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Foot and Mouth Disease in Egypt

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Abstract

Foot and mouth disease (FMD), one of the widest spread diseases affecting cloven-footed animals, which has detrimental effects on meat and milk production. The disease has been reported in Egypt over the last 50 years. The first detection of the disease was in 1950 when strain SAT2 caused an outbreak. The most sever outbreak in Egypt took place in February 1987. Buffaloes are the main native domesticated animals in Egypt so that it play major role as a reservoir for FMDV; buffalo keep the virus in the oro-pharyngeal region for more than 2 years. Foot and Mouth disease host is mainly animals, transmitted directly between animals, therefore, vector is not present. The reservoir hosts are present in the endemic areas. Zoonotic importance of FMD does not investigated in large scale, because the disease in man is self-limiting.

Introduction

Foot and Mouth Disease (FMD) were discovered in 1897 (by Loeffler & Frosch) (1). FMD is the highly contagious viral disease of cloven-hoofed animals caused by Foot and Mouth Disease virus (FMDV). Ruminants mainly cattle, sheep, goats, pigs are the most susceptible while other ruminants like camels, deer, and elephants are susceptible to infection but with lesser severity (2). FMDV core contain non enveloped, single strand of positive sense RNA of 7500 nucleotides surrounded by a capsid. The FMD virion and its capsid are manufactured in the cytoplasm of the infected animal's cells. FMD virus is considered small virus of 23 nm diameter and 32 capsomere units (2&3).

Several FMDV epizootics were attacks Egypt. First recorded attack was by the serotype “SAT 2” in 1950, then the serotype “A” was the causative agent for outbreaks of years1953, 1956 and 1958 subsequently. Serotype “O” of FMD virus was recorded in cattle for the first time in Cairo (the capital city of Egypt) in 1966. And then continuous FMD attacks were encountered, however serotype “A” was re-isolated from cattle in Alexandria (the main port of Egypt in the Mediterranean Sea) in 1967 (4).

Moreover, serotype "O" of FMD virus was the predominant serotype infected cattle and buffaloes in Egypt for the subsequent years until 2006. Following massive storm of importations of livestock of cattle from Ethiopia and the Sudan during the years

2005- 2006, a severe form of FMD was struck Egypt in 2006 causing nationwide infections among the native breads. The imported live cattle were harboring the active and virulent strains of foreign lineages of FMD virus. The serotype causing this outbreak was identified as A21 Kenya However the serotype O was still recorded during the routine surveillances for FMD during these outbreaks and continues to the present time. SAT2 reappear in Egypt in the last few years, causing severe losses and complicate the conditions of controlling programs of FMD in Egypt (5, 6, 7 &8).

Foot and Mouth Disease in Animals

Clinical signs

The symptoms of FMD in animals begin with fever, followed by Excessive salivation, redness of the eyes with severe lacrimation, and nasal discharges. After that, off food with contractions in the rumen, arched back, lameness is observed. Decrease in milk production usually followed the appearance of Vesicles on mouth and foot. Secondary bacterial infections may lead to Mastitis in lactating animals, erosions on teats and soft skin complicated by bacterial infections. Also, the secondary bacterial infections of erosions of foot and mouth usually observed. Abortions of pregnant animals is usual findings and Sudden deaths in young animals is prominent sequlae of FMDV which attacking the heart of young animals (9 &10).

Post-mortum examination

The postmortem examinations of infected animals with FMDV showed that: 1- Tiger heart: The macroscopic lesions of FMD in young animals are mostly in the myocardium. Lesions are in the form of whitish streaks on myocardium separated by dark and congested areas in longitudinal shapes giving the pathognomonic lesion of FMD in the young infected animal. 2- Skin: Vesicles and erosions usually seen in the areas of soft tissues: mouth, muzzle, nostrils, foot, udder, vagina and anal area, base of horns, conjunctiva (9&10).

