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Corneal ulcer, descemetocoele

Corneal ulcer

Affected Animals:

Any animal may develop a corneal ulcer. Recurrent ulcers and refractory ones that do not heal properly occur more commonly in middle-aged and older dogs. Cats are susceptible to herpesvirus infection and secondary ulceration of the cornea.

Overview:

The cornea is the multi-layered transparent part of the front of the eye. It plays a vital role in vision. Injury, bacterial, fungal, and viral infection, diseases of the eye and eyelid, and a number of other conditions can cause the cornea to ulcerate. A corneal ulcer can develop serious complications that may compromise visual acuity and even result in loss of sight if not promptly treated by a veterinarian.

A corneal ulcer is a defect or cavity in the two surface layers of the cornea and in a variable portion of its deeper layers. Virtually all injuries to the cornea are painful, even mild, superficial scratches or abrasions that only involve the surface layer. The deeper the ulcer -- the more layers that are missing -- the more painful the ulcer will be. Deeper ulcers also carry a greater risk for serious complications. During the healing process, blood vessel migration across the ulcer from the outer rim of the cornea and scar formation within the defect may impair the cornea's natural transparency. As a result, the affected animal may experience loss of visual acuity or even sightedness in the affected eye.

Treatment depends on the depth of the ulcer and on any associated complications that may be present. Minor scratches, abrasions and very superficial ulcers may be treated with antibiotics to eliminate or prevent infection. Atropine, a pupillary dilating medication may be given to relieve ulcer-associated eye spasm and reduce the tendency for adhesions between the cornea and the iris to form. Deeper corneal ulcers often require surgery to treat the ulcer and prevent possible blindness.

Clinical Signs:

Although the cornea lacks the presence of blood vessels, it is well equipped with nerves to detect pain. Even the slightest injury will provoke considerable discomfort. Other signs of corneal ulcer include blepharospasm, epiphora, purulent ocular discharge, and photophobia.

Symptoms:

Common symptoms of corneal ulcer include pain, squinting or blinking the affected eye, pawing or rubbing at the eye, excessive tearing or discharge, pus, redness, and behavioral changes such as hiding or avoiding light.

Description:

The cornea, or front of the eye, has three very important functions. It acts as a supportive barrier to keep the internal structures in place within the eye. The cornea allows light to pass into the eye and thus through the lens to the retina at the back of the eye. It also bends the incoming light rays to aid the lens in focusing the incoming light.

The cornea is composed of five microscopically identifiable layers. From outermost to innermost, the layers are called the epithelium, Bowman's membrane, the stroma, Descemet's membrane and the endothelium. Bowman's membrane and Descemet's membrane are basement membranes that support the epithelium and the endothelium, respectively. When the cornea is injured, the extent to which these layers are involved will determine the severity of the injury, the treatment required and the prognosis for saving the eyesight in the injured eye.

Corneal ulcers may be graded according to the depth of the ulcer and the corneal tissue layers lost. Corneal ulcers are superficial if only the outer, epithelial layer and Bowman's membrane is missing. If the ulcer also has up to one half of the underlying stroma absent as well, the ulcer is considered shallow to moderate in depth. Corneal ulcers with more than one half of the stroma missing are deep ulcers.

The specific cellular events underlying the healing of corneal wounds will depend on which layers of the cornea are denuded. Superficial scratches of the outer layer of the cornea, or epithelium, that do not penetrate deeply into this layer usually heal without veterinary medical treatment. Healing takes two to three days. The denuded epithelium in corneal ulcers heals by epithelization. In this process, intact epithelial cells move to the defect and undergo mitosis, or simple cell division, and the new cells close the crater in the epithelial layer. This normally takes seven to 10 days. If Bowman's membrane is also ulcerated, healing will take longer; this basement membrane is made up of connective tissue that takes longer to heal. A superficial ulcer generally will heal uneventfully in several weeks if it does not become infected. However, all corneal ulcers are susceptible to bacterial infection, which will delay healing. Additionally, delayed healing may be associated with increased scar formation, so veterinary treatment is necessary to facilitate as close to ideal healing as possible.

