Susceptibility of red deer (cervus elaphus elaphus) to BSE

Area of research interest: Foodborne pathogens
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Background

The major cause of the spread of the BSE epidemic was attributed to the feeding of contaminated meat and bonemeal (MBM) in the protein rations fed to cattle. The use of MBM in animal feed was not restricted to cattle rations and it is known that MBM was included in the concentrates fed to farmed deer. BSE has been shown to be naturally or experimentally transmissible to a wide range of different ungulate species and deer are known to be susceptible to an endemic TSE (chronic wasting disease, CWD) which is prevalent in North America. However, to date, no TSE infections of UK deer have been reported.
Should BSE infection have been transmitted into the UK red deer population, the CWD precedent would suggest that there is potential for both spread and maintenance of the disease in both free living and captive UK deer populations. The purpose of this study is to investigate the susceptibility of UK red deer to BSE infection and to determine the clinical and pathological phenotype.

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Research Approach

The principle objective of the study is to determine whether UK red deer are susceptible to bovine BSE agent. Groups of orally dosed deer were sacrificed at 6 and 12 months post inoculation and necropsies carried out. A group of deer with BSE injected intra-cerebrally plus a further group of orally dosed deer were maintained until clinical disease or the end of the project. A range of tissue samples were collected at post-mortem and analysed for the presence of signs of TSE disease. All animals were monitored clinically throughout the experiment to define any clinical phenotype.

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Results

No pre-clinically diseased orally infected animals were identified at the 6 months and 12 months post infection cull points. Intra-cerebrally (i.c.) infected animals were maintained until all 6 developed clinical disease. Only one out of six orally dosed deer developed clinical disease before termination of the project. The animals subjected to oral dosing were given a high dose

compared to that likely to occur under natural conditions. With only 1/6 of these animals developing clinical disease in seven years the susceptibility of red deer can be considered as relatively low.
The project confirmed that U.K red deer are susceptible to both oral and intra-cerebral inoculation with the cattle BSE agent. Six clinically positive (from 26-42 months post inoculation) i.c inoculated and one (56 months post inoculation) orally dosed deer that tested positive for TSE by immunohistochemistry and Western blotting using several primary antibodies demonstrated widespread accumulation of disease specific prion protein in the central nervous system, peripheral nervous system and enteric nervous system but none in lymphoreticular system. All showed several brain sites positive for disease specific prion protein and presented immunohistochemistry and Western blotting phenotypes with similarities to BSE in sheep, goats and cattle but unlike those seen in chronic wasting disease (CWD) in elk or scrapie in sheep. The vacuolar pathology and distribution of disease specific prion protein in red deer resembled that of CWD in most major respects however we have shown that BSE can be clearly differentiated from CWD by existing immunohistochemical and biochemical methods that are in routine use.
The knowledge gained as a result of this work will permit rapid and accurate diagnosis should a TSE ever be detected in European red deer and will also enable effective disease control methods to be quickly put in place.

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Published Papers

- Martin, S., Jeffrey, M., González, L., Sisó, S., Reid, H.W., Steele, P., Dagleish, M.P., Stack, M.J., Chaplin, M.J. & Balachandran, A. (2009) Immunohistochemical and biochemical characteristics of BSE and CWD in experimentally infected European red deer (Cervus elaphus elaphus). BMC Veterinary Research, 5, 26-35.

Research report

England, Northern Ireland and Wales

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