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## TUBERCULOSIS IN WILD OLIVE BABOONS, *PAPIO CYNOCEPHALUS ANUBIS* (LESSON), IN KENYA

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**ABSTRACT:** Several wild olive baboons from a single troop in the Masai Mara Game Reserve, Kenya were observed to be lethargic and emaciated. Five were trapped and tuberculin tested by intradermal inoculation of 0.1 cc (100 IU) mammalian old tuberculin in the upper eyelid. Two of the five showed positive reaction at 72 hr and were examined at necropsy. Gross lesions in both animals consisted of multiple nodules with caseation in the lung, spleen and tracheobronchial lymph nodes. There were multiple granulomas throughout the lung, spleen and the lymph nodes. Tissues were cultured on Lowenstein-Jensen media with and without pyruvic acid. Isolates were typed as *Mycobacterium bovis*.

### INTRODUCTION

Mycobacterial infections have been described extensively in populations of captive primates (Clarkson and Smith, 1969; Heywood and Hague, 1969; Tribe, 1969; Fiennes, 1972; Fourie, 1983; Suleman et al., 1983). Earlier reports identified *Mycobacterium tuberculosis* as the most prevalent agent, but more recently *M. bovis*, *M. avium* and atypical mycobacterial infections have been reported (Sesline et al., 1975; Costallat et al., 1978; Zumpe et al., 1980; Soave et al., 1981; Weiszfeiler et al., 1981; West et al. 1981; Himes et al., 1982). The presence of mycobacterial infections has been documented in non-primate wild animals (Paine and Martinaglia, 1928; Thorburn and Thomas, 1940; Robinson, 1944; Guilbride et al., 1963; Muirhead et al., 1974; Clancey, 1977; Himes et al., 1980; Woodford, 1982a, b) however little has been reported concerning wild non-human primates (Weiszfeiler et al., 1964-65; McConnell et al., 1974). *Mycobacterium tuberculosis* infection in newly imported primates has been attributed to contracting the disease from infected humans and subsequent

monkey to monkey transmission during the stressful transport period rather than by acquiring natural infections while in the wild (Tribe, 1969; Moulder, 1976), however the increased possibility of infection resulting from contact with humans and domestic animals has been reported (Fourie, 1983). This report presents two confirmed cases of bovine tuberculosis from a wild troop of olive baboons in Kenya, East Africa and suggests evidence of a high prevalence of natural infection.

### MATERIALS AND METHODS

A young adult female baboon (B-1) in a troop of baboons in the Masai Mara Game Reserve was noted to be weak, lethargic and emaciated and frequently coughing. Upon immobilization she died within 15 min and was examined post-mortem. An adult female (B-2) showed similar clinical signs and non-pruritic alopecia distributed on the back with the skin red tan in appearance. She was anesthetized and transported to the Veterinary Laboratories in Nairobi where she was killed and examined at necropsy.

Five additional baboons from the same troop were trapped and tuberculin tested by intradermal injection of 0.1 cc of mammalian tuberculin (100 IU) in the upper eyelid. One of these animals died subsequent to trapping (B-3); two of the remaining four showed marked erythema, swelling and drooping of the eyelid. The two baboons with positive TB tests (juvenile female, B4 and adult female, B5) were killed and a necropsy was performed. Tissues were fixed in 10% buffered formalin, embedded in paraffin, sectioned at 7  $\mu$ m, and stained

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with hematoxylin and eosin for histological examination.

Sections of lung, spleen and tracheobronchial lymph nodes were stained with Kinyoun's acid fast stain and impression smears stained with Ziehl-Nielsen acid fast stain. Specimens of the same tissues, preserved on dry ice, were submitted to the Kenya Tuberculosis Laboratory for culture on Lowenstein-Jensen media with and without pyruvic acid (Marks, 1963). Isolates were sent to *Mycobacterium* Reference Unit at Cardiff, Wales for typing as determined by their ability to remove amino acids from aqueous solutions (Barrow, 1981).

### RESULTS

In animal B-1 there were multiple nodules up to 1 cm in diameter in all lung lobes with the left lobes being more severely affected than the right. Nodules in the left apical lobe were firm; those on the other lobes were soft and had fluid containing granular material centers. Greyish-white nodules approximately 5 mm in diameter were present at both poles of the spleen. These had yellowish-white soft granular centers. Nodules similar to those described in B-1 were present in the lung, spleen, liver, mesenteric and inguinal lymph nodes of animal B-2. In animal B-3 there were fine fibrous adhesions between the left cardiac and diaphragmatic lobes. The anterior portion of the left diaphragmatic lobe was firm and nodular. On section of this area there were multiple tan to greyish-white nodules with caseous centers ranging from 2–4 mm in diameter. The tracheobronchial lymph nodes were enlarged ( $2 \times 1$  cm to  $3 \times 1.5$  cm) and on section they were greyish-white and had a thick fluid consistency. Nodules approximately 1 mm in diameter were disseminated throughout the spleen. There were fine fibrous adhesions between the left cardiac and diaphragmatic lung lobes of animal B-4. The anterior portion of the left diaphragmatic lobe was firm and nodular. On section of this area there were multiple tan to greyish-white nodules with caseous centers ranging from 2–4 mm in diameter. The tracheobronchial lymph

