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Atypical outbreak of foot and mouth disease in a dairy farm

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Abstract
An atypical outbreak of Foot and Mouth Disease (FMD) with absence of fever and foot lesions and mortality of 6 adult cows was encountered in a dairy farm. Besides the oral lesions, the clinical signs namely anorexia, multifocal bilateral dermatitis of neck region, ropy salivation with smacking noise and erosions around the vulval lips of the cows were observed in ten milch animals, of the farm. The Post-mortem findings were pneumonia, hepatic necrosis, enteritis and interstitial nephritis. The screened virology samples were positive for "serotype 'O' of FMD virus in the test carried out by Reverse Transcription-multiplex Polymerase Chain Reaction (RT-mPCR) and Enzyme-linked Immunosorbent Assay (ELISA) but were found to be negative for the viral genomes of Malignant Catarrhal Fever (MCF), Infectious Bovine Rhinotracheitis (IBR) and Bovine Viral Diarrhoea (BVD) by PCR. The histopathological findings were pneumonia, hepatic necrosis, cholangitis, enteritis, lymphocytic depletion of spleen, interstitial nephritis, myocardial hemorrhages, necrotic tracheitis, acute necrotic suppurative glossitis, necrotic suppurative dermatitis and vulvitis. In the bacteriological samples no pathogenic organisms could be detected. The toxicological samples were negative for pesticides like Organochlorine, Organophosphorus, Organocarbamates, Pyrethroids compounds and Nitrite poisoning and no significant level of mycotoxins could be detected. The outbreak was contained by carrying out ring vaccination for FMD.

Keywords: Atypical FMD, dermatitis, vulvitis, serotype 'O', histopathology

Introduction
The FMD virus belongs to the family Picornaviridae and genus Aphthovirus. FMD is an acute and highly contagious disease of cloven-hoofed animals characterized by fever, lameness and vesicular lesions of the feet, tongue, snout and teats. The debilitating effects due to such lesions, rather than mortality, are responsible for the severe productivity and economic losses associated with FMD. This makes FMD's status as the most important disease in limiting trade of animals and animal products throughout the world. The earliest recognition of the clinical entity of FMD is generally credited to (Fracastorius, 1546) [5] however, the first step towards understanding the pathogenesis of FMD was by (Loeffler and Frosch, 1987) [6] with their landmark demonstration that the disease was caused by a filterable agent. The natural infection of cattle and sheep occurs via the respiratory route by aerosolized virus (Donaldson *et al.*, 1987) [4], whereas pigs are more commonly infected by consumption of virus-contaminated food or through skin lesions while in contact with infected animals or their secretions (Alexandersen *et al.*, 2003a) [2]. Although airborne dissemination of FMDV by infectious aerosols is often implicated, the contributory roles of humans, wildlife and waterborne spread are often not easily discerned. Since FMD is an important determinant in international trade of livestock products, many resources are dedicated to surveillance, control and eradication of this disease. Such efforts in many areas of the world had resulted in the successful eradication or control of the disease. In this case study, the diagnosis of an atypical form of FMD and its prevention is discussed.

Materials and Methods

In a dairy farm, at Uthukuli taluk, comprising of ten milch animals and two calves an outbreak of FMD occurred and the morbidity of the disease condition was found to be 100% and the mortality rate reached 60%. It was reported that the owner was reluctant to the administration of vaccinations in the milch animals, previously. All those ailing animals were treated with antibiotics, antihistamines, proton pump inhibitor, intravenous fluids and liver supplements by the local Veterinarian with little improvement. A disease investigation was undertaken and the antibiotic Ceftiofur sodium was prescribed in addition to other previous drugs. The ten milch animals and two calves in the farm were reported to have skin eruptions in the neck region, glossitis and salivation and subsequently five cross breed Holstein Friesian (CBHF) cows had died within ten days after showing the clinical signs. The remaining ailing animals in the dairy farm on the day of disease investigation were two CBHF of 5 ½ years old and 4 ½ years old, one Cross Breed Jersey (CBJ) cow of 7 years old, two female buffaloes of 5 and 7 years old, one five-month-old CBJ calf and one 7-month-old buffalo calf. The CBHF cow of 5 ½ years old, brown skin coat with white patches, that had recently calved, was found on recumbency and died the next day. Post-mortem examination was conducted four hours after its death. The samples were collected for histopathology (skin, vulval lesions, tongue, lymph node, lung, liver, spleen kidney and heart), virology (vulval, nasal and oral swabs, whole blood and tissue samples of skin, vulva, tongue, lymph node, lung, liver, spleen kidney and heart on ice), bacteriology (heart and lung swab, peripheral blood smear and tissue samples of skin, vulva, tongue, lymphnode, lung, liver, spleen kidney and heart on ice) and toxicology (concentrate feed, cotton seed oil cake, maize floor & bajra green fodder) were sent to the Central University Laboratory, Chennai. The samples for the FMD investigation were sent to the ICAR-Directorate of Foot and Mouth Disease, International Centre of Foot and Mouth Disease, Arugul, Jatni, Bhubaneswar-752050, District Khorda, Odisha (India) and results were obtained from both the laboratories.

Results and Discussion

The clinical signs and lesions observed in the affected cows were ropy salivation with smacking noise, mucopurulent nasal discharge, erosion with yellow thick flaky adhesion at the dorsal surface of the tongue, ulcers and erosions around the vulval lips, ulcers in the tail superimposing the vulval area in the two CBHF cows, multifocal skin eruptions of 1-2 mm diameter intermingled with diffused hyperaemic abrasion of skin on either side of the neck region including the CBJ calf and congested conjunctival mucous membrane. The ailing animals also showed anorexia, voiding of scanty dung and urine. There was no fever or foot lesions.

