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9.1 Introduction

Eye problems are commonly encountered in the working equid population, and in most cases they are preventable. Most eye problems begin as a slight discharge caused by irritation from dust, flies or poorly fitting blinkers. However, due to the intense inflammatory reaction of equine eyes, the initial problem can quickly progress to scarring and blindness.

It is very important to understand how the eye functions and the importance of good husbandry. Advising the owner on early recognition of ocular changes and good eye management is an important responsibility as a working equine veterinarian. Prevention is better than cure.

9.2 Equine vision and blindness

How do equids see the world?

Equine eyes are designed to detect motion and act as an 'early-warning system' for predators. Equids have a wide range of vision, greater than 350 degrees (Hanggi and Ingersoll 2012) due to the positioning of the eyes on the sides of the head (Figure 9.2.1) with only two 'blind' spots; right in front of the head and right behind the tail. This allows them to see approaching predators even when their heads are lowered for grazing, initiating the 'flight' response if necessary (see Section 2.2 Behaviour).

The majority of the equine retina is comprised of rods with no area having only cones. This means that they are able to detect movement well, especially in low-level lighting (Saslow 2002).

There is limited information available on equine vision, evaluation of vision loss, or correction of vision defects.

Do equids have colour vision?

Reports state limited colour vision in horses (Saslow 2002); some studies found an ability for horses to distinguish red, blue, yellow and green from grey, but the number of animals in the studies was very small (Hanggi and Ingersoll 2007).



Figure 9.2.1 The equine eyes are positioned on the sides of the head to allow a wide range of vision.

Question: Which of the Five Freedoms is compromised in a blind animal?

Answer: Potentially all!

Blindness

Signs of blindness

- Bumping into objects
- High-stepping gait
- Reluctance to move forwards or turn
- Difficult to lead
- Fear/nervousness
- Startled easily

Blindness due to chronic injury vs. sudden onset

In working equids, it is rare to find blindness without any sign of chronic eye damage.

As stated earlier, most cases of vision loss in working equids will be due to chronic eye irritation leading to uveitis, corneal scarring and cataracts. Sudden onset blindness will most likely occur from damage to the optic nerve or retina from trauma such as head injuries or acute blood loss.

In true acute blindness, the pupil will be dilated, whereas blindness due to chronic irritation will normally have signs of pupil constriction, chronic uveitis, keratitis or injury.

In the same way that humans adapt, working equids may not show overt signs of blindness if kept in familiar conditions. However, once a routine is changed, the owner may notice something is wrong, and punish the animal for not going forwards. It is the responsibility of a veterinarian to diagnose blindness and inform the owner on ways to manage this. The animal may suffer unnecessary harsh treatment from the owner if a visual impairment is not diagnosed and treated. At the very least the animal will experience fear and distress if it cannot see properly from both eyes.

9.3

Anatomy of the eye and clinical significance of these structures

Orbit

The equid has a complete bony orbit. If the orbit is fractured concurrent palpation of both orbits will reveal crepitus.

Globe (eyeball)

Look at the size of the eyeball and compare to the other eye. The angle of the eyelashes and protrusion of the third eyelid often indicates an abnormal globe size, especially when the other eye is normal. A smaller globe (usually resulting from injury or chronic disease) should be differentiated from exophthalmos and enophthalmos.

Enophthalmos The normal-sized globe recedes into the orbit, usually as a result of pain (Firshman et al. 2003).

Exophthalmos The normal-sized globe is pushed forwards, usually due to retrobulbar disease, e.g. abscess/tumour in the orbit behind the globe (Naylor et al. 2010).

Eyelids

- The upper eyelids are used more in blinking than the lower, therefore any damage to the upper eyelids is extremely serious. To restore function very careful reconstruction, using good anatomical knowledge, must be carried out.
- Assess symmetry by comparing with the other eye, look out for swelling, tumours (Figure 9.3.1), wounds, etc.
- Eyelids must also be carefully inspected for signs of distichia (inappropriately placed eyelashes which could cause corneal ulceration) and foreign bodies.
- The orbicularis oculi muscle produces a strong closure of the eye and if stimulated may cause blepharospasm (an involuntary, forced closure of the eye) making examination impossible. The auriculopalpebral nerve block (see later in this chapter) can be used to stop blinking and make examination easier.

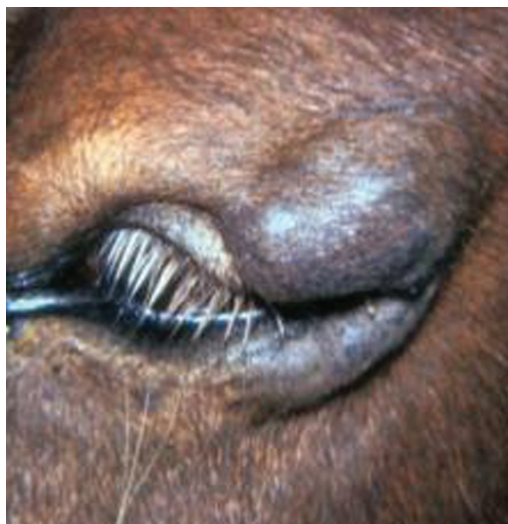


Figure 9.3.1 Appearance of a tumour involving the equine eyelids.

Remember the auriculopalpebral nerve block is a motor function block and will not provide pain relief.

- The eyelids have a large blood supply. Surgical treatment of eyelid damage must be attempted very carefully as even a slight misalignment of wound edges can cause painful scarring, resulting in dysfunction of the eyelid and the inability for the eyelids to close, leading to dry eye and keratitis/uveitis and subsequent blindness.

Nictitating membrane (third eyelid)

Gently press the upper eyelid onto the globe to cause eversion of the third eyelid (Herring 2003). It can be assessed for tumours, or granulation tissue from Habronema infection (see later in this chapter). The ventral fornix can be inspected for foreign bodies by pulling the third eyelid out gently with soft-end forceps and looking into the space.

Lacrimal system

The nasolacrimal duct runs from a small hole in the medial corner of the eye and exits from the nose. It is this duct which allows fluorescein dye solution to exit from the nose when placed in the eye to examine for corneal ulceration (see Section 9.4). Dye should pass within a minute, but allow up to 5 minutes (Ramsey 2003). Blockage of the puncta, either from dirt, dust, Habronema infection or swellings, causes tears to build up and watering of the eye which results in further dust accumulation potentially leading to conjunctivitis and even more severe ocular pathology.

The nasolacrimal duct can be catheterised and slowly flushed with warm saline. This is a good way to ensure a clear passage exists between the eyes and nose.

The nasolacrimal duct can also be used for medicating the eye, or flushing it, when the animal is head-shy; however, after repeated days of treatment the animal can become adverse to catheterisation.

Conjunctiva

These are the mucous membranes on the inside of the eyelids. Normally they are a pale pink colour and should be smooth and moist. They can be assessed for swelling, foreign bodies or inflammation; they are a place to assess mucous membrane colour.

Cornea

The cornea is a very thin epithelial layer over the front of the eyeball. It can be easily damaged by dust, flies and trauma, causing ulceration. Once the cornea is ulcerated, the return to full vision (if at all) is only possible if acted upon quickly. Equids have intense inflammatory reactions in the eye and scarring occurs quickly which permanently affects the vision.

The normal cornea will have no blood vessels and will be transparent.







Figure 9.3.2 Examination of the eye with a pen torch.

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Any disruption to the cornea will cause opacity which results in various colour changes to the eye (see Table 9.3.1).

Using a pen torch correctly (see detailed examination of the eye later in this chapter and Figure 9.3.2) will help differentiate between corneal opacities and a generalised problem within the globe, such as pus/blood/oedema in the anterior chamber.

Colour of the cornea	Potential cause	Photograph to illustrate
Blue/ opaque	<p>Corneal oedema:</p> <p>Focal Injury from external source, e.g. a stick, or directly around a corneal ulcer</p> <p>Diffuse More widespread intraocular inflammation, glaucoma</p>	
Red	<p>Corneal vascularisation:</p> <p>Focal Superficial injury. Blood vessels will grow from the limbal area (edge of the eye) towards an injured area of cornea, bringing cells and nutrients to assist healing. This takes time and, if blood vessels are present, it indicates that the corneal injury has not recently occurred.</p> <p>Diffuse inflammation With more widespread inflammation, blood and superficial blood vessels may be seen across the cornea. These can be circumferential and an indicator of widespread diffuse inflammation.</p>	
White	<p>Corneal scarring from an old injury. If a scar is present there will be no active inflammation in the eye. Provided it is small or out of the field of vision, it may have no impact on sight. However, if extensive and across the field of vision it can extensively limit sight.</p>	
Other	<p>Pus (yellow) from intraocular bacterial infection, or other colours due to corneal pigmentation, neoplasia</p>	

(Dwyer 2012)

Table 9.3.1 Corneal colour changes and potential causes.

