

THE PATHOLOGY OF SOME DISEASES FOUND IN WILD ANIMALS IN EAST AFRICA

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SUMMARY

Fifty-four post-mortem examinations were carried out on wild animals. A wide range of disease conditions was found and a number of these are discussed in detail. Two conditions of particular importance were parasitic bronchitis and muscular dystrophy; these were found in approximately one third of the antelopes examined.

INTRODUCTION

Although a background of disease statistics should be available to the conservationist studying ecological problems, relatively little information exists about the diseases of wild animals in East Africa and their relative incidence.

During 1963 and 1964, 54 detailed post-mortem examinations were carried out on wild animals. The results are tabulated and discussed in this paper.

This work was done while the author was seconded to the Pathology Department of the Faculty of Veterinary Science, University College, Nairobi.

MATERIALS AND METHODS

The animals were obtained from the Nairobi National Park and from game reserves in Kenya and Tanzania. A full post-mortem examination was carried out and blocks of tissue for histopathological examination were fixed in corrosive formal (Carleton & Drury, 1957), dehydrated and cleared in an alcohol-amyl acetate-chloroform series, and embedded in paraffin wax. The sections were stained routinely with haemalum and eosin; other stains used were picro-Mallory, Loeffler's methy-

lene blue, polychromatic methylene blue, Giemsa, periodic acid-Schiff, Weigert's elastin/van Gieson. Worm burdens in the gastrointestinal tract were calculated by the dilution technique described by Ritchie *et al.* (1966). Serum samples were examined for leptospiral agglutinins by the agglutination test (Mackie and McCartney, 1962: p. 721-722).

RESULTS

The post-mortem findings are presented in Table 1 and a number of the disease conditions found are further discussed below.

1. Muscular dystrophy

This was found in eight of the 26 antelopes examined post-mortem. It is well recognised in domestic animals. In Britain the disease, which occurs mainly in cattle, is usually due to a Vitamin E deficiency. Many cases are seen in lambs in U.S.A. and are associated with selenium deficiency. It may very well, however, have other unknown causes and it is known to occur in southwest U.S.A. in range cattle which have been herded after periods of drought. In two of the eight cases it was severe and was considered to be the cause of death. Both of these occurred in Hunter's antelope (Jarrett *et al.*, 1964). The lesions found in these antelope were indistinguishable macroscopically and microscopically from those in cattle. Grossly, whitish-yellow streaks were seen parallel to the plane of muscle fibre arrangement. They ranged in extent from being hardly visible to the state which has led to the name "white muscle disease." Histologically, in muscle there were some normal fibres, some showing hyaline degeneration with loss

of cross striations, some showing transverse breaks and some wholly degenerated with marked proliferation of the sarcolemmal sheath which gave a bizarre cellular appearance.

2. Parasitic bronchitis

Severe parasitic bronchitis was found in nine of the 26 antelopes. Although the species of worm responsible was not identified parasitologically, the macroscopic and microscopic findings were similar to those described by Jarrett *et al.* (1960) in bovine parasitic bronchitis as caused by *Dictyocaulus viviparus*.

In Great Britain and on the continent, parasitic bronchitis as caused by this species is responsible for considerable economic loss in cattle and sheep. Heavy infestations produce severe dyspnoea which may result in interstitial emphysema or heart failure followed by pulmonary oedema. A complication following some infections is bronchiectasis; the bronchi of a lobe fail to clear themselves of exudates and these become the nidus of low grade chronic bacterial infections. This is a common cause of the poorly-thriving stunted animal with a persistent cough.

Small lenticular subpleural lesions identical macroscopically and microscopically with those of *Muellerius capillaris* were found in the lungs of all 26 animals. *M. capillaris* is a very common parasite of sheep. It was found in almost all of 2,000 sets of sheep lungs examined in an abattoir survey in Kenya (Murray, 1967a). No clinical significance has been attributed to this parasite.

