would necessitate corrections for toe angle if large hooves were selected for, in an attempt to reduce the risk of slip and pressure-related claw disorders. It is possible that cattle could be bred for bottom hoof width, which was not related to toe angle.

Measurements of hoof width in live animals could differ from those obtained in this study owing to the different splaying characteristics in the live animal. Some splaying was observed in the hooves used in this study, but probably less than would have occurred in the live animal.

Further research is required to identify the precise characteristics of the bovine hoof that confer resistance to slipping. This study indicates that size and toe angle are important, but that they are probably not direct effects but mediated by their effects on the conformation of the sole of the hoof.

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A neuronal vacuolar disorder in young rottweiler dogs

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Veterinary Record (1998) **142**, 245-247

Four rottweiler pups from two litters developed severe progressive signs of spinal ataxia, cerebellar ataxia and tetraparesis/paralysis. The signs started with ataxia of the pelvic limbs at seven to eight weeks of age and progressed to tetraparesis and paralysis within three to five weeks. Postmortem, a vacuolar neuronal disorder was found in the cerebellum, brainstem and the spinal cord, associated with Wallerian type degeneration in the brainstem, cerebellar peduncles and the medullary cord. Electron microscopy revealed empty membrane-bound vacuoles. Immunohistochemistry for PrP^{Sc} was negative. The disorder differs clinically and pathologically from other neurological disorders in the breed and a new (familial) neurological disorder in the rottweiler is suspected.

MANDIGERS and others (1995) recently described a new neurological disorder in young rottweiler dogs with severe progressive signs of spinal ataxia, cerebellar ataxia and tetraparesis/paralysis. A vacuolar neuronal disorder was found postmortem in the cerebellum, brainstem and spinal cord.

Two familial neurological disorders have already been described in rottweiler dogs, leucoencephalomyelopathy (Gamble and Chrisman 1984, Wouda and van Nes 1986) and neuroaxonal dystrophy (Chrisman 1986, Braund 1987, Evans and others 1988). However, these disorders differ clinically and pathologically from the recent cases and a new (familial) neurological disorder in the rottweiler is suspected. This newly recognised neurological disease seems to be identical to that recently identified in some rottweiler pups in the USA and Switzerland (Kortz and others 1997) and Spain (Pumarola and others 1997). This paper gives a detailed clinical and morphological description of the disease.

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Case reports

The four rottweiler pups were derived from two litters. One litter, born on November 5, 1994, was reared in Belgium and consisted of six pups (three males and three females) of which all three males were affected. The second litter was born on August 11, 1994, and reared in the Netherlands; one female animal was affected. Pedigree analysis revealed no apparent relationship between the two litters, but since the sire of the Dutch litter was an 'unknown' rottweiler dog, a relationship cannot be excluded.

Clinical findings

All the pups had been vaccinated against canine distemper and infectious canine hepatitis, and clinical signs were first observed in all of them at seven to eight weeks of age. The signs started with ataxia of the hindlegs which became progressively worse within three to five weeks.

A neurological examination at three months of age revealed minor behavioural changes varying from unnecessary aggressive behaviour towards other littermates to absent-mindedness and difficulty in training. All the animals showed marked ataxia of all four limbs, and a hypermetric and dysmetric gait. The pelvic limbs were more severely affected and in all cases there was severe paresis of the pelvic limbs, but no muscular atrophy. In three of the pups there was also ataxia of the head. There were no cranial nerve deficits and no nystagmus, but all the pups had an inspiratory laryngeal stridor. Spinal reflexes were exaggerated in two of them, with a crossed-extensor reflex, and their hindlimbs showed abnormal postural reflexes which were not observed in the other two pups. No other physical abnormalities were found.

