

Bacterial infections reported in New Zealand farmed deer

Bacterial diseases of farmed deer are routinely encountered in veterinary practice and diagnostic laboratories in New Zealand. A comprehensive review of the major bacterial diseases of farmed deer has been published recently⁽¹⁾. Some bacterial infections are uncommon and have not been described in detail in the veterinary or scientific literature. Many are recorded only in *Surveillance* in brief reports that contain little history or description of age, sex or species. This review is therefore largely descriptive of the range of bacterial diseases that the veterinary practitioner may encounter on New Zealand deer farms.

Abscesses

A number of bacterial species are isolated from deer abscesses but few are reported. *Actinomyces pyogenes* is often cultured from abscesses diagnosed on-farm and from suspect tuberculous lymph node lesions at deer slaughter premises. *Streptococcus* species are occasionally cultured from non-specific abscesses⁽²⁾. As *Mycobacterium bovis* may cause lymph node abscesses, or superficial abscesses tracking from lymph nodes, all abscesses should be checked for *M bovis*, at least by a Ziehl-Neelsen smear and/or PCR, before being lanced, to avoid risk of environmental contamination.

Actinobacillus species have been isolated from granulomatous lymph node lesions resembling tuberculosis⁽³⁾. *Staphylococcus aureus* and *A pyogenes* have been isolated from cases of arthritis⁽⁴⁾.

Actinobacillosis and dermatophilosis

Pyogranulomatous dermatitis of the lips, antler base, legs, flanks and nostrils was reported in a four-year-old red deer stag, and club colonies resembling *Actinobacillus* spp were observed histologically⁽⁵⁾. A similar case was reported in a sika deer⁽⁶⁾. Similar organisms, which were identified by staining as *Dermatophilus congolensis*, were found in retropharyngeal and parotid lymph node lesions resembling those caused by *M bovis*⁽⁷⁾⁽⁸⁾.

Actinomyces pyogenes

As well as being associated with abscesses, *Actinomyces pyogenes* is commonly involved with acute tenosynovitis causing swollen lower limb joints, discharge of pus around the coronet and interdigital space, and ruptured distal limb ligaments and tendons⁽⁹⁾⁽¹⁰⁾. Culture of *A pyogenes* and *Fusobacterium necrophorum* together appears to be



A range of bacterial diseases has been reported in farmed deer, but their incidence is not known. Although most of the conditions have similar clinical appearance in deer as in other domestic ruminants, there are differences for some important diseases. Further information is needed to evaluate their significance to the deer industry.

common⁽⁹⁾. A pure culture of *A pyogenes* has been reported in one outbreak of foot abscess in elk⁽¹¹⁾. Cases often involve several animals, causing severe losses. Trauma appears to be an important initiating factor. These lesions do not respond well to treatment because of their severity and secondary abscesses. Concurrent pleurisy and pneumonia is common.

Brucella ovis

Brucella ovis was first reported in semen from a red deer stag in 1996⁽¹²⁾. Since then, a number of affected stags have been reported from two deer farms and lesions detected at slaughter⁽¹²⁾. Initial infection appears to come from direct contact with sheep and the infection transmits readily by direct contact from stag to stag⁽¹³⁾. The epidemiology and pathogenesis of *Brucella ovis* in deer has recently been reviewed⁽¹³⁾⁽¹⁴⁾.

Bacteroides nodosus

Culture of *Bacteroides nodosus* from a deer was first reported in 1983 by Skerman⁽¹⁵⁾. Under-running of the heel was observed in 60 deer in a herd of 700. In other cases, *Bacteroides* species have been observed histologically or isolated with *Fusobacterium necrophorum*⁽¹⁶⁾ from cases of foot lesions with concurrent lung

abscesses or a necrotising fibrinous pneumonia. Clinical observations suggest that haematogenous spread of bacteria from necrotising foot lesions to the lung, often causing acute respiratory signs, is common.

Campylobacteriosis

Campylobacter fetus fetus was isolated from the lung of an aborted deer calf⁽¹⁸⁾. Its significance is unknown.

