

The state of TB  
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By now many of you have read about the unfolding tale of Tuberculosis in the UK. The great loss of life among the llamas and alpacas there has been both sad and frightening. Recent scientific articles have called the TB skin test- the same method we use here in NZ- into question. I know there is a lot of concern for our animals, since TB is present in New Zealand. Let me start by saying (with all credit to the wise Douglas Adams)...

### DON'T PANIC

Yes, the current test is imperfect, and recent evidence seems to suggest that there may be significant problems with the skin test, but (and I know this will sound strange) the good news is that if it doesn't work today, it didn't work yesterday.

Why is that good news? Because we've managed to get away without a major TB outbreak here in NZ all these years. Nothing has changed. Today we know that there may be a problem with the test, and we can work towards a better system. This is a good thing.

Why haven't we had a massive camelid-TB outbreak here? Good question. It is probably a combination of less risk and good luck. The TB risk is kept down through the actions of the AHB; they test deer and cattle, and they control the possum population (a major vector for TB). From talking with people at the AHB, it appears that many of the new infections in cattle, deer and pigs occur in animals that graze adjacent-to or within blocks of bush filled with infected possums. Most llamas and alpacas are kept in more highly developed areas (lifestyle blocks near towns, not remote stations) where their risk of being exposed to TB is lower.

Have we had TB in camelids in NZ? Yes. I know of two cases: one in 2000, the other in 2003. I've spoken with the owner involved in the 2003 case. Both cases involved a single infected animal (though in 2003 a second animal was slaughtered based on a positive TB blood test, but no TB was found post mortem). In the UK we see reports of TB running through herds like wildfire, resulting in huge losses. Why didn't that happen here? I don't know. Maybe it was just luck. Maybe it was due to differences in animal management systems. Maybe the strain of TB was subtly different.

Those are the known losses to TB in New Zealand, I cannot rule out the possibility that other llamas or alpacas may have died from TB that were never detected or reported. Sometimes TB doesn't present any "classic" symptoms, the infected animal simply dies. If the animal was buried without inspection, nobody would know. So maybe we've had a couple of other camelid TB deaths. That can't be proved or disproved. What we do know is we have not had a camelid herd mass-infection here.

What's wrong with the old skin test?

It's true that no test is ever 100% sensitive and 100% specific. All tests have their strengths and weaknesses. The skin test was adopted because it made perfect sense at the time, based on the evidence available, as an effective screening method.

The skin test was never designed to be a single-animal yes/no check for TB. Rather the idea was that given a large enough herd, with a sub-population of infected animals within that herd, the test had a good chance of detecting at least one of the infected animals. This detection would alert the owner (and their Vet, the AHB, etc) that more testing was required, and start a chain of actions to control the situation (movement controls on the herd, culling, etc). The problem is that even the "big" llama and alpaca farms are quite modest when compared to large cattle and deer farms. And most camelids live in very small herds, only a handful, which makes it very hard for even a quite good screening test to detect the presence of TB in that herd.

Camelids also have very different sensitivities to the skin test depending if they are injected on the neck or by the tail (caudal fold). The tail site has much lower sensitivity. (1)

But that's not the only problem. Where infected deer and cattle can have TB for years before they die, the disease appears to hit camelids much more quickly (2), killing some animals in only a few months (3). If you are only testing once per year, you can easily have an infection kill one or more animals between testing visits, and thus never be detected. Based on the potential speed of the disease, we'd have to be testing every 60 to 90 days or so to have effective screening (though in alpaca that frequency of testing has not proven able to detect the disease, either (4)). But even if such frequent testing was effective, it might not be suitable here. The cost and inconvenience would drive most people away from such a scheme if it were voluntary. And with so many llamas and alpacas held in small herds as pets, a mandatory scheme is likely to be ineffective and pointless due to low compliance. Even worse, if you keep jabbing a llama or alpaca with the tuberculin proteins again and again in such a short time frame eventually some of them may start reacting. It's not that they have the disease, rather it is akin to vaccinating- the repeated dose "gets the attention" of the immune system. This makes it react. The llama doesn't have TB, and it isn't immune to TB, but it shows up on skin (and even blood) tests as being infected. Not good.

The skin tests require a cell-based immune reaction- that reaction is what causes the swelling at the injection site. It takes some time after first infection for the immune system to develop such a response; in cattle this lag can be up to six weeks. Additionally, when an animal is very sick (in the late stages of TB infection) it can go into a state of "anergy", where the immune system is so over-extended and wrecked by the infection that it is no longer capable of producing a swelling reaction in response to the skin test. The combination of these two means that there may be a very small window of time during which the skin test would be effective. For example, if a TB infection took three months to kill a camelid (and it may well work that fast), there may only be a window of a couple of weeks where the skin test even has a chance of getting a positive reaction.

Trials on llamas and alpacas deliberately infected with Tuberculosis (as part of efforts to understand how the disease affects new world camelids) showed that the skin test had a 100% detection rate. But this has not proved true with camelids infected under natural (field) conditions, where few or no infected animals are successfully detected (8).

