

PATHOLOGY OF FOOT AND MOUTH DISEASE (FMD)
OUTBREAK IN CATTLE, SHEEP AND PIGS IN IBADAN

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SUMMARY

The death of 18 calves (mostly of exotic breeds) during an outbreak of FMD (SAT-2) was attributed to severe heart lesions consisting of nonsuppurative myocardial degeneration, haemorrhage and calcification. Mouth and feet lesions were also present. In adult cattle as well as sheep and pigs, mortality was very low and was attributed mainly to some other concurrent or secondary conditions. In view of the unusual susceptibility of exotic cattle (especially calves) it is suggested that extra precautionary measures be taken against FMD when pregnant cows are imported to enzootic areas.

INTRODUCTION

Outbreaks of foot and Mouth Disease (FMD) occur sporadically in Nigeria and up to 1973, several outbreaks were reported each year from different parts of the country (Owolodun, 1971; Smith, 1974). The strains of virus involved were types O, A, SAT-1 and SAT-2. Animals affected were usually nomadic cattle,

NIGERIAN JOURNAL OF ANIMAL PRODUCTION 4(1) 1977.

hence, detailed investigations of the clinical and pathological manifestations of the disease in cattle or other susceptible animals under natural conditions were usually limited.

In 1973, FMD occurred in an Ibadan livestock station where cattle, sheep, goats pigs, horses and donkeys were kept. Detailed clinical, pathological and virological studies were carried out during the outbreak. This communication reports the results of the pathological studies, as a follow up of the virological investigations of the outbreak reported earlier where the virus was typed as SAT-2 (Tomori *et al.* , 1974).

MATERIALS AND METHODS

All animals examined originated from the University of Ibadan Teaching and Research Farm which at the time of the outbreak in 1973 stocked about 300 heads of cattle (indigenous and exotic breeds), 400 pigs, 400 sheep, 200 goats and a few horses and donkeys. The outbreak coincided with the calving time of many recently imported exotic cows. Only cattle sheep and pigs were affected, but all other animals dying in the farm during the period of the outbreak (over a month) were scrutinised for possible FMD lesions. At necropsy, tissues were removed, fixed in 10% formol-saline and processed routinely for histopathology. Special stains were employed when indicated.

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RESULTS

Gross Lesions

A total of 32 animals made up of 25 cattle, 5 sheep and 2 pigs were examined at necropsy. However, morbidity was reported to be almost 100% among these species in the farm.

Cattle: These consisted of 2 aborted fetuses, 18 calves (5 days to a few months old) and 5 yearlings and adults. Both fetuses, 15 calves and 3 adults were of exotic breeds (Holstein and German Brown) whereas 3 calves and 2 adults were of local breeds (White Fulani and N'Dama).

The fetuses were from FMD affected dams. They had severe subcutaneous oedema and ecchymoses on serous surfaces and the abomasal mucosa. One foetus also had a dome-shaped head due to hydrocephalus. No significant bacteria were isolated from these cases. Virus isolation was not attempted on foetal materials.

All the calves had few to many vesicles rupturing to produce erosions on the tongue, the upper and lower lips, palate and the cheeks. The lesions varied in size from a few mm to several cm in diameter. Within the tongue, they occurred in any region but tended to become confluent at the anterior dorsal portion (Fig.1). Erosions and ulcers were occasionally found on the mucosa of the oesophagus, rumen

Fig. 1. Bovine tongue:
There are necrotic and
ulcerative lesions which
are confluent on the
anterior dorsal surface.

