ANIMALS

EXOTIC DISEASE FOCUS: SCHMALLENBERG VIRUS: A NEW DISEASE OF RUMINANTS

History

The world is well aware of the dangers posed by newly emerging diseases such as SARS and avian influenza. Emerging infectious diseases (EIDs) are a real and on-going concern for both developed and developing nations. Rapid detection and response are critical to minimise potential impacts.

An EID is an infectious disease that has appeared in a population for the first time, or that may have existed previously but is rapidly increasing in incidence or geographic range. As well as being caused by novel micro-organisms or strains of micro-organism, EIDs can develop from existing organisms that have undergone an evolutionary change, have re-emerged (e.g., owing to drug resistance), or have spread to a new population or geographic area (e.g., following ecological change).

A new disease causing fever, reduced milk production, diarrhoea and abortion in cattle emerged in Germany in August 2011. A novel virus was subsequently demonstrated by real-time PCR and named Schmallenberg virus (SBV), after the location where the disease was first described.

Since then, disease caused by SBV has been reported in ruminants (cattle, sheep, goats, bison) in the Netherlands, Belgium, England, France, Luxembourg and Italy. The total number of SBV-affected animal holdings as of 17 February 2012 is 1043, involving 967 sheep farms, 44 cattle farms and 32 goat farms. The distribution among the countries is as follows:

COUNTRY	AFFECTED HOLDINGS	SHEEP	CATTLE	GOATS
Germany	607	558	23	26
France	152	149	3	0
Belgium	127	116	10	1
Netherlands	103	945	4	
UK	52	49	3	0
Luxembourg	1	1	0	0
Italy	1	0	0	6

Aetiological agent

The provisionally named Schmallenberg virus (SBV) is an enveloped negative-sense segmented single-stranded RNA virus. Viral sequencing indicates that SBV belongs to the Simbu serogroup of the Bunyaviridae family, genus *Orthobunyavirus*. Other members of the Simbu serogroup are the Shamonda, Akabane, and Aino viruses, and SBV is considered most closely related to the Shamonda virus.

Simbu serogroup viruses are mostly found in Asia, Australia and Africa, and have never previously been reported in Europe.

Epidemiology

VECTORS

The transmission of SBV needs to be confirmed but spatial and temporal distribution of the disease suggests that the virus is first transmitted by insect vectors and then vertically *in utero*. Other Simbu serogroup viruses are primarily transmitted by *Culicoides* midges or by mosquitoes, and it is likely that SBV is also transmitted by these blood-sucking insects. SBV has been shown also to transmit vertically from mother to offspring during prenatal development. Direct transmission from animal to animal or via products such as meat or milk has not been demonstrated and is unlikely.

VIRAEMIA AND INCUBATION PERIOD

Experimental infection in three calves showed mild clinical signs of acute infection at 3–5 days post-inoculation and viraemia at 2–5 days post-inoculation. No data are yet available for sheep and goats.

CLINICAL SIGNS

Infection with SBV has been associated with transient non-specific clinical signs including fever, reduced milk yield, loss of appetite, loss of condition, and diarrhoea, with signs disappearing after a few days. It is thought that animals infected during the first trimester of their pregnancy are most vulnerable to teratogenic problems. SBV infects the foetus in pregnant animals, causing abortions and a high rate of congenital malformations (crooked necks, hydrocephalus with brain hypoplasia, scoliosis, arthrogryposis and stiff joints) or weak live animals, mainly in lambs. The exact rate of infection is not known. Some sheep farms have reported more than 25% malformed lambs but the absence of specific geographical clusters of infections suggests that SBV may also be causing subclinical or inapparent disease.

Few Simbu serogroup viruses cause clinical signs of disease. However, SBV is the first of these viruses detected in Europe and it has significant potential to cause disease

and congenital malformations in the highly susceptible ruminants. As the experience with Akabane virus shows, once the virus is endemic it will rarely affect foetuses since breeding animals develop immunity prior to their first pregnancy.

HUMAN HEALTH

The Dutch National Institute for Health and Environment (RIVM) has performed an analysis of the potential risk to humans. From the available information, it says transmission of the virus to humans cannot be excluded but is very unlikely. This analysis has now been adopted by the European Centre for Disease Prevention and Control (ECDC). The closely related Shamonda and Akabane viruses have also only been found in livestock.

