

## Rift Valley fever: the Nigerian story

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### Summary

Rift Valley fever (RVF) is an arthropod-borne zoonotic disease of livestock. It is characterised by fever, salivation, abdominal pain, diarrhoea, mucopurulent to bloody nasal discharge, abortion, rapid decrease in milk production and death in animals. Infected humans experience an influenza-like illness that is characterised by fever, malaise, headaches, nausea and epigastric pain followed by recovery, although mortality can occur. RVF was thought to be a disease of sub-Saharan Africa but with the outbreaks in Egypt and the Arabian Peninsula, it may be extending its range further afield. Virological and serological evidence indicates that the virus exists in Nigeria and, with the warning signal sent by international organisations to countries in Africa about an impending outbreak, co-ordinated research between veterinarians and physicians in Nigeria is advocated.

### Keywords

Abortion, Africa, Rift Valley fever, Livestock handlers, Nigeria, Public health, Virus, Zoonosis.

## Rapporto sulla febbre della Valle del Rift in Nigeria

### Riassunto

*La febbre della Valle del Rift (RVF) è una malattia zoonosica del bestiame veicolata da artropodi. È caratterizzata da febbre, salivazione, dolore addominale, diarrea, scolo nasale da mucopurulento a ematico, aborto, rapida diminuzione nella produzione latte e morte negli animali. I soggetti umani infetti manifestano una malattia simile*

*all'influenza caratterizzata da febbre, malessere, attacchi di cefalea, nausea e dolore epigastrico seguiti dalla guarigione, sebbene possa verificarsi una mortalità. La RVF era ritenuta una malattia dell'Africa sub-sahariana, ma con i focolai epidemici in Egitto e nella penisola arabica è possibile che stia ampliando ancora di più il suo raggio. L'evidenza virologica e sierologica indica che il virus è presente in Nigeria e con sistema di allerta inviati dalle organizzazioni internazionali alle nazioni africane riguardante un imminente focolaio epidemico, è urgente in questo paese una ricerca coordinata fra veterinari e medici.*

### Parole chiave

Aborto, Addetti al bestiame, Africa, Febbre della Valle del Rift, Nigeria, Salute pubblica, Virus, Zoonosi.

## Introduction

Rift Valley fever (RVF) is also known as enzootic hepatitis of sheep and cattle. It is an acute, infectious and zoonotic disease of predominantly cattle, sheep, goat, camels, African buffalo (*Syncerus caffer*) and humans. The disease is caused by an arbovirus and is associated with periodic outbreaks that mostly occur on the African continent. It is a febrile disease that is accompanied by abortion in livestock and a severe fatal haemorrhagic syndrome in humans has been observed (11). It is a notifiable disease and is spread by the bite of mosquitoes.

The disease was first reported among sheep in Kenya by Montgomery in 1912 and Stordy in 1913 (4), but the disease was not isolated until 1931 (25). Presently, virological and serological evidence suggests that the virus exists

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throughout sub-Saharan Africa and Madagascar and, in the light of its recurrence in Egypt in 1993 and 2003 (5, 7, 9, 39), it may be extending its range even further. In September 2000, cases of unexplained haemorrhagic fever in humans and associated animal deaths in south-western Saudi Arabia and Yemen were confirmed as RVF and, by mid-January 2001, the disease had claimed several human lives in these countries (1); the outbreak on the Arabian Peninsula represents the first cases of RVF outside Africa. In 2007, an outbreak occurred in Kenya and Somalia where over 404 human cases, including 118 deaths, were reported (10). In South Africa, the last outbreak occurred in May 2010; preliminary investigation revealed that 186 humans were confirmed RVF cases out of which 18 died (40). An overview of the disease is necessary given climate changes that favour possible outbreaks (20, 24) and the warning signals despatched to countries in Africa by the Food and Agriculture Organization and World Health Organization (16).

## Aetiology

The RVF virus is the causal agent of the disease. The virus is of the genus *Phlebovirus*, family Bunyaviridae (26). It is an enveloped, single-stranded negative-sense RNA virus that measures between 80 nm and 120 nm in diameter with three segments named S (small), M (medium) and L (large) (8).

## Transmission

RVF is a mosquito-borne disease (2). *Aedes* is the species of mosquito that is incriminated in biological transmission (36, 37), although *Glossina*, *Culicoides*, *Culex* species and sand flies may play limited roles in biological and mechanical transmission (21, 25). Apart from these vectors, the disease has been reported to spread through needle inoculation, contact with infected animals or humans with high prevalence during periods of heavy rainfall (2, 34, 38, 42). Experimental transmission in sheep from infected mouse serum has been reported (35). Risk groups include animal handlers, particularly those assisting animals during

abortions/parturition, those treating sick animals and those nursing affected people, particularly in areas with outbreaks (38). Humans may be infected by direct and indirect contact with infected animals as well as by blood from fetuses or slaughtered animals (17). Transmission is also possible by mosquito bite (6, 25) and ingestion of unpasteurised or uncooked milk from infected animals (5, 31). Cases of vertical transmission have also been reported (3, 6).