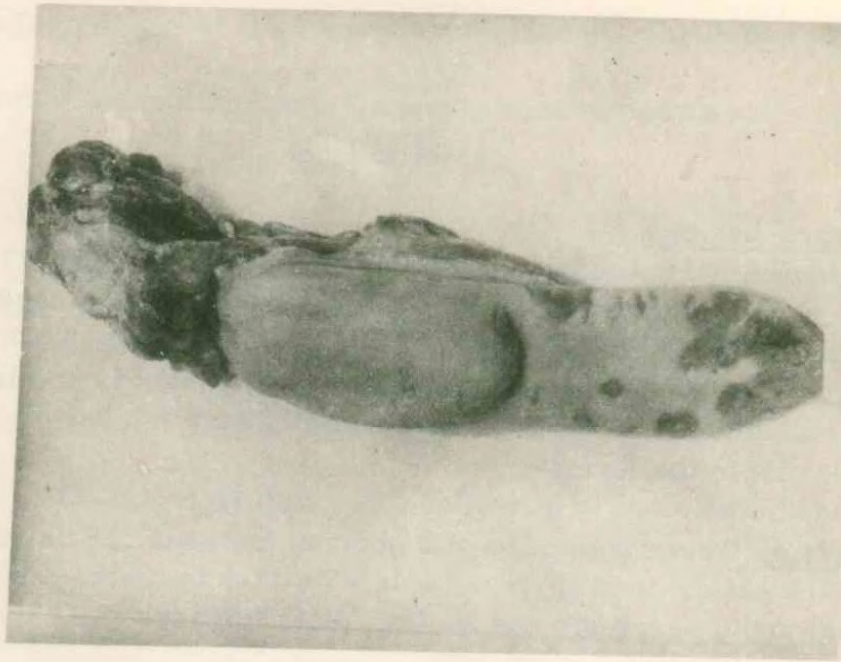


Fig. 2. Bovine feet:

There is necrosis of the
bulb and separation of
the hoof (right) as well as
a vesicle in the interdigital
space (left) in the same
animal.



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and abomasum. Usually, the abomasum was distended with gas and contained large clots of milk. The rest of the alimentary tract showed no significant changes.

Feet lesions consisting of erosions between digits were present in less than 50% of the calves. On the other hand, all calves had marked epicardial haemorrhages on the ventricles and atria. In addition, calves about a month old or older had extensive pale, grey, mineralized foci within the myocardium. There was associated severe pulmonary congestion and oedema. The liver was congested and enlarged (with rounded edges). The kidneys were also congested. Two calves had secondary mycotic infection of the rumen and lung respectively from which Aspergillus fumigatus was isolate.

The adult cattle that died during the outbreak had severe feed lesions consisting of vesicles occurring concurrently with necrosis of the bulb and separation of the hoof (Fig. 2). In the Oral mucosa and teat of the udders, there were scars of partially healed ulcers. One animal had gangrene of the tongue and was choked to death with coarse grass material stuck between the upper jaws and pressing on the glottis and larynx. In others, death was attributed to inanition (because the animals were unwilling to move to feed as a result of the feet lesions) and to obstetrical problems (dystocia and metritis).

Sheep and Pigs. The sheep were 10 months old and above. Death was attributed to internal parasitism (*Haemonchosis* etc.) aggravated by inanition resulting from severe lameness. Oral and feet lesions were in general similar to those of adult cattle, except that the hoof was lost in some cases. Similar feet and oral lesions were observed in two weanling pigs which died during the outbreak. Vesicles in the pig snout tended to become confluent to form large bullae or blebs which ruptured to expose large raw surfaces. Bacterial complications were evident in the sheep and pigs, as in the adult cattle.

Histopathology

Specific lesions were found in the oral mucosa and feet in the three species of animals and in the heart of the calves.

The vesicles started as foci of severe hydropic degeneration and swelling of the cytoplasm of cells in the deeper layers of the epidermis or stratified duct epithelium. This was followed by coagulative necrosis of superficial cells with mild infiltration by neutrophils resulting in the formation of erosions and ulcers (Fig. 3). The oral submucosa was hyperaemic and infiltrated by neutrophils and histiocytes especially around blood vessels. There was hyaline degeneration of isolated striated muscle fibres and cystic degeneration of mucous glands within the tongue.

