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Mini Review

# Perspectives of Malignant Catarrhal Fever Virus Infection: A Mini Overview

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## ABSTRACT

It is meant, in this mini-overview, to through some light and to gain broader perspectives on the complicated peculiarities of the Malignant Catarrhal Fever Virus (MCFV) disease. This takes into account its aggressive nature, mode of transmission and spread in cattle and other susceptible animal species, from the natural hosts. Absence of vaccines adds to complication of the epidemiological situation. All aspects of the disease are discussed. Such information is expected to help clinical field veterinarians, especially in developing countries, to arrive at a meaningful differential clinical diagnosis. This is particularly important as many of the serious cattle diseases, which have similar clinical picture exist in these parts of the world. So, a clue about the clinical differentiation can help in the right laboratory confirmation.


**Keywords:** Malignant catarrhal fever; Overview; Perspectives; Epidemiology; Discussion

## INTRODUCTION

MCFV is the causative agent of clinical Malignant Catarrhal Fever in cattle, pigs, deer, bison, water buffalo, Giraffidae, antelopes, banteng, elk, reindeer, gaur, greater kudu, nilgai and wapiti. Animals that develop clinical MCF are usually dead-end hosts [1-9].

Some of the laboratory animals that have been experimentally infected are rabbits, guinea-pigs, rats and Syrian hamsters [5,10].

The MCFV is present in some carrier animal species, with inapparent infections; these are wildebeest, sheep, and goats.

The causative agents of the MCF belong to the family Herpesviridae, subfamily Gammaherpesvirinae, genus Macavirus [11]. There are two major groups of MCF viruses-the Alcelaphinae/ Hippotraginae group and the Caprinae group. The two most important viruses are Alcelaphine herpesvirus 1 (AHV-1), which is endemic in wildebeest populations in Africa and worldwide where alcelaphines are kept in zoos, game farms or zoological gardens, causing wildebeest-associated MCF; and the ovine herpesvirus 2 (OHV-2), which causes sheep-associated MCF and is globally endemic in most sheep populations [2].

Both AHV-1 & SHV-2 are stable between pH 5.5 & 8.5. They are inactivated by common disinfectants including sodium hypochlorite. They are inactivated rapidly by sunlight. Cell-free virus is inactivated quickly in dry environments, however, it can survive over two weeks in humid environment. Cell-associated virus survives 72 hours outside the host.

## TRANSMISSION OF THE MCFV

The most striking features in the process of infection of the MCF is the mode of transmission of both causative viruses (AHV-1 & OHV-2). This process is almost the same for both viruses [12].

Two cycles take place in the process of transmission of these viruses; one cycle takes place within the carrier animal (natural host); the second is from the carrier animal to the susceptible (definitive) host; which is a dead-end of the transmission cycle; i.e. they do not transmit virus to other susceptible animals horizontally. This has indeed, limited the spread of the disease during outbreaks. The reason for lack of spread between MCF-susceptible animals is that these viruses replicate in a cell-associated manner in these species and cell-free virus is not produced. The reason(s) for such a phenomenon is not yet revealed.

In the wildebeest, the first cycle of transmission takes place from the carrier dams to their calves, starting from in-utero, whereby the virus is transmitted from the dam to the fetus through the blood. Some newborn virus-free calves can be infected by direct contact or aerosol routes. Transmission of AHV-1 within free-living wildebeest populations is very efficient: all wildebeest calves are infected within the first few months of life. Contamination of pastures may also contribute to transmission, as may fomites. Close contact is usually needed but transmission over one hundred meters has been reported.

The first cycle of the OHV-2 is characterized by infection of a very small proportion of lambs in-utero [2], with most lambs becoming infected perinatally, though infection may not occur in some situations till after 3 months of age by contact, potentially due to the effects of maternal antibodies. In the second cycle, infection of the definite hosts (cattle, bison, pigs, deer, bison, water buffalo, Giraffidae, antelopes, banteng, elk, reindeer, gaur, greater kudu, nilgai and wapiti) takes place.

MCF viruses, like other herpesviruses, establish lifelong, latent infections in their natural hosts.

