WHAT TO DO WITH DEEP CORNEAL ULCERS

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Overview:

General goals of treating corneal disease include quickly arriving at an accurate diagnosis as to the depth and severity of the lesion, determining the underlying cause of the lesions, ensuring mechanical integrity of the cornea, collecting the appropriate samples prior to therapy, preventing sepsis, and controlling intraocular pain and inflammation.

Corneal ulcerations are more serious than erosions, as loss of stroma occurs, which can lead to perforation. Typically, these ulcers are infected. Corneal infiltrate appears as a white or cream colored lesion in the cornea, usually with indistinct borders, with surrounding corneal edema, and neovascularization. An infected cornea generally leads to a reflex uveitis. If a benign appearing corneal ulcer is associated with hypopyon or severe uveitis, it is infected, and severe secondary uveitis cases often occur with Pseudomonas infections. Corneal malacia is another sign of an infected, serious ulcer. Malacic cornea appears as a softer, often grayish, area with stromal loss. In early stages, the stroma loss may not be as apparent due to malacic areas and/or corneal edema. Malacic cornea is often mistaken for discharge adhered to the cornea, but discharge should be easily washed away by gentle irrigation while malacic cornea will remain adherent. Deep corneal ulcers are associated with deep corneal vascularization, characterized by blood vessels that are very straight, appearing to start at the corneal limbus. Pain is another indicator of possible infection. Assessing the cornea with a slit beam is tremendously helpful to determine depth. A divet or crater in the cornea represents stromal loss. Looking at the width of the slit beam in normal cornea and comparing it to the width of the beam in the affected cornea provides a way to estimate the percentage of stromal loss that has occurred. If there is blood and fibrin within an ulcer, it has ruptured. Pigment that appears soft in the center (or bleeds when touched) signifies iris prolapse (rupture of the cornea ’plugged’ by iris). A clear area in the center of an ulcer is usually due to extreme thinning of the cornea, typically a descemetocele.
Further diagnostics:

If possible, perform a Schirmer tear test (STT) before fluorescein staining, but do not perform STT if the ulcer is very deep as rupture can occur. Cytology can be helpful in initial management. Cytology is obtained with topical anesthetic and the use of the dull (back) end of a scalpel blade to collect samples from the ulcer bed (if perforation is not pending) and margins. Culture and sensitivity for aerobic bacteria should be performed in rapidly progressive or deep corneal ulcers. Use 1 drop of topical anesthesia and a moistened mini-tip culturette, if available. If a descemetocele, very deep ulcer or perforation is present, a foreign body search, ophthalmic exam, and diagnostics should not be pursued until the dog has been referred or is sedated or under general anesthesia prior to treatment. A Seidel test is a way to check for corneal wound leaks. This test is performed by gently touching a dry fluorescein strip to the area in question, then looking for green rivulets of aqueous leakage.

Treatment:

Deep or rapidly progressive ulcers usually require hospitalization for surgery and/or frequent medical treatments and follow-up. In general, if greater than 50% of the corneal stroma is lost, surgical therapy is recommended, while medical therapy can be useful for shallower ulcers. The advantage of medical therapy is that it is usually cheaper and results in less scarring, however, the deeper the ulcer, the more likely it is to rupture during medical therapy. Medical therapy typically requires a much longer duration of treatment than surgical therapy. Surgical therapy results in a more rapid resolution and a higher success rate at maintaining the globe, but is usually more expensive and causes more scarring.

Medical therapy:

For infected, severe ulcers, a combination of two antibiotics is usually recommended when medical therapy is pursued. Even if you are unsure if a deep ulcer is infected, you should assume that it is and treat accordingly. Gentamicin, tobramycin, or ciprofloxacin are used for rods. Triple antibiotic, chloramphenicol, or Cefazolin are used for cocci. Combinations that are frequently used include Cefazolin (33-50 mg/ml) in artificial tears or saline (using IV formulation of cefazolin) and gentamicin, tobramycin or ciprofloxacin. Frequency of drops varies on severity and can range from QID to hourly for severely infected ulcers. Often, a dog with a deep, severely infected, rapidly progressive ulcer is hospitalized on q1hr therapy for 24-36 hours. At that point, the cornea has very high concentrations of antibiotic, and the frequency is decreased. For cats, generally the same combination of antibiotics is used, but consider adding trifluridine or cidofovir. Trifluridine is used 6-10 times per day and may be irritating. Idoxuridine is a less expensive alternative, but must be compounded. Oral famicylovir is the most effective and safe oral antiviral, but is expensive when dosed appropriately.

