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EFFECT OF SANITIZATION AND ANTEMORTEM SCREENING ON THE
INCIDENCE OF TUBERCULOSIS IN A ZOO AVIARY

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Tuberculosis has been recorded in the bird collection at the National Zoological Park for many years. Accurate figures are only available from 1969 through 1981, during which time 233 cases of avian tuberculosis (ATB) were diagnosed at necropsy (Table 1). In 1975, ATB was studied clinically and pathologically in 137 of the birds affected between 1969 and 1975 (MONTALI, et al., 1976). In that study, 12 of 22 orders were found to be affected by the disease. *Mycobacterium avium*, serotype 1, was isolated from 30 tuberculous birds cultured. There was no sex predilection and most of the affected birds were adults ranging from 1 to 10 years of age.

The mortality due to ATB in 1975 of 4 % (46 cases out of 1,125 birds at risk in the collection) was considered unacceptable. Because of the difficulty of diagnosing ATB in zoo birds, particularly early in the course of the disease, and due to the resistance of *M. avium* to antitubercular drugs, its control is extremely difficult once it has established itself in an aviary. Another factor is the nature of the disease process itself in birds, in that it usually involves the digestive tract, leading to shedding of the causative organisms into the birds' surroundings. The tubercle bacilli have been shown to survive in bird facilities for years (BLAGODARNYI, 1971). It was therefore decided to implement a sanitization and screening program to reduce the increasing frequency of this disease at the National Zoological Park. In 1976, the bird facilities on the zoo grounds were scheduled for complete renovation. This provided the opportunity to disinfect the premises and to establish a screening program for all birds returning to the new exhibit. The purpose of this paper is to review the sanitization and screening program and to show its beneficial effect in reducing ATB over a 5-year period.

Materials and Methods:

In 1976, the bird facilities at the National Zoological Park were completely renovated and all birds were temporarily housed at the conservation and research center at Front Royal, Virginia. In addition to the remodeling, the facilities were sanitized by removing all dirt (soil) and other loose substrate and burying this material deeply in a remote area free of animal exhibits. This required removal of large amounts of soil up to 3 feet deep in some of the cages. In addition, all wood, plants (with the exception of large trees in the indoor flight cage), sand, mulch, and pine needles were removed. Waterfowl ponds were equipped with separate drainage systems so that they could be emptied and disinfected on a regular basis. All surfaces in the remodeled exhibit were scrubbed with a phenolic disinfectant (Environ, Vestal Laboratories, St. Louis, MO). The exhibits were refurbished with less soil, and layered on sand and pea gravel for improved drainage to facilitate periodic changing. The screening of birds reentering the sanitized and renovated facility was performed by one or a combination of the following procedures: Physical examination, hematologic studies, radiography, laparoscopic examination, tuberculin testing, and lymphocyte transformation (LT). Some birds considered expendable from taxonomic orders that were previously shown to have high incidences of ATB (for example, Charadriiformes, Galliformes, Passeriformes, Anseriformes, and Gruiformes) were culled and necropsied.

Results:

Details of the screening procedures and their outcome have been published (BUSH, et al., 1978). The numbers of cases of ATB declined steadily for the next 5 years after 1976. Table 2 gives the number of cases of ATB for various orders by taxonomic order. Table 3 shows a decided decrease in the overall incidence of ATB of birds in the collection considered to be at risk. The increase to 5.2 % in 1976 was attributed to identifying more cases of ATB during the intensified scrutiny that was conducted. The next 5 years showed a downward trend in the incidence from 2.7 % in 1977 to less than 1 % for the years

1978 through 1981.

Discussion:

Although antemortem diagnosis of avian tuberculosis is difficult, it is clear that the sanitization and general clinical screening methods used were beneficial in reducing the overall incidence of ATB in our aviary. Of the following 6 screening procedures employed (physical examination, hematologic studies, radiography, laparoscopic examination, tuberculin testing, and lymphocyte transformation (LT), the first 4, although less specific for ATB, appeared to be most useful, whereas the more specific tests such as tuberculin and LT were either not helpful or impractical. Specific advantages and disadvantages of these procedures have been previously reported (BUSH, et al., 1978).