The AHV-1 is shed by wildebeest around the time of calving. Calves shed virus in nasal and ocular secretions, mainly in the cell-free form [13,14], Contact of cattle with fetuses and placental material of calving wildebeest has been advanced as another possible mode of transmission of AHV-1 . This mode of transmission was based on the demonstration of cell-free virus in unborn fetuses and placental tissue of calving wildebeest. Lankester et al. [15] demonstrated the presence of AHV-1 viral DNA in 50 % of placentae of calving wildebeest in Tanzania. He concluded that, transmission of AHV-1 from calving wildebeest to cattle through contact with fetal and placental material may be a possible mode of infection, and the physical presence of these tissues in rangelands should be viewed as visual indicators of newborn wildebeest calves, representing a real threat of infection to cattle. Most transmission by wildebeest calves occurs at 1–2 months of age – transmission after 6 months of age is rare, due to the development of neutralizing antibodies.

The second cycle of transmission of the OHV-2, does not follow the same pattern as in the case of the AHV-1. Ewes do not shed virus in placental tissues and secretions and do not experience more frequent shedding episodes around lambing time. Factors contributing to seasonality of SA-MCF are climatic influences on virus survival and the age - related shedding patterns in lambs [12].

OHV-2 is mainly shed by the respiratory route, probably in aerosols. It is shed intermittently in nasal and ocular secretions, particularly by 6- to 9-month old lambs [16]. Close contact with sheep by susceptible species is usually required, but cases have been reported when sheep and cattle were separated by 70 meters.

## THE CLINICAL PICTURE

Both AHV-1 and OHV-2 elicit similar clinical picture in cattle and other affected animal species. However, several overlapping

clinical forms have been described in clinical manifestations of MCF infection in the different affected animal species (Table 1). Disease course may range from peracute to chronic. Distinct patterns of clinical disease have been described for MCF in cattle; peracute, head and eye, alimentary, neurological and cutaneous [2]. The head and eye form is the most common expression of disease in cattle. Typical signs include fever, inappetence, ocular and nasal discharge lesions of the buccal cavity and muzzle, diarrhoea and depression. The clinical signs depend to some extent on the species infected, the virus and how long the animal survives after the onset of clinical signs.

The span of MCF clinical signs from start to death in cattle breeds is somewhat longer in cattle than in deer, bison,buffalo and Bali cattle; many deer die within 48 hours of the first clinical signs and affected bison generally die within 3days [9]. In contrast, cattle may survive for a week or more [17]. In cattle swollen lymph nodes and severe eye lesions are more frequent, and hemorrhagic enteritis and cystitis less frequent than in deer and bison. Peripheral corneal opacity is an important clinical sign suggestive of MCF in cattle. Skin lesions (erythema, cracking, exudation, crust formation) are common in animals that do not succumb quickly. As many as 25% of cattle experience chronic disease. However, mortality rates in clinically affected animals approach 100%.

The disease in Bison [18] and deer is often peracute resulting in sudden death. Deer survive for a few days and bison usually develop hemorrhagic diarrhea, bloody urine and corneal opacity. High fever (1060-1070 F) and depression are common. Other possible signs include catarrhal inflammation; erosions and mucopurulant exudation affecting the upper respiratory, ocular and oral mucosa; swollen lymph nodes; lameness and central nervous system signs such as convulsions, aggressiveness, hypo-responsiveness and trembling. From my experience with overt clinical viral diseases of cattle, such as rinderpest, bovine ephemeral fever [19,20); Bovine Infectious Rhinotracheitis [21] Bovine Papillomatosis, [22]; Foot and Mouth Disease [23]; Bovine Viral Diarrea [24]. MCF [17] was the most severe and aggressive. We experienced the MCF during late December 1999 and late April 2000, three locally bred Friesian calves (ageing 25, 28 and 35 days) in a dairy farm, at Al-Ahsa locality of the eastern region of Saudi Arabia. The calves showed dullness and inappetence. Their rectal temperatures ranged between 41 and 41.5 degrees C. One to 2 days later and onwards, the calves showed lacrimation, nasal discharge, salivation, oedema of the head, conjunctivitis, exo-ophthalmia and corneal opacity. One calf showed diarrhoea. The superficial lymph nodes were oedematous and swollen. The calves died after 7, 5 and 8 days, respectively, following the onset of the disease (the case fatality rate was 100%). Indeed, that was the most drastic and aggressive outbreak I ever seen in cattle.