3. Spirocercosis in a cheetah (Murray, 1964)

Spirocerca lupi is a spiruroid nematode which is found mainly in the dog and also in a variety of wild Canidae and Felidae. *S. lupi* has an indirect life cycle (Jerstad, 1940). Adult *S. lupi* worms live in submucosal nodules found in the terminal part of the oesophagus. Many of these nodules have openings or fistulas through which the caudal end of the female protrudes and deposits embryonated eggs which are voided in

the faeces. The eggs are ingested by various species of coprophagous beetle (Bailey, Cabrera and Diamond, 1963) in which they develop to infective third stage larvae. The beetle is then ingested by the finite host. The ingested larvae migrate through the stomach wall and along the walls of the regional arteries to the aorta whence they migrate to the oesophagus where they mature. Occasionally the coprophagous beetle is ingested by a transport host in which the third stage larvae remain infective until the transport host is ingested by the finite host. A wide range of birds, reptiles and mammals can act in this way.

S. lupi larvae may cause considerable damage to the aorta; superficial thrombi deposits with widespread dissemination or rupture of the aorta can occur. The nodules in the oesophagus containing the adult worms produce little clinical effect; however, there is a well-established relationship between these nodules and the development of malignant mesenchymal tumours in the oesophagus (Seibold *et al.*, 1955).

The cheetah examined was one of two brought from the Wajir area to Nairobi National Park. As a result of *S. lupi* larval migration along the aorta there were extensive deposits of thrombi. A linear thrombus was found in the terminal 1 cm of the aorta and this thrombus bifurcated along both iliac arteries for 3 to 4 cm. Thrombi were found in both branches of the pulmonary artery, the pulmonary embolism possibly being the lethal lesion.

Examination of a blood smear stained with Giemsa revealed coccoid and bacillary particles of chromatin in the red blood corpuscles. This organism was identical to *Eperythrozoon felis* which is found in domestic cats (Seamer and Douglas, 1959).

This blood parasite is a recognised cause of haemolytic anaemia, splenomegaly and jaundice in the domestic cat. In this cheetah, many particles of *Eperythrozoon felis* and numerous normoblasts, evidence of response to a haemolytic crisis, were found in the blood smear. No other haematological data were available but it was concluded that this cheetah must have had

a severe anaemia.

4. Nairobi bleeding disease

The term Nairobi bleeding disease is used to describe a condition of unknown aetiology found in Nairobi dogs (Murray, 1967b). This condition is characterised by severe pulmonary haemorrhage and necrosis and widespread ecchymosis. Two wild cats, a leopard and a lynx, presented post-mortem findings similar to those found in the dogs with Nairobi bleeding disease. Both cats came from Nairobi National Park, having died within five days of one another. The superficial, thoracic and abdominal lymph nodes were enlarged and congested. Numerous areas of haemorrhage and necrosis were found in all lung lobes. These areas varied in size from a few mm to 4–5 cm. In both cases there was a moderate increase in pleural and pericardial fluid. Petechial and ecchymotic haemorrhages were found in the epicardium. There was patchy congestion of the gastrointestinal mucosa.

5. Infectious feline enteritis

This is one of the most contagious viral diseases and is highly fatal. It has been reported in the majority of wild Felidae as well as in the domestic cat (Jubb and Kennedy, 1963). Four cheetah kittens received from Nairobi National Park showed post-mortem findings similar to those found in domestic cats with infectious feline enteritis. They had died within 24 hours of one another. All were in poor condition. There was moderate pulmonary oedema and congestion of the larynx and trachea. The gastrointestinal tract, which was patchily congested, was almost completely empty except for fluid faeces and a marked mucous exudate. The mesenteric lymph nodes were enlarged and congested. On the above findings a tentative diagnosis of infectious feline enteritis was made. No inclusion bodies were found. Demonstration of intranuclear inclusion bodies requires the use of rapid-acting acid fixative shortly after death.

6. Leptospirosis

Leptospira spp. are a well-recognised

cause of serious disease in domestic animals, both large and small, and they have also been reported in wildlife in Great Britain and the U.S.A. (Blood and Henderson, 1963).

Leptospiral agglutinins to *Leptospira icterohaemorrhagica* and *Leptospira canicola* were found in the sera of three of seven animals examined serologically; all three were topi. We found leptospiral agglutinins in the sera and cerebrospinal fluid of 5.5% of 165 dogs and 52.7% of 55 cattle examined serologically; these animals were from the Nairobi area.

Leptospirosis can be transmitted by ticks and it is likely that it can be passed from wild animals to domestic animals and vice versa.

