The Biology and Control of Rift Valley Fever.

INTRODUCTION

Rift Valley fever is a mosquito-borne viral disease of livestock and some wildlife species. Outbreaks of this disease have a severe economic impact on farming and present a health hazard for humans in the agricultural sector. During outbreaks cattle, sheep and goats show a high percentage of abortions and large numbers of newborn animals die. Humans in direct contact with infected animals contract an influenza-like disease, which in a small number of cases may cause permanent problems and even death.

Major outbreaks occurred in South Africa in the 1950s and the 1970s when flooding occurred across wide areas in the country including the OFS, NW Province and Limpopo causing huge losses of animals. The immunity of farm animals then declined in subsequent years due to reduced usage of the vaccine but disease outbreaks were not seen again until the late 1990s, probably due to summer rains falling late in the season. In the last few years incidence of RVF outbreaks has escalated due to the falls of heavy rain early in the summer.

BIOLOGY OF RVF

The transmission of RVF in livestock is biological: the virus is maintained in certain mosquito species that have a preference for feeding on livestock and wild animals. Outbreaks of the disease occur when climatic conditions are favourable for the breeding of these mosquito species in huge numbers. This occurs when there is heavy early summer rainfall which results in bodies of standing water such as vleis and pans. These conditions provide ideal breeding conditions for the RVF-infected mosquitoes, and cause outbreaks in late summer/autumn.

While mosquito transmission is the main method of infection in livestock, humans contract the infection by direct contact with infected animals and their tissues. Infected humans usually develop a febrile disease but severe haemorrhagic syndromes and even deaths may result in some cases.

THE DISEASE

When infected mosquitoes feed on ruminant livestock species including cattle, sheep and goats, the predominant manifestation is the abortion of pregnant animals and the deaths of newborn and young animals.
Young calves, lambs and kids are most susceptible to the virus, newborns being the most severely affected and adult animals being the least severely affected. Abortion is an almost invariable outcome mainly as a result of the fatal hepatitis in the foetus.

Abortions storms occur in cattle, sheep and goats at any stage of pregnancy. Sheep are particularly susceptible as they show high abortion rates (40-100%) while cattle show a lower incidence (15-40%). The disease has a very short incubation period in young lambs and kids less than 2 weeks old, as they become ill within 12-36 hours. Infected animals show fever, general signs of illness and abdominal pain. Most often 90% of lambs and kids die within 24-36 hours without showing symptoms. Older animals lose their appetite, show weakness and bloody diarrhoea. The mortality rate in these age groups is 5-30%. Calves show fever, loss of appetite, weakness, jaundice and bloody diarrhoea.

Adult cattle usually show abortions as the only sign, but some animals show fever, general signs of illness and bloody diarrhoea, or may even die.

**DIAGNOSIS**

RVF should be suspected when abortions and the death of newborn animals occur during a late summer/autumn season which has been preceded by heavy spring rains. Reports of flu-like illness in humans that have handled sick animals or cut up carcases will be additional supportive evidence of a possible RVF outbreak.

The disease can be confirmed by taking organ samples, in particular liver from foetuses and young animals for virus isolation as well as histology. Serology is only helpful in unvaccinated animals, as the antibody response to the vaccine may interfere with interpretation. A presumptive diagnosis can be made on the finding of severe liver damage in foetuses and young animals. Pan-necrosis of the liver in foetuses and young animals is considered pathognomonic for RVF.

**Caution: Veterinarians should take extreme care during RVF outbreak seasons, to limit their exposure to the virus by wearing masks, goggles and gloves during sampling and assistance with abortions.**

**TREATMENT**

There is no specific treatment for RVF infections in livestock.

**CONTROL**

**Vaccination**
Vaccination is the only economical control measure for prevention of the disease in livestock; there is no treatment for RVF in livestock (see discussion on mosquito control below). RVF vaccination should be done annually before the outbreak season (late summer-autumn), especially during wet seasonal cycles.

**Attenuated live** products are the only practical vaccines for controlling the disease effectively: the killed vaccine was developed for use in cattle in South Africa, on the erroneous assumption that the Smithburn strain did not protect in this species. The vaccine was then also recommended for use in small stock because of teratogenic effects caused by the Smithburn strain. However American studies showed that the killed vaccine must be administered 2-3 times with 3-4 week intervals before it gives protection against challenge. It is therefore of very little use during outbreaks when rapid protection is required. Use of the inactivated vaccine in the field during outbreaks in Saudi Arabia confirmed the results recorded by American researchers, providing no protection in vaccinated animals after a single inoculation.

There are currently two commercially available live vaccines that have been shown to be effective for protecting livestock; the Smithburn strain has been used for many decades in East and southern Africa. The teratogenic effects of the vaccine, recorded in small stock, have been greatly exaggerated by certain authors. A controlled study in South Africa showed that a small proportion sheep foetuses showed effects on the nervous system when the vaccine was administered during 30-60 days of pregnancy when the foetal nervous system is developing. No such effects have been reported in cattle.

A mutant strain designated Clone 13 has been shown to protect small stock against abortion on challenge and has been registered for use in livestock in South Africa. Controlled trials in pregnant sheep showed no teratogenic effects in foetuses during the danger period, namely the development stage of the nervous system.

Live vaccines confer immunity within 3-4 weeks after administration. The Smithburn vaccine strain is said to give lifelong immunity but since no scientific data available on this aspect it is recommended that vaccination should be done annually at least for the first few years of the animal’s life.

RVF vaccination should be done on a planned, sustained basis, 3-4 weeks before the RVF season to avoid all the problems that occur when doing this during an outbreak. All livestock can be vaccinated at any age, except for young animals of vaccinated mothers which must be vaccinated at 6 months. Avoid use of the Smithburn strain between 30-60 days of pregnancy in small stock if possible, but during outbreaks it may be preferable to risk this rather than lose larger numbers of lambs as a result of abortion.

**Mosquito control**
On farms where animals are unvaccinated, deltamethrin containing dips can be used to repel mosquitoes as an emergency measure for 3-4 weeks after vaccination (see below). This is an emergency measure only because it is expensive and labour intensive. Mosquito control should be done in conjunction with vaccination which will be protective 3-4 weeks after administration. The pyrethroid deltamethrin, which has a knock-down effect on mosquitoes, is the dip of choice. The most vulnerable animals, namely pregnant and young stock should be treated as described below:

Adult cattle can be dipped or sprayed weekly with deltamethrin containing dips (e.g. Decatix 3). Sprays must be applied at not less than 3 litres per animal. Alternately deltamethrin containing pour-ons (e.g. Clout or Decaspot in dairy cattle) can be applied, ensuring that application starts on the poll and is continued along the backline.

Young calves can be dipped or sprayed as for adult cattle. Deltamethrin pour-ons are less safe and effective in this age group.

Wooled sheep breeds can be treated with water based pour-ons (e.g. Wipe Out) which must be applied to the head and along the backline. Ideally these animals should also be belly bathed with deltamethrin containing dips (e.g. Decatix 3) to protect the legs and underline, since pour-on formulations tend to run off these areas.

Non-wooled sheep and goats can be dipped with deltamethrin-containing dips (e.g. Decatix 3). Alternately oil-based pour-ons (e.g. Clout) can be applied from the poll along the back, as well as in the axilla and the groin. Lambs should be carefully hand-dipped with a deltamethrin dip.

**RVF IN WILDLIFE**

RVF has been confirmed as a cause of abortions and deaths in wild ruminants such as buffalo and various antelope species. Vaccination of free-living animals is probably impractical but based on observations in livestock the use of live vaccines is probably safe. However controlled vaccination trials have not been published.

**References**


