RECURRENT OUTBREAKS OF RIFT VALLEY FEVER IN SOUTH AFRICA FROM 2008 TO 2010 BY LIEZA ODENDAAL AND LEON PROZESKY

DEPARTMENT OF PARACLINICAL SCIENCES

FACULTY OF VETERINARY SCIENCE

UNIVERSITY OF PRETORIA

Rift Valley fever (RVF) is a disease that primarily affects animals but also has the capacity to infect humans. The most important vector that transmits the disease is mosquitoes. Suspicion of RVF is therefore usually aroused when heavy rains are followed by the emergence of vast numbers of mosquitoes, and an increased number of abortions in ruminants accompanied by the death of particularly young and pregnant animals.

The ecology of the disease involves two distinct transmission cycles. The enzootic transmission cycle occurs during years of normal or below average rainfall. During this time the virus cycles between mosquitoes and wildlife. Evidence of virus transmission was confirmed in a variety of wildlife species such as African buffaloes, zebras, black rhino, elephants, warthogs, impala and waterbuck to mention but a few. Therefore, wildlife potentially serves as a maintenance host for the virus. What is also interesting is that normal rainfall patterns greatly limit the period available for vector activity. Also the survival of floodwater *Aedes* mosquitoes is dependent on drought-resistant eggs that remain viable for long periods (possibly for years) following drying of breeding habitats i.e. the limits of the flood lines of rivers. During years of abnormally high rainfall rivers flood their banks or large pools of stagnant water may be found as is the case in the Free State at the moment.

During these times extensive swarms of mosquitoes emerge, and with sufficient numbers of susceptible unvaccinated livestock such as cattle and sheep in the same area as RVF virus infected mosquitoes epidemics start to occur. In South Africa we have been experiencing high and persistent rainfall during the summer season for at least three years now. The first warning signs of an impending large scale RVF outbreak occurred in 2008. From January 2008 to June 2008, RVF occurred in small numbers of cattle, buffalo, and goats in

Mpumalanga, North West, Gauteng, and Limpopo. Eighteen laboratory confirmed cases of RVF in humans were reported. All 18 persons had close contact with infected animals or their tissues. These included veterinary practitioners, 4 veterinary students, and technicians exposed during post mortem examination, as well as a veterinary student who examined an ill calf and 10 farm workers who either handled infected animals or were involved in slaughtering livestock. Cattle and sheep were vaccinated to prevent additional cases. Small focal outbreaks of RFV were again reported in KwaZulu-Natal, Mpumalanga, Limpopo, and North West Provinces during the summer of 2009. An outbreak was also confirmed in sheep in a district of Mpumalanga Province in May 2009. No confirmed human cases have been linked to this outbreak. In October 2009 a small outbreak occurred in the Northern Cape next to the Orange River. In this instance two human cases were confirmed. During all these smaller outbreaks the virus was probably amplified in livestock and more mosquitoes became infected. Infection eventually also spills over into other species of mosquitoes such as *Culex* or *Anoplocephalus* so that the disease spreads quickly over very large areas. Yet again, in the summer of 2010 we are experiencing abnormally high and persistent rainfall and many farmers did not heed the warnings of the veterinary practitioners that they should vaccinate their livestock before the commencement of the rainy season.

Areas where RVF have been reported thus far were mostly in the northern and western parts of the Free State and in Colesburg in the Northern Cape. Seven confirmed cases of RVF among humans were reported in the Free State and Northern Cape, with one death (Fig 1). This time the disease caused high abortion rates in ewes, the death of up to 100% newborn lambs, and deaths of large numbers of adult cattle and calves (Fig. 2). The outbreak will most likely continue until the first heavy frost falls in the region, and the complete extent of the outbreak is yet to be determined.