7. Arteritis

Arteritis affecting the small distributing arteries in the lymph nodes and intestine was found in a rhinoceros. Similar lesions are found in horses with equine viral arteritis. This disease is characterised by fever and leucopaenia and by upper respiratory tract infection. No clinical data were available in this rhinoceros.

8. Cardiac lesions in the zebra

Cardiac lesions were found in two zebras (obtained from Dr. E. W. Fisher, Department of Veterinary Medicine, University of Glasgow). The first was found by itself although in the vicinity of other zebra; it did not appear to be lame. The second zebra fell behind the herd when it was chased; it was not lame. Both animals were destroyed. Both were stallions and their age was estimated to be between seven and ten years. Complete post-mortem examinations were not performed.

In the first zebra the heart was of normal shape. A large area of fibrosis was found in the myocardium of the left ventricle. There were no valve lesions. In the second case the heart was distorted by long fibrous scars twisting the left ventricle. These fibrous scars were extensive throughout the myocardium. No valve lesions were present but a raised transverse 2×1×0.2 cm high plaque was found in the aorta 7 cm

from the aortic valve. Histopathological findings were similar in both zebra. There were extensive areas of myocardial fibrosis. Few inflammatory cells were found and there were no lesions in the coronary arteries. These lesions might have been caused by infarction, myocarditis or the result of migration of parasites through the myocardium. The lesion in the aorta was a subendothelial plaque of collagen in which an inflammatory response of plasma cells and lymphocytes was found just below the endothelial lining.

DISCUSSION

In some cases the post-mortem examination was inconclusive, largely as a result of advanced autolysis caused by delay between death of the animal in the field and post-mortem examination at the laboratory.

It would seem likely from the above findings that parasitic bronchitis and muscular dystrophy are fairly common in wild animals and even mild forms must put antelopes at a serious disadvantage with regard to escape from predators and to the stress caused by capture and handling.

The incidence of spirocercosis in the domestic dog is high in Kenya, occurring in 33% of dogs in the Nairobi area (Murray, 1967c). No case was found in 53 domestic cats examined post-mortem. Although rarely of clinical significance, the possibility of the infection occurring in wild Canidae and Felidae which are exposed to the same intermediate and transport hosts as the dog, must be distinct as seen in the case of the cheetah.

Infectious feline anaemia due to *Eperythrozoon felis*, infectious feline enteritis and leptospirosis are all recognised diseases in domestic animals and in certain cases may infect a large number of a particular population. The occurrence of these conditions in wild animals must therefore be regarded in this light and the danger of these infections recognised.

Nairobi bleeding disease is a disease of unknown aetiology, the clinical and

pathological aspects of which are poorly defined and require further investigation.

The myocardial lesions in the zebra were of unknown origin; infarction, myocarditis or parasitic larval migrants were suggested causes. *Strongylus* sp. are frequently found in the large intestine of the zebra (Urquhart *et al.*, 1960) and one of these species in the horse gives rise to arterial lesions and may produce myocardial fibrosis (Pirie, 1966: pers. comm.).

REFERENCES

- BAILEY, W. S., CABRERA, D. J. and DIAMOND, D. L. (1963). Beetles of the family Scarabaeidae as intermediate hosts for *Spirocerca lupi*. *J. Parasit.*, 49 (3): 485-488.
- BLOOD, D. C. and HENDERSON, J. A. (1963). *Veterinary Medicine*, 2nd Ed. Bailliere, Tindall & Cox, London.
- CARLETON, H. M. and DRURY, R. A. B. (1957). *Histological Technique*, 3rd Ed. Oxford University Press.
- JARRETT, W. F. H., JENNINGS, F. W., MURRAY, M. and HARTHOORN, A. M. (1964). Muscular Dystrophy in wild Hunter's Antelope. *E. Afr. Wildl. J.*, 2: 158-159.
- JARRETT, W. F. H., JENNINGS, F. W., MCINTYRE, W. I. M., MULLIGAN, W., SHARP, N. C. C. and URQUHART, G. M. (1960). (1) The Disease Process. *Vet. Rec.*, 72: 1066-1068.
- JERSTAD, A. C. (1940). A review of the life history of *Spirocerca lupi* (*S. sanguinolenta*), the oesophageal worm of the dog. *Am. J. vet. Res.*, 1: 73-75.
- JUBB, K. V. F. and KENNEDY, P. C. (1963). *Pathology of domestic animals*. Vol. 2. Academic Press, New York and London.
- MACKIE and MCCARTNEY (1962). *Handbook of Bacteriology*. 10th ed. (Ed. R. Cruickshank). E. & S. Livingstone Ltd., Edinburgh & London.
- MURRAY, M. (1964). *Spirocerca lupi* in a cheetah. *E. Afr. Wildl. J.*, 2: 164.
- (1967a). Pulmonary Disease in Kenya Sheep (MS).
- (1967b). A Survey of Diseases found in dogs in Kenya (MS).
- (1967c). The Incidence and Pathology of *Spirocerca lupi* in Kenya (MS).
- RITCHIE, J. S. D., ANDERSON, N., ARMOUR, J., JARRETT, W. F. H., JENNINGS, F. W. and URQUHART, G. M. (1966). Experimental *Ostertagia ostertagi* infections in calves: Parasitology and pathogenesis of a single infection. *Am. J. vet. Res.*, 27 (118): 659-667.
- SEAMER, J. and DOUGLAS, S. W. (1959). A new blood parasite of British cats. *Vet. Rec.*, 71: 405-408.

