

Congenital coloboma in a llama

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The popularity of llamas (*Lama glama*) has increased markedly over the last decade. Recently, the diseases of the llama, including congenital anomalies, have been compiled, but limited information exists about specific anomalies in the eye (1,2). With the high cost of acquisition and limited availability of breeding stock in exotic ungulates, an increase in the expression of genetically based diseases may occur. Genealogical evaluation is often difficult because of a lack of records, or when the anomaly is not readily apparent on physical examination, but any available information may be important to the management and disposition of affected stock.

Congenital anomalies of ocular tissue have been reported in most domestic animals (1-4). Ocular colobomas usually result from defective closure of the embryonic fissure (5,6). This opening is located most frequently in the area of the optic disc (slightly ventral and medial to the optic nerve), but can occur in the iris or ciliary body (3,6). Colobomas can be unilateral or bilateral (6,7), associated with other ocular anomalies, and often have a genetic basis, particularly in color-dilution or incomplete albino breeds such as Charolais cattle and collie dogs (4,6,8). Colobomas may cause congenital or progressive blindness, or may be clinically inapparent for life (4,6,7).

We describe herein the clinical and histological evaluation of an optic disc coloboma in the right eye of an eight-month-old llama. Colobomas, which are congenital and possibly inherited, have not previously been reported in this species.

The eight-month-old female llama was referred to the Western College of Veterinary Medicine (WCVM) for evaluation of a cystic structure on the bulbar conjunctiva of the right eye. This structure was noticed shortly after birth. The owner related that the dam had been disturbed during parturition and had turned sharply while the cria (young llama) was partially delivered. It was thought that the cria's head was traumatized against a wall at this time. The local veterinarian lanced the structure when the llama was seven months old. The clear fluid obtained was not characterized, and the swelling recurred shortly thereafter.

On physical examination at WCVM, the llama was in good body condition and a complete blood count was normal. The right eye appeared normal, but a fluctuant structure protruded from the ventrolateral bulbar

conjunctiva. There was moderate ectropion of the ventral eyelid over the region of the swelling. Covering of the left eye caused the llama to drop its head and resist movement. The llama successfully negotiated an obstacle course only when the left eye was uncovered.

A fine needle aspirate of the fluctuant structure yielded a clear, tenacious transudate. The white blood cell count of the fluid was 0.3×10^9 cells/L, and the protein was 10 g/L. Cytologically, the fluid contained numerous macrophages with green-black granules consistent with melanin, occasional lymphocytes, and rare nondegenerating neutrophils.

The day following the aspiration, the right eye was partially collapsed, fibrin was present in the ventral portion of the anterior chamber, and the ventral cornea was opaque with neovascularization. Based on apparent blindness of the right eye, acute inflammation, and esthetically unpleasant appearance of the eye, enucleation was undertaken. The eye was enucleated using a routine method, and the defect in the eyelids closed.

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On dissection of the periocular tissue after enucleation, there was no visible connection between the conjunctiva and the eye. The conjunctiva contained numerous firm nodular masses, but the cystic structure noted preoperatively could not be identified, probably having collapsed during the enucleation. The ventral portion of the cornea was opaque and vascularized. The optic nerve was surrounded by pockets and thin layers of tissue, which appeared to be formed by the fascia of the periorbital muscles and separated connective tissue. Externally, the eye was normal in size and structure except for a 4 mm opening located 4 mm medial and ventral to the optic nerve. Retinal pigment epithelium extended over the edge of the opening and over the back of the choroid for 0.5 cm. The optic nerve was of normal size and color. The eye was fixed in Bouin's fixative for 18 hours and postfixed in 70% alcohol for four days. The eye and conjunctiva were embedded separately in paraffin wax, sectioned at 5 μ m, and stained with hematoxylin-phloxine-saffron (HPS) and hematoxylin and eosin stains.