DIAGNOSIS

Currently, infection is being confirmed on the basis of a RT-PCR test. Virus neutralisation and indirect immunofluorescence tests are also available. The virus is primarily detected in the brains of infected animals but blood, serum, meconium, placenta and amniotic fluids are also being tested. It is more difficult to prove the presence of SBV in calves than in lambs, owing to the longer gestation period and the reduced likelihood that virus will remain in the malformed foetus until parturition.

The clinical signs are not specific and other causes of diarrhoea and reduced milk production should be taken into account. Differential diagnoses for acute infection in adults include bluetongue, pestiviruses, foot and mouth disease, bovine viral diarrhoea, herpesviruses, and toxic substances. Differential diagnoses for the malformation of calves, lambs and kids include toxic substances, genetic factors, bluetongue, pestiviruses and other viruses of the Simbu serogroup (Akabane).

Risk assessment

It is recognised that Akabane is the most pathogenic virus in the Simbu serogroup. Although SBV is newly discovered, the risk it poses is not considered to be more than that of Akabane or any other virus of the Simbu serogroup. The Ministry of Agriculture and Forestry (MAF) has performed a rapid risk assessment to determine the risk of SBV introduction to New Zealand and concluded that the likelihood of its establishing here, and the consequences of its establishment, are negligible.

SBV could theoretically be introduced into New Zealand by animals or their germplasm (semen/embryos) if they are in the incubation period or viraemic at the time of introduction or collection respectively. However, the viraemic period is very short (3–4 days), animals that recover from infection are immune, and long-term carriers of the virus have not been noted, so the risk of introduction is very low.

SBV is not contagious and could only be transmitted to other ruminants in New Zealand by competent insect vectors. As with other Simbu serogroup viruses, *Culicoides* spp. are considered to be the main vectors. A *Culicoides* surveillance programme has been operating in New Zealand since 1991. Sentinel cattle are monitored for seroconversion to viruses transmitted by *Culicoides* spp. (bluetongue, epizootic haemorrhagic disease, Akabane and Palyam viruses). To date, seroconversion to arboviruses has not been detected in sentinel cattle and no *Culicoides* have been trapped. MAF is currently commissioning an operational research project to use wind trajectory modelling and climate modelling to evaluate this programme. Depending on the results of these studies, future surveillance may be limited to vector surveillance with serosurveillance in sentinels discontinued. As there is no evidence of a competent vector in New Zealand, the disease would be unable to establish.

Ongoing research

There are still many unknowns regarding SBV, such as its origin, immune status of animals following infection, economic impact and transmission pathways. European countries are combining research efforts and information is being shared internationally through networks and the media. Four priority areas for research have been identified: diagnostics, virus characterisation, epidemiology and vaccine development. There is little emphasis on development of a vaccine, because in similar viruses animals quickly develop natural immunity.

Other issues

None of the infections caused by viruses of the Simbu serogroup are notifiable to the World Organisation for Animal Health (OIE). The EU considers that restrictive measures against imports/exports of ruminants and their products are not justified, as it does not consider that

these goods pose a risk of virus transmission. Despite the Commission's insistence that there is no risk from trade, Russia has banned the import of cattle, sheep, goats and all associated products from affected countries. This is particularly significant because Russia is the EU's second largest beef market, and because there is an important live cattle trade between Germany and Russia.

Conclusion

The emergence of SBV in Europe illustrates the importance of maintaining a heightened vigilance for emerging infectious diseases. Early reporting of unusual or suspect exotic signs of disease can be made to veterinarians or the MAF exotic pest and disease hotline, 0800 80 99 66.

FURTHER READING

Dutch National Institute for Public Health and the Environment (RIVM): http://www.rivm.nl/dsresource?objectid=rivmp:60483&type=org&disposition=inline

European Centre for Disease Prevention and Control (ECDC): http://ecdc.europa.eu/en/publications/Publications/231112_TER_Risk_assessment_Schmallenberg_virus.pdf

Friedrich-Loeffler-Institut: http://www.fli.bund.de/de/startseite/aktuelles/tierseuchengeschehen/schmallenberg-virus.html

OIE technical fact sheet: http://www.oie.int/fileadmin/Home/eng/Our_scientific_expertise/docs/pdf/Schmallenberg_virus.pdf

OIE recommendations for safe trade: http://www.oie.int/fileadmin/Home/eng/Our_scientific_expertise/docs/pdf/Recommendations_for_safe_trade_Schmallenberg_virus.pdf

Helen Smith
Senior Adviser – Risk Analysis, Animals
Science and Risk Assessment Directorate, Standards Branch
helen.smith2@maf.govt.nz