

# Equine corneal ulcers

*Natasha Mitchell offers an insight into equine corneal ulcers and gives practitioners advice on performing an examination*



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Corneal ulceration is a common sight-threatening problem in horses which regularly presents to mixed practice and equine veterinary practitioners. The severity of corneal ulcers can vary greatly, and the outcome depends on rapid diagnosis, early instigation of appropriate medical and/or surgical treatment with both patient and owner compliance. Deep ulcers, melting ulcers and descemetocoeles are emergencies as they may very rapidly progress to globe rupture.

## DIAGNOSTIC TECHNIQUES

The aims of a clinical examination are to assess whether the horse can see; to look for signs of trauma such as facial lacerations; to examine the extent and depth of the ulcer; to assess the presence of any factors which would complicate healing; to assess as to whether appropriate treatment is medical or surgical; and, to decide on how medications may be delivered to the eye.

Whatever the eye complaint, it is best to carry out an examination in a systematic manner, in order to reduce the likelihood of missing an important step. The animal's history can provide valuable information, as sometimes horses with corneal ulcers have a known history of trauma,

such as a blunt injury sustained while out hunting. Duration and progression of the problem are also important pieces of information for a vet to obtain. Symmetry of the face and orbital area also need to be assessed.

Vision tests also must be performed these are, however, pretty basic. Wave your hand towards one eye at a time, taking care not to create an air current which could be felt by the horse. A normal reaction for the animal is to blink and possibly partially retract the head, known as a menace response. Shine a bright light into the animal's eye to perform a dazzle reflex. A normal reaction is to blink and attempt to look away. The pupillary light response is checked by shining a light in the eye and observing for the expected pupillary constriction.

The safety of the handler, the attending veterinarian and the patient during this examination are very important, and it is reasonable to consider sedating any horse which requires a detailed ocular examination. Sudden movements by the horse can impact against the instrument being used to examine the eye, which in turn can cause significant damage to the examiner's own eyes. For this reason, and because gentle patient handling is required in the case of deep corneal ulceration, sedation of the animal is a good idea.

While tear deficiency is not a very common problem in horses, it is worth performing a Schirmer tear test whenever there is ocular surface disease. Normal values are approximately 20-30 mm/minute. The value is significantly decreased if prior topical anaesthesia is applied. Eyes with low tear readings may have delayed corneal healing and require tear supplementation. A STT is not performed on eyes with deep or melting corneal ulcers due to the risk of trauma during the procedure. Topical anaesthesia is very useful to provide for easier examination, to facilitate tonometry for intraocular pressure measurement, and to allow scraping of the corneal surface for cytology. It increases the horse's compliance during examination by reducing pain. However, it should not be used as a treatment for painful corneal ulcers as it inhibits healing.

Nerve blocks are very useful when the eye is painful. Indeed, they are essential in the case of deep corneal ulceration to reduce the likelihood of the cornea rupturing during examination. A motor nerve block is performed by anaesthetising the auriculopalpebral branch of the facial nerve (CNVII) which innervates the powerful orbicularis oculi muscle. The nerve can be palpated under the skin at the highest point of the zygomatic arch, and it is blocked by subcutaneous infiltration with 2-3 ml of lignocaine or mepivacaine using a 25-gauge needle. A sensory nerve block is performed by anaesthetising the supraorbital nerve, which is a branch of the trigeminal nerve (CNV), which is sensory to the central upper eyelid. The nerve exits from the supraorbital foramen within the frontal bone, and it is blocked by the subcutaneous injection of local anaesthetic, as used for the auriculopalpebral nerve block. A combination of these blocks will reduce pain and stop spasm of the orbicularis oculi muscle, allowing the upper eyelid to be lifted and a more thorough examination to be conducted.

Next, examination with the naked eye is facilitated by the use of a strong focal light source, for example a transilluminator, looking for gross signs of ocular disease as follows:



**Figure 1:** Mucopurulent discharge with blepharospasm in a pony with corneal rupture.

- Globe for enophthalmos, exophthalmos, hydrophthalmos (enlarged globe suggestive of glaucoma), phthisis bulbi (shrunken globe), strabismus and nystagmus;
- Ocular discharge and its nature: tears, mucoid, or mucopurulent (**Figure 1**);
- Eyelids for blepharospasm, the ability to blink, mobility, anatomical position, and injuries;
- Conjunctiva and third eyelid for inflammation, mass lesions and foreign bodies. It is preferable not to manually protrude the third eyelid by digital pressure on the globe as this could cause globe rupture;
- Cornea for oedema, neovascularisation, presence of a foreign body, surface irregularities and iris prolapse (**Figure 2**);
- Anterior chamber depth (shallow, normal or deep), turbidity (aqueous flare is a sign of anterior uveitis) and contents, e.g. blood (hyphaema) or inflammatory cells (hypopyon); and,
- Iris: position, colour, size of the pupil at rest and mobility and shape of the pupil.