A reduction in the concentration of organisms in the exhibits from which substrate was removed was considered also to be extremely valuable in the decline of ATB. Although the pathogenesis of naturally occurring ATB is not entirely understood, birds appear to acquire the disease by repeated ingestion of the organism. Infection of the digestive tract followed by dissemination to the spleen, liver, and other organs then ensues. Infections are usually insidious and chronic, allowing the affected birds to shed organisms into the environment for long periods of time. As new birds develop the disease, the concentration of organisms in the substrate increases, providing heavier inoculations and enhancing the possibility of infections in more birds. Breaking this cycle of organism buildup is an important step in controlling the disease. Although daily cleaning and disinfection of cages is necessary in aviaries with known ATB, it is also very important to remove contaminated substrate on a regular basis. Continual screening is also very important--in particular--chronically ill birds should be considered tuberculous until proven otherwise. This means, of course, that all birds should undergo a complete necropsy with histopathologic examination employing special stains for acid-fast organisms. In addition to the standard acid-fast stains, a procedure employing auramine-O-rhodamine, a fluorescent dye, is most useful in identifying mycobacteria in smears or tissue sections (MANN, et al., 1982). It is very important also to carefully scrutinize birds that may have died from other reasons such as trauma, predation, etc. for ATB. Birds weakened from ATB (as with other underlying illnesses) are often picked on by cagemates or become good targets for predators.

With the decreased incidence of ATB at the National Zoo, there has also been some changing patterns of the disease. With the exception of an increased incidence in Columbiformes, the frequency of orders affected most recently with ATB is similar to those in the previous study (MONTALI, et al, 1976). However, there seems to be a differing pattern of organ involvement with lung and air sac showing a higher degree of involvement than recognized in earlier cases. One particular case--a male Stanley crane--had what appeared to be primary tuberculous involvement of major abdominal and thoracic air sacs and lungs with minimal involvement of liver and spleen (Fig. 3). The air sac lesions had extended through the keel and were evident in the right axilla. Microscopically, organisms were found to be less numerous than is usual in avian tuberculous lesions. As in the earlier report (MONTALI, et al, 1976), the serotype 1 of *M. avium* was the organism most consistently isolated from lesions at necropsy. In the more recent cases, occasionally serotype 2 and several serotypes not considered avian pathogens also have been isolated from lesions. Some of these differences may be dependent upon changes in the adaptabilities of the organisms and the hosts.

In summary, even though it may be difficult to entirely eliminate ATB from an aviary, prudent sanitization with good clinical screening and postmortem follow-up can keep this disease within more acceptable levels.

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Summary:Effects of Hygiene Action and Clinical Monitoring on Tuberculosis in a Flock of Zoo Birds

Hygiene action and clinical monitoring in the National Zoological Park of Washington, D.D., are carried out on the basis of methods which are described in this paper (clinical, haematological, radiological, and laparoscopic examinations as well as tuberculinisation and lymphocyte transformation test). Avian tuberculosis on the premises of the above zoo was thus reduced from four to 0.65 per cent.

Zusammenfassung:Zur Wirksamkeit von Hygienemaßnahmen und klinischer Überwachung auf das Tuberkulosegeschehen in einem Zoovogelbestand

Es wird über die im National Zoological Park, Washington D.C., durchgeführten Hygienemaßnahmen und klinischen Überwachungsmethoden (klinische, hämatologische, radiologische und laparoskopische Untersuchungen und Tuberkulinisierung sowie Lymphozytentransformationstest) berichtet. Auf Grund der getroffenen Maßnahmen konnte die Tuberkulose im Vogelbestand des Zoos von 4 % auf 0,65 % gesenkt werden.