Anterior chamber

In a healthy eye the anterior chamber is filled with a clear fluid called aqueous humour. Abnormal contents (such as pus or blood from haemorrhage) can be seen in the ventral portion of the anterior chamber often obscuring the iris in this region. If there is severe damage the entire anterior chamber can fill with inflammatory exudate or pus and the whole eye looks a different colour. (This must be differentiated from problems isolated to the cornea).

Appearance of the anterior chamber:

- Yellow/white Diffuse inflammation, fibrin or infection (Figure 9.3.3)
Do not drain!
- Red Haemorrhage or settling of red blood cells from an earlier bleed
- Black/brown Pupil distortion, iris adhesion, or neoplasia
- Blue Diffuse oedema

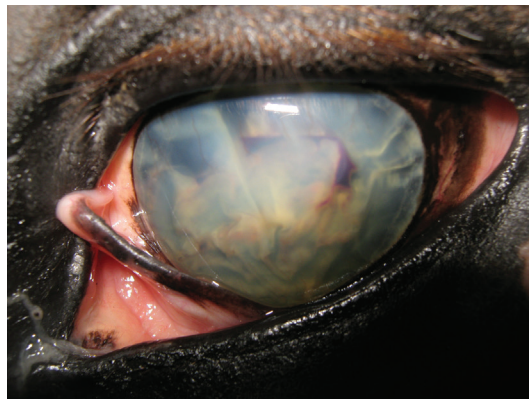


Figure 9.3.3 Inflammatory changes in the anterior chamber, the posterior structures of the eye can no longer be seen.

Iris

Usually brown coloured in most equids (Figure 9.3.4) but can be blue or white ('wall eye') in some animals (Figure 9.3.5); these are more common in colour dilute equids such as appaloosas, piebalds and skewbalds.

In equids, the iris has proliferative, well vascularised extensions of the iris that look like black cystic masses along the edge of the iris. These are not pathological; they are known as 'corpora nigra' (Figure 9.3.5) and are a variation of normal.



Figure 9.3.4 A brown-coloured iris.



Figure 9.3.5 A blue-coloured iris or 'wall' eye.

Pupil

The pupil is the black space in the middle of the eye. The pupillary light reflex/response (PLR) – a reduction in pupil size when light is shone on the eye – indicates whether the nerve pathways (retina, cranial nerves II and III) are working correctly, see Section 9.4 (Dwyer 2012). The equine pupil reduces down to a thin horizontal gap, see Figure 9.3.4 (not round as in humans). As light is shone in one eye there is a consensual response in the opposite eye where the pupil also constricts slightly.

The pupil can look distorted if there is neoplasia or scarring of the ciliary body preventing normal movement of the iris. During the inflammatory processes which occur with intraocular disease, adhesions can form between the iris and other structures; these are known as synechiae and are permanent. The normal oval shape of the iris will be distorted and this area will be unable to move, which can be easily assessed by the PLR.

Lens

The lens needs to be clear for the animal to see. A cloudy lens could either be a cataract or nuclear sclerosis which is a hardening of the lens in old animals where the fundus is still visible. Alternatively, lens luxation can occur secondary to trauma or uveitis (see detailed eye examination later). Any condition involving the lens requires surgery with specialist ophthalmological equipment, personnel and facilities; thus it is not suitable for field conditions. Common variations of normal may be seen, such as an 'onion ring' appearance which is of no concern.

Figure 9.3.6 shows a horse with anterior lens luxation in the left eye; this is not the normal position of the lens. There are also corneal striae on the corneal surface – this could be an indication of glaucoma.

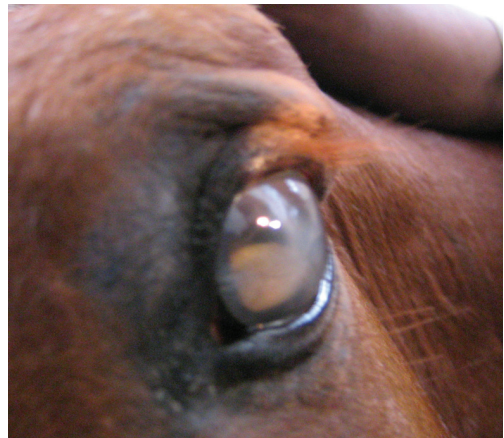


Figure 9.3.6 Anterior lens luxation in the eye of a horse.

Fundus (retina and optic nerve)

The structures at the back of the eye (fundus) can only be viewed with an ophthalmoscope and good pupil dilation.

There is a large variation in what is considered normal when examining an equine retina; both eyes should always be checked and this can provide a useful comparison, unless the pathology is bilateral. Refer to ophthalmic texts for further information on this, as well as Section 9.4 of this chapter.

Retina This contains neurosensory epithelium and is responsible for vision. It contains photoreceptors (rods and cones) which turn the light that reaches the back of the eye (fundus) into electrical impulses.

- The tapetal fundus is located dorsally. It is hyper-reflective and improves night vision. It can be green, yellow, blue or red.

Note: In colour dilute horses it can be absent and the underlying vessels will be visible in a tree-like pattern.

- The non-tapetal fundus is located ventrally. It is usually brown/black in colour due to pigmented cells within the retina.

Note: In colour dilute horses there can be none of this pigmentation so the underlying vessels will be visible in a tree-like pattern.

- The optic disc is normally circular in shape and salmon pink with many blood vessels extending out from it. It is situated just below the junction of the tapetal and non-tapetal fundus. The disc is where the optic nerve enters/leaves the retina and is also the entry point for many of the blood vessels which supply the retina and vitreous humour.

Ophthalmic examination and diagnostic tools

9.4

Examine the eye in a routine manner so nothing is missed. The early signs of ocular disease can be very subtle so a thorough examination is vital. It is extremely important to spend time with the owners of working equids stressing the importance of referring any eye problem to a trained health professional at an early stage in order to prevent serious complications arising, as these may end up threatening the vision of the animal (Dwyer 2012). Ensure that all foals, as well as older animals, have an eye examination. General aspects of an ophthalmic examination can be incorporated into all general clinical examinations to pick up any early symptoms of eye disease before they progress into serious eye problems (Figure 9.4.1).

Take a good 'eye' history

- Does the animal have problems seeing things? If so, for how long has it done so?
- Is the problem worse in one eye, or present in both?
- Is there a previous history of eye problems?
- Has there been any medication given previously?
- Are there any signs of pain in the eye?
- Are there signs of ocular discharge?
- Are there signs of upper airway respiratory disease?
- Is the problem getting worse, better, or staying the same?
- Are any other animals affected?



Figure 9.4.1 Take a full history and perform a clinical examination.

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Signs of ocular disease

Signs of an eye problem are closely associated with ocular pain (see Chapter 3 Pain).

- Epiphora (excessive tearing) (See Figure 9.4.2)
- Blepharospasm (blinking)
- Blepharoeidema (swollen eyelids/conjunctivae)
- Enophthalmos (normal-sized globe that is retracted into the orbit)
- Third eyelid prolapse
- Change in eye colour/cloudiness to the cornea
- Photophobia (sensitivity to light)
- Miosis (constricted pupil as a result of ciliary body spasticity)
- Reluctance to allow examination (head shy)
- Depression and anorexia



Figure 9.4.2 Epiphora (excessive tearing) and blepharospasm.

Initial examination of the eye in good light

For all examinations of the eyes ensure there is a competent handler, or sedate the animal if it is in distress or severe pain. Keep the handler on the opposite side of the head to the examiner so that there is space to view the eye easily.

Always examine both eyes.

Ocular discharge: Any amount is significant.

- Colour Clear indicates viral infection or allergy, whereas yellow/green suggests bacterial infection.
- Consistency Watery indicates ongoing/acute condition, whereas dry/crusting indicates chronicity.
- Amount Viral infections usually produce small amounts compared to the 'streaming' eyes associated with allergy or the presence of a foreign body.
- Lacrimal duct obstruction Suspect with signs of Habronema infection.