Examination with magnification greatly improves visualisation of the corneal ulcer. Ideally a slit-lamp biomicroscope is used, but magnifying loupes, an otoscope or the direct ophthalmoscope on the +15 to +20 setting may also be used for this purpose.

All red or painful eyes should be stained with fluorescein dye routinely. Fluorescein is a water-soluble stain which is hydrophilic and lipophobic. It is orange in colour, but turns green when it comes into contact with the alkaline pre-corneal tear film. There is no uptake in the normal cornea as the intact lipid-rich corneal epithelium provides a barrier. However, when corneal ulceration is present, fluorescein may gain access to the stroma where it uptakes. It is most readily observed when viewed with a blue light, which causes the dye to fluoresce and highlights even small breaks in the epithelium, and epithelial under-running may be appreciated. **Figure 3** is a stromal corneal ulcer, and **Figure 4** depicts the appearance after application of fluorescein. Thus, a deep crater-like lesion with no fluorescein staining



**Figure 2:** The eye of the pony featured in Figure 1 – the untreated central corneal ulcer has ruptured resulting in prolapse of the iris.



**Figure 3: Severe stromal necrosis in a pony.**



**Figure 4: Fluorescein staining of the deep ulcer featured in Figure 3.**

at the base indicates a descemetocoele which is an emergency as the globe is in danger of perforation. Anterior uveitis is frequently present when there is corneal ulceration due to reflex stimulation of the corneal sensory nerves. This may be seen clinically as a constricted pupil (miosis), aqueous flare (turbid proteinaceous fluid in the anterior chamber), hypopyon (accumulations of white inflammatory cells in the ventral aspect of the anterior chamber) and a low intraocular pressure, as measured by tonometry.

Deeper ulcers benefit from performing a culture and sensitivity test on a bacterial swab from the diseased area. This can provide very useful information allowing specific and appropriate antibiotic treatment to be given. However, the results take two-to-five days. Some laboratories will perform sensitivity testing with antibiotics which are not available as ophthalmic preparations, while not including the few that are.

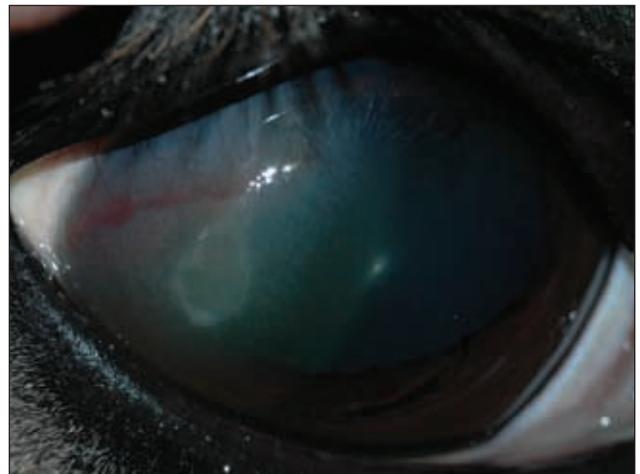
A more rapid test which is easily performed, but frequently forgotten, is cytology. A scraping is taken from the edge of the lesion using the blunt end of a scalpel blade or using a cytobrush. The harvested cells are smeared onto a clean microscope slide and air-dried. They may then be stained with Dif Quik stain and examined immediately. The

type of cells involved are seen, for example neutrophils, lymphocytes, eosinophils, plasma cells and epithelial cells, but also the appearance of any bacteria in the form of rods or cocci will assist in making an informed antibiotic choice. Fungal hyphae may be seen.

