Ulcereative corneal disorders in the dog and cat

Abstract:

Corneal ulceration is a relatively common problem in dogs and cats. The definition of the corneal ulcer is a break in the corneal epithelium, causing exposure of the underlying corneal stroma. It may be large or small, superficial or deep, complicated or uncomplicated. Corneal ulcers which are not treated, or which get secondary complicating factors, can be very serious and result in rupture of the globe and loss of the vision and the eye.

Clinical signs of corneal ulceration include those of ocular pain – lacrimation, blepharospasm and photophobia. There is usually conjunctival hyperaemia and corneal oedema, with varying degrees of corneal neovascularisation. The pupil is usually small (miosis) due to reflex uveitis caused by stimulation of the trigeminal nerve (sensory nerve to the cornea). Diagnosis is made from the clinical signs and from the retention of fluorescein stain.

Ulcers may be classified according to their depth (superficial, stromal, descemetocoele) or the underlying cause (e.g. bacterial, traumatic, immune-mediated etc). Ulcers may be simple, superficial and indolent (the classic Boxer ulcer) or complex. Factors that make corneal ulcers complex include melting, depth, foreign bodies, chemicals or penetrating injuries.

Corneal ulcers are very significant as they cause considerable pain (the superficial cornea has the most nerve endings of any tissue in the body). An ulcer which heals with scarring can cause impaired vision. There can be permanent intraocular sequelae such as anterior synechiae distorting the pupil margin. An ulcer can deepen causing perforation of the globe, which can lead to endophthalmitis, glaucoma, or phthisis bulbi.

As part of the evaluation of a corneal ulcer, it is important to look for an underlying cause. These include:

- Lagophthalmos (an inability to blink – facial nerve paralysis / exophthalmos)
- Eyelid masses (causing friction)
- Trichiasis (hairs contacting the cornea or conjunctiva) from entropion, distichia or ectopic cilia
- Foreign bodies
- Keratoconjunctivitis sicca
- Trauma
- Exophthalmos (corneal exposure)
Other complicating factors which may be present are infection or globe rupture. The degree of pain, nature of the ocular discharge and extent of neovascularisation are evaluated. The depth of the ulcer is assessed – superficial, stromal, descemetocoele or full-thickness. It is important to look for signs of melting (stromal malacia) which is due to destructive enzymes, collagenases and matrix metalloproteinases (MMPs), acting inappropriately within the corneal stroma.

**Simple corneal ulcers** heal quickly (at a rate of up to 2mm/day) and often are not even presented to the veterinary clinic. These may be treated with a topical antibiotic to prevent infection (such as Fucithalmic, Dechra), along with a systemic NSAID if they are uncomfortable. A buster collar may be supplied if they are rubbing at the eye. Most heal non-eventfully, unless a complicating factor occurs.

**Chronic superficial corneal ulcers** may fail to heal. The condition has many synonyms including spontaneous chronic corneal epithelial defects (SCCED), epithelial basement membrane dystrophy (EBMD), boxer ulcers, indolent / refractory / persistent ulcers, recurrent non-healing epithelial erosions. The definition of SCCED is a chronic epithelial erosion that fails to heal through the normal wound-healing process. They are characterised by the presence of a loose non-adherent lip of redundant epithelium at the edges with the defect lacking epithelial adhesion to the underlying stroma.

Normal corneal wound healing involves the adjacent epithelium sliding over to cover the defect in response to the release of fibronectin, and the new epithelium must adhere to the under-lying stroma. With SCCED, the epithelium tries to slide over but fails to adhere to the underlying stroma, which is why there is loose epithelium at the edges. The significance of these ulcers is that they are variably painful, and that they may persist for several months.

The clinical appearance of SCCED includes variable discomfort. Their shape varies and they may be in any location on the corneal surface. There is always an epithelial lip, which is a rim of loose epithelium at the edges of the ulcer. There is usually some corneal oedema and there is a great variation in vascularisation response. The syndrome typically occurs in older animals (7-9yo).

