

Progressive Retinal Atrophy in Related Cattle

Susan M. Stehman, *D.V.M.*

William C. Rebhun, *D.V.M.*

Ronald C. Riis, *D.V.M.*

Department of Clinical Sciences

New York State College of Veterinary Medicine

Cornell University

Ithaca, NY 14853

Introduction

Blindness secondary to retinal degeneration has been described in Hostein cattle.^{1,2} In the few reported cases, the disease is of unknown etiology, appears in apparently healthy adult cows with no other systemic signs of illness, and has not been linked to heredity. This report will describe two cases of an apparent familial retinal degeneration and blindness in related adult dairy cows.

History and Clinical Examination

The two affected animals, a mother and daughter pair, were part of a herd approximately 325 milking Holsteins and replacement heifers. The cows are housed in a free stall facility, fed a total mixed ration, and grouped in pens according to production levels. The heifers are housed by age group in part of the same facility or on an adjacent pasture with a run in shed, depending on age. All animals are bred by artificial insemination using commercial semen.

The first reported case of blindness in the herd was the mother, a nine-year-old Holstein cow (#2440) with no previous history of visual problems or systemic illness. In January, 1986, when moved to a different group pen, the cow appeared to see movement but ran into stationary objects. Initially, her vision was worse in dim light. The cow was examined by the herd veterinarian and found to be in good physical condition with no systemic signs of illness. The pupillary light reflex was sluggish but present; no menace response could be elicited. Over the next year, the cow's signs progressively worsened, and an ophthalmoscopic examination confirmed retinal degeneration. The cow was culled in early 1987; her eyes were collected at time of death and fixed for light and electron microscopic examination.

Cow #2440's daughter (#4033), a 2-year-old bred heifer, was examined in August, 1986, for apparent blindness. On physical examination, the heifer was thin and had a rough hair coat. She was bright, alert, and very excitable; her temperature was mildly elevated at 103.°F (39.44°C). In addition, a bloody, pasty stool, and serum oozing from her coronary bands were noted. Like her dam, she appeared to see motion but had no menace response; she did have a sluggish pupillary response to light. Ophthalmoscopic examination confirmed bilateral retinal degeneration. This heifer was identified as a persistently infected BVD carrier by negative serology and

isolation of non-cytopathic form of the BVD virus. Three months later, she was euthanatized after calving due to her blindness and poor health associated with the BVD infection. Her calf was sighted and had a normal fundus on ophthalmoscopic examination. The calf was also infected with non-cytopathic BVD.

After finding the daughter (#4033) positive for BVD, the dam (#2440) was tested and found to be negative for BVD virus isolation. This finding along with a positive BVD serology indicated prior exposure but no persistent infection. Cow #2440 has had three other daughters besides #4033; her first was sold as a bred heifer in a sale and could not be traced, the second daughter (#4033), was blind, and her third and fourth daughters are 20 months and 7 months of age, respectively. Both are sighted at this time and are normal on funduscopic and electroretinographic (ERG) examination. The two surviving daughters will be followed with periodic funduscopic and ERG examinations.

Ophthalmoscopic Findings

Both cows were blind and had normal anterior segments. Pupils were moderately dilated and only responded slightly to direct and consensual light stimulation. Lesions were limited to the fundus and included diffuse tapetal hyperreflectivity indicative of retinal thinning and vascular attenuation that was most pronounced in the peripheral fundus (Figs. #1, 2, and 3). Hyperreflectivity was more obvious in some tapetal segments than others but was generalized. The optic discs did not appear grossly abnormal, since loss of myelinated axons can be difficult to appreciate in the normally dark-colored bovine optic disc.