This leads to the problem of false positives and false negatives. All tests have a certain rate of incorrect results, so this is not an issue unique to the TB skin test. It's just that the skin test has an unacceptably high rate of both, given the consequences.

A "false positive" is when the test reads that an animal has TB, when it is actually fine. This can result in great expense (blood tests for the whole herd), stress, inconvenience (having your herd locked down, blocking you from many business and pleasure activities with your llamas) and may even result in the destruction of the supposedly-infected llama. False positives can come from a variety of sources, even down to the type of bedding! (1)

A "false negative" is when the animal reads as clear, while it actually has TB. This is worse than a false positive, as you are left with a dangerously infective animal in your herd that can spread the disease. At the Napier camelid vet conference in 2010 a vet (5) who had helped treat a badly infected herd (in Spain in this case) spoke of 25 of 50 animals dying of TB, and all the while they never got a positive skin test! I think this line from a recent abstract says it all: "Over 95% of the animals with evidence of TB failed to produce skin test reactions, thus confirming concerns about the validity of this method for testing SAC."(6)

If the test doesn't work, should you keep using the test? Tricky question. If you simply want to screen your herd for TB, the current test is of questionable usefulness. It might pick up an infected animal, but it might not. And you run the risk of false positives.

If you want to attend shows, then a "clear" certificate is required. In this case, testing is needed. If/when a new camelid testing/screening protocol is developed and accepted by AHB, then the testing requirements for shows will change, but until then the skin test is your only option. But remember, a "clear" result on the skin test doesn't prove you don't have TB in your herd.

What can we do?

I don't have a perfect solution, and I've been thinking about this for more than a year. I've got ideas, but these are going to have to be passed through veterinary review to make sure they are both realistic and effective.

First we need to understand that our risk profile is very different from a llama owner in SW England. The type, cost, and inconvenience of any testing scheme has to be proportional to the risk we face. What constitutes an appropriate test here may not in England, and vice-versa.

For screening of herds to detect the presence of TB I currently recommend Post Mortem examinations of all adult animals that die- for whatever reason. Only the most rudimentary Post Mortem is required, gross pathology. Practically this means the vet opens up the deceased animal and visually inspects its organs (lungs, liver, lymph nodes, etc). TB almost always causes very visible damage to the organs, particularly the lungs. An extensive study of predictors of TB infections in a llama herd found that: "The predictive value of suspicious gross lesions at postmortem examination was therefore high in the herd."(7) So even if your llama died for a readily apparent and unrelated reason (like being shot by an inattentive hunter), if it was carrying TB, it will likely show up during the Post Mortem. An examination such as this should cost less than \$100 if you can take the body to the vet, more if the vet must be called out.

If you ever have an animal that is both wasting away (rapid loss of body condition) and also has respiratory symptoms (coughing) you should immediately contact your vet so they can consider tuberculosis as a potential differential diagnosis. While TB does not always present with these "classic" symptoms, you need to take prompt action for the sake of the rest of your animals if you have a suspected case.

If a single animal needs to be confirmed as being TB free, then the antibody blood tests are currently the best bet. You can point your veterinarian towards the article I referenced above (6 and 8), as they cover technical details about the tests and their effectiveness.

In the months ahead TB testing in camelids is going to be a topic of active discussion here in NZ. I'll try and keep you posted as to any significant developments.

- (1) Vaughn Seed, NZLA AGM, April 2012, Manakau
- (2) Paratuberculosis in Deer, Camelids and Other Ruminants by Colin G Mackintosh and J. Frank Griffin, Chapter 17 of Paratuberculosis Organism, Disease, Control edited by Marcel A. Behr and Desmond M. Collins
- (3) Suspected transmission of *Mycobacterium bovis* between alpacas. Twomey D. F. et al. The Veterinary Record 121, July 25, 2009
- (4) Tuberculosis in Alpacas (*Lama pacos*) Caused by *Mycobacterium bovis* Garcia-Bocanegra, I. et al. J Clin Microbiol. 2010 May; 48(5): 1960–1964.
- (5) Jane Vaughn, Camelid Veterinary Conference, June 2010, Napier
- (6) Diagnostic Value of Animal-Side Antibody Assays for Rapid Detection of *Mycobacterium bovis* and *Mycobacterium microti* Infection in South American Camelids. Lyashchenko et al. Clinical and Vaccine Immunology. Dec 2011, p.2143-2147
- (7) Assessment of antemortem tests used in the control of an outbreak of tuberculosis in llamas (*Lama glama*) Twomey et al. Veterinary Record 2010;167:475-480

- (8) Diagnosis of Tuberculosis in Camelids: Old Problems, Current Solutions and Future Challenges. Alvarez, J. *et al.* Transboundary and Emerging Diseases. Vol. 59, Issue 1, pages 1-10, Feb 2012