Microscopic picture

Skin*:* showed vacuolated stratum spinosum, stratum corneum showed swollen cells in areas adjacent to the erosions with separation between basal cell layer and the stratum spinosum. Inflammatory cells infiltrates the skin mostly neutrophil and lymphocytes. Intracytoplasmic rounded inclusion bodies seen in cells of the basal membrane and stratum spinosum which showed vacuolar degeneration.

Gastrointestinal tract*:* Congested mucosa, hydropic degenerations along the mucous membranes of mouth, esophagus, abomasums, rumen, intestine, Erosions seen in the rumen and intestine. Congestions and streaks of hemorrhages, the submucosal tissues showed congested blood vessels and hemorrhages, lymphocytic infiltrations encountered in the intestine, and some lymphocytes, intracytoplasmic inclusion bodies also seen in the intestinal cells.

Heart**:** In young animals, myocarditis aphthosa, it is the picture of the degeneration and necrosis of myocardium, lymphocytic infiltrations gives the whitish appearance of the lesion. Congested blood vessels and areas of infarctions are seen. In severe infections, large animals showed severe myocarditis and endocarditis with accumulation of fluids in the epicardium (9&10).

FMDV Diagnosis

Sampling: For the diagnosis of asymptomatic and the early stage infections of FMDV by RT-PCR, the most suitable is nasal discharges. The fluids of vesicles and epithelium lining the erosions of the tongue and inter-digital cleft contain FMDV in considerable numbers and suitable for viral isolation techniques. However, semen, serum, blood with anticoagulant, milk of feverish animals and oro-pharyngeal fluids are also used for FMD diagnosis (11).

Identification: The conformational tests usually performed by the following laboratory methods: 1. Virus neutralization test, 2. Antigen Detection ELISA, 3. Polymerase chain reaction (PCR), 4. Sero-diagnosis: a. Liquid phase blocking ELISA and b. Non structural protein identification, 5. Sequencing and phylogenic analysis of the VP1 (11, 12, 13 &14).

Epidemiology

Foot and mouth disease hosts is mainly animals, transmitted directly between animals, therefore, vector is not present. The reservoir hosts are present in the endemic areas. Zoonotic importance of FMD does not investigated in large scale, because the disease in man is self limiting (2&10).

The causative agent: FMDV is small non-enveloped single strand with positive polarity RNA genome. FMDV belongs to Picornaviridae aphthovirus, it characterized by high genomic heterogeneity; there are several types and subtypes. FMDV have 7 known major serotypes (O, A, C, SAT1, SAT2, SAT3, and Asia1), which named according to first area isolate the FMDV strain; O=Oise, A=Allemande, SAT= South African Territories, ASIA= Asia. FMDV is epitheliotropic with high affinity to the epithelial cells of soft skin and mucous membranes of the gastrointestinal tract, giving its characteristic pathologic changes of the vesicle formations in the mouth and foot (2,10 &15).

The geographic distribution of FMD: FMD is endemic in almost all parts of Africa, Including Egypt. It is also present in Middle East, China, Russia, South America, Cyprus, Turkey and United Kingdom (2&10).

Transmissibility: FMD is a contagious viral disease of animal. It transmitted by many ways, mechanical transmission by vehicles, direct transmission by mucous membranes, skin erosions and contaminated food and raw milk and indirect by airborne transmission. Occupational infections in human occur due to the close contact with sick animals (2).

Susceptible species: FMDV has a broad host range including pigs, cattle, and sheep (2), buffaloes, camel are susceptible and serves as reservoirs.

Virus persistence: The FMDV can persist in the environment for years under moderate suitable conditions. These happen either as carrier state in cattle recovered from infection, which is usually the common state of disease as FMD is not fetal to adults, so that the virus remains dorminant in the posterior portion of the oro-pharyngeal region, or in the frozen meat of the slaughtered animals. So that all animals and animal products from endemic areas should be treated as the live infected species in regard to transportation and trade movements between countries (2 &10).