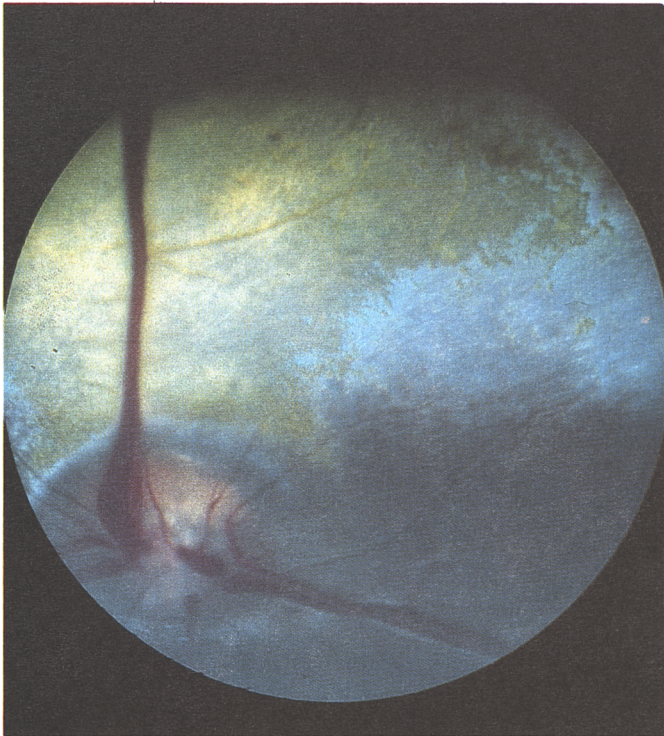
Pathology Findings

Light microscopy and electron microscopy studies of the eyes from both affected cattle were completed and a total absence of photoreceptors and outer nuclear layers were observed in all eyes (Fig. #4). The inner nuclear layers were reduced in numbers (Fig. #5), and the nerve fiber layer had marked degeneration of the individual nerve fiber bundles.

Discussion

Ophthalmic assessment of the bovine fundus requires care-

FIGURE 1. Fundus of no. 2440 (dam) showing tapetal hyperreflectivity and vascular attenuation. Although the major retinal vessels are easily observed, they are markedly attenuated for a cow.



ful evaluation of tapetal reflectivity and the diameter of retinal vessels. Attenuation of retinal vessels in ruminants may be difficult to appreciate since the normal vessels are very large, and moderately attenuated vessels may still appear “large” to examiners not accustomed to bovine fundus examination. Subtle to moderate vascular attenuation with diffuse hyperreflectivity indicates severe retinal degeneration in the cow. Small animals with diffuse retinal degeneration that has progressed to blindness frequently have severe vascular attenuation that is more easily appreciated than in the cow. In addition, the normal bovine fundus has pigment splotches present in the tapetum. These splotches usually are located 1 to 2 disc diameters dorsal to the optic disc in the nasal and temporal tapetal zone.³ These pigment splotches should not be interpreted as abnormal or as post-inflammatory retinal pigment epithelium hypertrophy.

Acquired retinal degeneration has been reported in cattle, but an inherited form of retinal degeneration or atrophy has not been described previously. Retinal degeneration or “Bright Blindness” has been reported in sheep following ingestion of bracken fern.⁴ This was considered in our cattle, but they had been raised in confinement and would not have had access to bracken fern. In addition, no unrelated animals were affected. Ingestion of male fern (*Dryopteris-filix mas*) has been reported to cause an optic neuritis in cattle,⁵ but this plant would not have been available to the cattle in this

Vitamin A deficiency has been proven to cause blindness

FIGURE 2. Tapetal fundus of no. 4033 (daughter) with diffuse hyperreflectivity and marked attenuation of small retinal vessels.

