

TUBERCULOSIS IN MONKEYS: A ZOO PROBLEM

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Non-human primates (monkeys) have long been recognised as an appropriate model for the study of human biology and behaviour (Goodwin and Angistine, 1975). Among disease in monkeys, tuberculosis in North Indian brown monkey (*Macaca mulatta*) commonly known as rhesus monkey has been reported in natural habitat (Jaswant *et al.*, 1951). Tuberculosis constitutes a major hazard to primate colony in captivity and the percentage of infected monkeys go on increasing when the animals are kept in captivity possibly by the infection of the normal animals kept side by side with the infected monkeys (Kennel, 1941). Tuberculosis of monkey is caused by humans, (*M. tuberculosis*), bovine (*M. bovis*) and (rarely) avian (*M. avium*) tubercle bacilli. Mycobacteria other than *M. tuberculosis* or *M. bovis* have also been reported as causing disease in non-human primates (Keys *et al.*, 1973).

Susceptibility

The susceptibility of primates to tuberculosis varies; New world monkeys resistant than old world monkeys.

Tuberculosis of the monkeys is caused by human, bovine and rarely swain tubercle bacilli.

Monkeys seem to be less susceptible to infection with avian bacilli than to infection with human and bovine types (Francis, 1958).

Macaca mulatta can be infected by as few as 1-10 viable organisms of *M. tuberculosis* or *M. bovis*.

In all monkeys, the establishment of infection as shown by a positive reaction to tuberculin can be detected within 3 weeks of exposure of an infective dose.

M. africanus an intermediate strain between *M. bovis* and *M. tuberculosis* has also been isolated from Chimpanzee.

Predisposing Factors

Lung diseases are activated and precipitated under captivity by environmental pollution, congestion, droplet infection and restricted movement (indoor housing).

Symptoms

Less playful, move less, take less interest in the environment when the disease is advanced, the monkey sits crouched, is dull and indifferent, they may cough, loss of weight, loss of appetite, enlargement of liver and spleen

Transmission

May be through the alimentary tract of aerosol; monkey to monkey contact; primate workers to monkey and vice-versa.

At least one monkey out of every ten monkeys caught in the neighbouring big cities suffer from Tuberculosis (Nair and Ray, 1954).

Pathology

Tuberculosis of varying sizes on different visceral organs enlargement of the liver and spleen, miliary form of tuberculosis

involving all organs, mesentery have been seen (Rishendra Verma, pers. observation).

Microscopically, tuberculosis lungs showed multiple granulomas with central area of causative necrosis and surrounded by epitheloid cells and lymphocytes, stray number of acid-fast bacilli (Varma *et al.*, 1994). Calcification has not been seen in old world monkeys but has been found in new world monkeys.

The same Mycobacteria can elicit a different response in different species. *M. tuberculosis* and *M. bovis* produce tubercles formation with necrosis in any species e.g. cattle, swine, monkeys, dogs man but the lesions are more diffuse in horse. *M. avium* produce discrete tubercles with caseation in most mammals and birds but in monkeys the lesions are diffuse with saprophytic mycobacteria like *M. avium* complex, *M. fortuitum* acid-fast bacilli occur single or completely fill the cytoplasm of epitheloid cells in the mucosa of intestine just resembling paratuberculosis of cattle caused by *M. paratuberculosis*. No necrosis, calcification, fibrosis or organisation of tubercles in such cases.

Diagnosis

- (1) Periodic tuberculosis testing
- (2) Chest X-ray
- (3) Additional tests like CFT, IRA, ELISA, SAFA etc
- (4) Autopsy

(1) Tuberculin testing

Each monkey should be tuberculin tested with 0.1 ml of Koch's old tuberculin or PPD given intracutaneously on the upper eye lid at 1:10 1C dilution containing 15 COTU. The test is read at 24, 48 and 72 hours and the reactions can be recorded as per Malik (1966-67). Some workers recommend the skin of the arm (Trolldenier *et al.*, 1966) or the abdomen (Schmidt, 1956). Intraperitoneal injection in upper eyelid of monkey was found suitable and easy to read and involve least handling of the animal.

These consecutive tests at an interval of 30 days may be done

(2) Chest X-ray

Primary complex in primates is seldom detected. Chest X-ray helps in identifying other abnormalities too in addition to advanced lesions of tuberculosis.

(3) Additional tests

Elisa, Safa, Pcr may be adopted for diagnosis of tuberculosis as adjunct to the conventional tuberculin test. Lysozyme, a non specific factor, has resulted in the increase in tuberculous monkeys (Verma *et al.*, 1994).

(4) Autopsy

Regular autopsy of any dead monkey must be conducted to monitor the health and to detect pathological lesions.

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Treatment

Briefly the following antituberculous drugs act in the following manner:

Isoniazid: Inhibits DNA synthesis and decreases lipid and carbohydrate content of the cell wall.

Rifampicin: Inhibits DNA dependent RNA polymerase

Ethambutol: Inhibits incorporation of mycolic acid into the cell wall and induces lethal imbalance in lipid synthesis.

Isoniazid or streptomycin modifies course of disease

Treated animals may show negative Tuberculin Test, thus interfere in diagnosis.

Varying Results of therapy

In view of the above facts, treatment offers little value in control of primate tuberculosis.

Control

- Detection of Infected animals.
- Destruction of Infected animals.
- Continued intense monitoring of contact animals
- BCG Vaccination- no Absolute immunity
- Periodic Tuberculin testing

References

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Mortality in zoo due to Tuberculosis in monkeys

Place	Species	Reference
Zoological Garden Calcutta	Rhesus	(10/57) Mitter, 1910
Zoological Garden Bombay	Bonnet	Liston and Poparkar, 1924
Zoological Garden	<i>Presbytis entellus</i>	Basak et al., 1976 (Langur)
All India Instt. of Hyg. & Public Health Calcutta	Rhesus	Krishna, 1936
Circus	Baboons	Iyer, 1940
Circus	Spider monkey	Arora & Parihar, 1982
National Zool. Park, Delhi	Nilgiri Langur	Arora, 1994
Madras Vet College	Pig tailed macaque	Chandrasekaran & Krishnamurthi, 1951
Malaria Instt. Del	Rhesus	Singh et al., 1951
Zoological Park Kanpur	Orang Utan Lion-tailed macaque	Sabharwal, D. N., Pers. Comm.
Zool. Park Bombay	Lion-tailed macaque	Karawale, Pers.Comm.