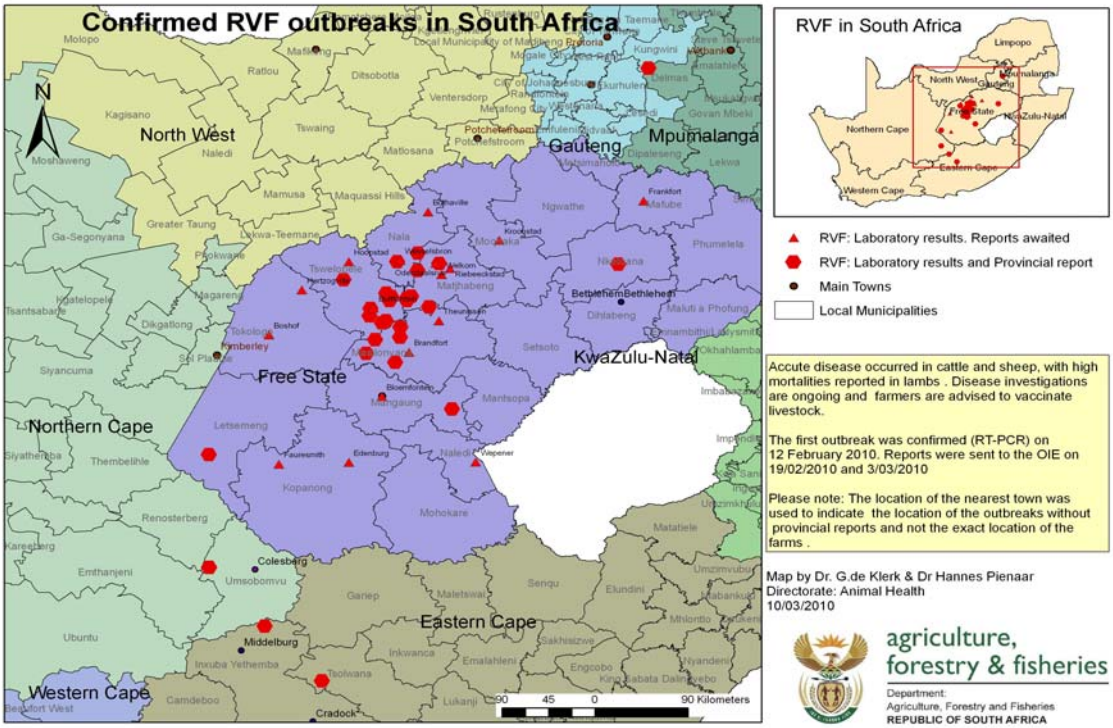

Fig 1 Confirmed outbreaks of RVF in the RSA during 2010. *Courtesy Drs G de Klerk and Hannes Pienaar. Directorate of Animal Health.*

Fig.2 Rift Valley fever causes high abortion rates in ewes and up to 100% mortalities in young lambs

The most characteristic post mortem lesions are multifocal or diffuse hepatic necrosis and wide-spread petechiae or ecchymosis on the serosal surfaces of the parenchymatous organs or the intestines (Figs 3-5). Haemorrhages are also noted in the subcutaneous tissues, lymph nodes, and the mucosa of the abomasum. Free blood is sometimes found in the lumen of the small intestines. Adult sheep often have marked icterus with necrotic foci and pin-point haemorrhages distributed throughout the parenchyma of the liver.

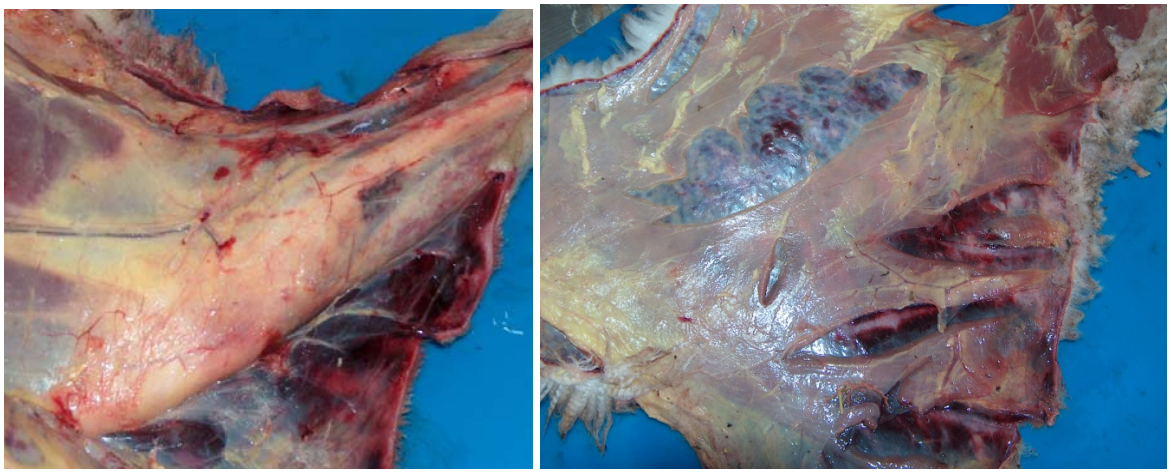

Figure 3: Rift Valley fever infection, adult ewe. Haemorrhages in the subcutaneous tissues. Also note the icterus evident in the subcutaneous fat. *(Courtesy Dr Lieza Odendaal, Faculty of Veterinary Science, University of Pretoria and Mr Wally Derbyshire, Department of Agriculture of the Free State, Directorate of Veterinary Science).*

