In order to understand the pathophysiology, select optimal therapeutic options for patients and provide clients with honest expectations for cases of canine glaucoma, clinicians should be familiar with a rational understanding of the functional anatomy of the ocular structures involved in this group of diseases. The topographical extension and the structural and humoral complexity of the regions involved with the production and the outflow of aqueous humor undergo numerous changes with aging and disease. Therefore, the anatomy relative to the fluid dynamics of aqueous has become a pivotal yet flexible concept to interpret the different phenotypes of glaucoma.

Glaucoma is a common ocular condition in humans and dogs leading to optic nerve degeneration and irreversible blindness. Primary glaucoma is a group of spontaneous heterogeneous diseases. Multiple factors are involved in its pathogenesis and these factors vary across human ethnic groups and canine breeds, so the clinical phenotypes are numerous and their classification can be challenging and remain superficial. Aging and oxidative stress are major triggers for the manifestation of disease. Multiple, intertwined inflammatory and biochemical cascades eventually alter cellular and extracellular physiology in the optic nerve and trabecular meshwork and lead to vision loss.

Primary glaucomas are a leading cause of incurable vision loss in dogs. Based on their specific breed predilection, a genetic cause is suspected to be responsible, and affected dogs should be excluded from breeding. Despite the high prevalence of primary glaucomas in dogs, their genetics have been studied in only a small number of breeds. The identification of canine glaucoma disease genes, and the development of genetic tests, will help to avoid the breeding of affected dogs in the future and will allow for earlier diagnosis and potentially more effective therapy.
Clinical Signs and Diagnosis of the Canine Primary Glaucomas
Paul E. Miller and Ellison Bentley

The diagnosis of glaucoma is highly dependent on a working understanding of the clinical signs and available diagnostic procedures. Clinical signs may be attributable to increased intraocular pressure and/or complex alterations in the physiology or molecular biology of the anterior segment, retinal ganglion cells, and optic nerve. Many diagnostic procedures seek to more fully characterize these alterations and to identify which clinical features increase the risk of overt primary angle closure glaucoma (PACG) occurring. Considerable progress has been made in identifying the anatomic features that predispose an eye to PACG, and in elucidating the role of reverse pupillary block.

Microscopic Lesions in Canine Eyes with Primary Glaucoma
Gillian Beamer, Christopher M. Reilly, and Stefano Pizzirani

Although the clinical classification of primary glaucoma in dogs is quite simple, the phenotypes of glaucoma in most of the species are indeed multiple. Ophthalmologists can often evaluate the dynamic changes of clinical signs at different times in the course of the disease, whereas pathologists are often presented with globes that have undergone abundant therapies and are at the end stage. Therefore, an open collaboration between clinicians and pathologists can produce the most accurate interpretation in the pathology report and improve patient outcomes. This article focuses on the histomorphologic elements that characterize, and are important to, canine primary glaucomas.

Medical Treatment of Primary Canine Glaucoma
Anthony F. Alario, Travis D. Strong, and Stefano Pizzirani

Glaucoma is a painful and often blinding group of ocular diseases for which there is no cure. Although the definition of glaucoma is rapidly evolving, elevated intraocular pressure (IOP) remains the most consistent risk factor of glaucoma in the canine patient. Therapy should be aimed at neuroprotection. The mainstay of therapy focuses on reducing IOP and maintaining a visual and comfortable eye. This article discusses the most current ocular hypotensive agents, focusing on their basic pharmacology, efficacy at lowering IOP, and recommended use in the treatment of idiopathic canine glaucoma.

Surgical Treatment of Canine Glaucoma: Filtering and End-Stage Glaucoma Procedures
Federica Maggio and Dineli Bras

Canine glaucoma is a common cause of vision loss associated with raised intraocular pressure, and leads to damage of the retina and optic nerve head. In most cases, medical treatment alone cannot provide long-term management of intraocular pressure control and preservation of vision. Surgical intervention is usually recommended to either decrease aqueous humor production, or increase its outflow. Among the current available procedures, filtering techniques are aimed at increasing aqueous humor outflow. Proper surgical timing and a combination of cyclodestructive and filtering procedures have been recently suggested to improve the long-term success of
surgical treatment in dogs. Bleb fibrosis and surgical failure are still common occurrences in filtration surgery with relapse of glaucoma and vision loss. End stage procedures, such as enucleation, evisceration with intrascleral prosthesis, and chemical ablation of the ciliary bodies are then recommended to address chronic discomfort in buphthalmic and blind eyes.

**Surgical Treatment of Canine Glaucoma: Cyclodestructive Techniques**

Dineli Bras and Federica Maggio

Videos on endoscopic cyclophotocoagulation for the surgical treatment of canine glaucoma accompany this article

Medical and surgical management of canine glaucoma can be challenging. The goal of surgical treatment is to manipulate the inflow and/or outflow of aqueous humor. This article describes the inflow-reducing, cyclodestructive techniques. Diode cyclophotocoagulation is the most common cyclodestructive procedure performed in humans and animals. Diode laser energy can be applied via a transscleral (transscleral cyclophotocoagulation [TSCP]) or an endoscopic (endoscopic cyclophotocoagulation [ECP]) approach. ECP provides direct visualization of the targeted ciliary body, allowing safer and more titratable treatment than TSCP techniques, offering a better long-term prognosis for vision and intraocular pressure control. Advancements in diode laser therapy seem promising.

**Feline Glaucoma**

Gillian J. McLellan and Leandro B.C. Teixeira

Feline glaucoma is often insidious in onset and slowly progressive with very subtle clinical signs. As a consequence, it is likely that the disease in cats is underdiagnosed. As cats typically present late in the course of disease, prognosis for long-term maintenance of vision is poor. Patient and owner compliance with frequent application of topical medications can be a limiting factor, and represents a serious clinical challenge. This review outlines the clinical features, classification, and pathophysiology of the feline glaucomas and provides current evidence on which to base the selection of appropriate treatment strategies for cats with glaucoma.

**Canine Secondary Glaucomas**

Stephanie Pumphrey

Secondary glaucomas are common in dogs, and occur due to obstruction of aqueous humor flow at the pupil, iridocorneal angle, or trabecular meshwork by numerous mechanisms. Secondary glaucoma is suspected based on examination findings, or presence of elevated IOP in an animal with a signalment inconsistent with primary glaucoma. Animals with secondary glaucoma require more diagnostic testing than animals with primary glaucoma. Management is challenging, and treatments used for primary glaucoma may be ineffective or even detrimental. Prognosis for vision and/or globe retention may be better than for primary glaucoma, particularly if underlying causes can be found and addressed promptly.