Clostridial diseases

A number of diagnosed or suspected cases of enterotoxaemia have been reported. One outbreak was in young well grown deer presenting with haemorrhage in the diaphragmatic muscles, haemorrhagic enteritis, brain congestion, glucosuria and

histological lesions of severe nephrosis⁽¹⁹⁾. Similar brain and kidney lesions were seen in three other cases in association with epsilon toxin in intestines⁽²⁰⁾. Sudden deaths of one-year-old stags with necrotic abomasal lesions yielded *Clostridium perfringens* from culture and Gram-positive bacilli in intestinal mucosa⁽²¹⁾. Combined culture of *C perfringens* and *C septicum* was reported from a three-year-old stag that died suddenly⁽²²⁾. Gas was noted at a recent injection site.

An outbreak of severe facial cellulitis after velvet antler removal has been described by Seifert⁽²³⁾, who reported that a similar syndrome had been observed by other practitioners. This is believed to be associated with *C septicum*, which has been isolated in at least one case.

Tetanus has been diagnosed clinically on rare occasions. Velvet antler removal may predispose to this condition and cases could go unnoticed. There have been no published laboratory reports of blackleg although it is likely that cases would be diagnosed on gross pathology or by farmers or remain undiagnosed and unrecorded. The author has confirmed blackleg in a two-year-old stag.

Colibacillosis

While no reports of *Escherichia coli* in deer appear in the New Zealand literature, colibacillosis has been diagnosed elsewhere in young deer and should be considered as a cause of diarrhoea in newborn deer, particularly when artificially reared, and when colostrum intake may have been inadequate.

Fusobacterium necrophorum

Fusobacterium necrophorum has been isolated along with *A pyogenes* from single or multiple cases of severe tenosynovitis⁽²⁴⁾⁽²⁵⁾ involving swollen joints, discharging fistulae and under-running of the hoof and interdigital inflammation. Several reports describe severe fibrinopurulent pleuritis, pneumonia, pericarditis and/or lung abscesses concurrent with foot lesions, either in three-month-old calves⁽²⁶⁾ or as outbreaks causing multiple deaths of older deer⁽²⁷⁾⁽²⁸⁾.

A severe outbreak of necrotic stomatitis⁽²⁹⁾ was reported in 17 of 22 red deer with foot lesions that also had concurrent ulceration of the dental pad and oral mucosa extending to the nasal mucosa. The cause was assumed to be *F necrophorum*.

Necrobacillosis associated with liver abscesses has been described in

young red deer⁽³⁰⁾. This syndrome is common in fallow deer in New Zealand, usually associated with grain feeding, but there are no published reports. Yellowish necrotic lesions at the base of the tongue and larynx, and rumenal ulceration with⁽³¹⁾ or without⁽³²⁾ lung lesions have been diagnosed histologically as *F necrophorum* on the basis of the presence of Gram-negative rods.

Leptospirosis

Animal Health Laboratory diagnoses of leptospirosis were reviewed by Wilson and McGie⁽³³⁾. Since then more reports have been published. It appears that both *Leptospira pomona* and *L hardjo* may produce haemolytic anaemia, jaundice and sudden death, generally in outbreak form in young deer in which the primary risk factor is mixing of deer from a variety of sources. The condition appears sporadically in older deer⁽³⁴⁾. *Leptospira copenhageni* is commonly detected serologically⁽³⁴⁾ and a clinical outbreak with only this serovar has been observed (Walker I, personal communication). Leptospiral infections appear to be widespread, and kidney lesions that are likely to have been caused by leptospiral infections are observed at deer slaughterhouses⁽³⁴⁾.

Pasteurellosis

Fibrinous pleuritis resulting in sudden death and caused by *Pasteurella multocida* was reported first in red deer⁽³⁶⁾, and the organism has since been grown in pure culture from a case of fibrinous pneumonia in fallow deer⁽³⁷⁾. Pneumonic pasteurellosis was diagnosed histologically in 20 weaners dying shortly after transport⁽³⁸⁾. *Pasteurella haemolytica* has been isolated from eight-month-old recently transported deer with necrofibrinous pneumonia⁽³⁵⁾. More recently, several outbreaks of pneumonic pasteurellosis associated with stress and concurrent foot injuries and abscesses have been diagnosed by gross pathology⁽⁴⁰⁾. However, it is likely that culture would be needed to differentiate pasteurellosis from the lung infections associated with foot lesions described above. The author has observed an outbreak of acute pneumonia caused by *P haemolyticum* in four-month-old weaners in a stressful research environment.

Listeriosis

Listeria monocytogenes has been reported elsewhere in deer but is not referred to in New Zealand laboratory reports. However, nervous disease has been diagnosed clinically and confirmed by histology and culture in farmed deer in this country.

