

The Aging Eye: We see it all!

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From cornea to lens to retina, every structure in the eye is affected by age. This lecture will review diseases of the eyes and help distinguish between pathology and normal aging changes. Examples of topics include corneal ulceration, cataracts, and retinal blindness with emphasis on providing practical diagnostic tips and treatment options.

Keratoconjunctivitis sicca (KCS)

Keratoconjunctivitis sicca or "dry eye" is a very common ocular disorder affecting the cornea and conjunctiva of older dogs and, less commonly, cats. This condition is the result of inadequate aqueous tear production such that the tear film (aqueous, mucus, lipid) is unable to effectively protect the cornea, clear debris and function in immunity. When left untreated, KCS can be a potentially blinding disease through severe corneal ulceration or pigmentation. However, it is relatively easy to diagnose with a Schirmer Tear Test (STT) and usually responds favorably to long-term medical therapy. While cats STT values can vary in a clinic due to stress, a normal reading in a dog exceeds 20mm/min.

There are many causes of inadequate tear production. Among the more common include: breed predisposition (inherited), immune mediated disorders (caused by the animal's own immune system attacking the tear gland), neurogenic, use of certain drugs, and some systemic diseases. Breeds most often affected with KCS include West Highland White Terrier, Bulldog, Cocker Spaniel, Boston Terrier, Lhasa Apso, and Shih Tzu. There is a tendency to see KCS more often in females than males and it usually occurs in middle to older age dogs.

KCS is usually a treatable disease; however, it requires a long-term commitment from the owner. The exact frequency of medication may vary, but often includes the use of a high quality tear film replacement compound or "artificial tears" to mimic the natural tear film. It may be necessary to instill these drops as often as every two hours in the early course of therapy. These artificial tears are usually used in conjunction with Cyclosporine (0.2-2%) or Tacrolimus (0.02-0.5%). When administered topically onto the eye, tear production will significantly improve in about 80% of all cases depending on the cause of KCS.

The exact mechanism by which these medications increases tear production is not fully understood but they suppress the immune system attack at the tear gland, thereby limiting the damage to tear production. When administered topically, they are considered to be a very safe drug with no systemic side effects reported. The increase in tear production usually occurs within the first 4-6 of weeks of therapy. Even when tear production returns to normal, therapy must be continued for the life of the patient. In certain cases, the frequency of the artificial tear therapy can be reduced or even discontinued once the full effects of the Cyclosporine or Tacrolimus have been realized. In many cases,

the damage to the cornea, including pigmentation, will significantly improve once the tear production returns to normal.

Failure to respond: For the few cases that do not respond to medical therapy, management can become very frustrating. A surgical option involving a parotid duct transposition exists but should be considered only after medical therapy has failed.

Indolent Ulcer

Indolent ulcers occur more frequently in older dogs and cats and are caused by a failure of the superficial epithelial layer of the cornea to adhere to the stroma below during the healing process. While a typical corneal ulcer should heal in 3-5 days, indolent ulcers can be present for weeks to months if left untreated. Indolent ulcers are most commonly seen in older-aged boxers, golden retrievers, Boston Terriers and Corgis.

Treatment can include corneal debridement, grid or burr keratotomy, or superficial keratectomy. Debridement of the ulcer promotes healing by removing the outer non-adhering layer of cornea with sterile cotton swabs. This procedure may have to be repeated for success. Bandage contact lenses may be placed to improve comfort and create a smooth surface under which the cornea can heal. During a grid keratotomy, a 25 or 27 gauge needle or a rotating burr are used to disrupt the hyalonized superficial stroma, stimulate cytokines that facilitate binding, and encourage fibrosis and healing. It is generally performed with only topical anesthesia but should never be performed in corneal ulcers that are infected or deep or in cats as the procedure can precipitate corneal sequestra. For chronic cases or those not responding to repeated keratotomy procedures, a superficial keratectomy is necessary. With this procedure, an outer or superficial layer of the affected cornea is surgically removed by careful dissection, using an operating microscope. This procedure is associated with a high success rate in a single surgery, but requires general anesthesia and the owner incurs higher costs.

Corneal Dystrophy vs. Corneal Degeneration

Corneal dystrophy is typically an inherited disorder of the cornea that affects both eyes. It can appear white or gray as a haze or a focal opacity as is usually not painful but may be progressive. The opacities may be fat or mineral (calcium). They do not require treatment unless corneal ulceration occurs. Since this is an inherited condition, it is recommended that owners should not use affected animals in breeding programs. Further investigation should be pursued to rule out the possibility of disease elsewhere in the body creating increases in fat or calcium that are subsequently deposited in the cornea from the bloodstream. Examples include high cholesterol or triglycerides, hypothyroidism, hypercalcemia and Cushing's disease. Therapy depends on identifying and excluding underlying causes that can be treated, including diet modification.

