



NSW Agriculture

## Neospora caninum infection in cattle

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*Neospora caninum* is a microscopic protozoan parasite. It was not specifically identified until 1989 as a cause of abortion in cattle, although abortions due to this previously-unidentified protozoan had been recognised since the 1970s. *Neospora caninum* is now considered a major cause of bovine abortion throughout the world.

In some areas, such as the North Coast of NSW, evidence from laboratory submissions indicates that *Neospora caninum* may be responsible for over 30 per cent of all abortions in both dairy and beef cattle. Neosporosis is diagnosed less frequently in inland NSW, but this may be partly because aborted foetuses are less likely to be noticed in extensive areas. Beef producers need to become more aware of this important parasite.

Previously, neosporosis was difficult to diagnose unless an aborted foetal brain was available for microscopic examination, which is possibly why the importance of the disease has been underestimated. More recently, blood tests have become available that indicate the infection is widespread in NSW dairies, although often at a low rate within herds.

Investigations in Queensland have estimated that approximately 20 per cent of that State's dairy herds are infected with *Neospora*, and recent testing suggests an even higher percentage in NSW dairies. Internationally, the disease is now recognised in many countries. Research conducted in United States dairies has reported a 5 per cent decrease in milk production of infected first-lactation dairy heifers, and a minor decrease in growth rates of infected feeder steers in feedlots.

It has been estimated that *Neospora* infection costs the Australian dairy industry around \$85 million a year and the beef industry about \$25 million.

### NEOSPORA IN THE COW

Cows are an intermediate host of *Neospora caninum*, and are most likely infected by eating oocysts (eggs) of the parasite passed by a dog (or possibly some other carnivore). Infection can then pass from the cow to her foetus via the placenta. Congenital infection is considered to be more important in maintaining infection within a herd than infection via dog faeces. Experimentally, it has also been shown that infection of calves via contaminated colostrum is possible, but this is regarded as a



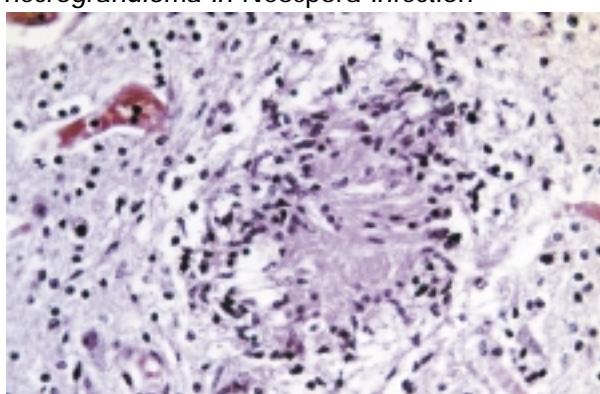
rare occurrence that is unlikely to contribute to the maintenance of an infection in a herd.

Adult cows show no clinical signs of illness following infection, and the majority have normal pregnancies. However, European studies have shown that infected cattle are three times more likely to abort than uninfected cows. Calves of infected cows, although born clinically normal, have an 80 to 90 per cent chance of being *Neospora* carriers. The female calves then have a high probability of infecting their own calves.

Recent studies in New Zealand report a much lower rate of congenital transmission (around 9 per cent) than the European studies. This suggests that transmission quite likely depends on a number of risk factors that can vary greatly between farms and regions (for example, presence of carnivores, feeding of concentrates, stocking rates and proximity to bush versus urban areas). If the transmission rate were close to 90 per cent it would be unwise to keep the offspring of infected cows if you were attempting to eliminate the disease. However, retaining these animals may be warranted if the transmission rate is only 9 per cent and the cattle's genetic merit is considered worth the risk.

Abortion due to *Neospora* typically occurs when cows are between 4 and 7 months pregnant, but it may occur anytime from 3 months to term. Abortion before 3 months has not been observed, so the role of *Neospora* at this stage of pregnancy is unknown. Abortion doesn't always occur as soon as the embryo dies, and mummified or partly 'digested' foetuses may be expelled.

