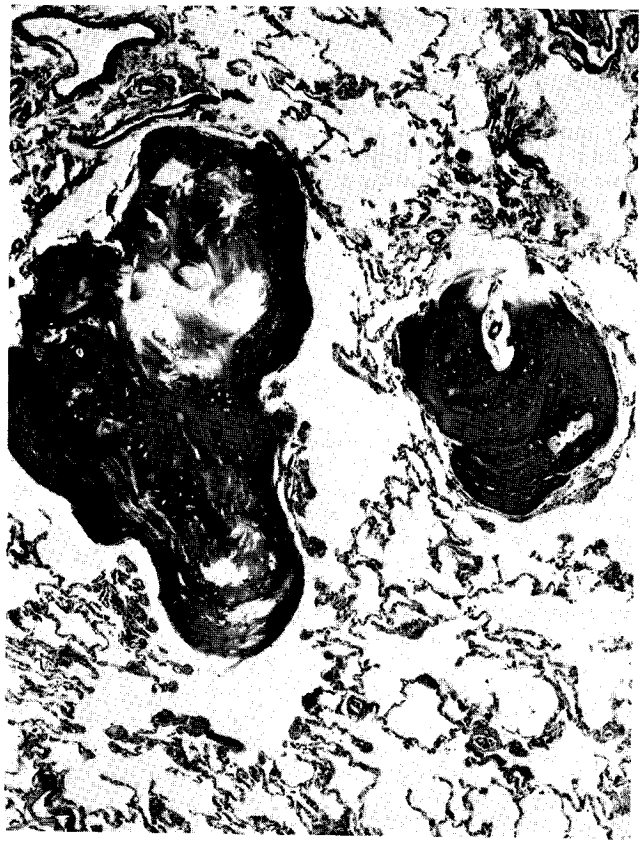


Fig. 3. Lung tissue from open biopsy with two microliths. They are attached to the alveolar septa and fill the air space (H & E X37).

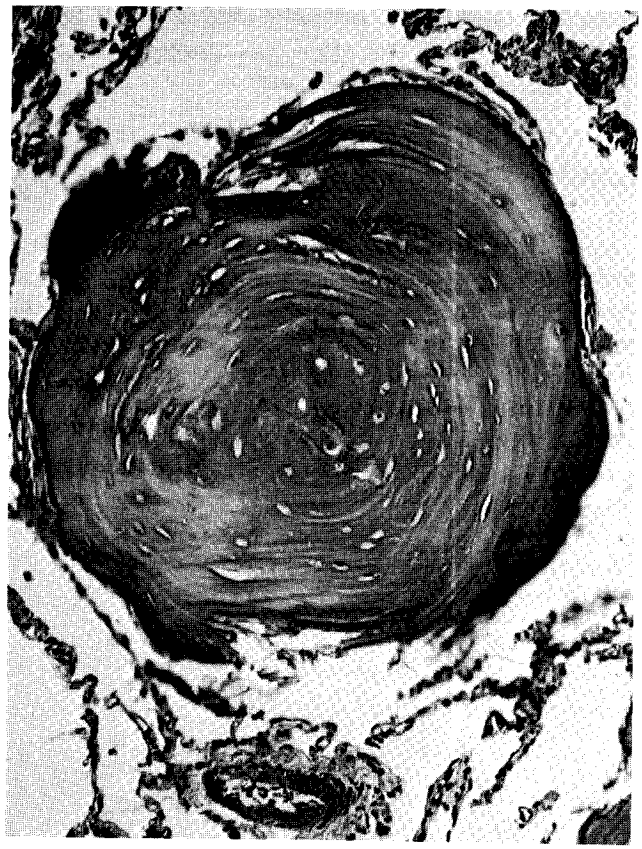


Fig. 4. Microlith showing concentric arrangement of osteocytes and bony lamallae (H & E X150).

are almost diagnostic. The usual differential diagnosis in man includes pulmonary calcification and ossification secondary to altered calcium and phosphate metabolism, hyperparathyroidism, sarcoidosis, renal failure, milk-alkali syndrome, hypervitaminosis D, intravenous calcium administration, and inhalation of powdered barium or beryllium. Miliary densities may sometimes be confused with this appearance, but they are actually coarser and never have a "mulberry-like" structure or calcific density. The absence of lymph node enlargement or pleural reaction is also a helpful differentiating feature to eliminate metastatic or pulmonary inflammatory disease. Multiple metastases are never as dense nor so well-defined. The regularity and consistent appearance of these dense alveoli, however, would not be seen in any of the above disorders except barium inhalation. In this circumstance the history will be specific.

The following differential diagnoses were considered in this binturong: the miliary spread of a bacterial or fungal disease; pulmonary metastasis of a neoplasm; inhalation of radiopaque material. The characteristic radiographic and histopathologic finding along with the lack of evidence of severe infectious disease supported the diagnosis of pulmonary alveolar microlithiasis.

We could find no generalized metabolic disease or inappropriate administration of medication to suggest a cause in our animal. The renal function was normal. Thus, the history and subsequent clinical course in this animal follows the most often encountered pattern of pulmonary alveolar microlithiasis.

SUMMARY

Pulmonary alveolar microlithiasis is described in a binturong (*Arctictis binturong*). The condition was observed in a chest radiograph made during an upper respiratory tract infection. An open lung biopsy showed bony foci with no associated pulmonary inflammation. The condition represented more of a diagnostic than clinical challenge. The microliths apparently are incidental, as the animal remains in good health.

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ZUSAMMENFASSUNG

Es wird die Mikrolithiase der Lungenalveolen bei einer Zibetkatze (*Arctictis binturong*) beschrieben. Der Zustand wurde auf während einer Infektion der oberen Luftwege gemachten Brustaufnahmen entdeckt. Eine offene Lungenbiopsie zeigte Knochenherde ohne damit verbundene Entzündung der Lungen. Der Zustand war mehr ein Problem diagnostischer als klinischer Art. Die Mikrolithen sind anscheinend beiläufige Erscheinungen, da sich das Tier in gutem Gesundheitszustand befindet.

RÉSUMÉ

Il s'agit d'une description de microlithiase alvéolaire du poumon chez une civette (Arctictis binturong). Le cas a été découvert sur une radiographie faite lors d'une infection des régions supérieures de l'appareil respiratoire. Une biopsie faite par prélèvement sur poumon a révélé des concressions osseuses sans inflammation pulmonaire en résultant. Le cas représentait plutôt un diagnostic qu'un problème clinique à résoudre. Les microlithes n'avaient apparemment qu'une importance secondaire étant donné que l'animal demeure en bonne santé.