

Progressive Ataxia of Charolais Cattle

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and

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Introduction

A progressive ataxia of Charolais cattle was first reported by Palmer, Blakemore, Barlow, Fraser and Ogden (1972) (1). The disease is confined to purebred animals, rarely occurs before the age of one year and is characterised by a unique form of demyelination in the C.N.S. ascribed to dysfunction of the oligodendroglia.

Clinical Signs

Up to the time of writing there have been 19 cases confirmed pathologically, 16 females and three males (2). All animals were bred either in the United Kingdom or imported directly from France although the condition has not been reported in that country. The disease occurs in Canada (Tryphonas, personal communication) and one animal exported from the United Kingdom developed manifestations in New Zealand. In the United Kingdom about 0.5% of imported and homebred stock appear to be affected.

The onset of clinical signs is insidious. Animals are usually affected when one to two years old, although one animal was noticed to be abnormal at six months and one at eight months. At first there may be a slight swaying gait of the hind legs; one leg may be affected more than the other. When standing a hind leg may be kept excessively abducted or adducted. As the condition progresses the hind feet are often dragged and the animal may have difficulty in rising. As it gains its feet there may be jerking movements of the tail and hindquarters. This jerking movement is often seen when the animals are urinating when the urine is passed in an uneven, squirting flow. An abnormal nodding movement of the head sometimes occurs on excitement. The incoordination usually becomes progressively worse. Loss of control of the hind legs is particularly evident on turning and occasionally an animal will collapse on its hind legs and adopt a dog-sitting posture. Total recumbency may finally occur. During the progression of the illness (which may last a year) there is no evidence of muscle atrophy or of cranial involvement. Appetite and general bodily condition remain normal.

Although clinical experience of this form of ataxia is limited, it is clear that diagnosis cannot be made on the basis of clinical signs only. One bull which showed

typical manifestations (except the head tremor) was found *postmortem* to be suffering from focal malacia of the grey and surrounding white matter of one segment of thoracic cord. Care must also be taken to eliminate hip dysplasia.

Pathology

Light microscopy

Pathologically, significant lesions are found in the C.N.S.; the peripheral nervous system is not involved (3). Eosinophilic plaques are found in the white matter of the brain and spinal cord (Figure 1), especially in the following regions: optic nerve, optic tract, internal capsule, centrum semiovale, corpus callosum, the lateral lemniscus, medial longitudinal fasciculus, the pontine decussation, the corpus medullare of the cerebellum extending into the white matter of the folia, the three cerebellar peduncles, and the ventral and lateral funiculi of the spinal cord where the plaques often occur adjacent to a blood vessel (Figure 2). The plaques are slightly granular (Figure 3) and stain diffusely with Luxol Fast Blue (for myelin). In sections stained with Glee's method, axons can be seen passing through the plaques (Figure 4). Surrounding tissue may show microcavitation (Figure 5), but it is difficult to establish whether there is an absolute increase in glia, because the normal population is probably concentrated, cells being pushed from their normal stations because of the expanding plaque. There is no phagocytic response on the part of the microglia and astrocytic reaction is minimal. Oligodendroglia, on the other hand become more prominent by acquiring stainable cytoplasm (Figure 6).

Electron microscopy

Ultrastructural observations show that the plaques seen with the light microscope contain several axons, myelin figures and hypertrophied oligodendrocyte tongues from which extend masses of small processes (Figure 7). These changes are always associated with the nodes of Ranvier which as a result are widened. The small processes which extend from the hypertrophied oligodendrocyte tongues are 0.05-0.3 μ in diameter and of indeterminate lengths. They tend to be arranged circumferentially around the axon and

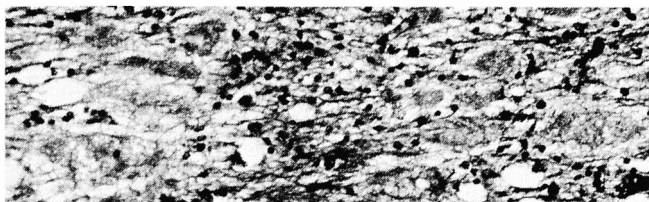


Figure 1. Multiple eosinophilic plaques in the internal capsule. H & E., x 240.



Figure 2. Eosinophilic plaques adjacent to a vessel in the lateral columns of the spinal cord. H. & E., x 160.

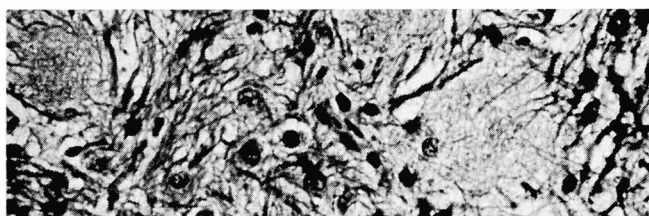


Figure 3. Granular appearance of plaques. H. & E., x 400.

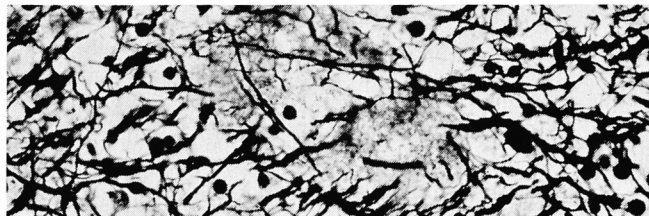


Figure 4. Axons passing through plaques. Glees' axon stain, x 400.

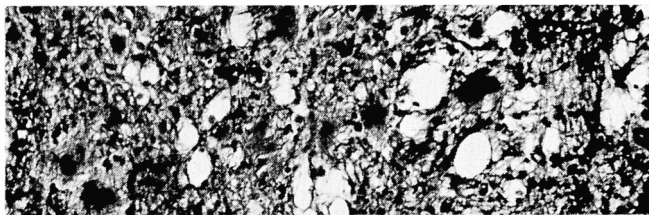


Figure 5. Microcavitation and plaques in affected white matter. H & E., x 160.