Always have an examination plan and check in a systemic way for any abnormalities to focus on when doing the detailed ophthalmic examination (Figure 9.4.3).



Figure 9.4.3 Initial examination from a distance.

Detailed eye examination

Equipment required: Dark area, pen torch, ophthalmoscope (if available, although an examination can be achieved with a pen torch alone)

A dark area and a quiet, calm animal are the two factors standing between a detailed examination and an examination where nothing useful is discovered. It is very important to have a competent handler. If there is not a trained equine handler available, select a competent person from the local community – this may not be the animal's owner, and often it is best if not, as the owner will want to observe and discuss the examination rather than staying on the opposite side of the head and concentrating on calming the animal.

Table 9.4.1 lists the anatomical structures of the eye and the abnormalities to look out for in the examination.

Structure	Abnormalities to look for
Globe	Exophthalmos/enophthalmos
Eyelids	Wounds, swellings
Conjunctiva	Colour, swelling, foreign bodies
Third eyelid	Protrusion, swellings, granulation tissue, foreign body trapped underneath the third eyelid
Cornea	Opacity, ulcers, vascularisation, oedema, rupture
Anterior chamber or 'aqueous humour'	Blood (hyphaema), pus (hypopyon), foreign bodies, 'aqueous flare' (mild greyish appearance of aqueous humour)
Iris	Size, symmetry, shape, colour changes, swellings, synechiae (adherence to back of cornea or front of lens), pupillary light response
Lens	Cloudiness, cataracts
Vision	See vision tests below.

Table 9.4.1 Anatomical structures visible in normal light and associated abnormalities.

Acute eye conditions will be very painful.

It is likely that even a chronic condition will have left the animal head-shy at some point in the early, painful stages. For this reason consider local anaesthesia (topical or via nerve blocks, see below) or even sedation to assist in the examination, especially if examination of the eye is not possible or a foreign body needs to be removed.

When out in the field, a dark area can be created if the animal allows a blanket to be placed over both the examiner's and the animals' head. However, this can be very dangerous for both parties so only attempt if the animal is known and fear and distress can be minimised. Consider sedation.

Ophthalmic reflex testing

Pupillary light reflex (PLR)

- This is the reduction of pupil size in response to a light source.
 - It tests the functionality of the optic nerve – cranial nerve (CN) II, the retina (sensory arm of the reflex) and the parasympathetic portion of the oculomotor nerve – CN III (motor arm of the reflex resulting in iris constriction).
- This test needs to be done in a dark area so that the pupils are dilated in response to decreased light.

- Shine the pen torch in the eye and observe constriction of the pupils. This should occur in both eyes since the neuronal pathways cross over. When a light is shone in one eye, ensure that the pupil in the other eye constricts as well – the ‘consensual reflex’. (The opposite eye will constrict less than the one with the light shining in it.)
- This reflex shows that the retina and the nerves to and from the eye are working. However, it does not necessarily indicate that the eye is visual as it is a subcortical reflex, and, therefore, does not involve the brain cortex which is required for vision.
- If the pupil is obscured by pathology in one eye, the PLR can still be tested by shining a light in the affected eye and looking for constriction in the other normal eye – i.e. checking the consensual reflex (Dwyer 2012).

Dazzle response

- A bright light is suddenly shone in the eye and the animal will partially close the eyelids to retract the globe.
- Loss of this subcortical reflex could be due to damage in any of the following areas: retina, rostral colliculus, supraoptic hypothalamic nuclei, or CN II, CN VII, and the orbicularis oculi muscle controlling closure of the eyelids (Dwyer 2012).

Palpebral blink reflex

- This tests the functionality of the trigeminal nerve (CN V) and the facial nerve (CN VII).
- Touching a clean cotton bud onto the skin next to the medial canthus should cause a blink reaction (eyelids close). Any area of the immediate peri-ocular skin can be touched for this test, but do not touch the eye itself as this could scratch the cornea.
- If there has been damage to either the CN V or VII there will be no blink reflex (Dwyer 2012).

Menace response

- This test produces a blink or head withdrawal response by the animal in reaction to a threatening movement towards the eye.
- It assesses vision (retina), the function of the oculomotor nerve (CN III), which is responsible for eye movement, and CN VII.

- In a neonate the menace response may be absent until 1–2 months of age.

- This test is done by standing at the side of the animal and moving a hand quickly towards the eye. Be careful not to create air currents when doing this, as the animal will blink from the sensation of air moving near its face rather than because it can visualise the 'menace' threat.
- If there is no response this may indicate damage to CN III, CN VII, the retina or the visual cortex.

Corneal response

- Touching the cornea will result in closure of the eyelids.
- This assesses CN V and VII. Damage to these nerves (or other pathologies) will result in inability of the eyelids to close, preventing the blink response.

Take care with this test. Ensure that anything used to touch the cornea is clean and preferably sterile (a sterile sampling swab is a ideal). Ensure the animal is calm and well handled so as not to cause any iatrogenic injury to the cornea.

Diagnostic tests

Intraocular Pressure (IOP)

- IOP should be the same over all areas of the globe; it measures the hydrostatic aqueous pressure. Reported normal values in horses give a range of 17–28 mmHg.
- IOP can be raised due to inflammation in the eye and is commonly associated with glaucoma and chronic uveitis. Although a tonometer is the tool of choice, it is possible to make an estimate of increased pressure by gently palpating both globes through the eyelids at the same time, and making a comparison. Knowledge of whether IOP is raised can help differentiate exophthalmos (see above) from an enlarged globe due to glaucoma.
Never place digital pressure on the globe unless it is through the eyelids.
- Studies have shown that IOP is reduced in horses sedated with xylazine and detomidine (Holve 2012) so bear this in mind when assessing and interpreting IOP in sedated equids. The study by Holve (2012) also suggested an initial increase in IOP after application of topical anaesthesia (proparacaine 2% ophthalmic solution).

Remember that the height of the head (and therefore the eyes) relative to the height of the heart can affect IOP. Recommendations are to keep the head up for 10 minutes prior to measuring the IOP (Holve 2012).

Fluorescein test

- Fluorescein is an orange dye (in drops or strip form) used to diagnose corneal ulceration.
- Place in the eye and wait 2 minutes. (It can also be done by placing strip/drops in a syringe with 2 ml sterile saline and squirting gently into the eye, as for local anaesthesia below.)
- If a corneal ulcer is present, it will stain bright green (positive) due to the alkaline environment (Brooks 2012b) as shown in Figure 9.4.4.

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- Fluorescein is a good tool to use to measure the healing progress of an ulcer. Draw diagrams of the ulcer in the clinical notes with mm measurements and assess the decrease in size over time.
- It can also be used to test the patency of the nasolacrimal duct – the dye should appear around the nose after a few minutes if the duct is clear; allow up to 5 minutes (Ramsey 2003).
- If the ulcer is very deep, a crater will form which will stain. However, if the base of this crater does not take up stain this indicates that the cornea has been eroded to the level of descemet's membrane – the final layer of the cornea. It is extremely important to recognise this; it very dangerous as it indicates that the cornea is close to perforation. Intensive treatment is required.



Figure 9.4.4 A positive fluorescein test result showing a superficial ulcer with no obvious crater.

Application of fluorescein dye should be a routine part of all ophthalmic examinations in order to detect early corneal ulcers (Brooks 2012b).

Rose Bengal stain

- This is a red dye used to detect defects in the surface epithelium and defects in the mucin layer of the tear film (Brooks 2012b).
- It may also indicate fungal infections or inadequate tear film (Brooks 2003, Dwyer 2012).
- There are varying reports on whether this is an irritant for the eye (Brooks 2012b).
- Place Rose Bengal in the eye after the fluorescein test.
- It is an important test to use in cases on non-healing ulcers (Brooks 2012b).

Schirmer Tear test

- This measures reflex tear production: the pre-corneal tear film.
- Application of topical anaesthetic (1% tropicamide) to the eye, prior to testing, significantly reduces tear production (Ghaffari et al. 2009).
- Test strips can be purchased – follow the instructions on the packet for application, length of time to be left in place (usually 60 seconds) and interpretation of reading.

Take care in interpretation as there are reported differences over the day, season, gender and sides! (Piccione et al. 2008, Beech et al. 2003).

- Values from 10 mm to over 35 mm have been reported as normal (Beech et al. 2003, Brooks 2012b). Lower values, less than 10 mm, indicate a reduced tear production, and very low values, less than 5 mm, indicate keratoconjunctivitis sicca (KCS) (Brooks 2012b).