The treatment for SCCED focuses on removing the redundant corneal epithelium (by debridement) and on wounding the underlying stroma to encourage effective healing. This is achieved by grid or punctate keratotomy, or a superficial keratectomy if all else fails. Medical treatment is also used but debridement is key to rapid healing. The equipment required for debridement and grid keratotomy is topical anaesthetic, dry cotton buds (sterilised), and 25 gauge needles. All cases of SCCED (NOT deep or melting ulcers) in dogs (NOT cats) benefit from debridement of the redundant loose epithelium. After applying topical anaesthetic (with light
sedation if necessary – deep sedation will cause the eye to roll ventrally), a dry cotton bud is applied to the ulcer and firmly pushed radially outwards in all directions, thus pushing off any epithelium that is not adherent. This may result in removal of the entire corneal epithelium, or the abnormal epithelium may travel a short distance from the ulcer. It would not come off if it was healthy, therefore remove as much as will come. A grid or punctate keratotomy is then performed – starting in the healthy corneal epithelium. The needle penetration needs to be deep enough to wound the underlying stroma and to provide a foothold for the new migrating epithelium, but not too deep.

A soft bandage contact lens may be placed after debridement. They are not suitable for deep or melting ulcers. They come in a variety of diameters and curvatures, and they will not stay in place unless the correct lens is chosen. In dogs with macropalpebral fissure, a temporary lateral tarsorrhaphy to hold them in place for longer. They stop any irritation from eyelids or hairs, spread the tear film evenly over the cornea, increase the temperature of the cornea which creates a healing environment and they provide comfort. Unfortunately they may fall out, and they are moderately expensive.

The debrided eye is then treated with a topical antibiotic to prevent infection (e.g. Fucithalmic, Dechra). Serum and doxycycline may aid treatment and are certainly not contra-indicated, but are usually used for deep or melting ulcers. Artificial tears lubricate and soothe the cornea. A buster collar may be provided if the animal is rubbing at the eye.

Cases with SCCED should be re-examined, typically 10-14 days later. At this stage it is expected the ulcer should be healed (85%), and therefore be fluorescein negative. If not, debridement may need to be repeated. Some cases take weeks and months to heal. A third eyelid flap is not contra-indicated, and may aid healing. However they do not seem to be necessary.

Cats with SCCED should be carefully examined for an underlying cause. If none can be found, and they do not respond to lubricating antibiotic ointment, the cornea may be debrided. A grid keratotomy procedure is avoided in cats as it has been shown to increase the likelihood of corneal sequestrum formation.

Two serious ulcers which occur relatively commonly are melting corneas and descemetocoeles. A melting ulcer occurs when excessive enzymatic destruction (by collagenases and matrix metalloproteinases) initiated by bacteria, host inflammatory cells or corneal cells results in a gelatinous appearance to the cornea due to stromal malacia. A descemetocoele is when the corneal defect is to the depth of Descemet’s membrane (DM), which may appear as a crater like defect with the elastic DM bulging through. Remember that DM does not uptake fluorescein
stain, so a deep ulcer with a non-staining base may be a bad sign.

Work-up may include culture and sensitivity of a corneal swab ideally. This should be done before any other diagnostic procedures or eye drops are applied so that the sample is not contaminated. The problem with this test is that it may take 2-4 days to get a result, by which time the eye could be lost. However they should be remembered as they could give a guide for treatment when initial treatment is failing to work. Some melting ulcers are sterile and yield no bacterial growth. Cytology is very useful and can by stained to check immediately if there are bacteria present, and if they are rods (e.g. Pseudomonas) or cocci (e.g. Staph or Strep), in order to initiate appropriate therapy.

Deep ulcers are assessed as to whether they should be treated medically or surgically. In general all descemetocoeles and deep ulcers that perforate require corneal surgery to provide structural support as well as healing. Usually ulcers more than half the depth of the stroma require surgery. Other ulcers are assessed on a case by case basis and it is difficult to make generalisations. Brachycephalic corneal ulcers require vigilant treatment and monitoring as these can worsen extremely quickly. Medical treatment involves:

- An appropriate antibiotic drop topically frequently. The frequency varies depending on the severity of disease – very worrying ulcers should have hourly treatment. Drops are preferred to ointment, as if the eye ruptures, ointment could gain access and cause severe inflammation, whereas a drop will do less harm. The choice depends on the bacteria involved – fluoroquinolones are a good choice such as ofloxacin (Exocin) or ciprofloxacin (Ciloxan). Chloramphenicol drops are appropriate for Staph or Strep infections, and they must be stored in the fridge. Gentomycin was traditionally the antibiotic of choice for Pseudomonas ulcers, such as Tiacil or Gentacin, but there is some bacterial resistance due to over-use.

