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Scientific Report

An uncommon clinical form of foot-and-mouth disease in beef cattle presented with cornual skin lesions

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Summary

Foot-and-mouth disease (FMD) is a major infectious disease in livestock. The common clinical signs in cattle include epidermal vesicles that are majorly distributed around oronasal cavity, feet and teats. The aim of this report is to document an uncommon clinical form of the disease which comprises the occurrence of classic vesicular lesion in a rarely observed location of the horn vegetative tissue. During Iran's outbreak of FMD in 2013, field investigation, clinical examination and sampling from the affected herds in Qom province were performed. Specimens of mouth epithelium and horn vegetative tissue were collected for virology and histopathologic study. All the samples collected from horns were positive for foot-and-mouth disease virus (FMDV) in both enzyme linked immunosorbent assay (ELISA) and polymerase chain reaction (PCR) tests, and the strain of the virus was identified as A05. Surprisingly, all the animals with horn lesion came from beef herds, were less than 12 months old and had more severe signs of the systemic disease. Since the same strain of virus did not cause similar lesions in surrounding dairy cows, it was concluded that occurrence of horn lesions may be more associated with host factors rather than virus strain.

Key words: Cattle, FMD, Horn lesion

Introduction

Foot-and-mouth disease (FMD) is an acute, highly contagious viral disease of cloven-hoofed livestock, characterized by vesicular lesions, erosions, and ulcers in the mouth and inter-digital areas and on the muzzle, teats, and coronary band (Smith, 2015). Although initial replication happens in lymphatics, a great part of the viral amplification occurs within the cornified stratified squamous epithelia of the skin (including the feet and mammary gland) and mouth (including the tongue), or in the myocardium of young animals (Alexandersen *et al.*, 2003).

The present report documents another clinical form of the disease which comprises occurrences of classic vesicular/erosive lesions at the uncommon location of the horn corneum layer during Iran's outbreak of FMD in 2013.

Materials and Methods

In August 2013, outbreak of a disease with vesicular lesions in mouth, was reported to Iran Veterinary Organization (IVO). It occurred in a husbandry complex in Qom province, including 223 active units. Most of the units were beef herds and only about 10% of units were dairy herds (27 herds). Overall, 92 beef herds (46% of beef herds) and 8 dairy herds (29% of dairy herds) were

affected by foot-and-mouth disease virus (FMDV) (totally 100 herds). The average number of cows in beef and dairy herds were 35 and 25, respectively. The average age of cows was 9 months and 3 years in beef and dairy herds, respectively (Table 1).

Table 1: The average size and age of the affected herds

Involved herds	Number of herds	Average number of cows	Average age
Beef herds	92	35	9 months
Dairy herds	8	24	3 years

Sampling

A total of 15 biopsy samples of the mouth epithelium and the corneum vegetative tissue of the horn lesions, were collected and sent to Central Veterinary Laboratory (CVL) (Tehran, Iran) for enzyme linked immunosorbent assay (ELISA) and reverse transcription polymerase chain reaction (RT-PCR) test to detect the suspected agent. In addition, 3 samples of vegetative tissues of horn were submitted for histopathology to the CVL and Razi Institute.

Laboratory tests

The Indirect-Sandwich-ELISA (IZSLER, Italy) on biopsy samples, was conducted in laboratory and subsequently RT-PCR was performed on ELISA positive samples for confirmation and typing of the strain of the causative organism. Universal primer (P32:P33) was

used in RT-PCR for the detection of FMD virus (Kadir and Ahmed, 2014).

Results

The lesions were seen in mouth, hoof, teat and horn in the visited herds (Figs. 1-5). The existence of lesion in affected herds, in mouth, hoof, and horn was 100%, 74%, and 36%, respectively. The existence of these lesions in affected animals was 100%, 61%, and 10%, respectively (Table 2). All horn lesions were recorded in beef cows with severe clinical disease. The other clinical signs included fever (mean= 40°C), inappetence to anorexia, decrease in ruminal movement, excessive salivation, drop in milk yield, dyspnea, tachypnea, and groaning. Heifers and young beef cattle (less than 12 months) were affected most severely, with incidence of heart failure in some cases. All the mortalities were young and less than 10 months, with visible necrotic myocardial lesions (Fig. 6).

The horn lesions were located in the base of the horn, and involved vegetative tissue resulting in separation of the horn in some cases. Ruptured vesicle, erosion, necrosis, and partial to total desquamation of the

corneum sheet were found in corneal lesions (Figs. 4-5). Histopathology findings showed infiltration of inflammatory cells in lamina propria of corneal tissue (Fig. 7).