Differentiating corneal injury from generalised intraocular conditions

If an ophthalmoscope is not available it is still possible to differentiate corneal injury from generalised intraocular conditions.

'How do I tell the difference between a focal problem with the cornea (e.g. corneal ulceration) and generalised inflammatory conditions of the eye such as uveitis – especially since both can present with similar signs of disease?'

Stand at the side of the animal in a dark area and shine the pen torch through the eye from the other side. Figure 9.4.5 shows the aspect to view the eye. By examining the eye from this direction it is possible to see whether the whole eye is cloudy (suspect intraocular disease), or whether it is just the cornea/anterior chamber affected. Use of fluorescein dye can help diagnose corneal ulceration if this is suspected (see below).

In very severe corneal injury, a full-thickness injury to the cornea can occur and in these cases aqueous humour can be seen leaking from the defect, or part of the iris may be seen prolapsing through the defect. This is a very serious condition that requires emergency surgery with specialised ophthalmic surgical equipment which will be neither available nor appropriate for the field situation.



Figure 9.4.5 Angle of view to differentiate corneal conditions from more generalised inflammatory conditions. The corpora nigra can clearly be seen in this photograph.

A pen torch and a lot of practice looking at normal eyes will help make this differentiation.

Ophthalmoscopy

An ophthalmoscope is used to examine the fundus (retina, choroid, sclera and optic nerve). Alternatively, use a diopter lens to conduct indirect ophthalmoscopy in which the whole fundus is seen at once. Either way, a dilated pupil will enable visualisation of a much bigger area of the fundus than a constricted one. Atropine drops (0.2 ml 1%) will result in a dilated pupil after 15–20 minutes, and are helpful when attempting ophthalmoscopy.

Indirect ophthalmoscopy

Indirect ophthalmoscopy uses a focal light source (pen torch or transilluminator) and a separate diopter lens (condensing lens) to scan the whole retina. This is done by standing about an arm's length away from the eye and directing the light source into the diopter lens which is held next to the eye. Different magnifications depend on the lens type so identify the lens type in use. A reverse image is provided this way, hence the tapetum (coloured part) appears in the ventral portion of the eye. Remember also that any medial lesion will appear in the lateral section of the fundus. The advantage of this method is that it allows visualisation of more of the fundus

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at once, for a more rapid examination. A dark environment is essential for this examination (Brooks 2012a).

Direct ophthalmoscopy

This is done with an ophthalmoscope, examining the eye up close to the animal. The disadvantage of this is that it is slower as only a small portion of the fundus can be seen at any one time. It is especially difficult/dangerous in nervous animals as the examiner's face is close to the eye. The advantage is that ophthalmoscopes are portable and simple to use, and the image is true (i.e. not reversed as with indirect ophthalmoscopy). There are many different types of ophthalmoscope. Ophthalmoscopy is not difficult but it does take practice. Here are some tips on its use:

Distant direct ophthalmology This can be done as an initial quick scan for abnormalities.

Close direct ophthalmology This can be used to examine all aspects of the eye, and is essential to full evaluation of the retina and origin of optic nerve (Bedford 1985, Brooks 2012a).

- Make sure the instrument is working. Ensure the batteries are charged.
- Test the settings. Ensure the light source is:
 - White Ignore the red; blue can be used to look at ulcers (Brooks 2012b).
 - Bright Have the light at maximum force rather than dimming function.
 - Circular Ignore the slits/crosses, turn the dial to a circle.

Get close. The closer to the animal's eye, the larger the field of vision.

- Remember human safety. Rest a hand on the head of the animal while examining the eyes.
- Observe the fundus with the setting on 0 to 3 diopters. (This number represents focal length; the negative numbers are usually in red.) The setting can be changed to bring abnormalities into focus. Beginning with the magnifying lens (from +30D), and gradually reducing the strength through to the reducing lens (to -30D), start from the outside surface of the eye and finish by viewing the retina (Brooks 2012a). Compare with the other eye. There is large variation of 'normal' in the equine eye. Note the reflectivity of the retina and the 'Stars of Winslow' (small dots in the tapetal fundus that are end-on normal blood vessels supplying the retina) which are scattered over the tapetum; do not mistake these for abnormalities. Look at the size, shape and position of the optic nerve papilla (disc).

Ensure that the animal's pupil is well dilated.

- The fundus is examined through the pupil and, if the pupil is miotic, visualisation is not possible. Having the animal in a darkened room will achieve this, although occasionally it is helpful to use a short-acting mydriatic to dilate the pupil (e.g. tropicamide).

A dark environment is essential for the best examination and visualisation.

Vision testing

The menace response is one way to test vision (see earlier in this chapter). Alternatively, conduct obstacle tests using locally available materials which will not cause harm to the animal if it knocks into them (Dwyer 2012). A good way for a worried owner to test an animal's vision is to change the routine slightly (e.g. put the animal in a different stall/stable, take a right turn instead of a left in the brick kiln or market, anything that will reveal a vision defect being covered up by the animal remembering its routine).

Careful observation of behaviour may reveal blindness.

By blindfolding each eye in turn, it is possible to assess sight in both sides and detect if there are unilateral defects in vision (Dwyer 2012).

Remember there are differing levels of vision defects. Many working equids have a white plaque over the front of the cornea, 'corneal scarring', from an old corneal ulcer or eye injury. This gives the appearance of looking through frosted glass; the animal can see shadows but not defined shapes. This could have an effect on the fear or distress that the animal experiences; the owners' actions may be unnecessarily harsh if they do not realise their animal cannot see well.

A veterinarian has a responsibility always to point out suspected vision defects to the owner, however slight, and ensure that the animal is managed appropriately.

Chemical restraint

Equids have fast reflexes and strong ocular muscles, the combination of which makes them averse to examination of the eye, even more so if the eye is painful. The eye has many sensitive nerves (and therefore can be extremely painful when injured) and a strong orbicularis oculi muscle producing the blink response and blepharospasm. If necessary, a combination of intravenous sedation and local anaesthesia can be used to facilitate examination and avoid unnecessary pressure when handling an injured globe.

Complete desensitisation of the eye (for painful procedures) will require blocking the supraorbital, lacrimal, zygomatic and infratrochlear nerves. However, topical anaesthetic will still need to be applied to the surface of the globe, in an ocular preparation.

For ophthalmological examination the supraorbital block alone will be sufficient as this will inhibit blepharospasm and most of the blinking that obstructs examination (see later in this chapter for details of these nerve blocks).

- **Sedate** Administer an alpha2-adrenergic agonist (e.g. xylazine/detomidine), ideally with an opioid (e.g. butorphanol) IV (see Chapter 5 or other equine formularly texts for dose rates).
- **Topical anaesthesia** This anaesthetises the cornea, facilitating examination, foreign body removal and washing; and makes the animal more comfortable. Examples include proxymetacaine or topical 4% lignocaine without adrenaline. Place 0.2–0.3 ml into a syringe (without the needle) and apply gently from a few centimetres. Analgesia occurs after 3–4 minutes and lasts about 20 minutes. This is not a long-term solution for analgesia. Topical anaesthetic has toxic effect on corneal epithelial cells and is short acting. So, while it may temporarily relieve an animal's pain, it will also impede healing. Therefore, although

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useful in the short term for examination and essential veterinary procedures, it is not suitable for long-term use, and alternative analgesics should be provided.

- Nerve blocks Know the anatomical landmarks. 2% Mepivacaine hydrochloride can be used (Pollock et al. 1998).

Remember, if sedation is used the head will lower towards the ground.

In order to comfortably conduct a thorough examination, the animal's head will need to be held up to the examiner's head height. If the handler is holding the head up he/she will tire, so ensure either that there is a second handler to take over or make a 'head-rest' out of suitable local objects. Ensure that the person holding up the head is not constricting the airways at the throat and neck.

Local anaesthesia for examination or treatment of the eye

A thorough examination of the eye and eyelids is difficult without the use of local anaesthesia, (often together with sedation). Complete desensitisation of the eye muscles and skin requires blocking the supraorbital, lacrimal, zygomatic and infratrochlear nerves, however the supraorbital block alone will often be enough for a thorough examination.

Note: With all of these nerve blocks the surface of the eye is not desensitised, so ensure topical local ocular anaesthetic is applied if this is required.

Auriculopalpebral nerve block

This does not provide analgesia.