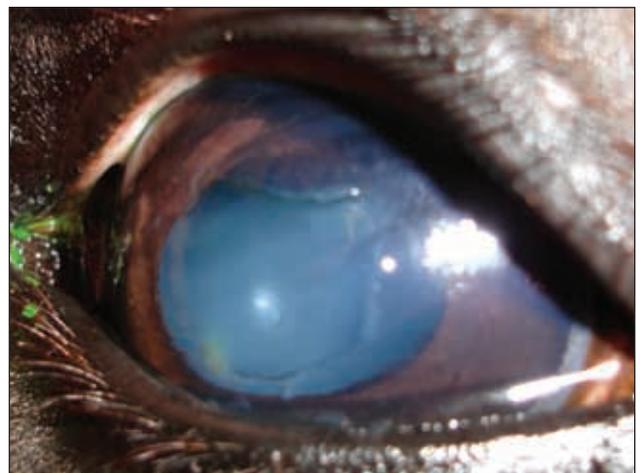
### CLINICAL SIGNS

Expected clinical signs include pain, blepharospasm, epiphora (**Figure 1**), slightly swollen eyelids, and conjunctival hyperaemia. Depending on the cause and duration of the problem, there will be a change in corneal appearance such as oedema, neovascularisation, inflammatory cellular infiltration (cream or yellow opacities), pigmentation, and mineral or lipid deposition. There may be a crater-like defect with or without a gelatinous appearance (melting). There is fluorescein dye retention.

Superficial uncomplicated ulcers are generally small in size, are shallow, and have no epithelial under-running at the edges of the lesion. Spontaneous chronic corneal epithelial defects (SCCED) are superficial ulcers, with surrounding non-adherent epithelium (**Figure 5** and **Figure 6**).

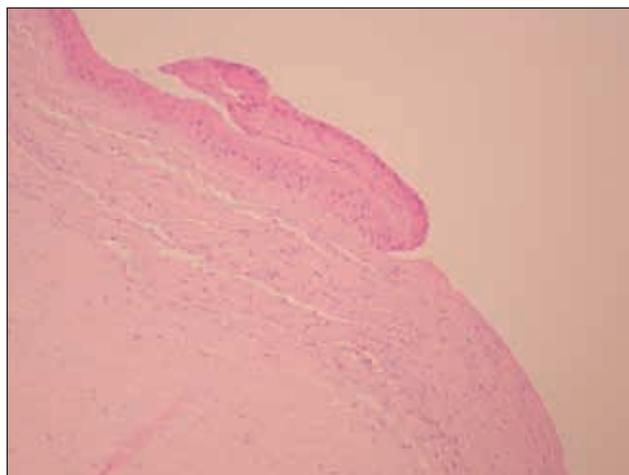


**Figure 5: Superficial corneal ulcer with non-adherent epithelium at the edges. There is corneal oedema and neovascularisation.**



**Figure 6: A large superficial corneal ulcer with no corneal neovascularisation response.**

The typical histology of this type of corneal ulcer is shown in **Figure 7**. Stromal ulcers may have a crater-like appearance with fluorescein retention throughout. Descemetocoeles are deep craters with fluorescein retention in the walls; but no stain uptake at the base. The elastic Descemet's membrane may bulge forwards. Melting ulcers have varying depth to the ulcer but have a gelatinous appearance (**Figure 8**).



**Figure 7:** Ulcerative neutrophilic keratitis with poor epithelial adhesion at ulcer margins, and anterior stromal necrosis in a 26-year-old Falabella. Haematoxylin and Eosin. 100x magnification. Photo: Karen Dunn at FOCUS-EyePathLab, North Kent Referrals, UK.



**Figure 8:** A melting ulcer in the dorsal cornea with fibrovascular reaction from the limbus.

## CURRENT RECOMMENDATIONS FOR TREATMENT

The aims of treatment are to relieve pain, to stop progression of the corneal ulcer, to encourage corneal healing in a manner which minimises long-term scarring and to eliminate secondary uveitis. These aims may be achieved medically, surgically or by a combination of the two, and each case and the surrounding circumstances are considered individually.

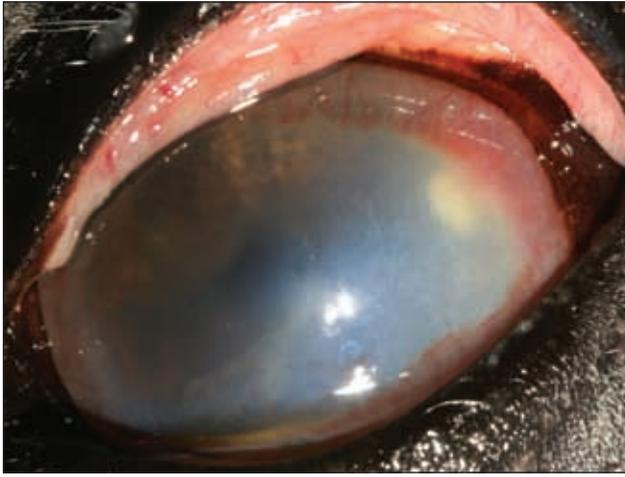
In order for medical treatment to work, the horse will need to be compliant and the owner will need to be committed. If the horse is not compliant, the use of a sub-palpebral