Tissue section of a brain showing necrogranuloma in *Neospora* infection



JOHN BOULTON, RVL WOLLONGBAR

Infected live calves are occasionally born showing abnormalities, but the majority have no clinical signs of disease. Abnormalities, if present, include being underweight and unable to stand, flexed or hyper-extended limbs, lack of coordination, decreased reflexes and sensory perception, and a 'pop-eyed' appearance or asymmetrical appearance of the eyes.

'Vertical transmission' from mother to daughter is thought to be the most important means of maintaining infection in a herd. If no new infection is introduced, usually only a small number of individuals throughout the herd will sporadically abort because of *Neospora*.

Occasionally, there may be an 'abortion storm', in which a large number of animals abort within a short period of time. Dairy herds in coastal NSW and Queensland have had up to 33 per cent of cows abort over a period of a few months owing to high rates of *Neospora* infection. Some of these abortion storms may occur when an uninfected herd is exposed to oocysts from an infected carnivore, but the majority are probably due to the occurrence of a herd event (for example, exposure to another infectious agent or to toxins in mouldy feed) that reduces immunity in a previously infected herd, causing re-activation of the parasite. A series of abortions then occurs in cows that would normally carry their calves to term.

The sporadic cases of abortion in carrier cows could also be caused by temporary suppression of their immune systems by other illnesses. This could allow a dormant *Neospora* infection to be activated at a crucial stage of pregnancy.

## NEOSPORA IN THE DOG

The dog has recently been recognised as a definitive host of *Neospora caninum*, and it is in the dog that sexual multiplication of the parasite takes place. Dogs, and possibly other carnivores, become infected after eating infected foetal tissue or afterbirth, then pass parasite oocysts in their faeces for several weeks. It is assumed that cows then ingest oocysts from contaminated pasture or other feed.

Like cattle, the majority of dogs infected with *Neospora* show no clinical signs of disease. However, *Neospora* infection in dogs can cause progressive weakness and paralysis of one or both hind limbs, usually in pups under 6 months of age. The muscles of the affected leg waste away. In rare cases *Neospora* has also been reported to cause difficulty in swallowing, sudden death due to heart problems, pneumonia and skin problems.

## OTHER SPECIES

Natural *Neospora* infections have been reported in many other animals, including dogs, sheep, goats, horses and deer. Experimental infections have been produced in mice, rats, dogs, foxes, goats, and pigs, among others.

*Neospora* is suspected of being capable of infecting humans because of its close relationship to *Toxoplasma*, a known cause of abortion and congenital infection in women and sheep. Infection with *Toxoplasma* can be induced experimentally in non-human primates, and one study

detected *Neospora* antibodies in 6.7 per cent of human blood samples tested at a blood bank. However, antibodies to *Neospora* have not been detected in women who have experienced abortions.

## DIAGNOSIS IN CATTLE

An aborted foetus is the best specimen to be sent to a laboratory to establish the cause of any abortion. In the case of neosporosis, the **foetal brain** and **heart** are the best specimens for diagnosis, as these organs show distinctive changes under the microscope in a high percentage of affected foetuses. Even mummified, decomposing or partly-eaten foetuses can be useful for diagnosis, provided that the head is intact, with the **brain** (and **heart** and lung) collected for fixation in 10% formalin solution for microscopic examination.

It is important to collect aborted foetuses, chill them and submit them to a laboratory as soon as possible. (To avoid the possibility of contracting leptospirosis and Q fever, use protective gloves, seal the specimens in plastic bags, and refrigerate them).

Alternatively, blood samples or foetal fluids can be tested for the presence of antibodies to *Neospora caninum*. Positive results from foetal samples are a strong indicator of exposure to the parasite, but negative results in younger foetuses are not reliable, as the immune system of the foetus may simply not have been mature enough to mount an immune response.

