The zoonotic importance of *Mycobacterium tuberculosis:* transmission from human to monkey

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ABSTRACT

A case of zoonotic *Mycobacterium tuberculosis* infection in a marmoset *(Callithrix jacchus)* is reported. Genomic typing of the relevant *M. tuberculosis* isolates strongly suggests that the marmoset, which was kept as companion animal, acquired the disease from an infected member in the household who had been treated for pulmonary tuberculosis 8 years prior to this case.

Key words: genomic typing, *Mycobacterium tuberculosis,* zoonosis.

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INTRODUCTION

The zoonotic importance of tuberculosis caused by either *Mycobacterium tuberculosis* or *M. bovis* has been the subject of renewed interest, especially in the wake of the increasing incidence of tuberculosis in the human population. The incidence of *M. bovis* infection in humans largely depends on factors such as the extent of the disease in the cattle population, social and economic situations and on the standard of food hygiene[3].

M. tuberculosis, on the other hand, can infect a wide range of pet animals that can serve as source of infection to humans. Pets might, however, also become infected through close contact with infected humans.

Tuberculosis has long been recognised as a major devastating disease in monkey colonies. Primates in captivity are probably the most susceptible group of mammals. The occurrence of disease is usually related to exposure to an infected human or the introduction of an infected colony member. The predominant route of infection is usually via the respiratory tract. Among the various primates, however, marmosets together with apes and New World monkeys were found to be much less susceptible to tuberculosis than Old World Monkeys[2].

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CASE HISTORY

A 3-year-old marmoset (*Callithrix jacchus*) with serious loss of condition was presented to a veterinary practitioner. It had been kept as a companion animal from an early age. The veterinarian palpated a nodule in the abdomen of the marmoset, which died during an attempt to take a biopsy. A superficial *post mortem* examination was carried out and the nodule, identified as an abscessed mesenteric lymph node, was collected and sent to the Onderstepoort Veterinary Institute, Pretoria, for bacterial culture.

Moderate numbers of acid-fast rods were observed microscopically and *M. tuberculosis* was isolated from the specimen after inoculation onto slants of Loewenstein-Jensen medium. Standard biochemical tests were used to identify the isolate[1]. Following the diagnosis in the marmoset, the owner and his family were examined by means of chest radiographs. It was found that the owner suffered from pulmonary tuberculosis of the right lung. In 1988 he had been diagnosed with tuberculosis in the left lung but declared free of tuberculosis after successful treatment. Although a sputum specimen from the owner was negative microscopically, *M. tuberculosis* was isolated at the Tuberculosis Laboratory of the City Council of Pretoria.

Genomic typing

M. tuberculosis isolates from the marmoset and its owner were cultured in 7H9 Middlebrook broth for 4–6 weeks. The turbid bacterial cultures were heat-inactivated at 80 °C for 25 min. DNA extraction, enzymatic digestion with P*vu* II (Boehringer Mannheim) and agarose gel electrophoresis with subsequent southern blotting was carried out as described by Skuce *et al.*[4]

The entire IS*6110* sequence was amplified[4] by PCR with simultaneous non-radioactive labelling with DIG 11-dUTP (Boehringer Mannheim) and used as a probe during hybridisation. For the post-hybridisation washes and the enzymatic detection of the DIG-labelled hybridisation product we followed the instructions of the manufacturer.

As shown in Fig. 1, the *M. tuberculosis* isolates from the marmoset and the human patient show an identical restriction enzyme fragment length polymorphism (RFLP) pattern. The 100 % homology of the 2 isolates was also confirmed by computer analysis of the DNA fingerprints using Gelcompar™ software. When compared to a series of human *M. tuberculosis* isolates in a high tuberculosis incidence region in South Africa[8], no significant homology to the isolate from the monkey was observed.

DISCUSSION

Genomic typing of *M. tuberculosis* by the RFLP method is a powerful tool in epidemiological studies to trace common sources of infection[6,7]. In our investigation this genomic typing method was successfully used to demonstrate the identity of the 2 isolates and at the same time the zoonotic character of tuberculosis. Numerous cases of zoonotic tuberculosis have been published that emphasise the role of the animal host as a source of tuberculosis to humans[3]. Although analysis of the original *M. tuberculosis* isolate made in 1988 would have been necessary to provide the evidence, we believe the direction of transmission in this case to have been from human to monkey (anthropozoonosis). The fact that the animal had lived in the owner's household from a very young age minimises the possibility of infection through other sources and thus the possibility of passing on the infection to the owner. The identity

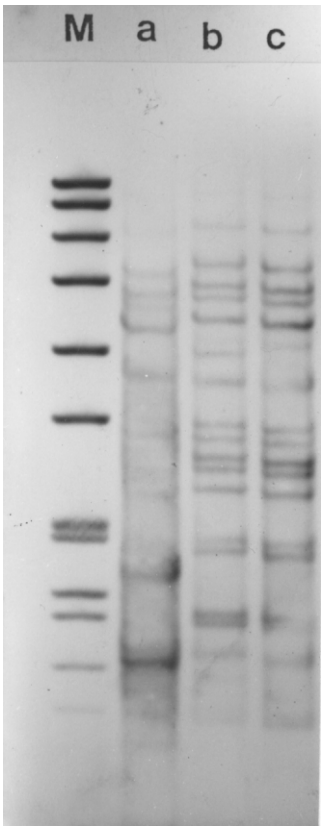

Fig. 1: **DNA from 3 *Mycobacterium tuberculosis* isolates restricted with P*vu* II and hybridised with DIG-labelled IS*6110.* M = DIG-labelled size marker** (fragment sizes: 8.0 kb; 7.1 kb; 6.0 kb; 4.8 kb; 3.5 kb; 2.7 kb; 1.9 kb; 1.85 kb; 1.5 kb; 1.4 kb; 1.15 kb); **a = isolate from an infected baboon; b = isolate from the diseased monkey; c = isolate from the owner.**

of the strains isolated, supported by the history of tuberculosis in the owner, strongly suggests a reactivation of his original infection. Our report is intended to again draw the attention of practitioners involved with exotic companion animals to the danger of mycobacterial infections transmitted from owner to pet.

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