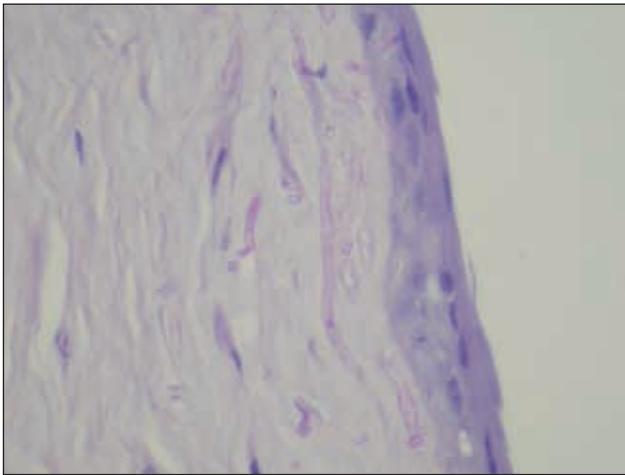
**Figure 9:** Sub-palpebral lavage system in place, exiting from the lower eyelid, to treat a corneal ulcer: there is fluorescein uptake in the cornea.

lavage system (**Figure 9**) is invaluable. A factsheet about applying these systems is available on [www.eyevet.ie/vet-information/tips](http://www.eyevet.ie/vet-information/tips). Note that there are very limited ophthalmic medications licensed for use in food-producing horses in Ireland. In situations where there is a threat to sight or comfort of the animal, the Cascade system or Essential Substances List may be employed. Be aware that this can have implications for the horse's status regarding the food-chain. Corneal ulcers must never be treated with steroids, either topically or systemically. Steroids can rapidly deteriorate an ulcer into a melting ulcer or descemetocoele.

If the cause of the corneal ulcer or complication factors are identified, treatment is targeted to bring about the most effective healing. Examples of complicating factors include bacterial infection, stromal abscess (**Figure 10**), fungal infection (**Figure 11**), eyelid abnormalities such as entropion, aberrant hairs, presence of foreign bodies, trauma from the foot-plate of an in-dwelling sub-palpebral lavage system, local swellings and deficiency in tear production. Fortunately for us, fungal infection is very uncommon in Ireland, although it is a frequent problem in warmer



**Figure 10:** A yellow focus (stromal abscess) in the lateral corneal stroma with significant uveitis (miosis, aqueous flare, fibrin in the anterior chamber) over which the epithelium has re-grown, but the stromal abscess remains and requires urgent treatment.



**Figure 11:** PAS stain of the superficial cornea showing epithelial ulceration and fungal hyphae in the anterior stroma. Photo: Karen Dunn at EyePathLab, North Kent Referrals, UK.



**Figure 12:** The appearance of a cornea 10 days after grid keratotomy for a superficial corneal ulcer. The corneal ulcer has now completely healed, and the grid keratotomy significantly reduced after one month.

climates.

Simple and non-complicated ulcers:

- Broad spectrum topical antibiotic ointment is prescribed;
- Topical Atropine 1% as a single application or once daily for three days;
- Systemic flunixin meglumide 1 mg/kg twice daily for three-to-five days; and,
- Re-examine in three-to-five days, at which time the ulcer is expected to have fully healed, in that there should no longer be any fluorescein up-take. If it has not healed, consider complicating factors discussed earlier, perform cytology and culture and sensitivity tests.

Superficial erosions with epithelial under-running (SCCED):

- Corneal debridement under topical anaesthesia;
- A grid or punctuate keratotomy may be considered (**Figure 12**);
- Broad spectrum topical antibiotic ointment;
- Topical Atropine 1% at time of debridement and then, to effect, to maintain a dilated pupil;
- Systemic flunixin meglumide 1 mg/kg twice daily for three-to-five days; and,
- Unless the owner notices problems, the eye re-examined in seven-to-10 days. These ulcers can persist, and stubborn non-healing ulcers should be referred.

