Equine Glaucoma

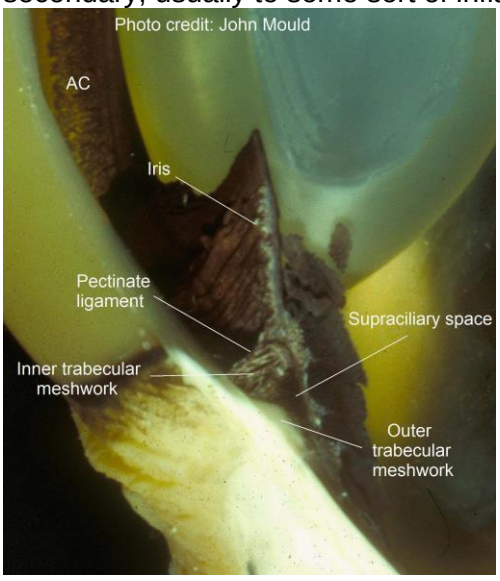
Dennis E. Brooks, DVM, PhD
Diplomate, American College of Veterinary Ophthalmologists
Professor Emeritus of Ophthalmology
University of Florida
brooksd@ufl.edu

Introduction

Equine glaucoma is a frustrating condition that can be difficult to diagnose and control. Understanding the pathophysiology of this condition and the consequences of altered aqueous humor dynamics is very important, especially since the disease is often unrecognized or recognized late in its course. The goal of this lecture is to describe the typical and atypical presentations of equine glaucoma, and discusses diagnosis, prognosis and current approaches to therapy for this condition.

Anatomy/Physiology

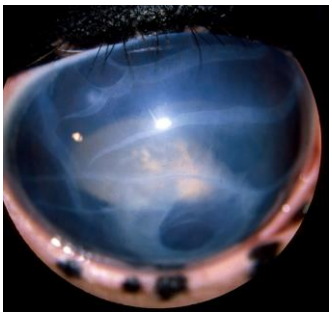
Aqueous humor performs the critical function of providing nutrition and oxygen to the anterior structures of the eye (cornea, lens and trabecular meshwork). It is produced in the ciliary body behind the iris through a combination of active secretion and ultrafiltration. Once formed, it moves anteriorly through the posterior chamber, between the iris and the lens, through the pupil and into the anterior chamber. Once it has fulfilled its nutritive function and collected the resultant metabolic waste products, it leaves the eye through the iridocorneal angle. The fluid then traverses specialized meshwork in the angle before entering the angular aqueous plexus and the intrascleral plexus and being dumped into the systemic vasculature (conventional pathway) or exits through a more primitive outflow pathway through the iris and ciliary body (unconventional pathway). Resistance or obstruction to outflow of aqueous humor results in accumulation of this fluid and an elevation in intraocular pressure (IOP) which is incompatible with the health and normal function of the eye. The majority of glaucoma cases in horses are secondary, usually to some sort of inflammatory insult that obstructs the outflow pathways.

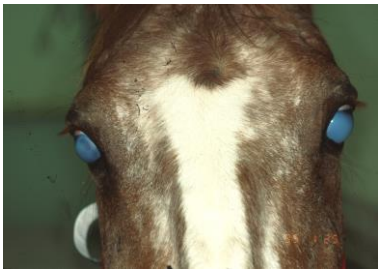


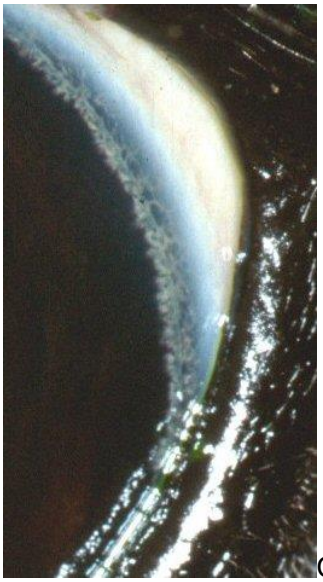
The glaucomas are a group of diseases resulting from alterations of aqueous humor dynamics that cause an intraocular pressure (IOP) increase above that which is compatible with normal function of the retinal ganglion cells and optic nerve. Horses with previous or concurrent uveitis, aged horses, and Appaloosas are at increased risk for the development of glaucoma. Iris and ciliary body neoplasms can cause secondary glaucoma. Congenital glaucoma is reported in foals and associated with developmental anomalies of the iridocorneal angle. The infrequency of diagnosis in the horse may be due, in part, to the limited availability of tonometers in equine practice, but also to the fact that large fluctuations in intraocular pressure (IOP), even in chronic cases, may make documentation of elevated IOP difficult.