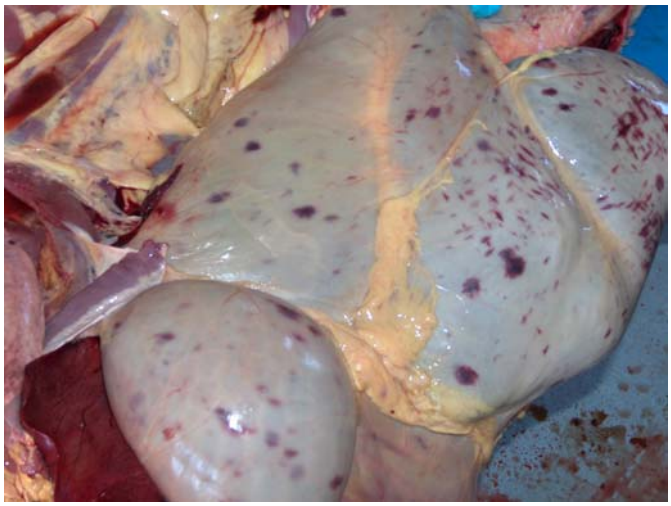

Figure 4: Rift Valley fever infection, adult ewe. Wide-spread petechiae or ecchymosis on the serosal surfaces of the rumen. *(Courtesy Dr Lieza Odendaal, Faculty of Veterinary Science, University of Pretoria and Mr Wally Derbyshire, Department of Agriculture of the Free State, Directorate of Veterinary Science).*

Herders, farmers, abbatoir workers and veterinarians are at high risk of infection (Fig.6). The virus can be transmitted to humans through the handling of animal tissue during slaughtering, assisting with dystocias, conducting veterinary procedures, or from the disposal of carcasses or foetuses. Human infections have also resulted from the bites of infected mosquitoes. While most human cases are relatively mild, a small percentage of patients develop a much more severe form of the disease. No human-to-human transmission occurs and symptoms of the infection are most often mild fever, headaches and muscle pain. The more severe form of the disease usually appears as one or more of 3 distinct syndromes viz. ocular disease (0.5-2 percent of patients), meningo encephalitis (less than 1 percent) or haemorrhagic fever (less than 1 percent). Most fatalities occur in patients who develop the haemorrhagic icterus form. Any person that handles potentially infected animals must wear protective clothing which must include disposable gloves, a mask and medical grade safety glasses. Anti-viral barrier cream and insect repellents for exposed areas of skin are also recommended.

Fig 5. Rift Valley fever is a serious zoonosis. Hospitalised veterinary student that contracted the disease while conducting a post mortem on an infected animal in 2008.

Histopathological examination of the liver is very useful for the preliminary diagnosis of RVF. However, the diagnosis should be confirmed by demonstrating the presence of antigen or antibody. Traditional diagnostic techniques such as virus isolation have been replaced in recent years by more rapid tests. The most widely used techniques include real-time reverse-transcriptase polymerase chain reaction (PCR), and immunohistochemistry (IHC).

The use of virus isolation or PCR is restricted to reference laboratories with appropriate expertise. Also these techniques require sufficient tissue samples transported on ice to the laboratory. Unfortunately, fresh samples are often not available either because the diagnosis was not suspected when the gross examination was conducted or the cold chain for the transport and storage of the specimens was not observed. In addition, the transport of such samples is hazardous given the zoonotic potential of the disease. These limitations may delay the diagnosis of the disease. As a result the initiation of control measures is also delayed resulting in wide dissemination of the virus with possible human fatalities and substantial economic losses to livestock owners. A rapid and accurate method that detects RVF virus antigen is IHC.