The post-mortem findings were as follows, the external appearance of the carcass revealed bloat, debilitation and presence of rigor mortis. The buccal cavity was congested, echymotic and had ulcers. Tongue's dorsal surface was eroded and diphtheritic membrane noticed. Lateral side revealed ecchymosis. In the nasal orifice mucopurulent discharge was noticed with congestion of nasal mucosa and the mucous membranes of the conjunctiva were congested. Decubitus wound lesions were found in the thigh region and other pressure points due to three days of recumbency. Neck region showed dermatitis bilaterally and diffused peeling of skin in some area. The epicardial petechiae was seen multifocally on the ventricles. The heart chambers contained clotted blood. In the trachea mucopurulent discharge was noticed at the bifurcation of the bronchi and bronchioles. The apical and cardiac lobes of the lungs were severely hemorrhagic and the cut pieces from that portion sunk in water indicating consolidations. Caudal lobes were edematous and mildly hemorrhagic and cut pieces floated on water. Cut sections revealed frothy serosanguineous exudate. The liver was enlarged, pale yellow with infarctions and one predominant focal red infarct at the periphery. The gall bladder was distended with 700ml thick dark yellowish green bile and the spleen was congested. The kidneys revealed pale infarction on the cortex and medullary congestion. Oesophageal serosa was congested. The rumen contained about 75 litres of digested ingesta. Besides ingesta, no abnormalities were noticed in the other fore stomach. The small intestine showed scanty catarrh mixed ingesta and mucosa was congested with haemorrhages at some foci. In the vulva and perineum region multifocal scabs were noticed. On rubbing such areas hyperemia observed underneath. The Post-mortem finding were suggestive of viral Pneumonia, hepatic necrosis, enteritis and interstitial nephritis.

The virology samples were positive for "serotype 'O' of FMDV by RT-mPCR and ELISA and were negative for the viral genomes of MCF, IBR and BVD by PCR. The histopathological findings were enteritis, hepatic necrosis, cholangitis, lymphocytic depletion of spleen, myocardial haemorrhagic foci in heart, pneumonia, interstitial nephritis, multifocal necrosis in tracheal mucosa, acute necrotic suppurative glossitis, necrotic suppurative dermatitis and vulvitis. In the bacteriological samples no pathogenic organisms could be detected. The toxicological samples were negative for pesticides like Organochlorine, Organophosphorus, Organocarbamates and Pyrethroids compounds. Besides there were no significant level of aflatoxin B1, B2, G1 & G2, Citrinin, Ochratoxin A and T2 mycotoxin were detected. The fodder samples collected from the dairy farm were negative for Nitrite poisoning.

FMD is one of the most important livestock diseases in terms of economic significance and leads to severe production losses in Indian dairy farming. The serotype 'O' confirmed in this investigation is a prevalent one in India and also reported in neighbouring countries like Pakistan and Egypt by (Abd-Ellatieff *et al.*, 2021) [1] and its genome had been sequenced by (Stenfeldt *et al.*, 2022) [9]. In the area where this investigation was carried out, FMD vaccination is administered twice a year; but the unwillingness of the dairy farmer to vaccinate his livestock had resulted in a huge loss with a mortality of 60%. Almost all cases of outbreaks investigated in India involving serotype 'O' have been due to low level of protective antibodies in the animals. The FMD vaccination had been able to substantially reduce the circulation of serotype 'O' virus in regularly vaccinated areas. The economic loss due to an outbreak in that area would have been a greater risk, if the control measures were not implemented, as the virus travels over extensive distances to cause incursions at previously virus-free premises (Alexandersen *et al.*, 2003b) [3]. The histopathological findings concurred with the findings of (Alexandersen *et al.*, 2003b) [3] for the heart and with (Singh *et al.*, 2008) [8] for the changes in the mucosal epithelium. Although a thorough laboratory investigation and molecular studies namely virology, bacteriology, toxicology and pathology, were carried out, no other concurrent pathogen or toxin along with the pathogenetic effect of FMD virus that could have led to

such severe mortality rate and dermatitis could be found. In the pathogenesis of FMDV discussed by (Rajan *et al.*, 2016) [7] the virus enters the host directly through inspiration, ingestion or through cuts or abrasions on the skin and after its major replication in the pharyngeal region, becomes viraemic and reaches the secondary replication sites, especially the skin including the feet and mammary gland and the epithelia of the tongue and mouth, where the main viral amplification occurs. But in this atypical outbreak of FMD there was only oral lesions and dermatitis in the neck and vulva without the involvement of hooves in all the cows.

Conclusion

Cure, prevention and eradication are the ultimate goals of the study of any disease. The movement of infected animals and vaccination are the most important factors in preventing the spread of FMD within the endemically infected regions of the world. This case report shows the importance of vaccination and the incidence of an atypical FMD which showed lesions that were suggestive of many other viral diseases like BVD, MCF and IBR that affects the oronasal region but were latter ruled out and confirmed as FMD by laboratory reports although there was absence of foot lesions. Ring vaccination against FMD was then carried out in the adjoining areas of FMD reported farm and an imminent outbreak was effectively controlled. This shows that where eradication is not feasible, vaccination of high-producing livestock is highly essential and warranted. The consequences of variable impact due to the unvaccinated animals and the risk of atypical FMD lesions should be considered in future planning of FMD disease control.

Conflict of Interest

Not available

Financial Support

Not available

Reference

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