## PATHOLOGY

MCF viruses seem to be pantropic i.e. causing lesions in almost all organs of the infected animal, however, severity can vary greatly. The basic cardinal lesions are inflammation and cell necrosis; leading to involvement of almost all systems of the body: the respiratory, alimentary, or urinary mucosal epithelium; subepithelial lymphoid infiltration; generalized lymphoid proliferation and necrosis; and widespread vasculitis. Mucosal ulcerations and hemorrhage are common. Hemorrhages may be present in many parenchymatous organs, particularly lymph nodes. A classic but not pathognomonic histologic lesion is fibrinoid necrosis of small muscular arteries, but vessels of all types may be inflamed, including those in the brain. Prominent white nodules representing intramural and perivascular proliferation may be apparent, particularly in the kidneys, where raised foci are seen on the surface [25].

## DIAGNOSIS

To arrive at a diagnosis for suspected cases of MCF, the following parameters should be considered: firstly the clinical picture of the disease. This needs differentiation from clinical similar conditions such as bovine viral diarrhea/mucosal disease, rinderpest, infectious bovine rhinotracheitis, and East Coast fever (theileriosis). When there are CNS symptoms, rabies and the tickborne encephalitide should be excluded. Secondly, a history of contact with a carrier species (sheep, goats, or wildebeest) can be helpful. Thirdly, recent molecular biological techniques (e.g. PCR) [2], are the test of choice for viral DNA detection and discrimination between the different viruses. Referred tissues for testing are anti-coagulated blood, kidney, intestinal wall, lymph node, and brain.

## TREATMENT & CONTROL

The case fatality rate in MCF- infected animals ranges from 95% to 100% so the prognosis is grave.

No treatment was found beneficial. No vaccines are available.

One of the effective control strategies is to separate carriers from susceptible species When large numbers of potent shedders are present, such as in lamb feedlots. A distances > 1 km may be necessary to protect highly susceptible species such as bison [2].

## DISCUSSION AND CONCLUSIONS

Looking at the global history of the MCF virus infection, it is obvious that some conditions have shaped the epidemiology of the disease worldwide. These factors are: 1. Presence of the carrier hosts, namely, the wildebeest and sheep. 2. Presence of the susceptible hosts (domestic or wild animals). 3. Proximity of the carrier animals to the susceptible hosts. 4. Lack of vaccines 5. Lack of treatment. This

**Table 1:** Clinical observation in susceptible animals.

| Clinical & Other Observations: | ANIMAL SPECIES | | | | | | |
|---|---|---|---|---|---|---|---|
| | CATTLE | BUFFALO | BISON | DEER | PIG | GIRAFFE | ANTELOPES |
| Incubation Period. | In all susceptible species the incubation period is around 2- 4 weeks. | | | | | | |
| Clinical Signs | Clinical signs, in the susceptible species, include fever, in appetence, ocular and nasal discharge, enlarged lymph nodes, lesions of the buckle cavity and muzzle, diarrhea and depression. Nervous signs were also reported. | | | | | | |
| Case Fatality Rate. | (95 – 100)% | (95 – 100)% | (95 – 100)% | (95 – 100)% | (95 – 100)% | (95 – 100)% | (95 – 100)% |
| Diagnosis: | 1. Diagnosis of MCF depends on a combination of clinical signs, histopathology and detection of DNA in blood or tissue samples.<br>2. The World Organization for Animal Health (OIE) recognizes histopathology as the definitive diagnostic test.<br>3. Direct ELISA has been developed recently that offers a simple and inexpensive alternative to other serological tests. | | | | | | |
| Prevention: | 1. Avoiding contact of susceptible animal species, with the reservoir hosts (wildebeest, sheep & goats).<br>2. Developments in vaccines are globally, in progress. | | | | | | |

scenario has actually played a big role in the incidence and spread of the MCF virus infections, worldwide.

Presence of the wildebeests in their natural habitat in Africa, or internationally in zoos or national parks or small animal gardens, have played a great role in the incidence and spread of AHV-1 infections. However, in anyway, its incidence has been greatly hampered and limited by presence of the wildebeests in defined geographical regions. Contrarily, the sheep – associated MCF virus infection is worldwide and is not limited by geographical boundaries. So, wherever you find sheep, you may find sheep-associated MCF in susceptible hosts that come in contact with them.

In spite of the existence MCF in many parts of the world, its spread has been limited due to the following factors: 1. the aggressive nature of the MCF in cattle and other susceptible hosts that lead to 95% to 100% case fatality rate; 2. that sick animal hosts produce non–infectious cell-associated virus that prevented horizontally spread of the disease.

The economic impact of the MCF infection on cattle industry can be destructive. Dairy cattle and feedlots should be located in a safe distance from sheep or wildebeest [25]. Published data indicated that great losses were experienced with sheep-associated MCF infections in cattle and Bison [2].

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