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THERE IS MORE TO GLAUCOMA THAN MEETS THE EYE

By Laura Liscum, PBGVCA Health Committee

Glaucoma is traditionally thought of as a plumbing problem. The normal eye has cells that produce fluid and the drainage of this fluid from the eye must match its production in order to maintain normal pressure within the eye. When drainage is blocked, the increased intraocular pressure damages the optic nerve and results in pain and impaired vision. In the early stages, the symptoms of glaucoma are relatively mild.¹ They include redness or cloudiness in the eye, squinting, and discharge from the eye. An affected dog may exhibit discomfort, lethargy, excessive sleeping and loss of appetite. Early diagnosis and rapid initiation of treatment is essential to preserve vision in the affected animal.

The 2010 PBGV health survey showed that 1% of our dogs had glaucoma, which means that the PBGV is not one of the breeds predisposed to glaucoma. (By contrast, over 5% of American Cocker Spaniels and Basset Hounds develop glaucoma.¹) However, eye problems as a whole were the most common diseases on the PBGV health survey and we want to ensure that glaucoma does not become a major health issue for the PBGV. Therefore, the PBGVCA has in the past contracted a veterinary ophthalmologist to inspect the dogs at our National Specialty using a technique called gonioscopy. Gonioscopy measures the iridocorneal angle, which determines the rate of fluid outflow from the eye. Dogs with an abnormal angle are at a higher risk for developing the drainage problem that leads to primary glaucoma. Since primary glaucoma is a genetic disease, it is important for breeders to have this information when making reproductive decisions about their dogs. (Secondary glaucoma occurs when other eye diseases causes reduced fluid drainage from the eye.)

In October, 2010 I had the opportunity to hear an excellent clinical lecture entitled "Glaucoma: Beyond Plumbing" presented by Stephanie Pumphrey, DVM, an ophthalmology resident at the Tufts Cummings School of Veterinary Medicine. Dr. Pumphrey noted that there are a number of mysteries about glaucoma that are changing the way ophthalmologists think about the disease. Among the mysteries are that some humans with glaucoma have normal intraocular pressure, and that some humans and dogs with high intraocular pressure do not develop glaucoma. Also, some humans and dogs with sustained elevations in intraocular pressure either don't go blind or lose their vision slowly, whereas others have only mild pressure increases and go blind quickly. In other words, if gonioscopy shows that a dog has a malformed iridocorneal angle, that doesn't mean the dog will develop glaucoma. And if the dog passes his/her gonioscopy exam with flying colors, the dog may still develop the disease due to other risk factors that predispose him/her to glaucoma.

Ophthalmologists now think that glaucoma is not simply a plumbing problem, but instead encompasses multiple disease processes that damage the retinal cells that form the optic nerve, called retinal ganglion cells. Dr. Pumphrey said "we need to start thinking about glaucoma like we think about cancer, using a multiple-hit model, in which no single risk factor is sufficient to cause disease in and of itself". A dog with a malformation that slows fluid egress from the eye may never have elevated intraocular pressure or develop glaucoma. However, if the dog suffers an additional stress to the eye, the scales may be tipped towards glaucoma. Dr. Pumphrey listed possible factors that are currently thought to promote glaucoma. They include changes in the environment around the optic nerve, dysregulation of cells that normally protect

¹ Luechtefeld, L. "Early diagnosis can delay glaucoma's onset." Tufts University Cummings School of Veterinary Medicine *Your Dog Newsletter*. November 2010.

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the retinal ganglion cells, the presence of inflammatory mediators and immune cells, an abundance of proteins that signal cellular stress, and indications of oxidative stress and mitochondrial dysfunction. Importantly, each of these factors represents a therapeutic target. Veterinary ophthalmologists are currently testing many potential interventions aimed at relieving these additional stresses and preserving vision in glaucoma patients.

The PBGV Health & Rescue Foundation funds research at the University of Missouri to identify the genes responsible for the development of primary canine glaucoma. If your dog has been diagnosed with glaucoma, we encourage you to participate in this research project by submitting a blood sample. Instructions for sending samples can be found in the "Glaucoma & Lens Luxation" section of the www.CanineGeneticDiseases.net website. You may also contact Project Coordinator Liz Hansen at HansenL@missouri.edu or by calling 573-884-3712.