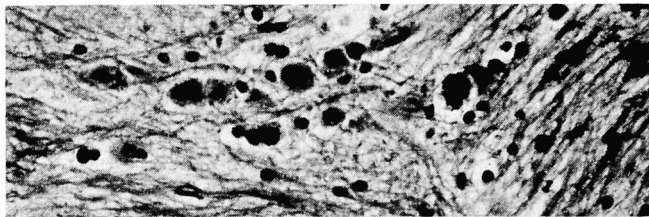
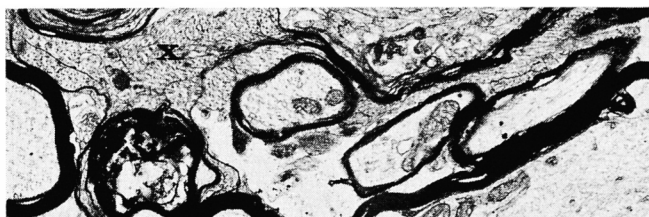


Figure 6. Hypertrophied oligodendrocytes. H. & E., x 400.



contain few organelles apart from an occasional dense body. There is no evidence of myelin degeneration. Although myelin figures are present within the plaques, in the paranodal region and adjacent to oligodendrocyte cell bodies situated near to plaques, these do not elicit a phagocytic response by microglial cells. The cell body region of oligodendrocytes appears normal, especially away from plaque-containing areas. However, in the region of the plaques the perinuclear cytoplasm of these cells is more abundant and contains a higher density of mitochondria than normal.

Discussion

The clinical signs of this ataxia can be ascribed to the lesions in the white matter, those involving the cerebellum and spinal cord probably being the most important. It is interesting that visual deficiency has not been diagnosed despite plaques being sometimes present in the optic nerve and tract.

Economically, one of the difficult features of the disease is the delay in clinical onset, an owner being unaware that he has an affected animal until he has kept it for an appreciable time.

The lesion in the brain is unique neuropathologically. The basic abnormality is a dysmyelination, associated not with degeneration, but rather with hypertrophy of oligodendrocytes in particular hypertrophy and hyperplasia of the cytoplasmic tongues normally found in the myelin sheath. These changes have already been extensively discussed (2,4).

The nature of the disorder is not fully understood and at present the cause is unknown. Although a transmissible agent and environmental factors cannot be eliminated, progressive ataxia may prove to be inherited, although at the moment there is insufficient data to establish a genetic basis.

At the present time a diagnosis can only be established *postmortem*. A specific clinical test would be most valuable in identifying potential victims.

Acknowledgements

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References

1. Palmer, A. C., Blakemore, W. F., Barlow, R. M., Fraser, J. A. and Ogden, A. L.: Progressive Ataxia of Charolais Cattle Associated with a Myelin Disorder. *Vet. Rec.*, 91, (1972):592.
2. Ogden, A. L., Palmer, A. C. and Blakemore, W. F.: Progressive Ataxia in Charolais Cattle. *Vet. Rec.*, 94, (1974):555.
3. Blakemore, W. F., Palmer, A. C. and Barlow, R. M.: Progressive Ataxia of Charolais Cattle Associated with Disordered Myelin. *Acta Neuropath. (Berl.)*, 29 (1974):127.
4. Blakemore, W. F., Palmer, A. C. and Barlow, R. M.: Leucodystrophy in Charolais Cattle. *Proc. VIIth International Congr. Neuropathology, Budapest, (1975) (in press).*

Figure 7. An axon (a) surrounded by a mass of small processes which extend from the hypertrophied oligodendrocyte tongues (x). x 7,000.

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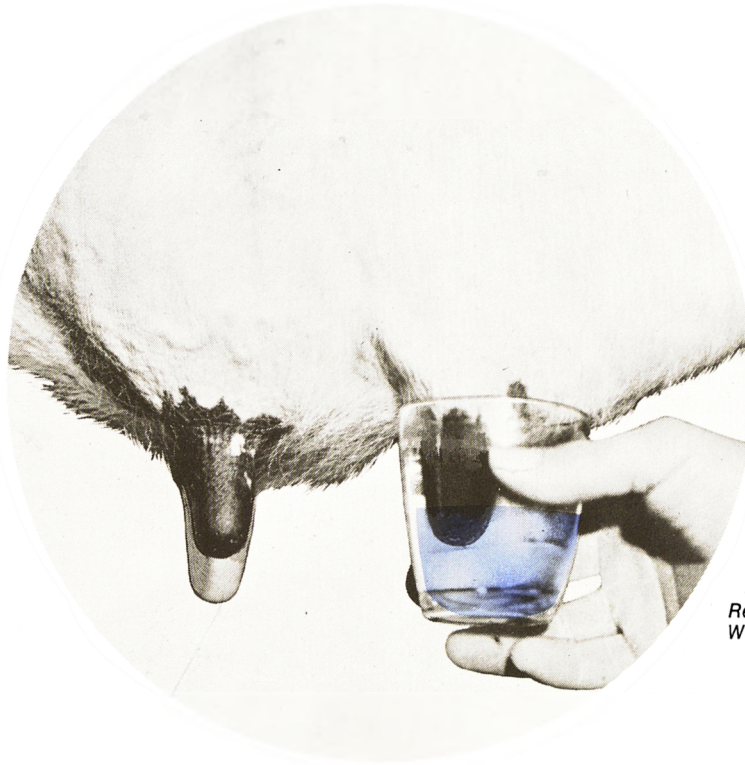
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