Tuberculosis in an Iberian lynx (Lynx pardinus)

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The Iberian lynx (Lynx pardinus) is the most endangered feline species in the world (Nowell and Jackson 1996). The current population of Iberian lynxes is estimated to be 1000 animals, distributed in small isolated groups in south-west Spain (Rodriguez and Delibes 1992). Because of the extremely small population of these lynxes, the control of infectious diseases, such as tuberculosis, in their ecosystem, is important for the future protection of this species. Tuberculosis has been described occasionally in wild felines in their natural habitat, for example, in feral cats (Felis catus) from New Zealand (Norbury and others 1998), in two African lions (Panthera leo) and in a cheetah (Acinonyx jubatus) from the Kruger National Park in South Africa (Keen and others 1996). Some cases have also been reported in lions and leopards (Panthera leo and Panthera pardus) from zoo collections (Morris and others 1996, Thorel and others 1998). Recently, Mycobacterium feliis was identified by PCR from samples of the right elbow of an adult Iberian lynx from the Doñana National Park (Briones and others 2000). This short communication describes the necropsy findings of the same lynx.

In October 1998, a five-year-old male Iberian lynx was found within the Doñana National Park, south-west Spain, (37°49'N, 6°26'O). The lynx was in poor body condition and died while being taken to a veterinarian.

Postmortem examination revealed severe weight loss, the animal weighed 5 kg, whereas the mean weight for an adult Iberian lynx is 13 to 15 kg. The most relevant gross finding was moderate hydrothorax. The left visceral pleura and pericardium were off-white in colour due to severe fibrosis (Fig 1), and there were numerous fibrous adherences with parietal pleura. The left lung was reduced in size, whereas the right lung showed generalised, severe congestion and multifocal pneumonia. Irregular and poorly defined off-white foci (1 to 5 mm in diameter) were widespread throughout the parenchyma of the right lung (Fig 1). Several necrotic foci (2 to 5 mm in diameter) were observed in the cortex and medulla of both adrenal glands. Mediastinal and mesenteric lymph nodes showed moderate enlargement without necrotic foci. The right elbow was enlarged, but at the request of the submitting veterinarian, the joint was not opened. The remaining organs did not show gross changes.

Histopathological examination revealed multifocal necrotising pneumonia, with large and poorly defined necrotic areas surrounded by slight infiltration of macrophages and neutrophils (Fig 2). Necrotic areas frequently involved bronchi, which contained abundant casseous material. These lesions were more extensive in the right lung, whereas the left lung showed severe fibrotic pleuritis, atelectasis in most of the parenchyma, and isolated necrotic granulomas. The non-necrotic areas of the right lung often contained foamy macrophages and epithelioid cells within alveolar lumina. Large necrotic areas surrounded by sparse infiltration were also seen in the cortex and medulla of both adrenal glands. Small non-necrotic granulomas composed mainly of macrophages were found in the liver, spleen and mesenteric lymph nodes.

No Langhans' cells were seen in the lesions of any of the affected organs. Ziehl-Neelsen staining revealed a large number of acid-fast bacilli in necrotic areas and within the cytoplasm of macrophages of the lungs (Fig 3) and adrenal glands, whereas occasional bacilli were found in the granulomas of the spleen, liver and mesenteric lymph nodes. The acid-fast bacilli were long, slender and showed hooked or looped morphology (Fig 3). In the areas where acid-fast bacilli were observed, strong granular immunoreactivity was obtained with an anti-M bovis polyclonal antibody (diluted 1:1500) (Dako) using the avidin-biotin peroxidase immunohistochemical technique.