- SEIBOLD, H. R., BAILEY, W. S., HOERLEIN, B. F., JORDAN, E. M. and SCHWABE, C. W. (1955). Observations on the possible relation of malignant oesophageal tumours and *Spirocerca lupi* lesions in the dog. *Am. J. vet. Res.*, 16: 5 - 14.
- URQUHART, G. M., HAY, D., ZAPHIRO, D. R. P. and SPINAGE C. A. (1960). Some internal parasites of game animals in Kenya. *E. Afr. agric. For. J.*, 26 (1): 11-20.

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TABLE 1
Diseases found in 54 wild animals

Species	Age*	Sex	Place of origin	Fate	Diagnosis
Hunter's antelope (<i>Damaliscus hunteri</i> (Solater))	Young adult	—	Lower Tana, relocated to Tsavo National Park	Death in captivity	Muscular dystrophy. Renal abscess.
	Young adult	—	"	"	Muscular dystrophy.
	Adult	—	Unknown	"	No lesions.
Topi (<i>Damaliscus korrigum</i> (Ogilby))	Adult	—	Rumuruti (in captivity)	Death in captivity	Parasitic bronchitis. Muscular dystrophy (mild). <i>Leptospira</i> sp 1:100.
	Adult	—	Serengeti	Shot	Parasitic bronchitis.
	Young adult (1 pair permanent incisor teeth)	M	Rumuruti (in captivity)	Death in captivity	Severe necrotising pleurisy (<i>Pasteurella</i> sp.), 6596. <i>Trichuris</i> <i>cervicapra</i> in large intestine. <i>Leptospira</i> sp. 1:100.
	Young adult	M	Rumuruti (in captivity)	Death in captivity	Severe pulmonary oedema of unknown origin. <i>Leptospira</i> sp. 1:100.
	Adult	—	Serengeti	"	Parasitic bronchitis. Muscular dystrophy (mild).
	Adult	—	Serengeti	"	No lesions.

Wildebeest (<i>Connochaetes taurinus</i> <i>albojubatus</i> Thomas)	2 years	—	Serengeti	Shot	Parasitic bronchitis, Muscular dystrophy (mild).
	2 years	—	Serengeti	Shot	Parasitic bronchitis.
	Young adult (2 pairs permanent teeth)	M	Arusha (in captivity)	Death in captivity	Myocardial fibrosis, Enteritis.
	Adult	—	Kajiado	Shot	No lesions.
Buffalo (<i>Syncerus caffer caffer</i> (Sparrman))	Calf	—	Serengeti	Death in captivity	Parasitic bronchitis.
Waterbuck (<i>Kobus</i> sp.)	Adult	—	Serengeti	Shot	Parasitic bronchitis and extensive pulmonary necrosis.
Grant's gazelle (<i>Gazella granti roosevelti</i> : Heller)	Adult	—	Kajiado	Shot	Parasitic bronchitis.
	Adult	—	Kajiado	Shot	Muscular dystrophy (mild).
Thomson's gazelle (<i>Gazella thomsonii</i> <i>thomsonii</i> Günther)	Young adult	F	Nairobi National Park	Death in captivity	Ruptured left eye, Parasitic bronchitis.
	Young adult	F	"	"	Severe bilateral corneal ulceration and meningitis, Mild interstitial nephritis (acute phase), Muscular dystrophy (mild).
	Adult	—	Kajiado	Shot	No lesions.
	Adult	—	"	"	Muscular dystrophy (mild).
	Adult	—	Serengeti	Death in captivity	No lesions.
	Adult	F	Nairobi National Park	"	Severe necrotising pneumonia with pleurisy and pericarditis, Severe interstitial nephritis (acute phase).
Duiker (Species unknown)	Young adult	—	"	"	Severe pulmonary oedema of unknown origin.
	Young adult	F	"	"	Enteritis.