Deep stromal ulcers (**Figure 3**) and melting ulcers (liquifactive stromal necrosis, (**Figure 8**):

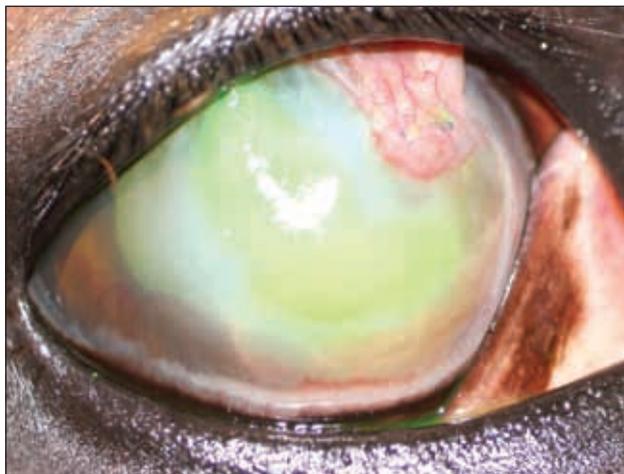
- In-dwelling, sub-palpebral lavage system is recommended;
- Bacteriology swab for culture and sensitivity;
- Corneal cytology to assess whether there are rods (likely Gram-negative *Pseudomonas aeruginosa*), cocci (likely Gram-positive *Staphylococcus* spp. or *Streptococcus* spp.), or fungi (which is uncommon in Ireland), therefore, allowing the choice of the most appropriate topical antibiotic. A mixed infection is also possible. Contrary to popular belief, not all melting ulcers are infected with *Pseudomonas* spp. Some melting ulcers are sterile, with no pathogenic bacteria isolated;
- Topical antibiotics:
  - ▲ The frequency of application varies depending on the seriousness of the condition. Hourly treatment is occasionally required in the presence of a melting ulcer.
  - ▲ Genticin (Roche) contains gentamicin 0.3% and this antibiotic has a good spectrum against gram negative bacteria, notably *Pseudomonas aeruginosa*. Unfortunately, its overuse as a first line antibiotic for a range of ocular problems has caused an increase in resistance among *Pseudomonas* organisms. This may be overcome by very frequent medication (every one-to-two hours) or fortifying the solution with injectable gentamicin.
  - ▲ Exocin and Ciloxan are topical fluoroquinolones with a broad spectrum of activity and are

recommended.

- ▲ Chloramphenicol is a topical antibiotic which is very useful for broad-spectrum therapy.
- Collagenolysis prevention to restrict the action of destructive enzymes is very important, and may be achieved through:
  - ▲ Autologous serum prepared from 10 ml of blood in plain tubes, which is centrifuged after clotting and placed in an eye dropper bottle. This is then stored in the fridge and should be replaced in three-to-five days. It is applied at the same frequency as the antibiotic drops, for example every hour for serious melting or deep ulcers, or three to four times daily for less severe stromal ulcers.
  - ▲ Topical Acetylcysteine 5% (I-lube, Alcon).
  - ▲ Topical EDTA 0.2-1%.
  - ▲ Oral tetracycline / doxycycline antibiotics – Engemycin injection (Intervet) or oral oxytetracycline antibiotics (Vibroxy 100 mg capsules) 10 mg/kg once daily.
- Uveitis control to minimise harmful sequelae:
  - ▲ Atropine 1% may be used topically up to three times daily, used to effect and then only as often as is required to maintain a dilated pupil. Caution should be exercised as systemic absorption of this drug can reduce gut motility and, therefore, cause colic. Monitoring for signs of colic is thus required.
  - ▲ Systemic NSAIDs such as phenylbutazone (4.4 mg/kg twice daily per os) or flunixin meglumide (the author's preference) at 1mg/kg twice daily I/V or per os will reduce the uveitis.

## SURGICAL TREATMENT

Surgery should be considered in cases where the ulcer is deep or melting, for corneal perforations, with or without iris prolapse, and in the case of a descemetocoele. The aims of surgery are to fill the deficit, thus creating a stronger repair, and to provide blood vessels to the diseased area which will promote healing and help arrest collagenolysis. Conjunctival grafts are very useful as they are readily available and have a high rate of success, although they do cause some long-term corneal scarring. Conjunctival grafts may be pedicle, free island, advancement hood, bridge or 360°. They are left in place for six-to-eight weeks. The most commonly used graft is a rotational conjunctival pedicle graft, whereby a flap of thin conjunctiva is raised from the paralimbal area and sutured into the deficit with 6/0 to 8/0 absorbable suture material (Figure 13). Amniotic membrane transplants are gaining popularity, and may be commercially available coated in equine limbal stem cells in the near future. This may reduce protease effects and reduce corneal scarring. Enucleation is required in cases where corneal rupture cannot be repaired causing considerable pain and discomfort; when secondary glaucoma develops which is unresponsive to treatment; or, if infection or



**Figure 13: Conjunctival pedicle graft three weeks after surgery in the Thoroughbred horse featured in Figure 9.**

overwhelming inflammation (endophthalmitis) occurs in the eye.