Deeper ulcers involving the stroma will take a number of weeks to heal. During stromal healing, blood vessels from the outer rim of the cornea may grow on the floor of the ulcer, a process called neovascularization. This process promotes deep healing by providing extra nutrients to the damaged area. During this process scar tissue will form. In some untreated ulcers the new blood vessels will regress and eventually disappear and scar tissue will have remodeled upon completion of healing so that vision is not impaired.

However, in many cases of untreated deep corneal ulcers, scar tissue sufficient to severely impair vision remains. For this reason, treatment aimed at minimizing scar formation and idealizing healing is always indicated. Residual new blood vessels and scar tissue potentially can result in vision impairment because these tissues are not transparent and the normal clarity of the cornea can be lost.

An ulcer extending to Descemet's membrane is especially dangerous. Without the stromal layer backing it up, Descemet's membrane, can herniate outward. Herniation of this corneal layer is called a descemetocoele. This weakened condition of these corneal layers can result in rupture of Descemet's membrane and structural failure of the endothelium. When this occurs, the aqueous humor -- the fluid in the anterior chamber of the eye immediately behind the cornea -- flows out and the outer part of the eyeball collapses. This is a surgical emergency that requires immediate attention to save the eye.

Some corneal ulcers may be refractory to treatment or may heal, only to re-ulcerate repeatedly. These ulcers have a defect in the epithelial cells of the outer cornea. This defect may have a genetic basis.

Diagnosis:

A tentative diagnosis of corneal ulcer is made based on physical examination findings correlated with the affected animal's history. The diagnosis is confirmed with a fluorescein test. Fluorescein eye drops are placed in the patient's affected eye and then washed away gently with sterile saline. In the normal eye, the stain will wash away completely. If there is an ulcer, the stain will bind to the damaged tissue and appear as an apple-green area on the cornea. Deeper ulcers involving Descemet's membrane often have a dark center and do not bind fluorescein. When stained, this area of the cornea will appear as a dark spot with an apple-green border around it. Illumination with a Wood's lamp, or black light, can enhance detection of fluorescein stain retention.

Once the diagnosis of a corneal ulcer has been confirmed, the veterinarian will search for its underlying cause. The eye and eyelids will be thoroughly examined. Tear production may be measured to determine if tear insufficiency has contributed to the ulceration. Bacterial cultures may be taken to determine if infecting organisms are present in the ulcer. In cats, viral cultures also may be collected to see if herpesvirus, typically FHV-1, is present.

Prognosis:

Dogs and cats with superficial or shallow corneal ulcers that are treated promptly and effectively have an excellent prognosis for a full recovery. In general, cats tend to heal faster and have less scar formation than dogs. Because scars from healed ulcers can obstruct vision, treatment with medications that reduce scar and neovascularization, or new blood vessel formation, when appropriate, can minimize visual disability.

Indolent or refractory corneal ulcers that do not heal properly are associated with a more guarded prognosis. Recurrences are common and complications are highly likely.

Significant corneal disease and ulceration associated with herpesvirus infections in cats are unpredictable in their response to treatment.

Owner compliance with veterinary instructions and patience throughout the healing process is very important and will have a significant impact on the clinical outcome.

Transmission or Cause:

Trauma is the most common cause of corneal ulcers. Typically, cats and dogs obtain scratches to the eyes from other animals or from tree branches. Also, a rough particle of dirt, gravel or other material stuck under an eyelid can damage the cornea. Other types of trauma include chemical burns from shampoo, medicated dips, and other substances. Surrounding hair that continually rubs the cornea, as occurs with entropion, or inverted eyelid, or an eyelash that continually rubs the cornea, may cause ulceration.