Mycobacterium bovis

Mycobacterium bovis is occasionally diagnosed in deer on-farm but is more commonly diagnosed in deer slaughter premises in characteristic tuberculous lesions. The disease is widely known and has been reviewed recently elsewhere⁽⁴¹⁾.



Mycobacterium paratuberculosis

Johne's disease is an emerging disease in deer in New Zealand and has recently been reviewed⁽⁴³⁾. Outbreaks of diarrhoea, loss of condition, retention of winter coat and death have occurred in herds of nine- to 12-month-old deer, suggesting a different age incidence for Johne's disease in deer compared with sheep and cattle. Sporadic cases are reported in older deer. Gross lesions often involve the ileocaecal area, frequently with enlarged and occasionally abscessed mesenteric lymph nodes and liver lesions. These often resemble lesions caused by *M avian* or *M bovis*. Both sheep and cattle strains of *M paratuberculosis* have been isolated from deer.

Other mycobacteria

Mycobacterium nonchromogenicum, *M diernoferi*, *M gastri*, *M chelonae*, *M smegmatis* and *M vaccae* have been isolated from deer but are not considered pathogenic. *Mycobacterium avium* can cause clinical disease and lesions similar to those caused by *M paratuberculosis*⁽⁴⁵⁾.

Salmonellosis

Salmonella Typhimurium was isolated from liver, lung, intestines and spleen of a three-week-old deer calf that died after depression and nervous signs, and with pale creamy intestinal content⁽⁴⁶⁾. The organism was cultured from lung, liver, intestine and thyroid from similar cases, suggesting septicaemia⁽⁴⁷⁾. There have been further isolates of *Salmonella* Typhimurium and *Salmonella* Bovismorbificans from laboratory cultures⁽⁴⁸⁾⁽⁴⁹⁾ but few from clinical cases. A clinical case of diarrhoea, from which *Salmonella* Typhimurium was isolated from spleen, liver, intestine and colon, was reported in 1983⁽⁵⁰⁾. That report suggested that salmonellosis was rare in deer in New Zealand, with three isolates from clinical cases and 12 as incidental findings. McCallum⁽⁴⁷⁾ also reported that *Salmonella* Typhimurium has been isolated from healthy stags. Henderson and Hemmingson⁽⁵¹⁾ were unable to culture *Salmonella* species from 3810 faeces from normal deer from 122 farms.

There have been no reports of *Salmonella* Typhimurium or *Salmonella* Bovismorbificans associated with clinical disease in deer in New Zealand since 1983. This could indicate that the disease is uncommon or that diagnoses have not been published. It is also possible that clinical diagnosis could be confused with yersiniosis if not confirmed by bacterial culture. The author has confirmed an unreported case that resembled yersiniosis, and was diagnosed by the farmer as such, from which *Salmonella* Typhimurium and not *Yersinia pseudotuberculosis* was cultured.

Salmonella Brandenburg was first isolated in 1999 from three hinds that died and showed no gross pathology at postmortem but had eosinophilic gastroenteritis suggesting parasitism⁽⁵²⁾. More recently, *Salmonella* Brandenburg has been isolated at postmortem from three separate cases involving adult stags with haemorrhagic enteritis and diarrhoea. One case had histological lesions of

malignant catarrhal fever so *Salmonella* Brandenburg may have been secondary⁽⁵³⁾.

Yersiniosis

Yersinia pseudotuberculosis is commonly reported from outbreaks of diarrhoea in young deer, usually associated with predisposing stress factors. This disease has been reviewed by Mackintosh⁽⁵⁴⁾, who also described development of a vaccine⁽⁵⁵⁾.

Conclusion

A range of bacterial diseases and isolates has been reported from farmed deer in New Zealand. No conclusions about their incidence can be drawn from the reports reviewed, since few specimens are submitted by practitioners for bacterial culture, and few that are cultured are reported. The manifestation of most bacterial diseases in farmed deer appears similar to that in other domestic ruminant species but their relative susceptibilities are not known. Clinical observations suggest important species differences in the manifestation of yersiniosis, Johne's disease, tuberculosis, pasteurellosis, possibly salmonellosis and combined foot and lung manifestations of *Fusobacterium/Actinomyces* infections. Further information is required to achieve a better understanding of the importance of bacterial diseases to the deer industry.

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