This block will prevent blinking as it blocks the motor function of the upper eyelid. The nerve runs over the highest point of the zygomatic arch; moistening the area with surgical spirit will make the nerve easily palpable.

- First, without the syringe attached, insert the 22–23G needle as the animal will react and move the head.
- Inject 2 ml local anaesthetic.
- Always use topical local anaesthesia on the cornea too, for the sensory block.

Supraorbital (frontal) nerve block

The supraorbital nerve emerges through the supraorbital foramen, located 5–7 cm dorsally to the medial canthus of the eye. It provides sensory innervation to the middle part (2/3rds) of the upper eyelid only. If the whole upper eyelid needs to be blocked do the frontal block first, then, once the middle is numb, inject local to the lateral areas via local anaesthetic infusion.

- Find the supraorbital foramen by palpation of the bony orbit over the top of the eye.
- Inject 3–4 ml local anaesthetic into the foramen itself, or along the dorsal orbital rim.
- Be careful not to inject into any of the blood vessels.
- Place the needle first, before attaching the syringe, and draw back before injecting.

Lacrimal, Zygomatic and Infratrochlear block

- Precise location of these nerves is difficult.
- Infiltration of 2–3 ml at each site of the four corners of a diamond positioned around the eye (ring block) will achieve complete desensitisation of the eye and eyelids (Pollock et al. 1998).
- This is very useful for examining and suturing injuries to the eye, or for enucleations.
- Again, remember to place the needle first before attaching the syringe.

Enucleations

The technique for enucleation is outside the scope of this text. Refer to a recent surgical text for the exact procedure.

Ocular therapeutics – Preparations, administration and principles

9.5

The challenge with ocular therapy is getting the right drug to the right place for an extended period of time so that effective therapeutic levels are reached. Ideally, any topical application of drops/ointments should occur at least four times daily. However, as time goes by, equids often become more resistant to intraocular medication and examination. It is the responsibility of the prescribing clinician to help owners understand the importance of continuing treatment, and to instruct them on the correct handling methods which will allow them to do this.

Routes of drug administration

There are four main routes for drug administration in ocular treatments:

- Systemic (e.g. IV NSAID therapy)
- Topical (e.g. eye drops/creams)
- Lavage (e.g. nasolacrimal or subpalpebral)
- Subconjunctival injections

The first three are the recommended routes, as subconjunctival injections are not well tolerated in equids; the level of restraint required would cause excessive fear and distress.

Systemic

This is the route of choice for conditions affecting the fundus (as topical treatment will not reach this) and to provide analgesia and anti-inflammatory medication in addition to topical

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treatments, for example in corneal ulceration, eyelid wounds/swellings. Although topical NSAIDs are the drug of choice for conditions such as corneal ulceration, these may be unavailable locally. Systemic NSAIDs will improve the general comfort of the animal.

Topical

This is the most well-known route (Matthews 2009) and theoretically the easiest for owners to use. It is used successfully to treat eyelids, conjunctival, corneal, anterior chamber pathology and adnexal disease.

Depending on the drugs and the formulation, some drugs (e.g. chloramphenicol) penetrate the intact conjunctival and corneal epithelium, resulting in therapeutic levels in the corneal stroma and anterior chamber, but topically drugs do not reach the posterior chamber.

Disadvantages of topical medication include the reluctance of the animal to co-operate after the first days of treatment, or the owner giving up or not actually succeeding in getting drops into the eye.

Additionally, if several different types of eye drops are being provided, 15 minutes needs to be left between each different drug to avoid too large a volume of fluid added to the eye, resulting in the medication overflowing.

One easy method of applying eye drops is via a syringe with a cut-off 22G needle (for veterinarians), or through a plastic intra-mammary syringe (for owners, to avoid unnecessary damage to the eye if the animal moves its head). This allows for greater control over placing the medication and it is not necessary to be as close to the eye so, theoretically, it will be better tolerated. Any topical application should be applied slowly and gently as the animal will react strongly to anything squirted into the eye.

As well as the pharmacokinetics of the drug administered, the preparation type effects the penetration and drug availability.

Solutions These have a high bioavailability which means that therapeutic concentrations are easily achieved. However, they have a short ocular contact time. As a general rule, solutions should be applied at least every 4 hours and, ideally, in the acute/initial stages of treatment, every 1–2 hours. If two or more solutions are being used, 15 minutes should be left between applications to avoid dilution, washing out or reactions. Failure to do so is a common cause of therapeutic failure.

Ointments On application, these melt into the tear film, aided by blinking. These preparations have relatively poor availability but much longer retention. Therefore they should be instilled every 6–8 hours. Although their availability is not as good as that of solutions, if an owner is not able to administer solutions at the correct frequency, then an ointment may be a better option.

Lavage

This method is useful since it allows application of eye preparations over a period of time without direct contact with the eyes, and once in place can theoretically be taught to owners.

The disadvantage is that the lavage system needs to be checked daily which is difficult in a field situation, and medications must be infused slowly as the animal will react strongly and start to resent the treatment.

The two main types of ocular catheterisation are via the nasolacrimal duct or a subpalpebral lavage.

Nasolacrimal lavage

This is a good method for flushing out larvae from Habronema infection, and in some cases can be used to administer eye drops if the animal is head shy.

Where are the nasolacrimal puncta?

There are species differences here:

- **Horses** The nasolacrimal opening is found **ventromedially**, very near the junction between the pigmented and non-pigmented mucosa (see arrow, Figure 9.5.1).
- **Donkeys** The puncta are found **dorso-laterally** and are often harder to find; evert the upper part of the nostril.

Insert a 16–18G catheter (or a very small urinary catheter) gently into the nasal punctum (Figure 9.5.2); this does not have to be inserted all the way. First applying local anaesthetic onto the catheter, and around the punctum, will allow its passage more easily. Gently slide the catheter up towards the eye for a small distance; do not force it which will risk puncture of the nasolacrimal duct. Slowly flush warm sterile saline gently through the catheter to encourage patency.

Always flush gently and be very cautious if resistance is encountered to avoid inadvertently rupturing the nasolacrimal duct.

The catheter can be left in place to administer long-term or frequent ocular treatment (Barnett et al. 1995).



Figure 9.5.1 Position of the nasolacrimal punctum in the horse.



Figure 9.5.2 Flushing tube inserted into the nasal punctum.

Subpalpebral lavage

Subpalpebral lavage involves inserting a length of pliable polyethylene tubing through the upper eyelid through which medication can be delivered. Details of this technique are included in many equine veterinary reference texts. It allows medication of the eye, over a number of days, with multiple preparations. This technique should not be used unless the practitioner is confident of how to place the sub-palpebral lavage system and is able to ensure follow-up involving daily visits to the animal. One study by Sweeney and Russell (1997) reported minor complications in 34% of cases and severe complications in 24% of cases. Minor complications were mild eyelid swelling, tearing of tubing and losing the cap; severe complications were removal of the system by the animal, eyelid infections, losing the footplate in the eye and ulceration of the cornea.

Therapeutic preparations for treatment of common ocular diseases

- **Mydriatics** Atropine/tropicamide. This causes mydriasis or 'dilation' of the pupil, allowing easier visualisation of the fundus. It is also an essential part of treatment for recurrent uveitis (see later in this chapter).

Caution: Atropine reduces gastrointestinal motility in equids so should only be used to effect, and animals on this treatment should be carefully monitored for colic.

Pupil miosis is a natural reaction to bright light which protects the retina by limiting the amount of light passing to it. If the pupil is chemically dilated this protective reflex is inhibited, therefore the animal must be kept in a darkened environment so harmful bright light does not damage the retina and cause discomfort.

Caution: Prolonged mydriasis has been reported in horses after a single dose of atropine, with effects for up to 14 days in one study (Davis et al. 2003) and more prolonged effects in Arabian horses.

- **Miotics** e.g. Pilocarpine. These constrict a dilated pupil, for example if an animal is uncomfortable after atropine administration. Often in chronic uveitis, synechiae form where the iris is stuck to the lens. Alternative administration of atropine and pilocarpine at 3-hour intervals is the treatment of choice to attempt to break down these synechiae.
- **Antibiotics** Gentamicin or chloramphenicol, in drop or ointment form, are commonly used preparations for treatment of conjunctivitis, keratitis and recurrent uveitis and wounds in the eye area. These need to be applied every 4–6 hours. Refer to Matthews (2009).
- **Corticosteroid anti-inflammatory drugs** Prednisolone or dexamethasone (topical applications). These are the drug of choice for uveitis and allergic conjunctivitis, however do not use if any infection is suspected, e.g. bacterial, viral or mycotic, as this will delay healing and may cause a sudden deterioration. Do not use systemically for eye conditions.