- Antibiotics are also given systemically. Doxycycline (Ronaxan, Merial) at 10mg/kg once daily is a good choice as it also promotes corneal healing by inhibiting the destructive enzymes.

- Topical mydriatics such as tropicamide (Minims vials – more short acting so apply 3-4 times daily) or atropine (Minims vials – longer acting so apply once daily then every other day, don’t use on dry eyes or if there is a suspicion of raised IOP). This paralyses the intraocular muscles, eliminating painful muscle spasms. It reduces the likelihood of permanent synechiae. It helps to control the inevitable secondary uveitis.

- Topical autologous serum is very useful for deep or melting ulcers. It inhibits the action of the destructive enzymes. EDTA and acetylcysteine also inhibit the enzymes but to a lesser degree. 10ml of blood is taken from the patient in plain or gel tubes. The blood is
left to sit for 10-15 minutes to allow it to clot, and then it is spun in a centrifuge at 1000rpm for 5 minutes. The serum is then decanted into an eye dropper bottle, which will need to be stored in the fridge. If stored properly, it may be used for approximately 5 days and then it should be replaced. If the affected animal is not suitable to give blood (temperament wise or because the eye is too fragile to take a jugular blood sample), another animal or the same species may be used, and if not available an animal from a different species may be used.

- Artificial tears are good at promoting healing as they lubricate the cornea and provide comfort.
- Pain relief should be considered but under no circumstances should topical or systemic steroids be given. Steroids potentiate the destructive enzymes, and can cause a simple ulcer to melt very quickly. Systemic NSAIDs may be given if the animal is in pain, although they do reduce some useful inflammation and may delay healing slightly.
- A buster collar should be applied to prevent self-trauma and protect the eye.
- The dog should be walked with a lead and harness rather than a lead and collar, in order to avoid any pressure on the neck which would raise the intraocular pressure and risk perforation of an ulcerated cornea.

Surgical intervention is required in some cases to save the eye. The goals of surgery are to retain the eye which is pain and infection free, and to preserve vision if possible. Cosmetics are less important to us but may be very important to individual owners. Treatment would involve removing the underlying cause if it can be identified – e.g. ectopic cilia, foreign body etc. Temporary tacking sutures are indicated if blinking is poor (lagophthalmos), offending hairs are plucked to allow the ulcer to heal although of course they will grow back and need permanent treatment then, entropion surgery is carried out if this is the problem. Do NOT do a grid keratotomy in these cases, and a third eyelid flap is NOT recommended as it hinders re-examination, traps in the infection, prevents good contact of medications, and puts pressure on a fragile globe. In general, a third eyelid flap should be done when they are necessary and if they are enough for treatment. They are over-used in ocular treatment.

Various grafts may be performed, depending on the case. A free island graft is when an isolated piece of conjunctiva is sutured into a corneal defect, and is suitable for vascularised ulcers near the limbus. A conjunctival pedicle graft is commonly used. This procedure requires magnification as fine suture material (8/0 or 9/0) is used. A section of bulbar conjunctiva is dissected, remaining attached at its base, and rotated onto the globe where its distal end may be sutured into the defect. This provides both structural support and a blood supply with healing factors. The pedicle may be cut under topical anaesthesia 6-8 weeks later in order to restore the
visual axis. Other surgical procedures are useful in certain types of ulcers. For example, a corneo-conjunctival transposition is a procedure in which adjacent healthy clear cornea is transposed onto the corneal defect, thus the affected area should be relatively clear after surgery. This is useful when the corneal defect is in the visual axis, and is carried out when the adjacent cornea is healthy enough and the defect is not too large. Corneal transplants are also carried out under certain circumstances.

Post-operatively, the animals are fitted with a buster collar for 1-2 weeks. Topical antibiotics are applied every 4-6 hours for the first week and then reduced, and topical mydriatics are required. Systemic antibiotics are also given. The cornea is usually very amenable to healing, and in particular the cat cornea can heal incredibly well.