Atropine can be used for secondary uveitis (caution with KCS). Aspirin or other oral NSAIDs may be used to reduce ocular pain and inflammation, although the efficacy of other NSAIDs for ocular inflammation is unknown at this time. Topical NSAIDs can exacerbate corneal melting and so are avoided with deep infected ulcers. Excessive physical activity and tension on the animal’s neck should also be avoided. The ipsilateral front leg should be put through the leash when walking, and an Elizabethan collar is always recommended.

Serum or plasma can be used topically to decrease melting in malacic ulcers. The animal’s own blood can be used, unless it is a very small animal or struggles excessively during blood draws, risking corneal rupture.
Use of another animal’s serum or plasma is acceptable. Typically, serum or plasma is applied 6-8 times daily. Serum/plasma should be kept refrigerated and sterile. I usually do not send it home with owner since it is easily contaminated. Treatment with serum/plasma is usually not necessary for more than 2-3 days.

Signs of improvement in deep, infected ulcers are lack of progression, corneal neovascularization, improvement of any secondary uveitis, decreased corneal infiltrate, decreased pain, and decreased corneal edema. Ultimately, ulcers that heal with medical management must completely vascularize for successful repair of the stromal defect. Some ulcers may require treatment for weeks at decreasing frequencies. If the ulcer is not healing, consider repeating cytology and culture/sensitivity.

**Surgical therapy:**

Again, if the ulcer is deeper than 50% of the stromal depth or rapidly progressive, consider referral to a veterinary ophthalmologist for repair. Surgical options include conjunctival graft or flap, corneoscleral transposition, penetrating keratoplasty (corneal transplant), cyanoacrylate glue repair, and direct suturing. Most of these must be performed using 8-0 suture or smaller under an operating microscope. The decision of which procedure to perform is based on the area and depth of the ulcer, integrity of the surrounding ulcer, the prognosis for vision (i.e., unlikely to perform a corneal transplant on a dog that has a pre-existing complete cataract), and the owner’s preference. Any ulcerated area of the cornea covered by a conjunctival flap will ultimately be too opaque to allow for useful vision, and so sometimes we elect cyanoacrylate repair of very large ulcers to attempt a better visual result. Cyanoacrylate functions by providing physical support to the cornea and encouraging blood vessel ingrowth. The cyanoacrylate is ultimately sloughed by epithelium growing underneath it. This procedure generally results in less scarring than a graft but has a longer time to healing and a longer time period before the cornea is stable (in other words, a longer time for the cornea to rupture). Perforated corneas should either be referred to a veterinary ophthalmologist or enucleated. Large corneal ruptures with extensive uveal prolapse and/or lens damage have a poor prognosis and are often enucleated.

Alternatively, the 360° conjunctival flap is performed by incising the conjunctiva 2-3 mm posterior to the limbus, and then bluntly dissecting towards the fornix. The conjunctiva is dissected enough that it can easily be pulled across the cornea to cover it, meeting in the middle. At this point, the conjunctiva can be sutured to itself, covering the cornea, using 6-0 vicryl in either a purse string or simple continuous suture pattern. The cut underside of the conjunctiva will adhere only to ulcerated corneal stroma, forming a crude conjunctival flap. The conjunctival will become attached to any de-epithelialized area of cornea. Due to the pressure on the conjunctiva, it will undergo dehiscence in 10-14 days; however, usually there is enough blood vessel growth into the affected cornea at that time to preserve the globe if it has not already ruptured. The advantage of this procedure is that it is technically easy and quick, and can be performed in general practice. The disadvantages are that the dog is temporarily blinded, and there is a lower success rate than when conjunctival pedicle flaps are used, since it will take several days before the cornea is stabilized, during which the eye may rupture. This surgery is a reasonable option if the owners are unwilling or unable to visit a veterinary ophthalmologist for treatment a deep ulcer.