Corneal Degeneration is also a white opacity but more commonly involves active ulceration or inflammation. Affected eyes with ulcerative corneal degeneration often show signs of blepharospasm and episcleral injection. Calcific keratopathy is a specific form in older dogs with a median age of 14 years in which calcium accumulates in the cornea; the deposits appear as dense white pickets. Ulcers should be treated with topical antibiotics and lubrication and may require debridement to heal.

Corneal Endothelial Degeneration

Corneal Endothelial Degeneration is a disease of the innermost or deepest layer of the cornea that results in severe corneal edema. In the normal cornea, the endothelial cells are a single cell layer that provide a water tight barrier to maintain the cornea's clear appearance. These cells are not able to replace or repair themselves so when lost with age or breed related Endothelial Degeneration, the water tight barrier deteriorates, allowing aqueous fluid to leak into the cornea.

This results in corneal edema (swelling), cloudiness of the cornea, and decreased or "blurred" vision.

With chronic (long-term) edema, the fluid accumulates, forming tiny pockets, known as bullae. These bullae can rupture through the outer layer of the cornea (epithelium), forming a corneal ulcer. These ulcers are painful, may be recurrent, and are often non-healing.

This disease is found commonly in breeds such as the Boston terrier, Labrador retriever and Chihuahua.

It is also found in older age dogs of all breeds, due to the perpetual loss of endothelial cells throughout life. Diagnosis of endothelial dystrophy is made from clinical signs and a complete history.

There are limited medical and surgical options available for treatment of endothelial dystrophy. Medical therapy consists of using topical drops of a 5% sodium chloride hypertonic saline solution. This drug is a hyperosmotic agent which works by pulling fluid out of the corneal cells to decrease the chance of fluid pooling into blisters or bulla that then rupture.

When medication is not enough to control recurrent ulceration, the most common surgical option is called thermal keratoplasty with Handheld cautery to heat foci of the affected cornea. These areas will then form scars, which prevent the spread of the fluid-filled bullae. While the cornea will remain white, it is less likely to form painful bullae and ulcers. Another surgical option is placement of a thin conjunctival flap called a Gundersen flap. This consists of making a flap of tissue from the conjunctiva (pink tissue surrounding the eye) and suturing it over the affected areas of the cornea. This procedure relieves the discomfort caused by corneal ulceration, however it will leave a scar on the cornea, and a blind spot in the animal's vision. The last surgical option is called a penetrating keratoplasty. This consists of surgically removing the entire thickness of the central cornea and transplanting a donor cornea into this site. This procedure is not commonly performed in animals due to its expense and high complication rate. However, in some patients it offers the only chance for restoration of vision.

Cataract

A cataract is any dense opacity within the lens that obstructs vision. Many older patients over the age of eight will present for "cloudy, hazy eyes," but the lenticular changes are nuclear sclerosis rather than cataracts. Since lens epithelial cells multiply from the periphery and migrate axially, this clouding of the nucleus results from years of dense, central packing of lens fiber. Nuclear sclerosis can be distinguished from cataract using retroillumination; a tapetal reflection will be present through nuclear sclerosis but obstructed by a cataract.

Cataracts can range from incipient (focal) to mature (complete) to hypermature (liquefied with lens capsule wrinkling). Fortunately, most age-related cataracts are incomplete, cortical cataracts that do not progress to a point of significant vision impairment. However, should cataracts become complete and lead to vision loss, a thorough eye exam is warranted. As cataracts and retinal disease can occur concurrently, it is imperative that all older dogs presenting for cataract surgery undergo an electroretinogram (ERG) to ensure that the retinal function is sufficient such that surgery to remove cataracts will restore vision.

Retinal Degeneration

Age-related retinal disease can occur in any breed and patients typically present for a decrease in vision in dim lighting or hesitation on stairs. Alternatively, an ophthalmoscopic exam will reveal changes in the retina in an older patient on annual health exams, but there is no reported history of vision loss at all. Age-related degeneration rarely results in blindness and differs significantly from Progressive Retinal Atrophy (PRA), an inherited condition that can occur suddenly in young to middle age and often results in complete blindness within months. In age-related retinal degeneration, the ophthalmoscopic exam might reveal a subtle thinning or shortening of the retinal blood vessels as opposed to the dramatic changes seen in PRA (i.e. thinning with tapetal hyperreflectivity and severe loss of retinal blood vessels).