TABLE 1 continued

Species	Age	Sex	Place of origin	Fate	Diagnosis
Steenbok (<i>Raphicerus campestris neumanni</i> (Matschie))	Baby	M	Nairobi National Park	Death in captivity	Cheek abscess.
Leopard (<i>Panthera pardus pardus</i> Linnaeus)	9 months	M	Nairobi National Park	Death in captivity	Severe pulmonary haemorrhage and necrosis.
	4-6 months	M	"	"	Sarcoptic mange and subacute enteritis.
Lion (<i>Panthera leo massaica</i> Neumann)	Cub	M	"	"	Hydrothorax of unknown origin.
Cheetah (<i>Acinonyx jubatus raineyi</i> Heller)	6 months	F	Wajir to Nairobi National Park	Death in captivity	Spirocerosis and severe anaemia (<i>Eperythrozoon felis</i>).
	Kitten	F	Nairobi National Park	Death in captivity	? Infectious feline enteritis.
	Kitten	F	"	"	"
	Kitten	F	"	"	"
	Kitten	—	"	"	"
	4-6 months	—	"	"	Focal hepatitis of unknown cause.
Serval cat (<i>Felis serval hindei</i> Wroughton)	Cub	F	"	"	Anaemia caused by massive flea infection.
	Adult	M	"	"	Encephalitis. Severe centrilobular degeneration in liver.
	6 months	M	"	"	Post-operative death (broken leg).
Lynx (<i>Caracal caracal nubicus</i> (Fischer))	8 months	F	"	"	Severe pulmonary haemorrhage and necrosis.
	5 months	F	"	"	Severe haemorrhagic enteritis.

Rhinoceros (<i>Diceros bicornis bicornis</i> Linnaeus)	3 years	M	Nairobi National Park	Death in captivity	Severe pulmonary emphysema and arterial lesions.
	6 months	M	Arusha	"	Gastroenteritis with 150 Bot larvae in the terminal oesophagus and cardiac area of stomach.
	3 months	M	Unknown	"	Gastroenteritis.
Zebra, Burchell's (<i>Equus burchelli</i> (Gray))	Foal	M	Nairobi National Park	"	Inconclusive with severe pulmonary oedema and pyonephrosis.
Burchell's	6 weeks	F	"	"	Inconclusive.
Grevy's (<i>E. grevyi</i> Oustalet)	Foal	M	"	"	Severe purulent bronchopneumonia.
Burchell's	Adult	M	Serengeti	Death in captivity	Mild (focal) interstitial nephritis (acute).
Burchell's	Adult	M	Tsavo National Park	Shot	Myocardial fibrosis.
Burchell's	Adult	M	"	"	Myocardial fibrosis and aortic plaque.
Giraffe (<i>Giraffa camelopardalis tippelskirchi</i> Matschie)	Adult	—	Serengeti	Death in captivity	Severe peribiliary fibrosis in liver due to round worms in the biliary tract.
Hyrax (<i>Dendrohyrax brucei hindei</i> Wroughton)	18 months	M	Nairobi (Zoology Dept.)	Death in captivity	No lesions.
Bush Baby (Species unknown)	Baby	M	Nairobi (pet)	Death in captivity	Fractured skull with cerebral haemorrhage and aortic lesions (medial sclerosis).
Monkey (<i>Colobus polykomos</i>)	Young adult	M	Unknown	"	Subacute enteritis (50 Oxyurids).
	Young adult	—	Unknown	"	5,000 Trichostrongylus and a few Oxyurids.

* Where age is stated accurate information on the date of birth of the animal was known. Where this was not known, age was estimated i.e. cub, young adult, adult etc. on the basis of tooth development and size and condition of the animal.