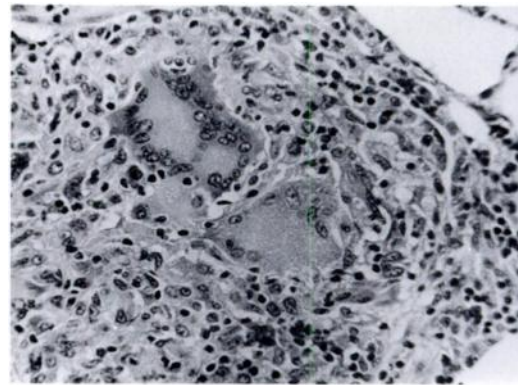


FIGURE 1. Lung from an olive baboon infected with *Mycobacterium bovis*. A granuloma is present with central multinucleated giant cells and peripheral small mononuclear cells. (H&E,  $\times 40$ )

nodes were enlarged ( $2 \times 1$  cm to  $3 \times 1.5$  cm). The entire left side of the lung of B-5 was adherent to the parietal pleura by a diffuse sheet of fibrous connective tissue. The parenchyma of these lobes was finely nodular on section. The tracheobronchial lymph nodes were mottled light and dark grey. On section these nodes had circular greyish-white distinctly demarcated areas which were solid in consistency.

Tissues were available for histologic examination from B-2, B-3, B-4 and B-5. There were multiple granulomas throughout the spleen, lung (Fig. 1) and liver of B-2. These were characterized by a central area of epithelioid cells, often with multinucleated giant cells, bordered by a thick rim of small mononuclear cells. There was central necrosis of several of the pulmonary granulomas. Only the lung of B-3 was available for histologic examination. There were several granulomas throughout the parenchyma. These inflammatory foci had an abundant eosinophil component and sections of lung mites were identified. Lesions in B-4 and B-5 were similar to those of B-2. In addition, granulomas were present in tracheobronchial lymph nodes. Some splenic and lymph node granulomas had large central necrotic areas with mineralization (Fig. 2).

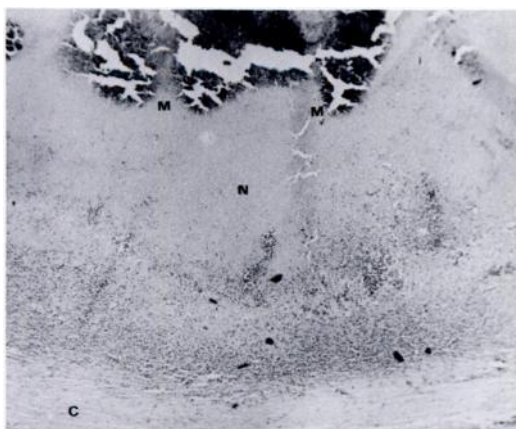


FIGURE 2. Tracheobronchial lymph node from an olive baboon infected with *Mycobacterium bovis*. There is a large amorphous necrotic area (N) with central hyalinized foci of mineralization (M). (C—capsule of lymph node.) (H&E,  $\times 64$ )

A few acid fast rods were seen in an impression smear from the lung and on a histological section of lung from B-4. Organisms isolated from lungs, spleens and tracheobronchial lymph nodes of B-4 and B-5 had cultural characteristics of either *M. bovis* or *M. africanum*. These isolates were typed as *M. bovis*.

#### DISCUSSION

In Kenya human tuberculosis is a notifiable disease when clinically recognizable. Approximately 6,000 to 8,000 new cases of tuberculosis in humans are reported annually. It is suspected that there are two unreported cases for every reported case (Aluoch, 1982).

Tuberculosis is considered to be a naturally occurring simian disease in some instances, but is thought to be mainly a disease acquired in captivity (Fiennes, 1972; Goldsmith and Moor-Jankowski, 1972; Fourie and Odendaal, 1983). Previous reports of mycobacterial infections in captive animals have implicated contact with infected humans (Fiennes, 1972; Fourie and Odendaal 1983), mammals (Himes et al., 1980, 1982), birds (Sesline

et al., 1975) and contaminated water (Fleischman et al., 1982). The presence of bovine tuberculosis in wild baboons suggests that these primates are infected naturally and may serve as a reservoir for the disease. Possible sources of infection include contact with cattle, wild herbivores, contaminated food and water sources. The current prevalence of bovine tuberculosis in domestic animals in Kenya is uncertain, but a study in 1965 reported a low frequency of occurrence (Waddington, 1965), and the prevalence in wild animals is unknown. Mycobacterial infections have been reported in other countries from Marsh antelope, *Kobus lechwe* (Clancey, 1977), deer, *Dama dama*, *Cervus nippon*, and badger, *Meles meles* (Barrow and Gallagher, 1981). Weiszfeiler et al. (1964–65) reported a typical mycobacterial infection in feral monkeys. The baboons in this report came from a troop which frequently scavenges from a refuse dump in common with hyenas and vultures and may have contracted the disease from contaminated waste.

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