Résumé :A propos de l'efficience de mesures d'hygiène et de la surveillance clinique de la tuberculose dans une groupe d'oiseaux gardés

L'exposé évoque les mesures d'hygiène et les méthodes de surveillance clinique utilisées au National Zoological Park de Washington D.C. (examens cliniques, hématologiques, radiologiques et laparoscopiques ainsi que tuberculinisation et test de transformation des lymphocytes). Les mesures prises en l'occurrence ont permis de faire tomber le pourcentage des cas de tuberculose parmi les oiseaux du jardin zoologique de 4 % à 0,65 % au cours de cinq années.

Резюме:Эффективность гигиенических мероприятий и клинического контроля для профилактики туберкулеза у птиц зоопарка.

Сообщается о принятых в зоопарке Вашингтона гигиенических мероприятий (клинических, гематологических, радиологических, лапароскопических, а также туберкулинизации и теста по трансформации лимфоцитов). В результате принятых мероприятий заболевание туберкулезом снизилось с 4% до 0,65%.

References:

- BLAGODARNYI, R.A., et al (1971): Isolation of Atypical Mycobacteria from Spontaneously Infected Bird Ticks (*Argas persicus*). *Probl. Tuberk* 49; 75-77.
- BUSH, M., MONTALI, R.M., SMITH, E.E., and W.S. PERATINO (1978): Clinical Experience with Tuberculosis in Exotic Birds. In *Mycobacterial Infections of Zoo Animals*, R.J. MONTALI, Ed., Washington, D. C.: Smithsonian Institution Press, 199-204.
- MANN, P.C., MONTALI, R.J., and M. BUSH (1982): Mycobacterial Osteomyelitis in Captive Marsupials. *I. Am. Vet. Med. Ass.* 181; 1331-1333.

MONTALI, R.J., BUSH, M., and E.E. SMITH (1978): Pathology of Tuberculosis in Exotic

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Year	Cases of ATB
1969	24
1970	20
1971	11
1972	10
1973	8
1974	18
1975	46
1976	47
1977	23
1978	8
1979	5
1980	7
1981	6
<u>Total 233</u>	

Table 1
Cases of Avian Tuberculosis at the National Zoological Park, 1969-1981

	1976	1977	1978	1979	1980	1981	Total
Anseriformes	5	4	3	3	4	3	22
Passeriformes	10	3	1	-	-	-	14
Galliformes	11	12	1	2	-	-	26
Columbiformes	8	-	-	-	1	-	9
Caprimulgiformes	1	-	1	-	-	-	2
Charadriiformes	1	2	-	-	-	-	3
Ciconiformes	1	-	-	-	-	-	1
Piciformes	-	1	-	-	-	-	1
Tinamiformes	-	-	-	-	1	-	1
Cuculiformes	1	-	-	-	-	-	1
Strigiformes	-	-	-	-	-	1	1
Gruiformes	5	1	2	-	-	1	9
Psittaciformes	4	-	-	-	1	-	5
Falconiformes	-	-	-	-	-	1	1
	<u>47</u>	<u>23</u>	<u>8</u>	<u>5</u>	<u>7</u>	<u>6</u>	<u>96</u>

Table 2
Avian Tuberculosis at the National Zoological Park By Order, 1976-1981

Table 3. Declining Incidence of ATB at the National Zoological Park After Sanitization and Screening Program, 1975-1981

	Birds w/ATB Necropsied	Total Birds Necropsied	% ATB	Total Birds at Risk Necropsied*	% ATB	Total Birds in Collection at Risk	% ATB
1975	46	516	8.9%	323	14.2%	1,125	4.08%
1976	47	592	7.9%	242	19.4%	906	5.19%
1977	23	369	6.2%	276	8.3%	854	2.69%
1978	8	241	3.3%	186	4.3%	860	0.93%
1979	5	172	2.9%	134	3.7%	891	0.56%
1980	7	170	4.1%	115	6.1%	886	0.79%
1981	6	355	1.7%	229	2.6%	929	0.65%

*Excludes birds dying at 30 days or less



Fig. 1

Opened thoracic cavity of male Stanley crane with extensive tuberculous air sacculitis