CASE REPORT

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Atypical foot and mouth disease (FMD) in a Holstein Friesian cow in Kubau, Kaduna State, Nigeria

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Abstract

Foot and mouth disease (FMD) remains a critical threat to livestock economies worldwide, including Africa. This report documents an atypical case of FMD in Holstein Friesian cattle, in which four animals suddenly died overnight in an intensive dairy farm located at the Kubau Local Government Area of Kaduna State, Nigeria. Post-mortem examination revealed bloody nasal and oral discharges from the carcases. Based on this post-mortem observation, anthrax was suspected, which limited the clinicians from collecting more samples. Lameness and anorexia with reduced milk production were also observed in other animals from the shed and herd where the dead animals were identified. The bloody oral and nasal discharges were sampled for laboratory analysis. Gram staining of samples revealed a gram-positive rod, while a more specific confirmatory diagnosis for *Bacillus anthracis* performed using reverse transcriptase polymerase chain reaction (RT-PCR) turned out negative. Further laboratory analysis using real-time reverse transcriptase polymerase chain reaction (rRt-PCR) produced positive result for FMD. This finding presents an unusual FMD disease, and reveals challenges in controlling FMD outbreaks and the potential impacts on the dairy industry in Nigeria. This case underscores the importance of strict biosecurity measures, routine surveillance, rapid diagnosis and timely implementation of appropriate control measures to prevent FMD outbreaks in livestock farms.

Keywords: Cattle, Dairy, Foot and Mouth Disease, Kaduna State, Real Time PCR

Introduction

Foot and mouth disease (FMD) is endemic in Nigeria and many regions of the world (Ehizibolo *et al.,* 2020). It is one of the most economically devastating viral disease affecting wildlife and livestock, particularly cloven-hoofed animals such as cattle, sheep, pigs and goats (Knight-Jones & Rushton, 2013). Outbreaks of FMD are common among the pastoralist herders who practice free and open grazing system with no movement restriction, vaccination and any form of biosecurity (Ularamu *et al.,* 2020). FMD is caused by the Foot and Mouth Disease Virus (FMDV), an *Aphthovirus* in the *Picornaviridae* family. The FMDV has seven antigenically different groups of serotypes (O, A, C, Asia 1, SAT 1, SAT 2, and SAT 3) which do not cross protect immunologically. The clinical presentation of FMD typically includes fever, lameness, excessive salivation, and vesicular lesions on the mouth, feet, and teats (WOAH, 2022). However, the disease can exhibit atypical manifestations in naive exotic breeds such as Holstein Friesians, which are less adapted to local conditions, and when subjected to high-stress situations, or when complicated by secondary infections. Such presentations pose diagnostic challenges, as they may overlap with other bacterial and high-priority viral diseases (Lyons *et al.,* 2015).

FMD remains a major obstacle to the sustainable development of Nigeria's livestock sector which contributes significantly to the agricultural GDP (Ehizibolo *et al.,* 2020; Ularamu *et al.,* 2020). The loss of productivity, combined with reduced trade opportunities due to the country's FMD-endemic status, hampers the growth of the dairy industry. Outbreaks result in reduced milk production due to the systemic effects of the disease, particularly in rural communities and small holder farmers that depend on milk as a primary source of protein and income (Madin, 2011). Nigeria is known to harbour multiple FMDV serotypes, contributing to the complexity of FMD control (Ularamu *et al*., 2020). The predominant serotypes identified in outbreaks include O, A, SAT 1, and SAT 2. However, other topotypes and strains or serotypes from other regions have also been reported in circulation in Nigeria; this is often associated with specific risk factors such as seasonal livestock movements, limited biosecurity measures and porous borders which allow movement of livestock from neighbouring countries into Nigeria, thus posing additional challenges for vaccine formulation and efficacy (Ularamu *et al.,* 2016). The atypical presentation of this disease in this report presents several important factors, including the challenges of managing FMD in high-value dairy farms and the need for routine surveillance and biosecurity. This outbreak underscores the complexity of FMD in imported livestock breeds, particularly in endemic regions where continuous exposure to the virus may influence disease dynamics.

Case Report

Case history and presentation

A suspected case of FMD in cattle was reported by a farm staff, when four exotic breed of cattle aged between 10 and 18 months suddenly died and three other sick ones manifested lameness, and decreased milk production. The farm is located on a piece of land that was formerly used as a grazing reserve in Kubau LGA Kaduna State, Nigeria. As at the time of visit, the farmer had 358 cattle raised on intensive system of farming. The farmer was planning to vaccinate against FMD and anthrax before the occurrence of the disease.

During the visit, clinical signs including sudden death were observed. The carcases of four cattle that died suddenly were seen with bloody nasal and oral discharges (Plate I). Other clinical signs including lameness, anorexia, fever (ranging from 39.5℃ - 40.5℃), and decreased milk production were observed in the sick animals. Given the sudden death and the presence of haemorrhagic nasal discharge (Plate II) from one of the dead animals, anthrax was suspected and anthrax-specific containment measures were implemented, including increased biosecurity, disinfection, and access restriction.

Laboratory investigation

Having suspected anthrax, appropriate PPEs were used for the collection of samples. Samples including postmortem blood sample (in EDTA containers) were collected aseptically from the ear vein and Gram staining routinely performed on the blood smear revealed the presence of Gram positive rod-shaped bacterium, which could be *Bacillus anthracis* since the organism is a Gram-positive, spore forming, rod-shaped bacterium. Sera and oral swabs, and other body secretions were also aseptically collected from the dead and clinically sick cattle for ELISA and PCR. All samples were transported in a cold chain to the National Veterinary Research Institute, Vom, where they were analysed.