Never use corticosteroid preparations in the presence of corneal ulceration as this will severely damage the eye and cause irreversible blindness.

- **Non-steroidal anti-inflammatory drugs (NSAIDs)** Diclofenac drops (topical), phenylbutazone or flunixin meglumine administered IV (systemic).

Systemic NSAIDs should be considered in all painful eye conditions (see Chapter 4).

Diclofenac drops are also very effective in reducing eye pain; however, the drug itself has been legally banned in many countries due to environmental concerns (Oaks et al. 2004).

- Serum This can be easily collected and then separated (leave a blood sample to settle in a plain tube). It contains naturally occurring anti-proteinases and anti-collagenases which inhibit corneal autolysis. It is also thought to contain anti-inflammatory agents which may reduce ocular inflammation and can be an adjunct to the treatment of corneal ulceration (Brooks 2010a). This is now considered better than EDTA.

Remember that any unused serum must be kept cool and clean and discarded after 3 days if not used.

- EDTA 2% Anti-collagenase used as an adjunct to the treatment of severe or 'melting' corneal ulcers (Brooks 2012b) to stop autolysis of corneal tissue. This drug is easily acquired by mixing other topical treatments in an EDTA tube before applying to the eye. This is painful when added to the eye so the animal may resent administration.

Common eye diseases

9.6

With all conditions of the eye ensure adequate pain relief.

Conditions of the eyelids

Entropion

This is inversion of the margin of the lower eyelids, more frequent in foals and either primary (congenital) or secondary to malnutrition, dehydration, septicaemia or uveitis. In equids this is usually secondary to another problem rather than primary congenital entropion found in other species. Diagnose and treat the underlying cause.

Clinical signs

- Eye irritation – a few days after birth with congenital entropion, or following another primary inciting cause if entropion is secondary
- Excessive lacrimation
- Blepharospasm
- Photophobia
- A potential sequela is corneal ulceration.

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Diagnosis

A history of the systemic conditions and clinical signs described. Observation of corneal ulceration due to eyelashes rubbing on the cornea (fluorescein staining is an essential part of diagnosis see Section 9.4. of this chapter). Close examination of the eye will reveal inverted margins of the lower eyelid.

Treatment

Manual eversion of the lower eyelid is often possible and topical antibiotic treatment is recommended for secondary ocular infection, especially in the case of corneal ulceration and conjunctivitis.

Always treat the underlying cause as most cases resolve spontaneously when this is done, e.g. correct hydration status.

If congenital primary entropion is suspected, use a temporary vertical mattress suture to pull out the skin slightly (Brooks 2002). This is easier, less painful and more successful than saline/tetracycline/penicillin injections into the lower eyelids which should not be done.

Eyelid swelling (blepharodema)

Injuries, orbital fractures and bites/stings are common in working equids. The eyelids are very vascular and bleed profusely when injured although this excellent blood supply also helps in the healing process. Eyelids swell quickly in response to allergic reactions or other injury, including systemic illness.

Wounds should only be cleaned with clean water, mild saline solutions or 0.2% saline dilution of povidone iodine (1:50). Use of irritant solutions such as chlorhexidine/cetrimide or surgical spirit will cause severe corneal inflammation and damage. Use only antibiotic creams or ointments designed for ocular use.

Diagnosis

Remember: Always perform a thorough examination of the eye. If the eyelids are too swollen and painful to do this straight away, treat with anti-inflammatory drugs and antibiotics (if required) and reassess at a later stage (Millichamp 1992).

Palpation will reveal warm oedematous eyelids (Figure 9.6.1) and possible orbital fracture, as well as obtaining an accurate history of recent trauma.

Remember in any case of trauma near the eye that there is potential for the globe to be injured due to the prominent position of the equine eye (Brooks and Dan Wolf 1983).

If systemic disease is suspected, such as African Horse Sickness or hypersensitivity, proceed by diagnosing and treating this condition.

Remember that eyelid swelling and conjunctivitis can reflect more serious systemic disease that may be notifiable and contagious e.g. African Horse Sickness.

Treatment

Systemic treatment is effective due to the aforementioned blood supply. NSAIDs and antibiotics are useful, also cold compresses (e.g. cold water inside a latex glove, or soaked cotton pads placed over the area) can help reduce the swelling. In allergic conditions, corticosteroids such as dexamethasone can inhibit the allergic response and reduce swelling.



Figure 9.6.1 Upper eyelid swelling and serous discharge.

Eyelid lacerations

These are very common in working equids as they are prone to trauma in their daily work and tend to rub their heads on protruding objects (Figure 9.6.2). Trauma may be secondary to parasites such as lice. Most lacerations heal quite well due to good blood supply; however, assess and treat them very carefully as scarring can be excessive and lead to an inability to close the eye, which can lead to exposure keratitis and corneal ulceration in the future.

It is important to repair lacerations without delay, removing all dirt and foreign bodies, and ensure restoration of the eyelid margin.

Diagnosis

Standing sedation and local anaesthesia (both motor and sensory nerve blocks, see Section 9.4 of this chapter) are mandatory to see the eyelid margins clearly.

Treatment

- When suturing eyelid defects, alignment of the eyelid margin closest to the globe must be exact. Poor alignment leads to corneal ulcers and pain. Wound debridement should be minimal; never cut off skin flaps, unless there is absolutely no doubt that they are necrotic, as this leads to loss of structure and function (Brooks and Dan Wolf 1983) resulting in corneal ulceration and exposure keratitis.

- The animal must be well sedated and regional/topical anaesthesia should be administered to ensure there is minimal movement and pain during the repair.



Figure 9.6.2 A lower eyelid laceration.

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- Prepare the eyelids using aseptic technique (Section 4.6) as secondary infection is common. Do not use full-eyelid-thickness sutures as this will lead to the suture material rubbing on the cornea, causing ulceration. Start by first aligning the margin of the eyelid closest to the globe to ensure the edges meet exactly which is absolutely critical. Then continue suturing the wound away from the margin edge.
- Use a thin, soft absorbable suture material, such as 4–0, 5–0 or 6–0 catgut or polyglycolic acid (Brooks and Dan Wolf 1983, Millichamp 1992) and cut the ends as close as possible to prevent tags from the knots rubbing on the eyelid. Avoid placing too much tension on the sutures.
- Topical antibiotic eye drops are useful for aftercare but be aware that, if the owner cannot administer these without putting pressure on the injured region, it will be necessary to rely solely on systemic delivery rather than risk wound trauma and infection. Systemic anti-inflammatory drugs should be given for analgesia and to reduce inflammation.
- The area needs to be kept clean, dry and protected by the owner. It may be possible to cover the injured area with a piece of cotton held in place with adhesive tape, although in the field this may be unrealistic. Placing petroleum jelly around the affected area will stop excess discharge/tearing irritating the adjacent skin.
- See surgical texts for more details and diagrams of eyelid repair.

Orbital fracture

The frontal, zygomatic and lacrimal bones are the most commonly injured due to their location (Caron et al. 1986).

Clinical signs

- Oedema, swelling, pain, blepharospasm and subconjunctival haemorrhage may result from head trauma.
- Subcutaneous emphysema may be present if the frontal/maxillary sinuses are damaged.
- Palpable disruption of the bony orbital rim occurs if fracture fragments are displaced.
- Globe position may move.
- Nasal discharge may be present.
- Facial asymmetry may be apparent.
- Crepitus can be produced.

Diagnosis

- Diagnosis is normally straightforward due to the history of trauma.

■ Ensure a complete physical, ocular and neurological examination is performed.

- Assess the PLR of the injured eye; consensual PLR can be used if extensive trauma obscures the pupil.
- Ensure the cornea is stained with fluorescein dye at the first examination, and all subsequent, as damage can be latent. Fully evaluate the eye movement in all directions.

Treatment

- Cold compress, administer analgesics and anti-inflammatory drugs.
- Systemic antibiotics if an open wound is present. Fractures which extend into the paranasal sinuses should be treated as open fractures due to the normal fungal and bacterial flora present in the sinuses.
- Frequent application of artificial tears to lubricate the eye is essential if there is any impairment to the eyelids.
- Monitor for signs of uveitis secondary to blunt trauma and treat immediately and aggressively if present.
- Observe and treat any developing ophthalmic condition.
- Rapid fibrous fracture callous formation occurs around bone fragments/fracture lines. Surgical repair is usually not practical for working equids. However, satisfactory results can be obtained in some cases with symptomatic care and rest.