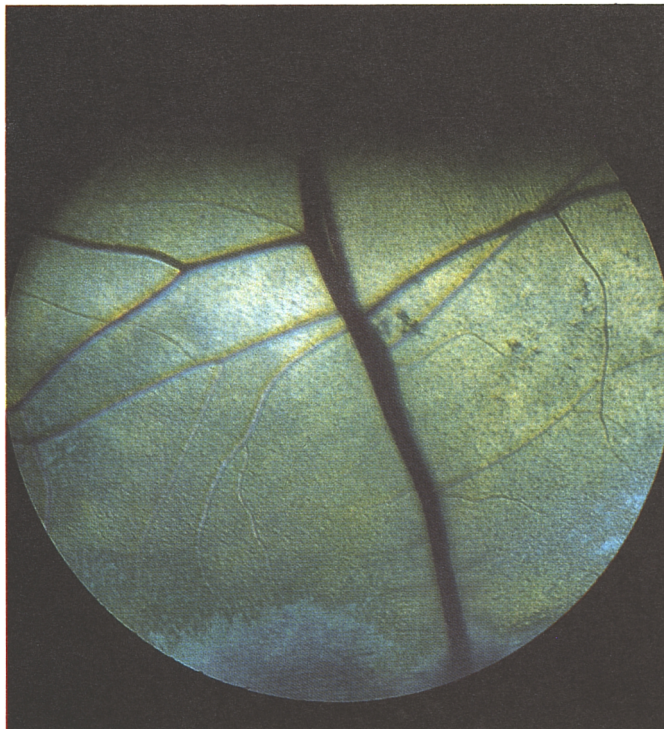
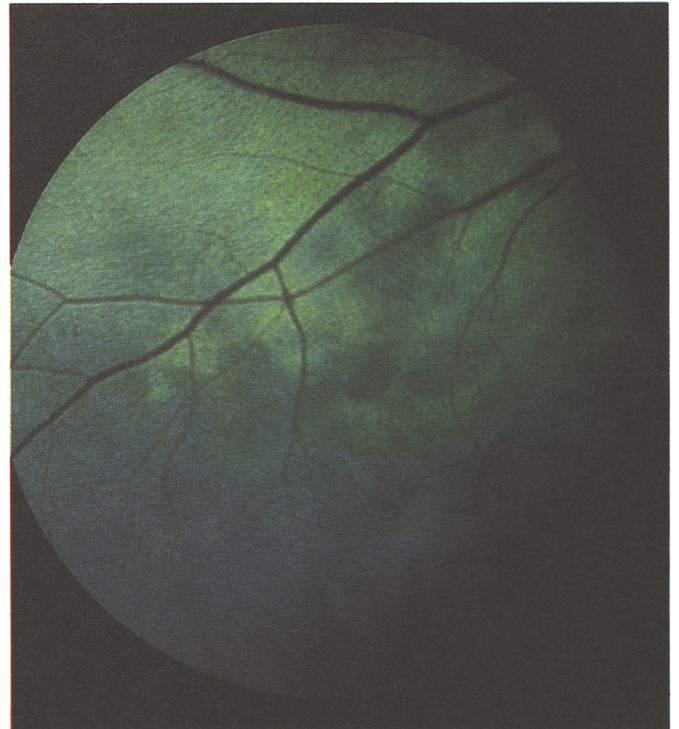


FIGURE 3. Peripheral fundus of no. 4033 (daughter) with severe vascular attenuation.



and papilledema in young^{6,7,8} and adult cattle.⁹ The pathogenesis differs in growing cattle where optic nerve lesions predominate versus adult cattle where increased cerebrospinal fluid pressure probably results in papilledema and blindness. Nyctalopia may exist in either form. The lesions are reversible with vitamin A supplementation in the early stages but irreversible if chronic or if optic nerve degeneration has occurred. This lesion is unlikely if a balanced ration is being fed and would be expected to occur in multiple animals with no genetic predisposition.