Routine haematological and blood chemistry examinations revealed no abnormalities. Cerebrospinal fluid (CSF) was collected from the cisterna magna of two of the dogs and also showed no abnormalities. Attempts to isolate distemper virus by the cultivation of peripheral blood leucocytes from all the dogs and CSF leucocytes from two of them were unsuccessful. Serum ELISA IgG-

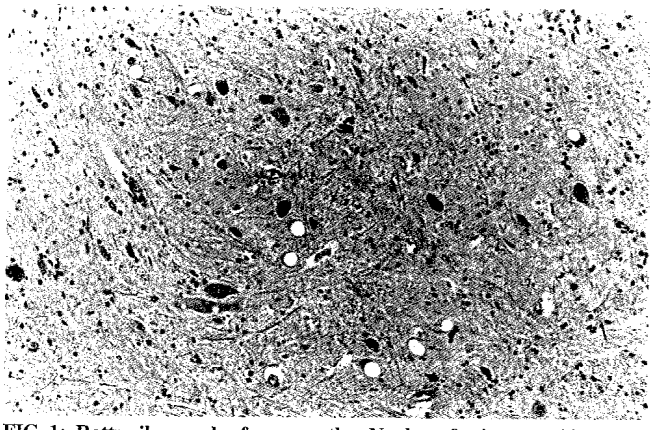

FIG 1: Rottweiler, male, four months. Nucleus fastiguus: widespread neuronal vacuolation. Haematoxylin and eosin x 140

and gM-antibody titres for distemper in two of the dogs were 1:1000 (IgG) and <1:30 (IgM), compatible with a vaccination titre; the CFS ELISA IgG- and IgM-antibody titres for distemper in the other two dogs were <1:30. Routine radiographs and a myelogram performed in one dog and routine electromyographic examinations of two of the dogs revealed no abnormalities. Clinical diagnosis indicated a multifocal or generalised disorder of the central nervous system. The four dogs were euthanased with an overdose of barbiturate because of the severity of the neurological signs and the poor prognosis. The three dogs referred to the Utrecht University Clinic were examined postmortem.

Pathological examination

Macroscopic examination revealed no abnormalities. The internal organs, the brain, the spinal cord with spinal ganglia and the ischiadic nerves were fixed by immersion in 10 per cent neutral buffered formalin. For light microscopic examination blocks were cut from the formalin-fixed material, dehydrated and embedded in paraffin. Sections 6 µm thick were stained with haematoxylin and eosin, cresyl-Echt violet and luxol fast blue. For transmission electron microscopy small blocks were taken from the formalin-fixed brain taken from one dog immediately after it was euthanased at the site of the cerebellar nuclei and medulla oblongata, post-fixed in 2·5 per cent glutaraldehyde at 4°C for 24 hours and in 1 per cent osmium tetroxide for 16 hours at 4°C, dehydrated in graded water-acetone mixtures and embedded in an Epon-Araldite mixture. Semi-thin sections were stained with toluidine blue. Ultra-thin sections were stained with uranyl magnesium acetate and lead citrate and examined with a Philips EM410LS electron microscope at 60 kV. Immunohistochemical examinations for scrapie-associated prion protein (PrP^{Sc}) were made on sections of the cerebellar nuclei and medulla oblongata from all three dogs as described by van Keulen and others (1995).

Microscopical examination

All three dogs showed similar abnormalities. Lesions were restricted to the nervous system. In the CNS there was cytoplasmic vacuolation of neurons in the brainstem, the cerebellar and vestibular nuclei and the medulla oblongata and also in the ventral and intermediate neurons of the spinal cord. The extent of the lesions varied, but they were most prominent in the cerebellar (Fig 1) and vestibular nuclei and at the cervical and lumbar enlargement (intumescentia cervicalis and lumbalis) of the spinal cord. Affected neurons appeared normal except for the presence of single or multiple sharply demarcated intracytoplasmic vacuoles (Figs 1 and 2); in addition, a solitary degenerated or necrotic neuron was observed. The lesions were associated with moderate to marked Wallerian-type degeneration and some axonal swelling in the white matter of the brainstem, the cerebellar pedunculi and throughout the medullary cord. In the ischiadic nerves slight Wallerian-type degeneration was observed. Immunohistochemistry for PrP^{Sc} proved to be negative.