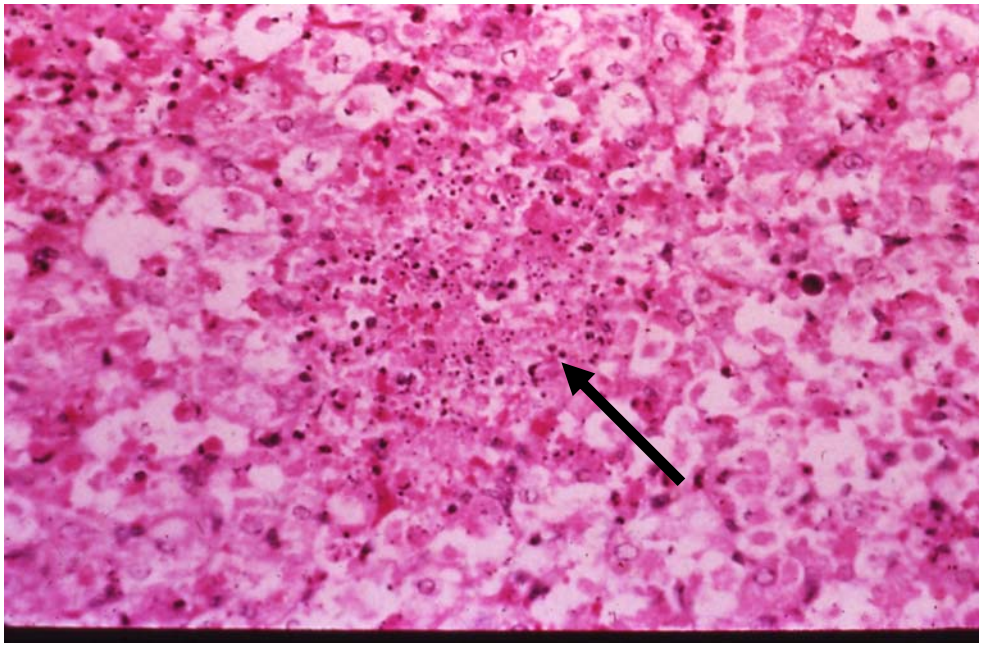

Fig. 6 Characteristic hepatic necrosis (arrow) in a young lamb that died of Rift valley fever

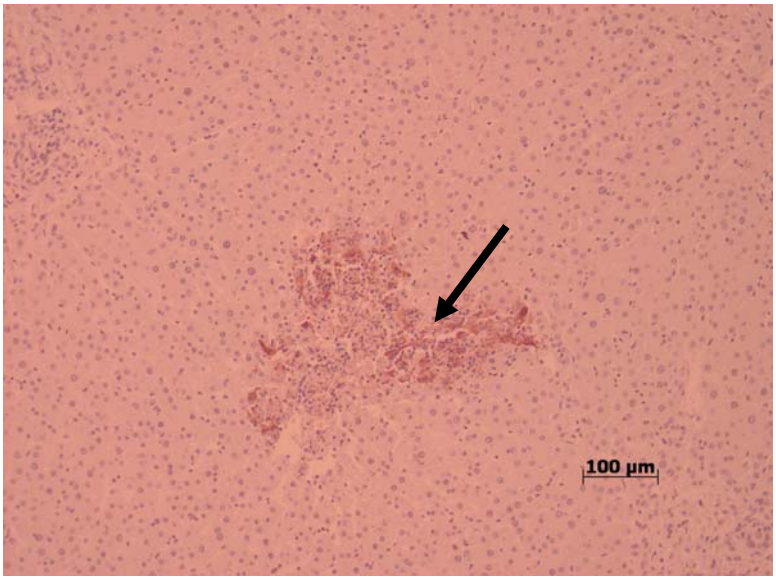

Fig. 7 Positive immunoperoxidase staining (arrow) in the liver of a young lamb that died of Rift valley fever

This method is inexpensive and requires formalin fixed specimens. IHC for RVF is now a routine procedure employed at the Veterinary Pathology Laboratory of the Faculty of Veterinary Science of the University of Pretoria. This diagnostic method is the most suitable not only for the rapid detection of the disease and timely response by animal health and public health officials, but also for an effective targeted surveillance plan for RVF virus in areas such as the Western or the Eastern Cape. Formalin fixed specimens must include small blocks of tissue no larger than 1cm by 0.5cm from the liver, kidneys, spleen, lungs, heart, cerebrum, cerebellum, and the hippocampus. Including all these organ specimens will make it possible to determine the cause of the actual death if RVF as a possible diagnosis was excluded.

Humans that were in contact with confirmed cases of RVF must be appraised of what symptoms to expect should they have contracted the disease. They must seek advice from a medical practitioner. Furthermore all ewes and cows after they have lambed or calved must be vaccinated with the live RVF vaccine. Rams and bulls may be vaccinated with the live vaccine at any time. Pregnant animals should be vaccinated with the inactivated (dead) vaccine. It has however been reported that the live vaccine can be used in pregnant animals. For more information regarding the use of RFV vaccines please contact Onderstepoort Biological Products.

The financial implications of RFV are not confined to mortalities in animals but also affects trade of animals and animal products. Following the current outbreak of RVF, China which is currently buying approximately 57 % of the local wool production, has banned the import of wool from affected areas with far reaching financial implications for farmers. Rift Valley fever will always be an important disease in southern Africa. Due to unpredictability of outbreaks it is difficult to motivate farmers to vaccinate animals on an ongoing basis. Consequently when an outbreak occurs, the demand for the vaccine exceeds the availability, resulting in high mortalities in non- vaccinated stock.