

## Popular Article

### Foot-And-Mouth Disease: The Forgotten Zoonosis

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#### *Abstract*

Foot-and-mouth disease is considered to be a highly contagious disease among domesticated farm animals, especially ruminants. However, very little light has been shed on its zoonotic side and potential. The incidences are low, but can be of concern if the virus is given the chance to mutate. Hence, strict vigilance and measures must be taken even if a small outbreak occurs among the animal population to reduce the probability of the disease becoming a major threat to public health.

#### **Introduction**

Foot-and-mouth disease (FMD) or more commonly known in the earlier days as ‘epizootic vesicular stomatitis’, ‘apha epizootica’ or ‘vesicular murrain’ is essentially a highly infectious animal disease. Its susceptible hosts mainly consist of all cloven-footed animals. The disease is mainly characterized by fever and emergence of vesicular lesions on the epithelial surfaces. Although foot-and-mouth disease virus mainly infects animals, there have also been cases of human infections from the same virus, proved by isolation and typing. These cases are mostly from Europe, Africa and South America. The incidence is fairly low, but it can be ruled out that FMD is in fact, a zoonosis which can be of concern and should not be neglected.

#### **About the etiology**

FMD is caused by the Foot-and-Mouth Disease virus (FMDv) of the genus Aphovirus under the family Picornaviridae. Other pathogenic genera that come under this family are Enterovirus and Teschovirus causing poliomyelitis in humans and polioencephalomyelitis in pigs respectively.

The Picornaviridae family consists of viruses which are non-enveloped, of positive sense single stranded RNA genome encased in an icosahedral capsid of approximately 30 nm in diameter. Images from X-ray crystallography and electron micrographs suggest that the virion is smooth and round in appearance. Most of the virions of the family consists of 60 copies each of four major structural proteins namely VP1, VP2, VP3 and VP4.

Seven serotypes of the FMDv- O, A, C, SAT 1, SAT 2, SAT 3 and Asia 1 have been identified yet through rigorous serological and cross-protection testing. All the serotypes are antigenically distinct. The most common serotype to be isolated from the human cases is O (Pan Asia serotype), followed by C and A. However there have been many suspected cases of FMD which were confused as hand, foot and mouth disease which is relatively a mild disease caused mainly by Coxsackie A16 viruses. They were and are still confused sometimes with vesicular stomatitis (caused by a Rhabdovirus) and herpes simplex virus infections. The incubation period of the virus in most humans is found to be 2-6 days. The virus particles can stay viable for a long time in fresh, partially cooked meat and unpasteurized milk and its products.

### **A view from the historical standpoint**

History has suggested many suspected and confirmed cases of FMD infections in humans. However, the reports of such cases before 1897, i.e., the year of discovery of FMDv were not confirmed by isolation or serological testing. The timeline goes as follows:

- 1695: The earliest recorded and suspected case of FMD in man was given by Valentini in Germany.
- 1834: Three veterinarians deliberately infected themselves with suspected FMD by drinking raw contaminated milk from infected cows.
- 1838: In Germany, there was an FMD epidemic amongst the cattle population in which many people were also suspected to be affected with the same.
- 1872: According to an account by William T. Briscoe in the British Medical Journal for October, a young woman was affected with FMD. She worked closely with infected cows and had consumed their milk.
- 1896: In Switzerland, two suspected FMD cases were recorded in children, aged fourteen and ten in which the clinical lesions were the same as that of FMD in animals.
- 1961: A human case of FMD was recorded in Chile.
- 1967: In the outbreak of FMD in the United Kingdom, a farm worker's tissue sample was found to be positive for FMD. He also had clinical manifestations

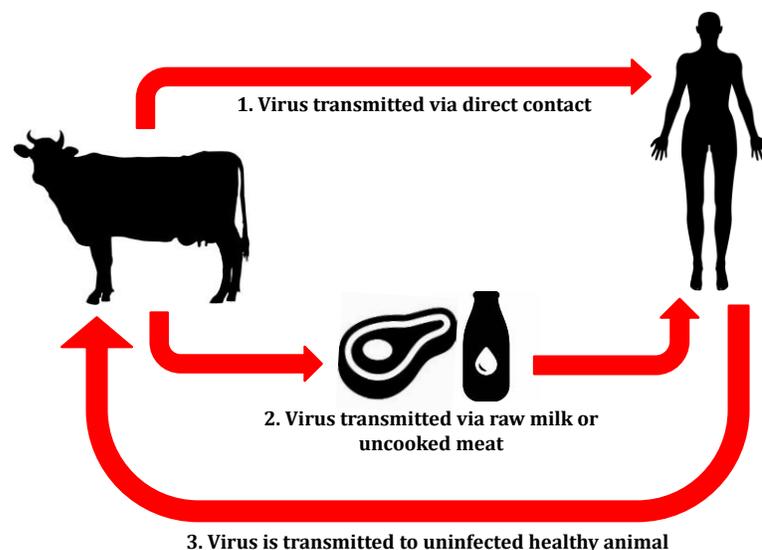
of the same.

- 1969: A report documented an asymptomatic case of FMD in man.

Since the first documented case, there have been more than 40 confirmed human cases with clinical manifestations of FMD till date. With respect to other zoonoses, though the cases are comparatively low, it has the potential to be a serious issue to global health. The 2001 outbreak of FMD in the United Kingdom was caused by a strain much virulent than the 1967 one, providing the possibility of occurrence of mutations that would enable the virus to jump the species barrier.