Clinical Diagnosis

The diagnosis of glaucoma in the horse is made with the presence of clinical signs specific to glaucoma and an elevated IOP. This diagnosis can be challenging, especially since the equine IOP fluctuates a great deal and glaucomatous eyes may not be elevated at the time an IOP measurement is made, but may be elevated at another point in that same day. The normal IOP is 23.3 ± 6.9 mmHg (range in the horse is up to 37 mmHg. This variation not only makes diagnosis difficult but can complicate monitoring of the disease and its response to therapy. Diagnosis may also be difficult because often the clinical signs of glaucoma in the initial stages are subtle and overt signs of discomfort are uncommon. Corneal edema and mydriasis are often the first clues that point to intraocular pressure elevations or fluctuations. Afferent pupillary light reflex deficits, corneal striae, decreased vision, lens luxations with or without cataract, iridocyclitis, posterior synechia and optic nerve atrophy/cupping may also be found in eyes of horses with glaucoma. Buphthalmos occurs as the globe stretches from chronically elevated IOP. Secondary corneal issues from exposure and impaired nutrition are common in the later stages of the disease.



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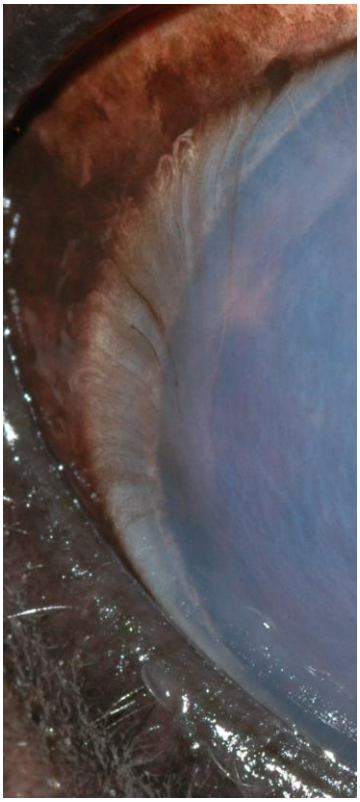
Closed


Chronic glaucoma

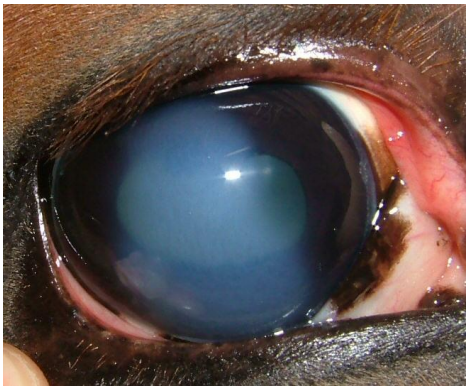


Table 1: Clinical signs of glaucoma

Clinical Sign	**Acute Glaucoma**	**Chronic Glaucoma**
Corneal edema	Variable, mild to moderate, often focal	Usually present, mild to severe, often permanent
Aqueous flare	Usually present, variable degree	Inconsistently present
Pupil	Mydriatic	Variable, often restricted by posterior synechia
Lens	Variable, may see subluxation	Cataract present, subluxation or subluxation may be present
Posterior segment	Unusual, mild if present	Common; chorioretinal lesions, optic nerve atrophy, exposed lamina cribrosa

Blepharospasm	Variable, mild to severe	Unusual
Buphthalmos	Not present	Common
Corneal band opacities	Unusual	Often seen
Vision loss	Unusual	Common