Because many cows may be positive for *Neospora* but not abort, care must be taken in interpreting the mother's blood results. Comparing antibody levels in cows that have aborted with levels in pregnant cows in the same herd is more likely to provide meaningful results than a sample from a single cow.

## NEOSPORA CONTROL

Where practicable, make every effort to prevent contamination of pasture and feed sources by dog faeces. Prevent farm dogs from scavenging aborted foetuses and afterbirth by not letting them wander freely, especially during the calving season. Control wild dogs and foxes as much as possible. Aborted foetuses, dead calves and afterbirth should be buried, burned or otherwise disposed of, and not left in the paddock to be scavenged by carnivores. Even afterbirth from apparently normal calvings should be cleared away, as it may also contain parasites that are infectious to dogs. The effort you put into this clean-up will reflect the extent of the problem being caused by the disease!

Some advisors recommend culling any cows that abort, as well as their offspring (provided that *Neospora* is confirmed as the cause). If the prevalence of *Neospora* is high, this may not be an option. If you are attempting to eradicate *Neospora* from your herd, you must be confident that the cattle are unlikely to become re-infected by contact with carnivore faeces or the introduction of infected cows.

Before deciding to cull aborters, you need to determine whether the main method of infection in your herd is vertical (that is, from mother to daughter) or whether new infections are occurring through dogs and wild carnivores. To find out, it is essential that you keep good reproductive records of all cows; this will also allow you to identify repeat aborters that

need to be culled. However, some cows abort once because of *Neospora* and then become immune – these may be desirable animals to retain.

Some producers who have taken the option of culling all *Neospora*-positive cows have had disastrous abortion storms when infection has been re-introduced to their herds, which no longer had any immunity. Until a vaccine is available, it may be better to live with the disease and cull only those animals that abort more than once. This decision will be based on the frequency of abortions being experienced.

A vaccine has been released in the United States, but limited information on its efficacy has been published and it is unlikely that such a vaccine would be available in Australia for a number of years.

Experimental drug therapy for the parasite in cattle has not been successful and would be impractical in dairy herds because of the need to abide by milk-withholding periods.

There is currently limited understanding of why *Neospora* sometimes causes significant reproductive problems but at other times causes only the occasional abortion. The development of clearer prevention and control strategies may become possible with more research about the factors that modify the impact of this disease.

## NEOSPORA RESEARCH

Current research aims to better understand the impact of *Neospora caninum* on the beef and dairy industries of Australia and to devise methods for controlling the disease. The NSW Cattle Compensation Fund has funded work on the parasite at the University of Technology Sydney and the University of Sydney, in collaboration with NSW Agriculture. This work has focused on developing better diagnostic tests for the disease, which may help in understanding how the disease spreads in infected herds. In addition, the Queensland Department of Primary Industries and the Dairy Research and Development Corporation's Subtropical Dairy Program are funding work in Queensland, in collaboration with the NSW group.

## CONCLUSION

*Neospora caninum* is present in both dairy and beef herds in NSW, and has been responsible for both sporadic disease and abortion storms, particularly in NSW coastal dairies. There is serological evidence that infection is widespread, but the frequency with which it contributes to reproductive disease in this State is not yet clear. It is probable that the impact of *Neospora* infection becomes more significant when the immune system of the infected animal is compromised by other factor(s).

Diagnosis of the cause of abortion in cattle may be complex, and requires veterinary expertise to determine which infectious agents (if any) are involved. Fertility can be affected by a number of different agents, and also by non-infectious factors.

Check your pregnant cows and heifers closely. If you observe any abortions, submit both the foetus and placenta

for laboratory examination through your private or district veterinarian.

If the foetus cannot be recovered, collection of blood samples from at least 10 aborting or in-contact cows is recommended. These would normally be tested for other diseases known to cause abortions, such as brucellosis, leptospirosis and pestivirus, as well as for neosporosis. Vaginal mucus for testing for vibriosis may also be collected.

Further information on bovine abortion is available from the Rural Lands Protection Board and NSW Agriculture offices.

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