Transmitters and Potential Transmitters of Malignant Catarrhal Fever

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Introduction

Malignant catarrhal fever (MCF) occurs under conditions where cattle live in close association with blue wildebeest *(Connochaetes taurinus).* The assumption that sheep are inapparent hosts of MCF has been based on circumstantial evidence only (1.9). Serological evidence, however, suggests that sheep harbour a MCF virus antigenically related to the herpes virus of wildebeest-associated disease (8). Involvement of black wildebeest *(C.gnou)* is mostly based on circumstantial evidence. Experimental transmission of MCF to cattle has only once been performed by the inoculation of blood, obtained from a healthy black wildebeest (2).

According to Mettam (2), MCF never occurs when cattle are pastured with other game. However, it has been demonstrated (7) that, in addition to blue wildebeest, the topi *(Damaslicus korrigum)* and the hartebeest, *(Alcelaphus buselaphus)* of the sub-family *Alcelaphinae* and the fringe-eared oryx *(Oryx beisa)* (3) of the sub-family *Hippotraginae* may have virus neutralizing antibodies (VNA) to blue wildebeest-associated MCF virus. Herpes virus, antigenically related to wildebeest-associated MCF virus, has also been isolated from hartebeest and topi (4). However, it is not known whether these species can transmit the virus to cattle or not.

Outbreaks of MCF have also been reported in cattle that have not had any contact with wildebeest or sheep at all (1,2,9). This indicates that other carriers or factors that have not yet been identified may play a role in the dissemination of MCF.

During the past decade game has been incorporated into the farming economy of South Africa. This has resulted in an increase in the incidence of MCF. The result of an investigation of the involvement of different species of game in the epidemiology of MCF are reported in this paper.

Materials and Methods

Virus neutralization tests

A micro-neutralization test was performed, using foetal lamb kidney cells, two-fold dilutions of serum and 10-30 infective units of the WC11 strain of MCF virus. After collection, serum specimens were stored at -20°C. Immediately before testing, the sera were inactivated for 30 m at 56°C. The inoculated test plates were incubated at 37°C in an atmosphere of 3% CO_2 and examined from Day 4 onwards. When plagues were clearly visible in wells containing negative serum, the plates were rinsed in tap water and immersed in alcohol for 10 m. To facilitate reading of the test, the cells were stained with a 5% solution of crystal violet in water.

Serum specimens

Serum specimens were collected from different species of game including blue wildebeest, black wildebeest, gemsbok *(Oryx gazelle),* sable antelope *(Hippotragus niger),* elephant *(Loxodonta africana),* black rhinoceros *(Diceros bicornis).* Burchell's zebra *Equus burchelli,* Hartman's zebra *(E. hartmannae),* giraffe *(Giraffa cameopardalis),* buffalo *(Syncerus caffer),* tsessebe *(Damaliscus lunatus),* impala *(Aepyceros melampus),* springbok *(Antidorcas marsupialis),* kudu *(Tragelaphus stepsiceros),* and eland *(Taurotragus oryx).*

Outbreaks

Information on outbreaks (Table 1) was obtained from veterinarians. Where possible, the diagnoses were confirmed by virus isolation on primary foetal lamb cell cultures and/or histopathological examination.

Results

Antibodies against blue wildebeest-associated MCF virus were encountered in blue wildebeest, black wildebeest, gemsbok and sable antelope. Suspicious reactions were observed with sera of impala and springbok. All the black wildebeest herds and 11 out of 12 blue wildebeest herds tested were positive. Although the percentage of positive individuals was very similar in the 2 species, the levels of antibody in black wildebeest were invariably lower than the levels in blue wildebeest. No VNA were detected in 101 serum specimens collected from 9 other species of game which include 7 elephant, 18 black rhinoceros, 7 Burchell's zebra, 1 Hartman's zebra, 3 giraffe, 20 buffalo, 3 tssessebe, 15 eland, and 27 kudu. In all the positive blue wildebeest and black wildebeest herds tested, a positive diagnosis could be made by testing 3 specimens selected at random.

Twenty-nine outbreaks of MCF in cattle with a mean

TABLE 1. The role played by potential transmitters in 29 outbreaks of malignant catarrhal fever.