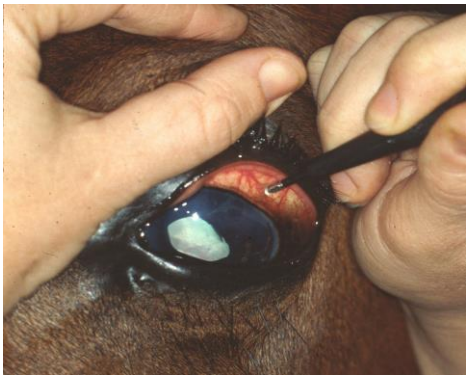
Differential Diagnosis

The majority of glaucoma cases in horses are secondary, especially to equine recurrent uveitis. It is very important when a diagnosis of glaucoma is made, that the eye be examined thoroughly for signs of previous, chronic or active intraocular inflammation.

Treatment

Medical: The topical carbonic anhydrase inhibitor dorzolamide (2% TID), and the beta-blocker timolol maleate (0.5 % BID-TID) have been utilized to lower IOP in horses with varying degrees of success And are considered the mainstays of topical glaucoma therapy, especially when combined with medical therapy for the primary uveitis which is usually causative. The newer prostaglandin derivatives cause low grade uveitis and may exacerbate the IOP in horses with glaucoma. They are often used, however, when more traditional medical therapy has proven ineffective or is no longer effective. Topical atropine therapy was once thought to reduce the incidence of glaucoma in horses with uveitis, but should be used cautiously in horses with glaucoma as it may cause IOP spikes. The systemically administered carbonic anhydrase inhibitor acetazolamide (1-3 mg/kg QD, PO) may be helpful in controlling IOP, however, it may have undesired systemic side effects and in many cases is cost-prohibitive. Anti-inflammatory therapy, consisting of topically and systemically administered corticosteroids, and/or topically and systemically administered nonsteroidal anti-inflammatories also appear to be beneficial in the control of IOP.

Surgical: Laser destruction of the ciliary body (cyclophotocoagulation, or CPC) is the most commonly employed surgical method for controlling IOP and preserving vision in horses. The goal is to lower the production of aqueous humor by ablating some of the tissue that produces aqueous and restoring the balance between production and outflow. Most cases of CPC are performed in the standing, sedated animal, however, a type of endoscopic CPC may be performed under general anesthesia. The advantage to this type of CPC is that it allows the surgeon to visualize the ciliary body and therefore performed targeted and precise delivery of laser energy and confirmation of the tissue destruction. A few studies have looked at placement of gonioshunts in horses which divert fluid out of the eye, increasing outflow rather than decreasing production. There is no data available on success rates or length of control in glaucomatous eyes however. When vision is lost and/or the chronic complications that occur with uveitis and glaucoma develop, enucleation is often indicated to restore the animal's comfort. Globe sparing salvage procedures, such as an intraocular prosthesis or chemical ablation (intravitreal gentamicin), may be considered if the cornea is healthy and not ulcerated. These procedures are typically performed for cosmetic purposes.



Contraindications/possible interactions/long-term sequelae

Conventional glaucoma treatment with miotics may provide varying amounts of IOP reduction in horses. Miotics and prostaglandins can potentiate the clinical signs of uveitis and should be used cautiously in horses with anterior uveitis. Topical atropine does not appear to have the benefit of lowering IOP in a majority of glaucomatous horse eyes as originally proposed.

The horse eye seems to tolerate elevations in IOP for many months to years that would blind a dog, however, vision loss will eventually occur. Buphthalmia, or stretching and enlargement of the globe, can predispose the eye to exposure keratitis and corneal ulcerations and degeneration. Chronically enlarged and inflamed eyes are also at risk for the development of cataract, lens subluxation and luxation and band keratopathy (usually accompanied by ulceration), all of which can exacerbate intraocular inflammation and feed into a viscous circle of pain and pressure woes.

Conclusions

Glaucoma is an extremely frustrating condition in horses and will hasten loss of vision in an affected globe. Diligent therapy and monitoring are necessary, however, even with proper care, chronic complications and damaging, painful sequelae are common.

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