Ovine Progressive Pneumonia: A Brief Overview

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INTRODUCTION

Ovine progressive pneumonia (OPP), a chronic debilitating disease of adult sheep, develops insidiously over a long incubation period. The infection is widespread and may produce a fatal multisystemic lymphoproliferative disease.

There is evidence that OPP virus infection is common in western and midwestern sheep flocks. A survey of cull ewes from western states revealed serological prevalence rates of up to 67%.[1] In Idaho, infection rates within range flocks were 51–90%.[2] A recent serological survey of the Iowa State University sheep flock indicated that 49% of the ewes have OPP virus antibodies and carry the virus.

The disease is caused by a non-oncogenic single stranded RNA virus belonging to the family Retroviridae and subfamily Lentivirinae. The OPP virus is very closely related serologically, morphologically, and biochemically to the Maedi-Visna virus in Icelandic sheep and to caprine arthritis encephalitis virus (CAE). These viruses possess only slight antigenic differences detectable by nucleic acid hybridization or radioimmunoassay.[3] The Lentivirinae viruses are cell-associated viruses possessing an RNA-dependent DNA polymerase. This enzyme catalyzes both the formation of single-stranded DNA provirus from an RNA template and subsequent synthesis of double-stranded DNA.[4] Once infected, sheep are unable to eliminate the OPP virus despite a good serological and cell mediated response.[5] Viral persistence is promoted by the covalent integration of the provirus into the host cell genome.[4] Since the genetic information of the virus is not expressed there is no target for the immune response. Thus the virus escapes immunological clearance and yet maintains reproductive capabilities. The *in vivo* mechanisms of virus activation and disease production are unknown.[6]

The phenomenon of antigenic drift allows new antigenic variants to escape immune defenses thereby permitting "new" infections. Antigenic drift has been described with equine infectious anemia, another lentivirus.[7] Research has shown similar antigenic mutations with Visna virus.[8]

Ovine progressive pneumonia is a disease of sheep although goats may be affected. The virus is transmitted primarily through the colostrum and milk. It is theorized that virus infected cells ingested in infected colostrum pass the intestinal epithelium and infect lambs.[9] All ages of sheep may be infected through contact by inhalation of virus-contaminated droplets from the respiratory tract of infected sheep.[10] Intrauterine transmission has been reported.[11]

CLINICAL SIGNS

Most OPP virus infected sheep do not exhibit clinical signs until at least two years of age due to the unique virus-host interaction.[12] Ovine progressive pneumonia is a fatal multisystemic lymphoproliferative disease with involvement of lungs, central nervous system (CNS) and joints. Weight loss and weakness despite a normal appetite are frequently the first signs of OPP.[13] The pulmonary form is the most common in the United States. Initially the respiratory rate may increase when the sheep are worked and they may lag behind the flock.[14] Progressive respiratory distress is observed during the 3 to 8 month clinical

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course.[15] Sheep are afebrile unless a secondary bacterial pneumonia occurs.

Sheep with CNS involvement exhibit hind limb ataxia progressing to paresis. The extensor muscles are involved first resulting in involuntary flexion of the fetlock and pastern joints.[16] Tetraplegia completes the clinical course.

Chronic nonsuppurative polyarthritis is a recently reported feature of natural and experimental OPP virus infection.[15,17] Severe swelling of bursae and affected joints, usually carpal and tarsal, with lameness and emaciation were seen.[17]

The pneumonic, neurologic, and arthritic forms of OPP can be observed naturally within the same flock and have been experimentally reproduced.[15,18]

DIAGNOSIS

Tentative diagnosis of OPP can be made from history, clinical signs, and a seropositive test. Due to widespread seroconversion to OPP virus, definitive diagnosis is established post mortem based on typical lesions and or virus isolation.

Serological tests used to detect OPP virus antibodies include enzyme-linked immunosorbent assay, agar gel immunodiffusion test (AGIDT), and an indirect immunofluorescent test. The three methods are equal in sensitivity and specificity, but the AGIDT is usually employed for simplicity.[19] The National Animal Disease Laboratory performs AGIDT for OPP and CAE antibodies, as do the Minnesota and Washington State Veterinary Diagnostic Laboratories.

Actively acquired precipitating antibodies to OPP virus are slow to develop.[5] Once infected, the animal is a persistent carrier and potential shedder of OPP virus for life, despite high levels of circulating antibodies.

The virus is strongly cell-associated and usually requires co-culture techniques for isolation.[15] Viral antigens can be detected in the indicator cells by immunofluorescent staining.

At necropsy the affected lungs are gray to pink-brown and do not collapse when the thorax is opened. They are heavy and exhibit 3–5 mm gray foci on cut surface. Tracheobronchial lymph nodes are enlarged and edematous.[13,15] Microscopically there is a chronic interstitial pneumonia characterized by thickened intralveolar septa. Perivascular and peribronchial lymphoid hyperplasia is observed.[13,15]

The CNS lesions in sheep affected with the neurologic form of OPP are seen only on histologic examination. Perivascular cuffs of lymphocytes, macrophages, and plasma cells associated with areas of demyelination and focal necrosis are observed in white matter of the brain.[14]

With chronic nonsuppurative arthritis, the affected joints are swollen and have thickened capsules. Synovial membranes are hyperemic, hyperplastic, and brown.[17] Necrosis and erosion of articular cartilage occurs with reactive fibroplasia eventually resulting in ankylosis. Microscopically, hyperplastic synovium is thickened by infiltration of lymphocytes and plasma cells. Compression of articular cartilage and subchondral bone is seen.[15]

Lymphoid hyperplasia in intralobular and periductal areas of the mammary gland resulting in a hard indurated udder is another lesion of OPP.[9] Viral particles and or infected lymphocytes or macrophages are thought to be shed into the lactiferous ducts.

TREATMENT

There is no effective treatment to eliminate OPP virus infection and no available vaccine. Palliative treatment of infected sheep possibly enhances the spread of the disease. Attempts to control OPP in flocks must be based on detecting and eradicating infected animals. Since all individuals with positive AGIDT harbor the virus, serologic testing can be used as a basis of control. A test and removal method has been used to effectively eradicate OPP virus from flocks.[9] All seropositive sheep and goats on the premises and their progeny under 1 year of age are removed. The flock is kept closed and isolated. Only seronegative animals are added and annual flock serologic testing is recommended. Another control method to establish a clean flock is to isolate and artificially rear progeny on pasteurized milk or milk replacer.[9]

CONCLUSION

Ovine progressive pneumonia is a persistent viral disease affecting the pulmonary, central nervous and joint systems. Adult sheep lose condition and exhibit progressive respiratory difficulty. Less commonly, polyarthritis and neurologic signs are observed. Definitive diagnosis is based on history and clinical

signs, gross and microscopic lesions, and virus serology and isolation. The disease is fatal in animals with clinical signs. No therapy or vaccine is available. Attempts to control OPP should be directed at establishing virus-free flocks. Serologic testing by the AGIDT is used as a basis for detection and culling of infected animals.

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