## Clinical signs

The incubation period for the disease is short. It ranges from 1 to 6 days in animals, although it is shorter in younger animals, and between 4 to 7 days in humans (2, 33). In adult animals, it is characterised by fever within 24 h of infection that lasts between 6 and 7 days but peaks between days 2 and 4 post infection; viraemia coincides with fever which peaks on day 3 post infection (29). Abortions occur in pregnant animals and signs, such as salivation, abdominal pain, diarrhoea, mucopurulent to bloody nasal discharge and rapid decrease in milk production in particular, are observed in dairy cows (2, 25, 35, 41). In younger animals, lambs and neonates, death usually occurs within 24 h but signs of fever, depression, anorexia and abdominal pain are prominent prior to death (33).

The disease in humans is influenza-like and is characterised by fever, malaise, headache, nausea, epigastric pain, sensation of fullness over the region of the liver, followed by complete recovery. However, it may evolve into a haemorrhagic fever syndrome, meningo-encephalitis or even affect the eyes (2, 19, 25, 32, 33).

Animals that die of the disease show extensive liver necrosis and enlargement at post-mortem examination, with oedema and haemorrhages on the wall of the gall bladder. In newborn lambs infected *in utero*, the contents of the abomasum and small intestine are of a chocolate-brown colour (8). In addition, the lamb will exhibit generalised hepatic necrosis.

## Diagnosis

Diagnosis is performed by isolating and identifying the virus or by observing a fourfold rise in specific neutralising antibody titre between acute and convalescent sera. Upon post-mortem examination, characteristic histopathological findings of liver necrosis in all susceptible animals often provide the first clue to the disease. Confirmatory diagnosis is by serology using IgM or IgG antibody-specific enzyme-linked immunosorbent assay (ELISA), complement fixation, viral neutralisation, haemagglutination inhibition and the plaque reduction test.

Differential diagnosis in animals includes the following:

- bacterial septicaemias
- poisoning
- rinderpest
- peste des petits ruminants (PPR)
- bluetongue
- bovine ephemeral fever
- enterotoxemia of sheep
- brucellosis
- campylobacteriosis
- toxoplasmosis
- trichomoniasis
- heartwater
- other abortifacient causal agents.

## Epidemiology

RVF was thought to be a disease of sub-Saharan Africa, but the disease has spread to East and Central Africa (14) and to western Saudi Arabia and Yemen (25). In addition to cattle and sheep, other animals have been reported to be susceptible to the disease. Antibodies against the disease have been detected in African buffalo, black rhino (*Diceros bicornis*), lesser kudu (*Tragelaphus imberbis*), impala (*Aepyceros melampus*), African elephant (*Loxodonta africana*), kongoni (*Alcelaphus buselaphus cokii*), waterbuck (*Kobus ellipsiprymnus*) (11), goats, camels and horses (29) but evidence of the role that these animals play in maintaining the virus between outbreaks is still unknown. However, LaBeaud *et al.* (23) reported that older males living in rural

villages and who had disposed of animal abortuses were responsible for inter-epidemic transmission in Kenya.

In Nigeria, Ferguson first isolated the virus from animals (15). Subsequent serological evidence suggests that the virus may be circulating at low levels in domestic livestock and in the human population, particularly among livestock workers and wildlife rangers (28). Cattle, sheep goats and camels in the States of Kaduna and Sokoto have revealed significant antibody titres in their serum (12). Serological prevalence of the disease in these animal species in Ile-Ife and Ibadan was observed by Olaleye *et al.* (27) who confirmed the existence of the disease in Nigeria. Apart from these observations, experimental infection with different strains of the disease in three indigenous breeds of sheep in Nigeria, namely: the West African dwarf, Yankasa and Ouda have resulted in fatal disease (13). Further studies are therefore required to determine the present status of the disease in Nigeria.

## Treatment

There is no treatment for animals, but an initial 50 mg/kg loading dose of ribavirin followed by 10 mg/kg at 8 h interval for 9 days has been suggested to contribute to the prevention or to provide therapy in humans (30).

## Prevention and control

Prevention is best achieved by vaccination. A live-attenuated and killed vaccine is available for livestock. The live-attenuated Smithburn strain provides long-lasting immunity but it produces a teratogenic effect in sheep when administered in the first trimester (22) and it is abortogenic in pregnant ewes (25). Apart from these, the vaccine has been documented experimentally not to protect against the Nigeria and Lunyo strains of the virus in West African dwarf sheep (35). The live virus vaccines are recommended for use in endemic areas, while the killed vaccines are recommended for use outside endemic areas. A formalin-inactivated vaccine is safe for

pregnant ewes but provides only short-term immunity and hence requires a booster inoculation to maintain durable immunity. The only vaccine cleared for human use is the killed product available only from the United States Army Medical Research and Materiel Command (USAMRMC). It is an initial three-dose series for protective immunity with annual booster inoculations required to maintain that immunity (25). This vaccine has been used to elicit immune response among laboratory staff in Nigeria (18).

Vector control of mosquito populations and restricted movements during outbreaks can be effective measures since animals have high levels of viraemia and consequently amplify transmission. Educational campaigns to

prevent human exposure to infected animal tissues or abortuses and exposure to mosquito vectors are effective. Vaccination of people in high-risk occupations is equally effective in combating an outbreak.

## Conclusion

In conclusion, RVF is emerging in new areas and there is some re-emergence of the virus in previously affected areas. Hence, there is a strong need for the African continent to strengthen regional and national warning systems, such as co-ordinated research between veterinarians and physicians, which will contribute to the prevention of an epidemic.

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