Keratoconjunctivitis, or "dry eye," can cause corneal ulceration. In this condition, tear production is inadequate. As a result, the eye can dry out and the surface layers of the cornea can break down.

Viral infectious diseases like feline herpesvirus or various bacterial infections can cause corneal ulcers in cats. Identification of the underlying cause of the ulcer, whenever possible, will facilitate treatment and the prevention of recurrent ulceration.

A structural problem at the cellular level may underlie superficial corneal ulcers that recur or fail to heal. In these cases the corneal epithelium is abnormal and the cornea is predisposed to spontaneous ulceration. Both eyes of an affected animal may ulcerate when defective corneal epithelium is present. These structural problems are more likely to occur in middle-aged to older breed dogs. This is especially true in the Boxer breed, which appears to have a genetic predisposition to spontaneous corneal ulceration.

Treatment:

The type of treatment the veterinarian prescribes for the affected dog or cat will depend on the severity of the corneal ulcer, its duration, and the suspected underlying cause. Generally, veterinary care is focused on treating or preventing infection, controlling pain and inflammation, preventing further corneal damage, and minimizing the disruption of the clear cornea by limiting scar formation.

For superficial ulcers, the use of an antibiotic ointment is very effective in preventing bacterial infection while the eye heals. Viral-associated corneal lesions in cats may benefit from topical antiviral preparations, which are likely to be used for several weeks. Fungal infections are uncommon, but when present must be treated with specific antifungal medications for a successful outcome.

Corneal ulcers often cause painful spasms within the eye. Topical atropine eye drops may be used to reduce these spasms. Atropine also dilates the pupil; in so doing, it reduces the potential for adhesion of the iris to the cornea. Dogs and cats given this treatment should be kept in a low-light area, since the atropine will make the eyes very sensitive to direct sunlight.

Deeper ulcers must be treated aggressively to minimize complications. When the ulcer involves Descemet's membrane, surgery will be needed to place a protective graft over the ulcer. Several surgical techniques are available. The most common type is a conjunctival pedicle graft, in which a flap is created from the conjunctivae, which are the thin membranes attached to the eye, and is stitched to the edges of the ulcer. This graft protects and supports the ulcer as it heals, and provides a blood supply to facilitate healing. The graft is removed when sufficient healing has occurred.

If the Descemet's membrane ruptures through all the layers of the cornea, the fluid within the front part of the eye will leak out, resulting in collapse of the eyeball. This is a surgical emergency and quick action is needed if the eye is to be saved and vision spared.

Corneal ulcers that are not healing properly may require additional treatment measures. Tissue adhesives are used to treat selected superficial punctures, deeper ulcers that do not appear to be healing properly and non-healing superficial corneal ulcers. Surgical debridement, or excision, of necrotic and uneven tissue margins on the surface of a chronic non-healing ulcer is commonly performed to facilitate healing. Chemical debriding agents may also be used. Multiple procedures are usually required over several weeks to months, depending on the ulcer's progress. In many cases systemic antibiotics in addition to topical ones are prescribed. Drugs that promote epithelial growth and anti-proteases that inhibit degradative enzymes may also be given.

Self-trauma can dramatically worsen any eye lesion, and most animals will be tempted to rub or scratch the painful eye. Elizabethan collars are often recommended to limit the possibility of such self-trauma, especially when the dog or cat patient is unsupervised.

A dog or cat undergoing treatment for a corneal ulcer must return to the veterinarian frequently for re-evaluation until the ulcer has healed. Complete healing is evident when fluorescein drops placed on the cornea no longer stain it. Complicated cases may require referral to a veterinary ophthalmologist.

Prevention:

Treating the underlying cause of viral- or bacterial-induced ulcers of the cornea is a critical measure in preventing recurrence. Environmental conditions conducive to eye trauma should be modified if possible. Dogs and cats should be prevented as much as practically possible from having access to such environments.