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Tear physiology

Tears have an important role in maintaining the health of the ocular surface, as they supply the metabolic requirements of the avascular cornea. Tears also contribute to ocular defenses, as they contain globulins and other antimicrobial factors, and wash away foreign bodies and dirt. Though the tearfilm is composed of three layers, most of these physiological functions are conducted through the middle, aqueous layer. In the dog, it is accepted that approximately 2/3 of the aqueous layer is produced in the main lacrimal gland, with the balance produced mainly by the lacrimal gland of the third eyelid. After washing over the corneal surface, tears flow through the punctas into the nasolacrimal system, draining into the nasal or oral cavity. Diseases of the lacrimal system may be roughly divided into problems of production (which may be insufficient or excessive) and problems of reduced drainage [1].

Tear Insufficiencies

The most common tear insufficiency is caused by reduced production of the aqueous layer of the tearfilm, causing quantitative tear deficiency. The reduced production leads to an inflammation of the conjunctiva and cornea known as keratoconjunctivitis sicca (KCS) or “dry eye”. Causes of KCS include genetic disposition (Bulldogs, West Highland White Terrier and brachycephalic breeds); chronic eyelid/conjunctival inflammation; viral infection (notably canine distemper and feline herpes); parasympathetic denervation (frequently in conjunction with Facial nerve paralysis); and iatrogenic causes, due to surgical removal of the 3rd eyelid or treatment with drugs (sulfas, Etodolac and atropine). However, the most common cause of KCS appears to be an autoimmune inflammation of the tear gland [1, 2].

A history of recurrent inflammation which improves whenever treatment is administered is suggestive of
KCS. The diagnosis of KCS is based on clinical signs of acute or chronic keratoconjunctivitis, and confirmed through low Schirmer tear test values. As most cases are due to gland inflammation, topical cyclosporine has become the “first line” treatment. Therapy leads to increased tear production and resolution of clinical signs of inflammation, though owners should be instructed that most cases require lifelong therapy. Tacrolimus is another immuno-modulatory drug that can be used in immunogenic KCS. Secondary infection, ulcers and inflammation should also be treated. Refractory cases may be treated with pilocarpine (for cholinergic gland stimulation) or surgically, through parotid duct transposition [1, 3].

**Tear overflow**

Epiphora is defined as an overflow of tears (causing staining of the facial skin) that may be due either to excessive tear production or blocked drainage through the nasolacrimal duct (NLD). Clinicians presented with epiphora should first rule out excessive production, which is usually caused by irritation or inflammation. The patient should be checked for conformation of eyelids (entropion, ectropion), aberrant eyelashes, caruncular hair, foreign bodies, chemical irritation, allergy and other causes of conjunctivitis/keratitis. Abnormal lid closure, nasal folds, and orbital conformation that results in a small lacrimal lake, predisposes some brachycephalic dog and cat breeds to epiphora. The primary cause of epiphora should be treated. Oral tetracycline or metronidazole may reduce the extent of the brown tear stain caused by the tear overflow [1].

**Drainage Obstructions**

Obstructions to drainage may be due to congenital or acquired disorders. The most common congenital disorders of the nasolacrimal system are an imperforate or micropuncta (especially of the lower lid). However, other components of the system may also be maldeveloped. Acquired disorders include traumatic laceration of the nasolacrimal system; inflammation, i.e., dacryocystitis; foreign bodies lodged in the nasolacrimal system; or external compression of the nasolacrimal system by bone fractures, cellulitis or neoplasia in the surrounding tissue. In cats, cicatricial obstruction of the punctas is a common complication of feline (herpetic) keratoconjunctivitis.

As noted, epiphora cases should first be checked for causes of increased tear production. Clinicians suspecting drainage obstruction should inspect the lower lid for the presence, location and size of the puncta. Patency of the entire nasolacrimal system may be evaluated by checking for fluorescein passage from the eye to the nostril or mouth, or by cannulating the punctas and flushing. The nasolacrimal system may also be imaged through contrast radiography (dacryocystorhinography). If compression by surrounding tissue is suspected, radiography or advanced imaging of the nasal area is warranted.

Treatment depends on the cause of obstruction. Cannulation and flushing of the nasolacrimal system may dislodge foreign bodies or inflammatory material. In case of the latter, the flushed fluid may be submitted for culture/cytology. Inflammation may be treated with antibiotics/anti-inflammatory drugs and an indwelling cannula. Imperforate or micropunctas may be enlarged using fine scissors. Lacerations should be referred for microsurgical repair. Surgery may also be used to create new drainage pathways to the oral or nasal cavities [1].

**Third eyelid disorders**

Prolapse or protrusion of the third eyelid is a common presentation. Bilateral protrusion is usually caused
by decreased orbital mass (e.g., dehydration or cahexia) causing enophthalmos. It may also be observed in cats with Haw’s syndrome, or cases of extraocular polymyositis. Unilateral protrusion is commonly seen due to space occupying retrobulbar diseases that are pressuring the third eyelid (e.g., retrobulbar abscess or tumor). Pain, causing globe retraction, and sympathetic denervation (Horner’s syndrome) will likewise cause unilateral protrusion [4].

The third eyelid may also be visibly prominent in cases of conjunctivitis. Though the bulbar and palpebral conjunctiva are usually also affected, clinicians should remember the presence of lymphatic follicles on the inner surface of the third eyelid. These may hypertrophy during inflammation, and may need to be debrided following its resolution [4].

Another common problem is “cherry eye”, or prolapse of the tear gland located at the base of the third eyelid. This is probably caused by weakness in the attachments to the periorbita, and some dog breeds may be genetically predisposed. Prolapsed glands should be replaced surgically, most commonly by various pocketing techniques or anchoring to the periosteum of the ventral orbit. Excision of the gland, which makes a significant contribution to overall tear production, predisposes the dog to KCS. It should be avoided at all costs, and indeed it is contraindicated except in cases of third eyelid neoplasia or severe trauma [4, 5].

Scrolling of the third eyelid is another disorder with genetic predisposition that can only be repaired surgically. And finally, clinicians presented with a painful eye should always remember the possibility of foreign bodies “hiding” behind the third eyelid [4].

**Recommended Reading**