A mycobacterium was found by isolation from lung samples only in Lowenstein-Jensen medium, without glycerol, after incubation for 27 days. The bacterium was not fast-growing or catarrheogenic by photoinduction. The strain degraded urea, o-esters and phenolphthalein phosphate, but did not grow at 25°C and 45°C, or in media containing sodium chloride (5 per cent), picric acid (2 mg/ml), p-nitrobenzoic acid (0.5 mg/ml), hydroxyamine hydrochloride (0.5 mg/ml), isoniazid (1 and 10 µg/ml), thioacetazone (10 µg/ml) or thiophene-2-carboxylic acid hydrazide. Other tests (Kubica 1973) to which the bacterium was subjected, such as the pyrazinamide reduction test, reduction of nitrates, β-galactosidase reduction test, catalase test, hydrolisis of Tween 80, and niacin production, gave negative results. The microbiological characteristics of the strain isolated were consistent with those of M bovis.

The necropsy findings and histopathological examination of this Iberian lynx revealed multiple granulomatous lesions in the lungs, adrenal glands, spleen, liver and mesenteric lymph nodes. M bovis was isolated by culture from samples of these granulomatous lesions, and this is consistent with that obtained by Briones and others (2000) who identified M bovis by PCR from the right elbow of the same lynx. The gross and histopathological lesions of the lynx in this study are quite similar to those reported in tuberculosis of exotic cats, such as lions, leopards and cheetahs, in which emaciation and extensive pulmonary lesions were recorded. These lesions consisted of extensive necrotic areas surrounded by macrophages and epithelioid cells, the absence of Langhans' cells and minimal fibrosis (Keen and others 1996, Morris and others 1996, Thorel and others 1998). The lynx in the present study also had more disseminated lesions, with severe necrotising adenalitis and granulomas (without necrosis) in the mesenteric and mediastinal lymph nodes, spleen and liver.

Tuberculosis in wild cats, such as lions, leopards and cheetahs has been caused by M bovis (Keen and others 1996, Morris and others 1996, Thorel and others 1998), which was the organism identified from the lesions of the lynx of the present study. In domestic cats, however, disseminated mycobacteriosis has been associated with Mycobacterium avium (Jordan and others 1994), with a mycobacterial variant with characteristics between M tuberculosis and M bovis (Blumén and Smith 1996, Gunn-Moore and others 1996) and rarely with Mycobacterium tuberculosis (Greene 1984).

FIG 1: Lungs of the lynx showing off-white colour in the left pleura (#) and pericardium (*), reduced size of the left lung, and multiple poorly defined off-white foci (arrowhead) in the right lung.
The diagnosis of tuberculosis in a lynx from the Dofana National Park is not surprising since it is known that the presence of just one infected host in an ecosystem may result in the spread of the disease to other species within the same habitat. For example, tuberculosis in ferrets (Mustela putorius furo) and feral cats was reported in areas of New Zealand, associated with low-grade infection of cattle and deer (Walker and others 1995). In the Dofana National Park, the prevalence of bovine tuberculosis is low because of eradication campaigns, but cattle are not completely free of the disease, and the traditional method of semi free-ranging farming may allow contact between cattle and wild species, contributing to the maintenance of tuberculosis within the ecosystem.

Determining the route and source of infection to the affected lynx is of crucial importance in preventing the infection of other lynxes. The most possible route of infection is the ingestion of contaminated food (Greene 1984). In South Africa, the ingestion of organs from infected buffaloes was the most likely route of infection of lions, cheetahs and baboons (Keet and others 1996). Several wild species, such as wild boar (Sus scrofa ferox) (León-Vizcaíno and others 1990), red deer (Cervus elaphus) (Lugton and others 1997), fallow deer (Dama dama) (Hunter 1996) or badgers (Meles meles) (Cheeseman and others 1989) may contribute to the natural maintenance of M bovis. Tuberculosis has substantially increased in the red deer, fallow deer and wild boar living in the Dofana National Park during recent years (León-Vizcaíno and others 1999, Briones and others 2000). If these potential prey suffer disseminated tuberculosis presenting a cachectic stage, as was reported in wild boar (León-Vizcaíno and others 1990), and are hunted by lynxes, the disease may spread to the cats. Molecular characterisation by spoligotyping revealed that the lynx isolate of M bovis and those isolated from samples of wild boar and fallow deer were identical (Briones and others 2000).

References