## Transmission

FMD is a highly contagious disease and spread occurs by direct contact with infected animals. Such infected animals shed the virus in their nasal secretions, saliva, milk, faeces, urine and semen. Cattle are mainly the indicator hosts while infected pigs are the amplifier hosts. Pigs shed the virus 3000 times more than cattle. Sheep and goats are classified as maintenance hosts. Farm personnel can also spread the virus within and between farms. Contaminated feed and fomites also play a major role in the transmission. The confirmed cases of FMD in man are found to be mainly due to direct contact with infected animals. The virus can enter the person by abraded skin or oral and nasal mucosa. Person-to-person transmission has not been reported yet. Infection from animal to human mainly occurs by the consumption of contaminated raw milk, milk products and meat which is uncooked. Apart from the ones mentioned, rodents and flies can also act as vectors of the disease. Laboratory personnel can also get the infection if they are not careful while handling of the virus.



**Fig 1: Transmission of Foot-and-Mouth disease from animal to man and vice-versa.**

Studies show that the virus can survive in the nasal cavities of the human for 28 hours after direct exposure to infected animals. Another study demonstrated that the virus showed low rates of survival after 16-22 hours after direct contact with infected animals. However, there was the expected chance of a longer survival time if the ventilation was shut down. All the studies conducted and the information known suggests us that farm personnel, veterinarians, and farm attendants are at a high risk of contracting a possible FMDv infection.

### **Clinical signs and lesions**

As the name of the disease suggests, the prominent clinical signs and lesions mainly involve the oral mucosa and feet. In domestic farm animals, vesicles are formed in the oral mucosa of tongue, lips, cheeks, gums; teats and cleft of the foot. These rupture later on leaving ulcers and sores very painful for the animal. High fever (104oF-106oF), depression and anorexia are also observed. The clinical signs and lesions found in the documented cases of FMD in human also correlate to the animal cases. The signs in the symptomatic cases which were reported are:

- High fever and anorexia
- Conjunctivitis
- Dry tongue
- Inflamed condition of the nasal and oral mucous membranes
- Pinkish papules on the face, neck, and anterior forearm regions
- Blisters and ulcers on the oral mucosa and tongue accompanied by severe pain of the mouth
- Excessive salivation
- Pharyngitis
- Tachycardia

The clinical signs and lesions listed above in humans are generally mild and recovery usually took within a week. No human who has contracted an FMDv infection and has died have been reported yet.

### **Diagnosis**

There are many diagnostic methods that are used to diagnose FMD. All of those methods can be used to diagnose FMD both in animals and humans. Complement fixation test (CFT) and sandwich ELISA are used to detect the FMDv serotype specific antigen. Liquid phase blocking ELISA and virus neutralization test (VNT) are used to detect the FMDv serotype specific antibody. However, the antibodies produced by infected and vaccinated (by current vaccines against FMD) animals are almost similar to each other. Present methods rely on detection of

antibodies to non-structural proteins (NSPs) for differentiation between virus infected, carrier and vaccinated animals. Consecutively, the virus can also be isolated in cell lines like BHK-21 (baby hamster kidney), IBRS-2 (pig kidney) and in primary bovine (calf) thyroid cell monolayer. Isolation is also done in suckling mice and guinea pigs by intraperitoneal inoculation and intradermal inoculation of clinical material respectively. Molecular diagnostic methods include real time and reverse transcriptase polymerase chain reactions (PCR).

## **Prevention and control**

Vaccines for animals are available but the currently available ones only provide temporary protection and vaccinated animals can still be carriers of the virus and shed it without showing any clinical signs.

The persons who are in direct contact with those animals should remain extremely cautious during an outbreak. The use of Biosafety level 2 (BSL-2) practices and equipment in laboratories should be promoted. Some of the measures that should be maintained to ensure that

### **FMD does not spread to humans are**

- Regular vaccination of the animals.
- Consumption of unpasteurized milk and milk products from infected animals should be avoided.
- Consumption of unprocessed and partially cooked meat should be avoided.
- During the examinations of FMD vesicles in animals, gloves should be used at all times.
- Disinfection of any equipment, clothing or vehicle that enters or exits the farm premises.
- Carcasses should be disposed off scientifically either by incineration or deep burial method.
- Avoiding visits to farms in areas affected with FMD.

Many FMD affected areas in the world are still underdeveloped. The farmers and farm attendants usually lack proper knowledge about biosafety measures and mitigation of animal diseases. Hence, apart from the measures mentioned above, education regarding animal and human health imparted to the people involved in the farm should be given the most primary measure.

## **Conclusion**

There has not been a human case of FMD being reported for a few years now. But it should be taken into consideration that FMD is highly contagious and has spread to humans with clinical manifestations in some instances before, and therefore, it can be said that FMD is in fact, a zoonotic disease which has now been forgotten and neglected. Hence, all positive cases of FMD in animal should be taken seriously. Although the documented cases of FMD in humans are low, there is

still the risk of contracting the infection. The FMDv, being an RNA virus has the possibility and potential to rapidly mutate, jumping the species barrier to emerge as a major threat to public health. Concern has also been raised for the same. Proper biosafety measures and preparedness are the only keys to make sure that this economically catastrophic and potentially dangerous viral disease does not affect the human species again.

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