Heart lesions in calves were characterised by haemorrhage, extensive hyaline degeneration of myocardial fibres and marked interstitial infiltration by

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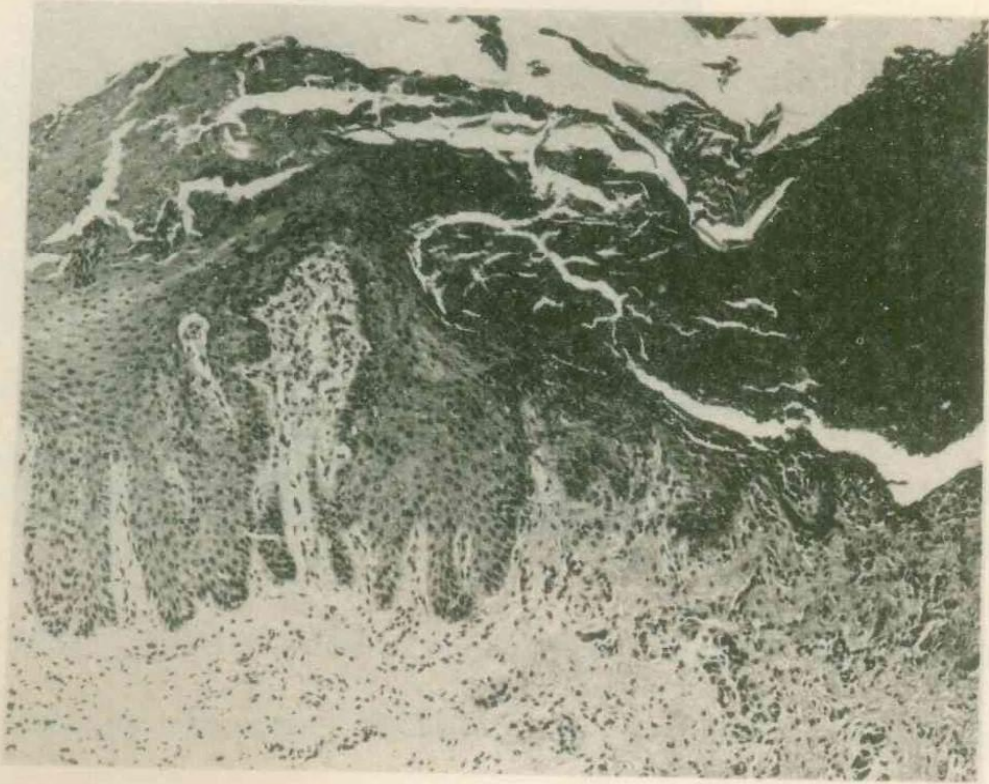


Fig. 3. Photomicrograph of bovine oral mucosa showing necrotic cellular debris covering an ulcer. H & E stain. X 75.

monuclear cells, chiefly histiocytes, lymphocytes and plasma cells (Figs. 4 & 5).

The inflammatory reaction extended from the epicardium to the endocardium.

In some cases, there was calcification of the degenerate myocardial fibres (positive von Kossa stain). Heart lesions were absent in adult cattle or other animals.

Fig. 4.

Photomicrograph of bovine heart muscle showing mononuclear cellular infiltration and hyaline degeneration of myocardial fibres. H & E stain. X75.