To confirm the validity of the Gram staining result, an Anthrax specific Multiplex polymerase chain reaction (PCR) test was carried out using *Bacillus anthracis* specific primers (Ogawa *et al.,* 2015), but the test returned negative for *Bacillus anthracis*.

Confirmation of FMD

The negative PCR result for *Bacillus anthracis* and the report of sick cows exhibiting significant lameness, anorexia, with temperatures of between 39.5℃ and 40.5℃, and decreased milk output, led to further diagnostic investigations to determine the cause of the disease outbreak. Thus, FMD was suspected, and the diagnosis was considered. A Real-time reverse transcription polymerase chain reaction (RT-PCR) using FMDV-specific primers and probes (Callahan *et al.,* 2002; WOAH, 2022) confirmed the presence of the virus (Figure 1).

Plate I: Carcass of a typical FMD in Holstein Friesian cattle

Management

Following the confirmation of the diagnosis, the clinically sick animals were identified, quarantined in a separate pen, and a broad-spectrum antibiotic (procaine penicillin injection at 4mg/Kg for 5 days) by intramuscularly to take care of possible bacterial infections. The farmer was advised to vaccinate the whole herd for FMD and anthrax when the animals are fully recovered from clinical disease. Enhanced biosecurity measures, sanitation and disinfection with 1% Virkon® every day for one week were implemented on the farm.

Plate II: Bloody nasal discharges from the carcass of a Holstein Friesian cattle with a typical FMD

Discussion

The outbreak of FMD in this exotic breed of cattle underscores the complexity of managing highly contagious diseases in high-value dairy operations, especially when the clinical presentation is atypical and mortality occurs. Although death in naive adult animals infected with FMD is uncommon. However, when it does occur, it is usually attributed to complications such as secondary bacterial infection (Rahman *et al*., 2025) as well as the severe systemic effects of the viral infection, particularly in highly susceptible naive breeds like Holstein Friesians, which are less adapted to the local environment and disease pressures. Holstein Friesians, being exotic to Nigeria, are more susceptible to stress-induced immunosuppression, which can exacerbate the effects of infections like FMD. Implementing appropriate control measures for FMD was delayed due to the initial suspicion of anthrax as the cause of the mortality, which is endemic in many regions of Nigeria. Due to differential symptoms, the disease characterization can sometimes resemble or overlap with severe cases of other infectious diseases, such as FMD (Lyons *et al.,* 2015). This initial misdiagnosis illustrates challenges faced with the diagnosis of diseases, which hampers the early implementation of FMD-specific interventions; this allowed the virus to spread and cause more severe infections, leading to mortalities. The report from farm staff that three sick animals among the herd had manifested clinical signs, including lameness, anorexia, fever (ranging from 39.5℃ - 40.5℃), and decreased milk production, which were suggestive of FMD, led to the consideration of the laboratory analysis, which confirmed FMD virus as the cause of the outbreak. Possible secondary bacterial infections might have contributed to the sudden deaths and the bleeding observed in this outbreak. Although Gram-positive

rod-shaped bacteria were demonstrated from the blood smear; bacterial infections might have also contributed to the clinical outlook of the disease, but the organism was not elucidated. This outbreak highlights several critical lessons for managing infectious diseases in dairy farms, especially for diseases with overlapping symptoms.

The severe economic impact due to reduction in milk yield, loss of exotic animals and the costs associated with managing the outbreak, including emergency vaccinations, diagnostic testing, carcass disposal, and enhanced biosecurity, represents a significant financial loss.

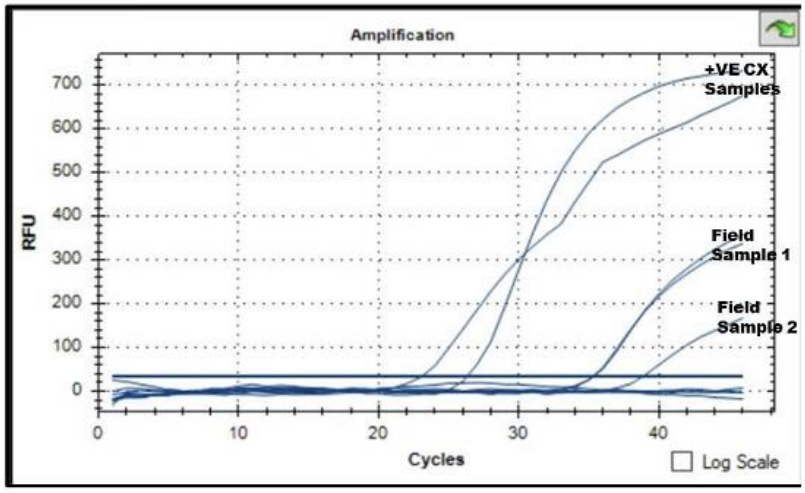

Figure 1: Real-time PCR for FMD showing the sigmoid curve for the positive control and field samples 1 and 2 collected from the sick and carcass of a Holstein Friesian cattle with atypical FMD

Standardized rapid diagnostic kits are essential to ensure timely diagnosis and the deployment of appropriate treatment and containment strategies. Comprehensive disease surveillance should be implemented routinely, particularly in farms with imported livestock, to detect early signs of infectious diseases like FMD. Vaccination remains the cornerstone of FMD prevention and is crucial, particularly in endemic regions. Emergency vaccination campaigns, while necessary during outbreaks, are insufficient substitutes for routine vaccination and other ongoing preventive measures. Enhanced biosecurity is paramount, particularly for imported high-value breeds like Holstein Friesians, which are more vulnerable to endemic diseases.

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