## ON-GOING MONITORING

Signs of improvement include elimination of the signs of ocular pain (blepharospasm and ocular discharge)

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and a reduction in the depth and extent of the corneal ulcer. Fluorescein is an invaluable test for monitoring the progression of the healing process. Photography is a very useful tool which is, nowadays, easily accessible. Digital cameras are capable of taking high resolution photos and using the macro function can improve the quality of close-up pictures. This is a good way of monitoring the changes which occur over time and may be used as part of the case notes.

The ideal time for the first re-evaluation of the case depends on the seriousness of the presenting signs. Deep or melting corneal ulcers should be examined the next day. Superficial ulcers which were debrided are generally not checked for seven days. Signs of insufficient healing to look out for include any deepening of the corneal ulcer, stromal malacia at the edges, worsening anterior uveitis (pupil remaining constricted, posterior synechiae, aqueous flare and hypopyon) and the lack of any blood vessel response within the cornea.

### PROGNOSIS FOR RECOVERY

All corneal ulcers have the potential to deepen and perforate the globe (**Figure 2**), which leads to loss of sight and would possibly require enucleation. Other potential outcomes include phthisis bulbi (blindness and shrinkage of the eye) or blindness due to scarring, cataract formation or secondary glaucoma. Less serious, but undesirable outcomes include corneal scarring and permanent anterior or posterior synechiae. However, the fate of the case rests in the hands of the owner seeking timely urgent veterinary attention and complying with the treatment plan, and also in the veterinary care provided with a thorough examination, appropriate diagnostic tests and treatment.

### FURTHER READING

- Equine Ophthalmology. Brian C Gilger. Elsevier Saunders. ISBN 0-7216-0522-2.
- Equine Ophthalmology: An Atlas and Text Second Edition. KC Barnett, SM Crispin, AG Matthews. Saunders. ISBN 0-7020-2748-0.
- Ophthalmology for the Equine Practitioner. Dennis E Brooks. Teton NewMedia. ISBN 189344151-2.

## CONTINUING EDUCATION: QUESTIONS AND ANSWERS

### 1. THE FOLLOWING TECHNIQUES ARE USEFUL WHEN EXAMINING A DEEP CORNEAL ULCER:

- Retrobulbar nerve block
- Auriculopalpebral and supraorbital nerve block
- A Schirmer tear test to check for insufficient tears
- Vision assessment using PLR

### 2. SUPERFICIAL CORNEAL ULCERS WITH EPITHELIAL UNDER-RUNNING REQUIRE:

- Debridement and grid keratotomy with topical antibiotics and mydriatics, possibly repeated in 10 days.
- Conjunctival pedicle graft with topical antibiotics and mydriatics.
- Debridement and grid keratotomy every three days, with topical antibiotics and mydriatics.
- Topical serum and mydriatics, with oral doxycycline.

### 3. WHICH OF THE FOLLOWING STATEMENTS IS TRUE REGARDING DESCMETOCOELES?

- Descemet's membrane uptakes fluorescein stain.
- Descemetocoeles are best treated medically.
- Descemetocoeles require debridement and grid keratotomy.
- Surgical repair should be considered for descemetocoeles.

### 4. MELTING CORNEAL ULCERS SHOULD BE TREATED WITH:

- Topical antibiotic and steroid in combination with systemic NSAID and antibiotics.
- Topical antibiotic, mydriatic and serum with systemic steroids and antibiotics.
- Topical antibiotic, mydriatic and serum with systemic NSAID and antibiotics.
- Grid keratotomy followed by topical antibiotic, mydriatic and serum with systemic NSAID and antibiotics.

### 5. CORNEAL ULCERATION MAY CAUSE:

- Reflex uveitis
- Glaucoma
- Globe rupture
- All of the above

ANSWERS:  
1. B  
2. A  
3. D  
4. C  
5. D