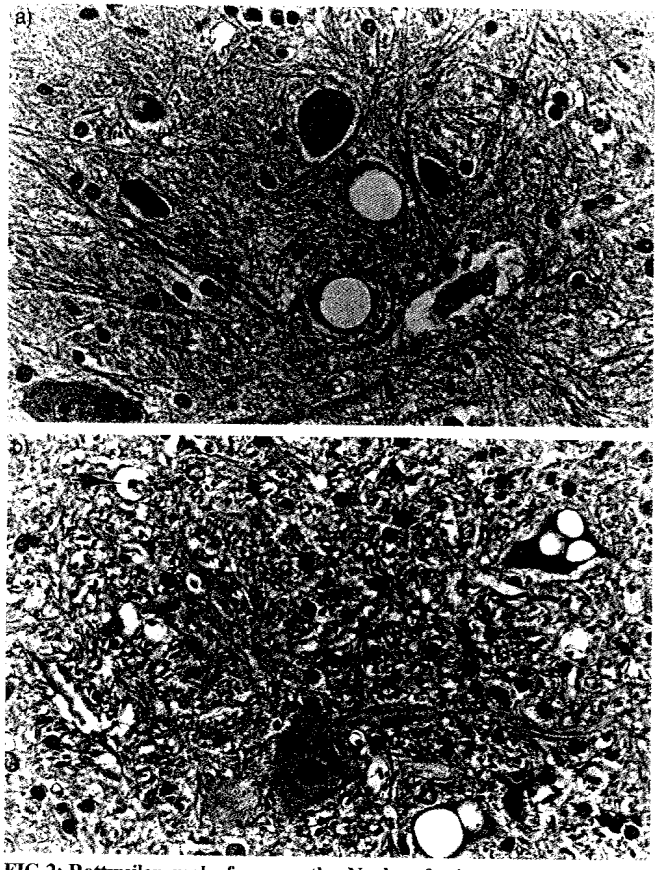

FIG 2: Rottweiler, male, four months. Nucleus fastiguus: a) two neurons with single, large, well demarcated vacuoles; b) two neurons with multiple vacuoles and a lipid macrophage (Wallerian type degeneration) in the white matter (arrow). Haematoxylin and eosin X 560

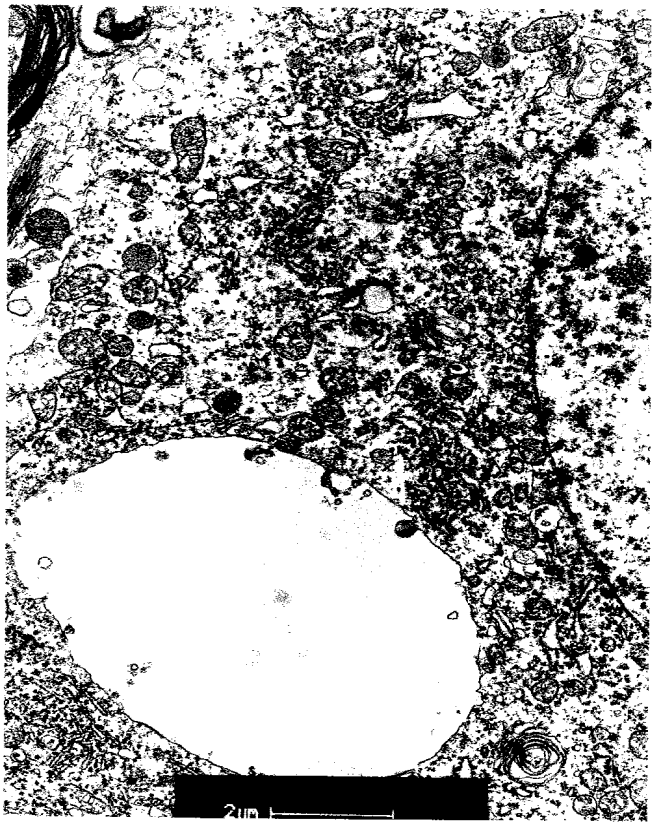

FIG 3: Electron micrograph of neural tissue from a male, four-month-old rottweiler. Nucleus fastiguus: neuron with a large empty, membrane-bound vacuole and small protrusions from the wall. X 11,000

Electron microscopy

The affected neurons showed a largely empty, membrane-bound vacuole with some slight protrusions from the wall (Fig 3). Apart from the vacuoles, slight rarefaction, loss of ribosomes and swelling of the endoplasmic reticulum were observed. It was not possible to determine the origin of the vacuoles.