All samples from mouth and corneum were positive in ELISA and PCR tests, and the strain of the virus was A05.



Fig. 3: Several vesicles and inflammation of the teat in 2 years old cow



Fig. 1: Lesions in mouth, including ruptured vesicles and necrotic membrane in hard palate



Fig. 4: 12 month old bull with ruptured vesicle of FMD in base of right horn



Fig. 2: Severe lesions at the skin-hoof junctions of an 8 months beef cattle



Fig. 5: Separation of horn tissue in a case of FMD

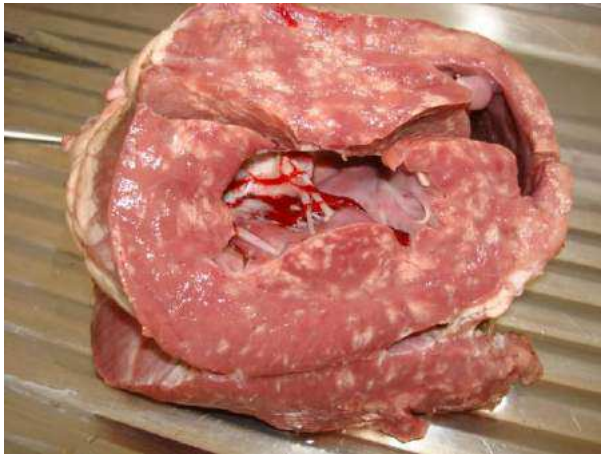


Fig. 6: Pale streaks in the ventricle of a 5 months old beef cattle

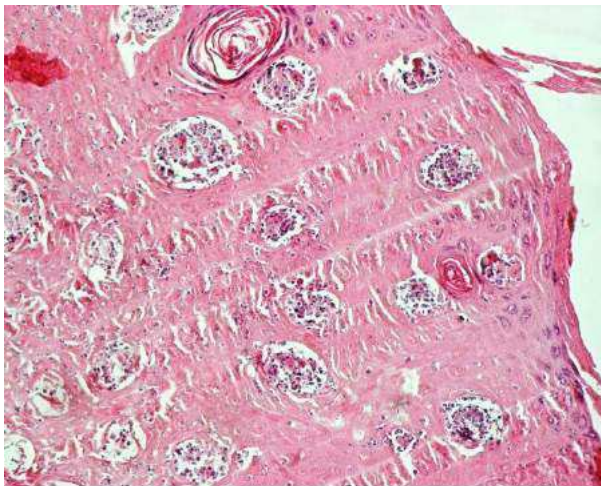


Fig. 7: Inflammation (infiltration of inflammatory cells) in tissue sampled from base of horn

Table 2: The existence of lesions in affected herds and animals

Lesions		Numb	Percent
Mouth lesion	Herd	20	100
	Cow	620	100
Hoof lesion	Herd	15	76
	Cow	378	61
Horn lesion	Herd	7	36
	Cow	62	10

Discussion

The typical clinical signs in different studies include high temperature, excessive salivation, formation of vesicles on the oral mucosa, nose as well as inter-digital

spaces and coronary bands on the feet (Kitching, 2002; Jamal and Belsham, 2013). In present report the same lesions were also observed. Very severe lesions were detected in tongue. In dairy herds, vesicles were detected in teats and caused a significant drop in milk yield. The severity of the clinical disease and mortality in dairy herds were significantly lower than beef herds. Same results have been previously recorded in different studies (Arzt *et al.*, 2011).

We observed lesions associated with FMD on the base of the horn, resulting in separation of horn vegetative tissue from the epithelium of the horn base. Surprisingly, the animals with horn lesion all came from beef herds that were less than 12 months old and had more severe form of disease. The mortality, cost and duration of therapy was considered to be higher in this group, hence higher economic losses. Same strain of virus (A05) was isolated from older animals of the same population but without any horn lesions and also from the surrounding dairy farms with stricter preventive program where no animal was presented with horn lesions. Consequently, it was concluded that occurrence of horn lesions may be more associated to host factors such as age, lack of proper immunization or management practices such as dehorning procedures among beef herds which leaves a susceptible actively growing vegetative tissue for virus invasion. Although specific affinity of A05 strain of FMDV to fast growing horn tissue in juvenile bovines was not shown in this study, a possible tendency may be speculated. Further investigation would be warranted if repeated cases are reported to control additional economic losses.

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