Zoonotic importance of FMD: FMDV susceptibility in human has not largely investigated. Trials of isolation of FMD from suspected people were preformed in some

studies. However, only certain strains were recorded in man which is types, O, A, and C. The international organizations which are concerned with public health and animal diseases usually neglected FMD in enumerations of zoonotic viral infections. Meanwhile the workers in the field of animal's diseases usually observed certain infections among people in contacts with the sick animals. However, these recorded human infections with FMD were usually personal efforts and in very small scales. In regarding the pathological effects in man, one can expected its extent by studying the pathological picture of FMD in animals. As precautionary measure Children should take into considerations because the disease in young animals is fetal, and attack the myocardium causing severe affections and sudden deaths (2&10).

Preventive and Control measures of FMDV in Egypt

The preventive strategies depend on the continuous active surveillances for FMD with the periodical vaccination for all susceptible species by the government. Quarantine measures were taken for preventing the introduction of foreign serotypes into Egypt. Vaccination of animals in Egypt depends on vaccines produced locally which used by the government and also importing the vaccines by the farmers, so that two lines of vaccination in Egypt; 1-Official vaccines produced locally: (Inactivated trivalent) produced locally by the institute of Agriculture Research Center of Egypt: it composed of three strains: Sat 2; O Pan Asian 2; A Iran 05, 2-Private vaccine imported from other countries by owners: a-Vaccine contain 6 serotypes: O, A, C, Asia1, Sat 2, Sat 3, b-Vaccine contains 7 serotypes: O, A, C, Sat 1, Sat2, Sat 3, Asia(16, 17, 18 &19).

Discussion and Conclusion

Foot and mouth disease (FMDV) causes severe economic losses along its history in all affected areas. So that, the free countries from FMDV usually refuse to import animals from endemic areas, which led to more economic losses to the produced countries which is usually the poor nations like some African countries which depends largely in its economy on the animal wealth. Foot and Mouth Disease is endemic in Egypt. The disease causes the formation of vesicles (blisters), mainly in the mouth and on the feet. Vesicles subsequently rupture leaving painful erosions. The disease is rarely fatal, although it can cause sudden death in very young animals. After infection, there may be a drop in milk yield, which can be permanent and chronic lameness (2&9). Buffaloes are the main native domesticated animals in Egypt so that it play major role as a reservoir for FMDV; buffalo keep the virus in the oro- pharyngeal region for more than 2 years. Transmission of the infections through carrier animal is questionable but in the endemic area occurs mainly through direct and indirect contact with animal movement

especially the partially immunized animals with mild clinical signs and or subclinical cases shedding the FMD virus (12). The foot and mouth disease is highly dangerous for the livestock industry. It is not fatal to adult animals; it might cause abortions and losses in productivity regarding meat and milk production. However, it is fatal in young animals by attacking the myocardium causing myocarditis aphthosa (Tiger heart). Man is susceptible to FMDV but with self limiting infections (2, 9&10).The FMD virus is endemic in Egypt, serotype O was the only circulating for long time till the epidemiological situation became more complicated due to multiple introduction and country wide outbreaks started from 2006 where type A was introduced by the imported animals from Ethiopia. Asian topotype O, O Pan-Asian 2 and A Iran05 during 2010 which followed by the Major SAT2 outbreak during 2012 after introduction of two different SAT2 lineages and other type O East African topotype from Sudan and type A African subtypes during the years 2012-2014. The endemic state of FMDV in Egypt is owned to the continuous introductions of foreign strains from different origins, mainly from Africa through animal's movements in between (8). FMDV strains in Egypt in the present time are: A, A Iran 05, A Sudan, A East African, O Manizian, O Sudan (Erytheria, Ethiopia), O Pan Asian1&2, O African, SAT 2 (Tanzania, weak diversity with origin from Lypia- Sudan) (personal communication, AHRI).

First Human infection with FMDV was recorded in Germany in 1695 (Valentini) (20). However, in 1834 some scientists investigate the infectiousness of milk of infected cattle by drinking untreated fresh and raw milk; they observed that milk can transmit the infection (Hertwig) (21). FMD in human should differentiate from the viral infection with Coxsackie A group virus, as it causes disease called hand and mouth disease. Some sporadic cases in human infections were reported along years, but all indicate the benign characteristic of FMDV infection in man (2&10).

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