Potential transmitters	Outbreaks	Cattle		
		Involved	Mortality	Mortality %
Blue wildebeest	7	1570	35	2.2 (1-13)
Blue wildebeest & other game	7	4640	202	4.3 (1-13.3)
Blue wildebeest & game & sheep	2	1100	3	0.2
Sheep	6	1400	86	6.1 (1-19)
Sheep & other game	5	535	17	3.1 (1-15)
Black wildebeest	1	80	2	2.5
Black wildbeest & other game	1	200	25	12.5
Totals	29	9325	370	3.9
Most likely vector - blue wildebeest	14	6210	237	3.81
Most likely vector - sheep	11	1935	103	5.32

mortality rate of 3.8% were investigated (Table 1). Blue wildebeest were involved in 16 outbreaks, sheep in 13 outbreaks and black wildebeest in 2 out of 7 outbreaks and sheep were the only possible transmitters in 6 outbreaks. Five outbreaks occurred without direct contact between cattle and potential transmitters. Two of these outbreaks were associated with blue wildebeest, 2 with sheep and 1 with black wildebeest. MCF virus was isolated from a cow in this last outbreak in which 2 out of 80 animals died of disease. Outbreaks associated with blue wildebeest occurred from April to December, with a peak incidence during September to December. No seasonal incidence was observed with outbreaks associated with sheep.

Discussion

The presence of VNA against wildebeest-associated MCF virus in wildebeest in South Africa is not unexpected. The high incidence of positive wildebeest and the levels of antibody titres are comparable to those in East Africa where almost all the blue wildebeest are positive (6). The incidence of VNA in black wildebeest against blue wildebeest-associated MCF virus is similar to the incidence in blue wildebeest, but the antibody titres are invariably lower in black wildebeest.

Parallelism exists between these results and the results obtained with hartebeest and topi sera (7). The low titres in hartebeest and topi were ascribed to stimulation by closely related viruses. Unlike the experience with topi and hartebeest, black wildebeest had previously been associated with MCF (2). The isolation of MCF virus from a cow during an outbreak, associated with black wildebeest, is further proof of the involvement of black wildebeest. The demonstration of VNA against blue wildebeest-associated MCF in gemsbok and sable antelope increased the number of potential transmitters of MCF to 7 species. Four of these species, blue wildebeest, black wildebeest, topi, and hartebeest are members of the subfamily *Alcelaphinae*. The other 3 species, the fringe-eared oryx, gemsbok and sable antelope belong to the subfamily *Hippotraginae*. It thus seems quite possible that other members of these 2 subfamilies may also be potential transmitters of MCF.

In sera positive blue and black wildebeest herds it was possible to determine the status of a herd by testing 3 randomly-selected serum specimens. The absence of antibodies in species where more than six specimens from 2 or more herds were examined thus indicates that these species probably do not play a role in the transmission of the disease. These species are elephant, African buffalo, black rhinoceros, kudu, and eland.

The blue wildebeest seems to be the most important transmitter of MCF in South Africa. This species was the most likely transmitter in 14 out of 29 outbreaks investigated (Table 1). In these outbreaks 237 cattle died. Although sheep were the most likely transmitters in 11 outbreaks, only 103 cattle succumbed to MCF in these outbreaks. However, there is no significant difference between the mortality rate in outbreaks caused by sheep or outbreaks caused by blue wildebeest. Where blue wildebeest were involved, the mortality rate varied from less than 1% to 13.3% and, where sheep were involved, the mortality rate varied from less than 1% to 19%. Because of their smaller numbers, black wildebeest and other game probably play a less important role in the transmission of the disease. However, in one particular outbreak associated with black wildebeest, 25 out of 200 cattle died of MCF.

To control MCF, farmers are usually advised to prevent contact between cattle and wildebeest or sheep. In this investigation 5 outbreaks occurred where no direct contact between cattle and potential transmitters could be established. Two outbreaks were associated with blue wildebeest, 2 with sheep and 1 with black wildebeest. In 3 cases a wide fence was the only partition, but in 2 cases the potential transmitter and cattle were separated by more than 500 m. From these observations it is clear that direct contact is not a prerequisite for transmission of the disease.

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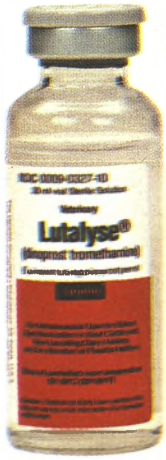

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