Discussion

Two familial neurological disorders are well known in rottweiler dogs, leucoencephalomyelopathy (Gamble and Chrisman 1984, Wouda and van Nes 1986) and neuroaxonal dystrophy (Chrisman 1986, Braund 1987). These disorders usually do not begin until adulthood, although an earlier onset has been recorded for neuroaxonal dystrophy (Evans and others 1988), and they both differ clinically and pathologically from the present cases. The new disease is also different from the spinal muscular atrophy described in two littermate rottweiler pups by Shell and others (1987), which showed a progressive flaccid quadriparesis, with head tremors, dysphagia and megaoesophagus. That disease was characterised pathologically by central chromatolysis of the lower motor neurons in the brainstem and spinal cord and was associated with muscular atrophy. In contrast with these dogs and with other breeds with spinal muscular atrophy (Braund 1987) the most conspicuous lesion in the rottweiler pups was neuronal vacuolation. Moreover, their electromyogram was normal and muscular atrophy was not observed. The pathomorphological findings were also different from other inherited disorders of the nervous system in other breeds. However, both the clinical and pathological findings appeared to be identical to those recorded in four rottweiler pups recently identified in the USA and Switzerland (Kortz and others 1997) and one rottweiler pup in Spain (Pumarola and others 1997).

Neuronal vacuolation in the canine brain is an extremely rare lesion; it was reported in two dogs in the motor trigeminal nucleus of the medulla oblongata but was regarded as an incidental finding (Pumarola and others 1995). Although similar vacuoles in other species are an important hallmark for spongiform encephalopathies such as scrapie and bovine and feline spongiform encephalopathy (Summers and others 1995), this possibility is very unlikely in these dogs, first because they were very young and these diseases have a very long incubation period, and secondly because immunohistochemical tests for PrP^{Sc} against a conserved antigen which reacted in mice, cats, sheep and cattle, were negative both in these pups and in the cases identified in the USA (Kortz and others 1997). Additional cases and pedigree analysis are necessary to investigate the possible familial or hereditary nature of the disorder.

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Abstracts

Hyaluronate concentration in equine tracheal lavage fluid

THE concentration of hyaluronate (HA) was determined in healthy control horses (n=7) and cases of chronic obstructive pulmonary disease (COPD) (n=18). HA, determined by radiometric assay, was about seven times higher in tracheal lavage fluid in COPD horses (1800 ± 309 µg/litre) than in controls (256 ± 72 µg/litre). While the increased concentration may reflect pathophysiological changes in connective tissues around bronchi and bronchioli, and the technique may be useful as a marker of chronic inflammatory changes, further investigation is needed to determine whether these differences also exist in mild or subclinical forms of COPD.

TULAMO, R. M. & MAISI, P. (1997) *American Journal of Veterinary Research* **58,** 729

Comparison of intravenous fluids for rehydration of fasted cattle

SEVEN Holstein bullocks had feed, salt blocks and water withheld for 48 hours. The reductions in bodyweight and relative plasma volume were 7·72 and 21·93 per cent, respectively. In successive experiments, five isotonic commercial fluids (Nippon Zenyaku Kogyo) were given intravenously at 30 ml/kg: isotonic saline, Hartmann's solution, 5 per cent glucose, Ringer's solution and a combination of Ringer's solution and 2·5 per cent glucose This combination solution was found to be the preferred fluid, intravenous infusion producing no change in blood pH or blood electrolytes, and inducing normal renal reabsorption of glucose. In practice, it is rare to give sufficient volume to meet the specific requirements of the patient.

SUZUKI, K., AJITO, T., KADOTA, E., OHASHI, S. & IWABUCHI, S. (1997) *Journal of Veterinary Medical Science* **59,** 689

Abortion in Israeli dairy herds

THE abortion density, proportion of aborted cows and abortions per confirmed pregnancy were 4·2, 5·9 and 10·2 per cent, respectively, in an epidemiological study including multivariate analysis of 58,048 pregnancies from 111 Israeli kibbutz herds in 1995. Heifers had the lowest and cows of second parity had the highest risk of fetal death (odds ratios 0·6 and 1·3, respectively.) Recurrent risk ratio for abortion in the same lactation was high (odds ratio 2·7). Risk of abortion in the autumn and early winter was greater than in the summer months. An increased risk of abortion was associated with eight of the 233 sires used (odds ratios of mates to abort ranged from 1·9 to 3·9).

MARKUSFELD-NIR, O. (1997) *Preventive Veterinary Medicine* **31,** 245