Conditions affecting the conjunctiva and cornea

Conjunctivitis: Inflammation of the conjunctiva

Conjunctivitis is a non-specific symptom or response of the eye to injury. The conjunctiva includes the bulbar and palpebral conjunctivae: the mucous membrane covering the sclera and posterior eyelids including the nictitating membrane (third eyelid).

Causes

- **Viral** Seen in association with viral upper respiratory disease (equine influenza, herpes and adenovirus), or other systemic viral disease such as Equine Infectious Anaemia and Equine Viral Arteritis (Brooks 2010b)
- **Irritant** Inflammatory reaction to a foreign body, dust, flies or unsuitable application of eye preparations topically
- **Bacterial** Primary bacterial infections *Moraxella*, *Streptococcus*, *Actinobacillus* and *Rhodococcus* spp. (Brooks 2010b), or secondary to viral or irritant conjunctivitis, defined by a mucopurulent (yellow/green) discharge as opposed to the watery, clear discharge of viral and irritant conjunctivitis
- **Foreign bodies** Food or grass seeds in the fornix or under the third eyelid
- **Fungal** Seen with infections caused by *Aspergillus* and *Fusarium* spp.
- **Protozoal** Seen with Equine Protozoal Myeloencephalitis
- **Trauma** Conjunctivitis occurring secondary to trauma
- **Allergic** In response to allergens in the environment
- **Neoplasia** e.g. squamous cell carcinoma, lymphoma and melanoma

■ **Systemic disease** Remember conjunctivitis can be a symptom of systemic disease, e.g. African Horse Sickness and Epizootic Lymphangitis, so always ensure animals are examined for other signs that may indicate this.

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Clinical signs

- Hyperaemic (red) conjunctiva, with or without watery/mucopurulent discharge (Figure 9.6.3)
- The type of discharge can often define the causal agent e.g. serous (viral, allergic, environmental) or purulent (bacterial).
- Associated respiratory signs (especially upper respiratory tract) can indicate viral association, which can also be indicated by other animals in the same area showing signs.
- Animal shows discomfort/irritation e.g. rubbing the eye.
- Chemosis (oedema)



Figure 9.6.3 Mild conjunctivitis (above); note the ocular discharge. Severe conjunctivitis (below) associated with trauma to the eye.

Treatment

- Wash the eye area daily with clean water to remove dirt. If it is severely contaminated, apply topical anaesthetic and flush copiously (Brooks 2010b).
- In severe cases of swelling, or where uveitis is suspected, topical corticosteroids can be used to decrease swelling. However, always use fluorescein first to check there is no corneal ulceration, especially if a foreign body (FB) is the suspected cause.
- Systemic NSAIDs can be used to provide analgesia and reduce swelling, then check for FB or ulcer the next day, and proceed with topical corticosteroids if there is no ulceration.
- Antibiotic eye ointment (e.g. gentamicin or chloramphenicol) every 4–6 hours for 5 days is recommended if bacterial infection is present. Culture and sensitivity testing can allow changes in initial therapy.
- Fungal and viral infections are treated with appropriately selected medication specific for the causal agent.
- Parasitic causes (habronemiasis and onchocerciasis) are debrided and treated topically and systemically.

Prognosis

The prognosis is good, if the cornea is not severely damaged.

Corneal ulceration (ulcerative keratitis)

An ulcer is a disruption to the thin corneal epithelium/stroma which covers the front of the eye.

Consider every ulcer seriously, with the potential to result in blindness, as the equine cornea is easily inflamed and heals slowly with extensive scarring.

Furthermore, an infected ulcer can deteriorate rapidly and form 'melting ulcers' where the globe is degraded by infectious and inflammatory processes. To avoid these complications prompt and aggressive treatment is necessary. Consider all ulcers as an emergency and infected unless proven otherwise.

Causes

- **Trauma** Foreign bodies, dust, entropion, rubbing or hitting an object
- **Infection** Bacterial: Primary (*Pseudomonas*, *Staphylococcus*, *Streptococcus*, *Bacillus* spp.), or secondary due to injury or therapy; fungal (*Aspergillus*, *Fusarium*, *Penicillium*, *Phycomycetes* spp.) (Severin 1998)
- **Metabolic** Altered tear production, various corneal disorders
- **Neurogenic** Affecting normal function of the eyelids

Clinical signs

Pain is pronounced in the acute stages but decreases as scarring occurs.

- **Photophobia** (light is painful to the eye), blepharospasm (spasm of the eyelids so that they are tightly closed) and increased lacrimation
- **Secondary infections and anterior uveitis** are common (differentiate from primary uveitis with fluorescein staining to show the ulcer). Assess carefully for signs of secondary reflex uveitis as this will also require aggressive treatment in conjunction with ulcer treatment.
- **Corneal oedema** is common; it can be localised around the perimeter of the ulcer or can be diffuse across the entire corneal surface.
- **Ocular discharge**
- The ulcer may be visible with the naked eye without staining and will be seen as a depression in the usually smooth cornea.
- **Fluorescein staining** will allow better visualisation of the ulcer (Figure 9.6.4). There is uptake of the fluorescein stain by the exposed corneal stroma. Deep ulcers, which extend to descemet's membrane, retain the stain circumferentially as descemet's membrane itself does not take up stain. This is a very serious presentation as only a thin membrane is left and the cornea is almost perforated.
- Note tear production, eyelid position and function, and look for any causes. Carefully examine the cornea, conjunctiva, sclera, and third eyelid for any other pathology or foreign body.
- As healing begins, new blood vessels develop on the cornea and ultimately the cornea heals with grey/white scar tissue.



Figure 9.6.4 Corneal ulcers stained with fluorescein dye.

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It is crucial to make an accurate note in the clinical records of the ulcer's size, position, depth, amount of corneal oedema and pupil size. This provides a baseline for future examinations and allows monitoring of deterioration or improvement.

Treatment

- Systemic non-steroidal anti-inflammatory drugs are essential to relieve pain and reduce inflammation in the eye, which decreases the likelihood of secondary uveitis (Severin 1998).
- Appropriate topical treatment related to the cause, e.g. if a bacterial cause, apply topical antibiotics e.g. gentamicin drops every 4 hours, or chloramphenicol ointment every 6–8 hours. (See notes on solution versus ointment eye preparations in Section 9.4 of this chapter.) For fungal agents use miconazole 1% parenterally.
- Apply atropine 1% drops (2 drops every 24–48 hours) if available.

Caution: Atropine inhibits gastrointestinal motility, so monitor for colic and use only to effect.

This will treat miosis (pupil constriction) which results from secondary uveitis.

- Fresh serum has anti-collagenase properties and stimulates growth factors for healing.
- Protect the healing ulcer from further trauma; eyelid/nictitating membrane suturing (be aware that the progress of the ulcer cannot be monitored with this technique).

What is a 'melting ulcer'?

Melting ulcers are characterised by the appearance of a white, stringy ocular discharge due to the breakdown of corneal tissue by autolytic enzymes; the eye is in danger of rupture. This type of ulcer may not be positive to a fluorescein test as the ulceration is so deep in the cornea that descemet's membrane is exposed and this does not take up stain.

Note: 'Melting ulcers' carry a guarded prognosis; the globe may perforate due to an untreated corneal ulcer. The eye cannot then be saved.

Treatment

- Analgesia – systemic anti-inflammatory drugs/analgesics – NSAIDs
- Anti-collagenase therapy is essential – serum (blood collected and left to separate) or EDTA 2% (see ocular therapeutics) should be applied to the eye for at least 48 hours. This is known as 'anti-collagenase therapy' and helps to decrease the production of autolytic enzymes by bacteria and fungi which result in rapid corneal destruction.
- Antimicrobial treatment frequently, e.g. every 2 hours (depending on the preparation) to maintain an effective concentration of the drug in the eye
- Leave 15 minutes between the application of each medication to the eye – to avoid dilution, wash out, or drug reactions (Matthews 1999).
- Mydriatics – atropine 1%
- Owners must be made aware that without this aggressive treatment the globe will rupture, and even with treatment the prognosis is guarded.