Histologically, the extension of the retinal pigment epithelium over the opening of the coloboma was confirmed (Figure 1). The retinal layers were normal at the edge of the coloboma, but became progressively thinner, with loss of the inner nuclear layer as the retina extended over the choroid. The pockets of tissue around the optic nerve were formed by periocular fascia and connective tissue. There was moderate edema and occasional neutrophils in all periocular

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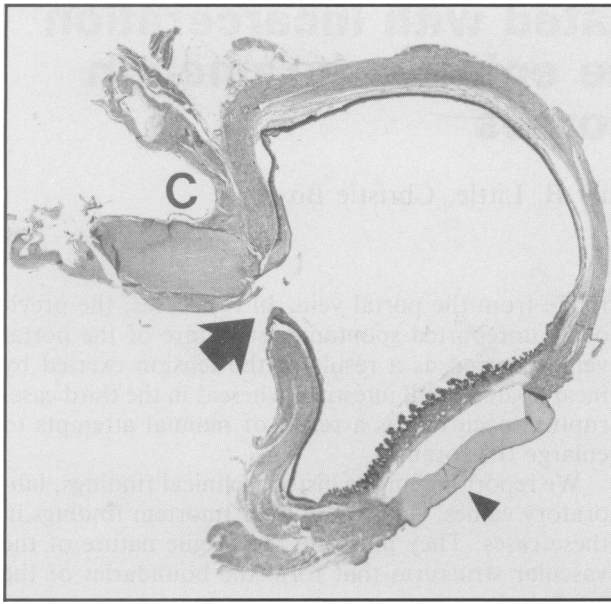


Figure 1. Subgross photomicrograph of llama eye with coloboma of optic disc (closed arrow) and cavity around the optic nerve (C). Arrowhead indicates the cornea. (HPS).

tissue, including the conjunctiva of the lower eyelid. Marked proliferation of the submucosal lymphoid tissue, with lymphoid follicle and germinal center formation, was present in the conjunctiva of the lower eyelid. A cyst was not found in the conjunctiva. The ventral half of the cornea contained multiple foci of edema with neutrophilic infiltration. All other structures of the eye were histologically normal.

Six weeks after surgery, the llama was in good health. However, fundoscopic examination of the left eye showed a prominent hyaloid artery remnant. The optic disc did not have discrete edges and the entire area of the optic disc did not appear to have normal vasculature or pigmentation. These observations suggested that an anomaly, possibly a coloboma, might also be present. Ophthalmoscopic examination of the dam and sire of this llama, and all related cria, was not possible.

Colobomas may result from asynchronous development of the retinal and choroid layers, or focal dysplasia of the retina with failure to induce the overlying choroid (6). Neural crest cells are responsible for both coat color and formation of certain connective tissues, including the sclera and choroid of the eye. Therefore an abnormality of neural crest cells may produce ocular anomalies in color-dilution breeds (5,8). However, normally-pigmented animals may have a sporadic form of coloboma (7). Infrequently, colobomas are associated with retrobulbar cysts formed from dilatation of the sclera (6,7). In this llama, enucleation resulted in damage to the retrobulbar tissues so that scleral ectasia or a retrobulbar cyst could not be confirmed. However, massive scleral ectasia extending from the coloboma to the ventral conjunctiva may explain the conjunctival cyst. The anomaly in this llama may be an example of "micro-

phthalmia with cyst" (9), although overt microphthalmia was not identified. The conjunctival lymphoid tissue was structurally similar to that described for conjunctiva-associated lymphoid tissue (10). Hyperplasia of normal lymphoid tissue in response to chronic irritation from the conjunctival swelling and prolapse are likely responsible for the nodular proliferation. Fundoscopic examination of the visual left eye in this llama suggested that there might be an optic disc lesion, but the lesion could not be well characterized. A persistent hyaloid arterial remnant, also found in the left eye, is a heritable condition in dogs (2).

Colobomas are associated with a full range of visual impediments from an unrecognized condition to total blindness, and the degree of visual impediment depends on the size and location of the deficit. While it is well known that colobomas are inherited in some species (3-6,8), it is also recognized that the condition can occur without a genetic basis (6,7). The presence of a coloboma in an individual animal raises questions regarding its etiology and, in this case, its possible genetic implications.

Llamas specifically, and South American camelids in general, are known to have a number of congenital conditions (1,2). Documentation of these problems is encouraged in order to provide a larger data base for decision making in breeding programs, and the possible exclusion of affected animals from the genetic pool. The instances in which well defined conditions with genealogical background can be documented are more valuable than anecdotal reports. Caution must be exercised in ascribing a genetic basis to camelid conditions until the mechanism of inheritance has been described fully. However, advice to breeders may still be given based on extrapolation from the information available from other species. With the strong possibility that a coloboma could be an inherited condition, it was recommended that the llama described in this report not be used as breeding stock. CVJ

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