Tuberculosis in goats

Tuberculosis (Tb) in goats has always been considered of minor importance in New Zealand, even though the disease has been seen sporadically in feral goats captured.

Within the last few years the demand for feral does as embryo-transfer recipients and the search for feral cashmere genes have resulted in the extensive capture and distribution of feral goats throughout New Zealand. Many of the capture operations have been centred in areas known to have continuing Tb problems in cattle and deer, associated with established infections in the local possum (Trichosurus vulpecula) populations.

Tuberculin testing carried out has confirmed the presence of Mycobacterium bovis in goats captured from these endemic areas. More recently, the export of live goats has resulted in tuberculin tests being conducted on goats destined for export, together with flocks of origin. Reactions to some of these tests has raised questions regarding the attributes of the tuberculin test.

Evidence

Gross and histological evidence suggests that M. bovis infection in goats is a chronic disease similar to that in cattle and deer. The lesions may be found in all the major lymph nodes of the body, and generalised Tb has been seen. However, lesions in the lymph nodes of the head and thoracic cavity, together with lung lesions, are the most common findings, suggesting the respiratory system as the principal route of infection.

The lesions contain yellow caseous material and are often encapsulated. Microscopically, the picture is central necrosis and caseation, with giant cells in the outer granulomatous zone. Low to moderate numbers of acid fast organisms are frequently visible and M. bovis can be cultured from a proportion of cases. Calcification does not appear to be a feature.

The disease has been seen predominantly in recently captured ferals from problem areas. It has however also been seen in farm bred goats, of both dairy and fibre breeds, which have grazed within endemic areas.

There is still dispute as to the risk of goat to goat transmission of Tb. Some evidence from overseas, however, suggests infected goats can be a source of spread to cattle and humans.1,5

Diagnosis

Recent test results: The figures summarised in table 1 show the results of testing recently captured feral goats from the West Coast, tests on goats grazed in the endemic areas, recent project work, diagnostic tests conducted in other areas of New Zealand where tuberculosis has been suspected, and export certification tests conducted around the country over the last 18 months.

The crude prevalence of Tb in captured feral goats from the known tuberculous possum areas of the West Coast is 7.2% (41/587). Of those

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that have been autopsied, 45.5% had lesions of Tb. Individual groups of goats captured from different areas had prevalences ranging as high as 31%.

The goats tested for export have been mainly from properties with no history of Tb. The reactors were according to the British Export Protocol classification. In some cases, however, there were additional goats with reactions of less than 2 mm skin thickness difference. These small swellings have ranged from small “rice grain” reactions to diffuse increased skin thickness over the whole clipped or shaved area, often with some reddening. Comments have suggested sunburn particularly in white-skinned goats tested during the heat of summer, reaction due to shaving, needle trauma, and extremely rapid growth of hair between injection and reading day.

The tuberculin test: The single cervical test is the same as that used for deer, i.e., 0.1 ml of 1 or 2 ml bovine PPD injected at the mid-cervical site and read at 72 hours. Any visible or palpable swelling at the site of the injection is taken as a positive reaction. However, the British Export Protocol for goats classifies any swellings with an increase in skin thickness of 2 mm or greater, or any swellings showing oedema, as positive.

In applying the test it is essential to have good individual restraint. An area in the mid-cervical area should be shaved. Hand held clippers are suitable. Care should be exercised in injecting, as it is easy to place the tuberculin subcutaneously instead of intradermally, owing to relatively thin skin. Our recommendation is to tent the skin and inject at an angle into the tent.

Unfortunately, little information exists on the sensitivity or specificity of diagnostic tests for Tb in goats, although there are reports of both intradermal and complement fixation tests being used. 2, 3, 4

Subjective assessment of the attributes of the tuberculin test suggest that it has acceptable sensitivity, perhaps comparable to that in cattle or deer, but that the specificity may not be as high. Certainly the sensitivity is less than 100%, as in one instance on the West Coast tuberculin tests on two recently captured goats showed only one reactor. However, when both goats were slaughtered and subjected to autopsy, both had lesions consistent with Tb.

