SCHMALLENBERG VIRUS – KILLER IN THE WOMB

Professor S P Borriello
Chief Executive, Veterinary Medicines Directorate

Professor Trevor Drew
Head of Virology, Animal Health and Veterinary Laboratory Agency.

This time last year few knew of the German town and no one had heard of the virus. Not so now. So where did it come from, how did it get here, why is it a problem, and what is likely to happen next?

WHERE DID IT COME FROM AND HOW DID IT GET HERE?

Throughout late summer and autumn of 2011, farmers and veterinarians in northwest Germany, and in the Netherlands reported an unidentified disease in dairy cattle, consisting of fever, decreased milk production, and diarrhoea. In October 2011, an investigation of such a case in dairy cows in the small German town of Schmallenberg finally yielded a novel virus that was related to a number of exotic viruses that also caused birth defects and were known to be transmitted by insects. German scientists spread the word about their findings and continued to monitor cases and were particularly concerned when, in December 2011, they detected the virus in a stillborn calf.

Scientists all over Europe, including the Animal Health and Veterinary Laboratories Agency (AHVLA) in the UK, set up diagnostic capability and the Netherlands soon reported the virus in cases of malformed aborted lambs, as well as in calves. They were quickly followed by other European countries, with more reports of infection in Germany and also in Belgium, UK, France, Italy, Spain and Luxembourg. A few cases in goats have also been reported on the continent.

How the Schmallenberg virus appeared in Europe is unknown, though it is most likely to have been introduced either by an infected animal and transmitted by infected midges, or directly by infected midges from abroad. For England, the most likely route of introduction was by infected midges arriving from Northern Europe aided by prevailing winds. It is estimated that the virus first arrived here during the summer or autumn of last year.

A more interesting question is the origin of the virus. Is it a known virus that has simply been given a different name, a variant of a virus that has until now been harmless to mammals and only came to our attention because of a mutation that enables it to cause fetal abnormalities, or one that causes undiagnosed problems in less developed parts of the world and has now spread?

Analysis of the genetic make-up of the virus means we can identify the family to which it belongs (Bunyaviridae) and the genus (Orthobunyavirus). We also know that it is closely related to other viruses in that genus, which were first described in Japan (Akabane, Aino and Shamonda), which cause infection in livestock, and probably originated in Africa.

THE CURRENT SITUATION IN THE UK

At present cases have only been detected in the South of England, as of mid-April 243 farms located in 24 counties are known to be affected. The most severely affected counties are Kent, East Sussex and West Sussex with 42, 41 and 38

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TABLE 1: CONFIRMED CASES OF SCHMALLENBERG VIRUS IN EUROPE

COUNTRY	CATTLE	SHEEP	GOATS	TOTAL
England	28	215	-	243
Belgium	195	167	2	364
France	104	1058	12	1174
Germany	293	840	45	1178
Italy	1	-	1	2
Luxembourg	6	5	1	12
Netherlands	148	107	6	261
Spain	-	1	-	1
TOTAL	775	2393	67	3235

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affected farms each. Of the remaining counties 13 have less than five affected farms; four have between five and ten affected farms, and four have between 10 and 21 affected farms.

The figures have to be treated with caution for a number of reasons. Firstly, there is no single absolute method of diagnosis, and even though the figures for England are based on a molecular method which detects the nucleic acid of the virus (and thought to be the most sensitive and specific test currently available), we know of some cases that fit all of the case definitions for this infection and have all of the expected histological features at post-mortem investigation, but which are negative in the molecular test. Secondly, we must remember we are looking at an infection that actually occurred last year – we are only seeing the effects today. For lambs, the virus survives the pregnancy period, but for cattle, with a longer pregnancy period, the virus has often disappeared by the time of birth. Thirdly, the disease is not notifiable, so there is no obligation to report. However, the number of submitted samples strongly indicates a willingness to report presumed cases. Of 619 reported likely cases where there has been clear laboratory diagnostic confirmation, 39% were positive, showing a high level of submission of suspected (but negative) cases (61%). For affected calves, laboratory confirmation is more difficult as the virus has disappeared by birth, due to the longer gestation.

WHY IS IT A PROBLEM?

The most obvious problem of course is that it causes loss of life in utero and birth deformities, with economic consequences and disrupting replenishment of livestock. The deformed fetus can damage the dam at birthing, particularly as a consequence of deformed limbs. Although symptoms in adult animals are very mild, there may be a drop in milk production in dairy cattle. Farmers also have to employ more staff to assist in lambing and calving, also often incurring extra costs if a vet needs to be called. Compounding the economic problem is anxiety amongst unaffected countries leading to eight suspending imports of ruminants (and in some cases also pigs) from affected countries. Though the US has not stopped importation of live animals, it has suspended importation of European source embryos and semen, as have some other countries.

WHAT'S NEXT?

Although much has been learnt about the virus in a very short period of time, it remains the case that there is more we don't know than there is that we do know. Can it infect humans? What explains the current host range for the virus? Will sheep that have been infected attain an immunity that will protect against fetal infection in the future? Will the virus survive the winter in some way and the disease become established in Europe to become a new endogenous infection? Is a vaccine needed and can an effective vaccine be easily produced? Are there other ways the virus can be transmitted?

Fortunately, it is now considered very unlikely that humans are at risk. Reassurance comes from the fact that very few of the relatives of the virus cause disease to humans and despite heightened awareness and opportunity for exposure, along with some monitoring for evidence of exposure, no human cases (or other cases other than in ruminants) of this virus have been found. Interestingly this is not because the virus cannot grow in the laboratory in cells from other species. Evidently, inability to infect other animals is not due to a lack of virus receptors on the cells (viruses must bind to and enter cells in order to hijack the host cell's machinery to replicate itself).

The pattern of cases will change as the lambing season closes, and as calving occurs later than lambing, an increase in infected calves is expected. It will be interesting to see whether a few cases occur in the less commonly farmed ruminants such as deer and whether new world camelids, such as alpacas, are also susceptible. What is less clear is the extent to which this disease is now established and will become part of the usual endemic diseases profile in the UK. We now know that the biting midges normally resident in the UK can likely transmit the virus, and that the virus can most likely establish in midges, meaning that the virus doesn't have to survive in animals for midges to become re-infected next spring, but could survive over the winter in the midges themselves. We need to find out whether other biting insects, like mosquitoes are also involved, or if infected animals can spread disease just by contact. We also don't know how long immunity in sheep or cattle (or other ruminants) lasts, and if such immunity would protect fetuses. If there is good long-lasting protective immunity following natural infection, this would help reduce the number of cases, and may already have done. Husbandry practice could be tailored to maximise this effect. However, it is likely that areas less affected or unaffected by the disease could be vulnerable next year, particularly on the borders of the area where disease has occured this year. Reliance on such an approach would be less effective than a vaccine, though if required it is unlikely to be available until next year other than for emergency use. There is a good precedence for a vaccine to this virus in that an effective vaccine has been produced for Akabane virus, a close relative.

This is a rapidly unfolding story, exemplifying the rapid progress that can now be made in identifying new causes of disease, developing diagnostic tools, characterising the new pathogen, and developing interventions, made possible by new technological advances. It is also a reminder of the continual threat of new pathogens and how much we still don't know.

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