A progressive retinal degeneration of unknown etiology characterized by diffuse hyperpigmentation of the tapetal area with vascular attenuation and decreased tapetal reflectivity has been reported² in a single cow. One of the authors has observed retinal degeneration ophthalmoscopically similar to the retinal degeneration in this report in 2 unrelated mature cows in a 100 cow dairy. The cause never was determined.¹⁰

A herd outbreak of blindness due to acquired retinal degeneration has been reported in England.¹ Ophthalmic lesions were present in 7 of 80 cows in the herd and consisted of diffuse retinal degeneration characterized by diffuse tapetal hyperreflectivity and vascular attenuation. Subsequent pathologic study found lesions primarily limited to the outer nuclear layer and the rod and cone layer. However, in the most severe cases, a reduction in the inner nuclear layer also contributed to the marked decrease in retinal depth.¹¹ The ophthalmoscopic signs and pathologic studies from that report are similar to the findings in the 2 related cows included in our report, but the affected cattle in the English report were not related, and a genetic correlation was not suggested.

Retinal detachments have been observed in related Irish Friesian cattle, but retinal atrophy was not observed in this herd.¹²

Bovine Virus Diarrhea virus (BVD-V) can cause retinitis, optic retinitis, cataracts, and other ocular inflammatory lesions in fetal calves during the mid-trimester of pregnancy.¹³ Histopathologic study of BVD-V retinal lesions demonstrates

FIGURE 4. Peripheral tapetal retina of no. 2440 (dam) showing total absence of photoreceptors, sparse outer nuclear layer and reduced inner nuclear layer.

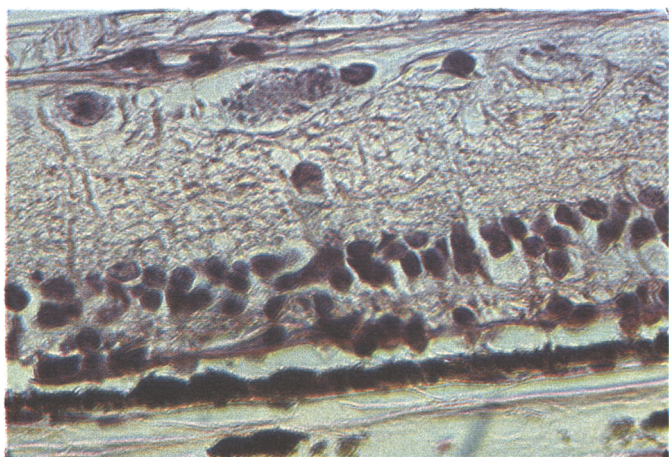
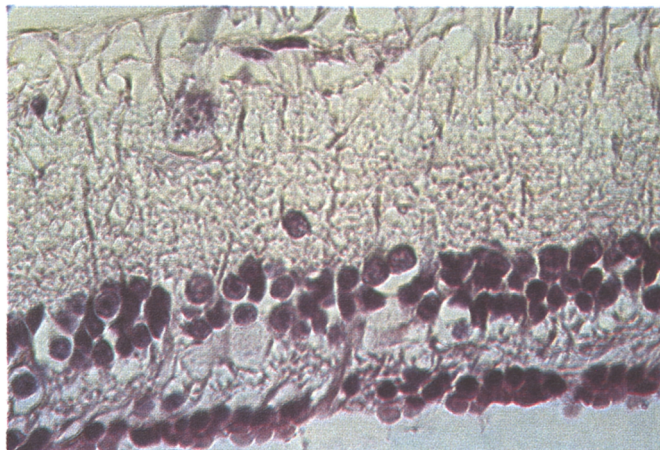


FIGURE 5. Peripheral tapetal retina of no. 4033 (daughter) with single row outer nuclei attached to disorganized photoreceptor remnants. The inner nuclear layers are reduced in number (40x).



inflammatory destruction of involved retina with disorganization of retinal layers and scarring. Although the daughter cow was persistently infected with BVD-V, her retinal degeneration did not resemble BVD-V retinitis ophthalmoscopically or histopathologically. In addition, her blindness was acquired rather than congenital and BVD does not cause ocular lesions in postnatal cattle.

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