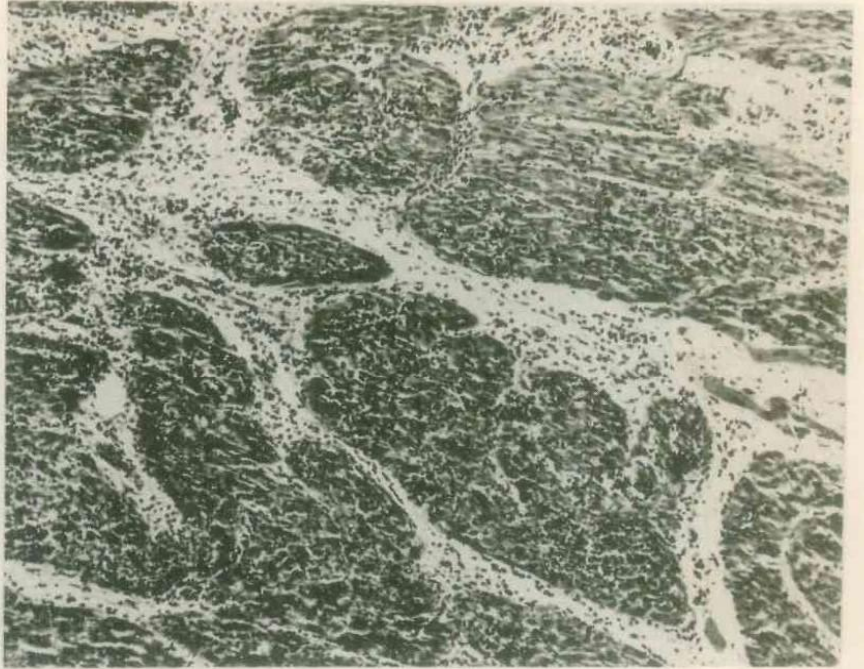
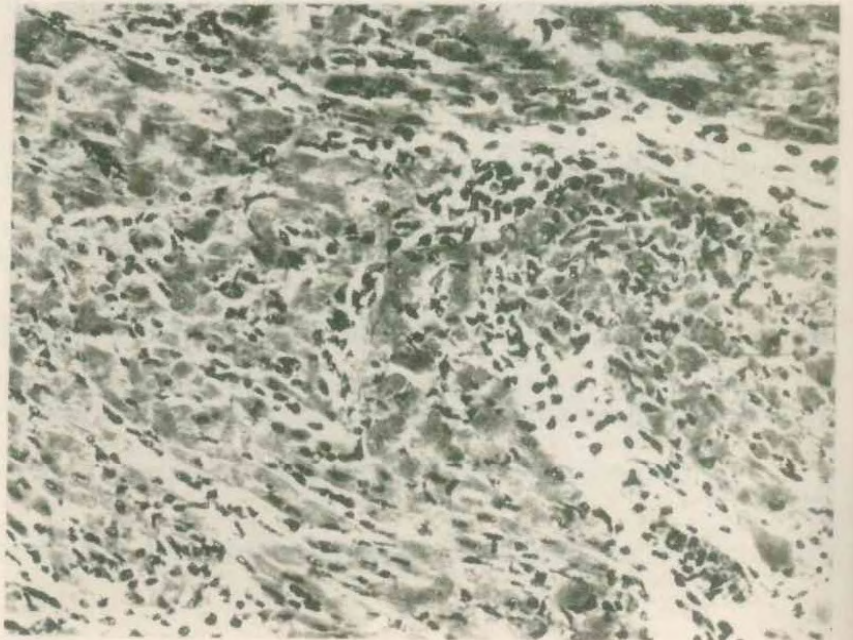


Fig. 5.

Higher magnification of Fig. 5. H & E stain. X190.



DISCUSSION

Although cattle, sheep and pigs of all ages were affected during the FMD outbreak, the mortality was high only in calves. Most of the calves were born shortly before and during the outbreak, the dams having been imported from Western Europe as pregnant heifers. The high virulence of this strain of virus (SAT-2) for the exotic calves was probably due to lack of previous exposure of the dams to this or closely related strains of FMD. In similar outbreaks in Vom, Northern Nigeria (Smith, 1974) and other parts of Africa (Arudo, 1973 a & b), exotic breeds of cattle were also reported to suffer more severely. It is therefore necessary to take extra precautionary measures against FMD -(such as vaccinations against local strains, fencing etc. as suggested by Atang, (1968) - when exotic animals, especially pregnant cows are imported into enzootic areas such as Nigeria.

Death in the calves was attributed to the extensive myocardial lesions resulting in acute heart failure - the so-called malignant form of FMD (Jubb and Kennedy, 1970). The degenerative changes in the heart muscle resemble those of white muscle disease (nutritional myopathy) except that cellular infiltration is also a major component of the heart lesions in FMD. Deaths in adult cattle, sheep and pigs, however, were usually due to some concurrent or secondary conditions such

as internal parasitism or inanition (resulting from severe mouth and feet lesions). It was not established whether or not the two cases of abortion were due to the FMD virus crossing the placental barrier and affecting the foetus directly. Abortions had been reported previously in FMD outbreaks (Aruo, 1973a).

It is noteworthy that although goats were in close proximity with the sheep in the farm, they did not appear to contract the disease throughout the outbreak.

ACKNOWLEDGEMENTS

The senior author wishes to thank Professor Isoun and Dr. Oduye, his co-pathologists at that time, who examined four of the cases towards the end of the outbreak, and Mr. Peter C. Amajuoyi for typing the manuscript.

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