

# Experimental tuberculosis infections in red deer (*Cervus elaphus*)

372

C.G. Mackintosh, J.F.T. Griffin<sup>1</sup> and K.A. Waldrup

AgResearch Invermay, PB 50034, Mosgiel, New Zealand and <sup>1</sup>Department of Microbiology, University of Otago, Dunedin, New Zealand

Research into the epidemiology and immunology of tuberculosis (TB) caused by *Mycobacterium bovis* in red deer (*Cervus elaphus*) can be greatly facilitated by using an appropriate experimental infection model. Such a model must simulate "natural" TB, be reproducible and be relatively simple and safe.

Unlike TB in cattle, which is primarily a disease of the thorax, TB in deer primarily affects the head, with over 50% of cases having a single lesion in a head lymph node, especially the medial retropharyngeal. Other nodes affected include abdominal (20%), thoracic (10%), mixed systems (10%) and body nodes (<5%). Most cases are chronic, with a time-course of over 12 months.

Previous experimental infections in deer have used intravenous, subcutaneous or intra-tracheal inoculations with dose rates of  $10^4$  to  $10^6$  colony forming units (c.f.u.) and in the majority of cases have resulted in serious, generalised and acute disease which does not simulate naturally occurring TB.

A trial at Invermay compared intra-tracheal, intra-nasal and intra-tonsil inoculation in young weaner red deer at two dose rates,  $10^2$  and  $10^4$  c.f.u. (Mackintosh *et al.*, 1993). The animals were monitored for eight months and then slaughtered. As anticipated, intra-tracheal inoculation at both dose rates produced moderate to severe, acute TB, especially in the thorax, in the majority of cases.

Intra-nasal inoculation, which also put the operator at risk, was unreliable at  $10^2$  c.f.u. (80% uninfected) while it produced severe acute TB at  $10^4$  c.f.u. Intra-tonsil inoculation, by contrast, produced typical mild to moderately severe TB in the majority of animals. Most had a single lesion in the medial retropharyngeal lymph node. Lymphocyte transformation and ELISA (antibody) patterns of the affected animals were typical of those seen in naturally infected animals. Subsequent trials have used this intra-tonsil challenge model to verify its validity in adult stags, to study the effects of dexamethasone (simulated chronic stress) on susceptibility to TB and to challenge BCG-vaccinated animals. In these trials it reliably produced "natural" TB infections in 50-100% of susceptible animals, and satisfied the other criteria of simplicity and safety. Doses as low as 8 c.f.u. resulted in TB infections in four out of eight animals inoculated. For most purposes around  $10^2$  c.f.u. appears the optimal dose rate which results in TB in 70-100% of susceptible animals.

## REFERENCES

- Mackintosh, C.G., Waldrup, K.R.E., Labes, R., Griffin, J.F.T., Buchan, G.E., Cross, J. & de Lisle, G.W. 1993. Experimental *Mycobacterium bovis* infection in red deer weaners - preliminary findings. *Proceedings of the Deer Branch of the New Zealand Veterinary Association* 10:297-304.