A rough calculation of the specificity of the single cervical tuberculin test based on the available figures is shown in Table 2. A sensitivity of 80% is assumed (although varying sensitivities have little effect on the marginal totals), and this gives a specificity of 99.1%. Reasons for non-specific reactivity have been discussed above, but it has also been observed that goats reacting to the test, with no visible lesions on autopsy, frequently have other diseases such as mastitis, heavy parasitic burdens, or severe foot infections. In addition, avian tuberculosis has been diagnosed in a group of Auckland Island feral goats and in a flock grazing among infected poultry.

Where there are reactors and there is sufficient doubt as to the presence of infection, based on sound epidemiological assessment, the comparative cervical test (CCT) can be used as the definitive test. It is recommended that 60 days be the minimum interval between tests, and that both sides of the neck be used, i.e., 0.1 ml of 0.5 mg/ml avian PPD injected on the left side of the neck, and 0.1 ml of 1 mg/ml bovine PPD injected on the right side of the neck. Experience has shown that the reactions can be large and oedematous, rendering the CCT unreadable, when conducted on one side of the neck only.

It is essential to remember that Tb is a Second Schedule Disease under the Animals Act 1967, with the imposition of quarantine restrictions on properties where the disease is diagnosed.

**Discussion**

It is obvious that a low prevalence of Tb exists in feral goats sourced from endemic areas, and that infected goats have probably been spread throughout New Zealand. It is therefore imperative that farmers, and their practitioners, be aware of the potential problem.

**Table 1: Testing results**

<table>
<thead>
<tr>
<th>Test type</th>
<th>No. tested</th>
<th>Rx found</th>
<th>No. tested by CCT</th>
<th>No. CCT +ve</th>
<th>No. killed</th>
<th>No. Tb</th>
<th>No. Nvl</th>
</tr>
</thead>
<tbody>
<tr>
<td>W Coast (ferals)</td>
<td>587</td>
<td>41</td>
<td>4</td>
<td>4</td>
<td>41</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td>W Coast (others)</td>
<td>889</td>
<td>31</td>
<td>14</td>
<td>0</td>
<td>15</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>W Coast (project)</td>
<td>18</td>
<td>0</td>
<td>18</td>
<td>0</td>
<td>18</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>NZ diagnostic</td>
<td>2050</td>
<td>29</td>
<td>16</td>
<td>4</td>
<td>21</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>NZ export</td>
<td>6943</td>
<td>69</td>
<td>138</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>10487</strong></td>
<td><strong>170</strong></td>
<td><strong>190</strong></td>
<td><strong>8</strong></td>
<td><strong>100</strong></td>
<td><strong>23</strong></td>
<td><strong>65</strong></td>
</tr>
</tbody>
</table>

**Table 2: Calculation of test specificity**

<table>
<thead>
<tr>
<th>Disease</th>
<th>Test +</th>
<th>Test -</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Totals</strong></td>
<td><strong>75</strong></td>
<td><strong>298</strong></td>
</tr>
</tbody>
</table>

Before the goat industry embarks on any formalised control or eradication scheme, some further investigative work needs to be conducted. Firstly, it needs to be established whether or not goats transmit the disease to other goats, or other species. Secondly, there is an urgent need to investigate the attributes of the intradermal tuberculin test, not only to test its applicability in a control programme, but also in relationship to export protocols.

Introduction of a formalised regular reporting system for all goat Tb tests conducted in New Zealand is proposed. A project to establish the sensitivities and specificities of the single intradermal cervical test and the CCT is already being conducted by MAF staff at Greymouth.

Finally, some transmission studies need to be planned and implemented. The goat industry should be prepared to commit itself seriously to this type of work to avoid the problems that the deer industry experienced.

**References**


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Fig. 1: Tb lesions throughout goat viscera.