Corticosteroids by any route are contra-indicated in the treatment of corneal ulcers as they increase the chance of an ulcer developing into a 'melting ulcer'.

If the cornea is ulcerated, re-examine the eye as often as possible to monitor progress. Ideally, do so daily and stain with fluorescein (and Rose Bengal if available – see Section 9.4 of this chapter), and encourage the owner to continue with intensive treatment. Make an eye bandage to protect ulcerated eyes from light and further damage.

Prognosis Depends on how early the condition is identified and treated. However, in neglected cases, extensive scarring usually results in vision loss.

Intraocular conditions (affecting the iris, ciliary body, choroid, and the aqueous/vitreous humour)

Equine Recurrent Uveitis (ERU, 'moon blindness', 'periodic ophthalmia')

Uveitis is a common cause of blindness.

Uveitis is inflammation of the uveal tract: the iris, ciliary body and choroid layer of the eye, i.e. inflammation originating from the inside of the eye. It can be unilateral or bilateral; taking note of this may help differentiate the initial cause. There are many different causes that are aggravated by specific ocular immune responses. In working equids uveitis most likely occurs as a result of chronic irritation from dust/fly/bacteria or viral respiratory disease. Leptospirosis is an important cause of 'moon blindness'. Uveitis may also occur secondary to *Onchocerca* infestations (Attenburrow et al. 1983).

As with corneal ulceration, uveitis is serious and needs immediate, intensive treatment to prevent blindness.

If uveitis is not treated aggressively it can initiate immune changes within the eye which can lead to recurrent uveitis (where there are repeated episodes of uveitis that ultimately result in permanent damage, cataract formation and blindness).

Consider uveitis in any case of acute ocular pain (Matthews 1999).

Clinical signs of active uveitis

- Intense ocular pain
- Blepharospasm – Sedation, topical anaesthesia, and/or an auriculopalpebral nerve block to stop the blepharospasm may be needed to allow proper examination of the eye.
- Reddened conjunctiva (conjunctival hyperaemia)
- Aqueous flare (hypopyon) – Inflammatory debris (proteins and cells) in the aqueous humour causes a characteristic flare when examined (Figure 9.6.5). It is usually subtle and best examined in a darkened area.
- Miosis (pupil constriction) – If only one eye is affected, when the animal is placed in a darkened environment there will be a marked asymmetry in pupil sizes (anisocoria) with the affected pupil being much smaller.

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- Photophobia – eye pain in response to light (examine in a darkened area)
- Corneal oedema starting at the edge and spreading towards the centre (Figure 9.6.6)
- Thickening/swelling of the iris and hypopyon (pus in the anterior chamber) possible
- Enlarged scleral blood vessels
- Lacrimation (Matthews 1999)

Clinical signs of chronic uveitis

- Corneal changes: diffuse oedema
- Fibrovascular in-growth from the limbus – which can be focal or diffuse
- Synechiae (iris stuck to the lens) (see Figure 9.6.7)
- Distorted pupil shape
- Cataracts with/without lens luxation
- Generalised corneal oedema
- Globe atrophy (Matthews 1999)

Treatment

- Analgesia – Systemic NSAIDs daily, e.g. phenylbutazone or flunixin meglumine. These also give an anti-inflammatory effect.
- Anti-inflammatory drugs – If no corneal ulceration is present (negative fluorescein test), use topical corticosteroid drops, ideally prednisolone acetate 1% frequently according to the formulation (solutions hourly, suspensions every 3–4 hours), or 0.1% dexamethasone (Matthews 1999). If ulceration is present, use topical NSAIDs if available.
- Atropine drops 1–4% administered hourly until pupil dilation is achieved, then as frequently as needed to maintain mydriasis; this is to prevent synechiae formation (Matthews 1999). They can be used alternating every 3 hours with pilocarpine drops (which constrict the pupil) if synechiae are present; the constant dilation/constriction of the pupil will result in the breakdown of adhesions.



Figure 9.6.5 Aqueous flare seen in the eye of a working equid with uveitis.



Figure 9.6.6 Marked corneal oedema and corneal vascularisation.



Figure 9.6.7 An eye with chronic uveitis. Note the iris synechia.

Note: Atropine reduces GI motility and can result in colic, so the minimum effective dose should be given and the animal monitored for signs of colic.

When the pupil is dilated the animal should be kept in a darkened environment as there will be no protection for the retina against bright light.

- Subconjunctival injections of medications such as steroids can be administered under the bulbar conjunctiva (not palpebral); this should only be done if the cornea is healthy and there is absolutely no risk of corneal ulceration. They carry a risk of introducing infection, irritation and pain so caution is advised; good restraint or sedation is required to avoid inadvertent trauma to the globe. They do not substitute topical steroid medication but supplement it. Antibiotics should not be delivered by this route as effective concentrations are not delivered to the eye.
- Good eye care – Clean any discharge regularly, apply petroleum jelly below the eye to prevent staining, keep the animal in a dark environment and feed from the ground.

Prognosis

Fair, if acute condition diagnosed and treated early and aggressively. Poor, when chronic signs are present or uveitis is recurring.

Glaucoma

Glaucoma is associated with elevated intra-ocular pressure (IOP) and is often secondary to recurrent uveitis. Most cases are chronic and insidious in onset. Early signs of glaucoma are subtle and often missed. Although rarely reported in horses, it is a cause of blindness (Pickett and Ryan 1993).

Clinical signs

- Ocular pain is rare.
- Hydrophthalmos (an enlarged globe) is present (differentiate from exophthalmos using IOP – see Section 9.4 of this chapter).
- Dilated, fixed pupil and visual defects/blindness can be suggestive but sight is variable in the horse (Brooks 2002).
- Lacrimation, photophobia, blepharospasm are variably present.
- Corneal changes – oedema can occur: ranging from mild to severe and diffuse.
- Linear white lines/bands of oedema called striae can be seen (Figure 9.6.8).

Diagnosis

Very difficult without a tonometer (to measure IOP). However, glaucoma is suspected with a history of uveitis/vision loss. Use simultaneous digital palpation of the globes, through the eyelids, to detect differences in intra-ocular pressure. Fundic examination with an ophthalmoscope may show changes in the colour/size/shape of the optic nerve in later stages.

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Treatment

Options are limited in the field situation:

- Miotics can help but have been known to exacerbate uveitis (Brooks 2002).
- The best thing to do is try to decrease the pressure using systemic NSAIDs and topical treatment of either NSAIDs, if available, or corticosteroids, as long as a fluorescein test is negative.
- If available, use ophthalmic beta-adrenergic antagonists such as timolol maleate (0.5%) every 12 hours and a carbonic anhydrase inhibitor (that reduces the production of aqueous humour, hence lowering IOP) such as dorzolamide every 8–12 hours (Brooks 2002). These medications work to reduce the volume of aqueous humour present in the globe, thus reducing IOP.

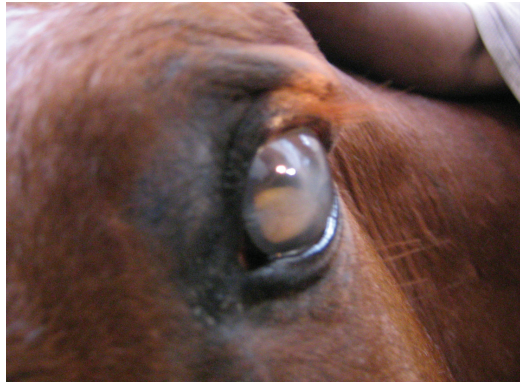


Figure 9.6.8 Glaucoma – corneal striae evident in this image, see the linear corneal oedema. The lens has luxated and is in the rostro-ventral portion of the globe.

Prognosis

Generally poor in the field situation; the disease is difficult to manage, usually leading to blindness.

Disease of the lens

Cataracts

'Cataract' means increased density or opacity of the lens reducing the transmission of light to the retina. Cataracts can be focal or diffuse, unilateral or bilateral, congenital or acquired.

Causes

- Congenital/developmental result from disrupted evolution/development of the lens in-utero and in development/growth after birth.
- Acquired/secondary result from ocular insult (trauma) or disease; this includes ocular (ERU) and systemic disease, in addition to well documented external factors such as UV light, ionising radiation and toxin ingestion.
- Senile cataracts are seen in aged horses (> 20 years old) (Brooks 2002).

Clinical signs

- Lens opacity is observed as greyness or 'bubbles'/'cracks' in the lens. Progresses to white or grey density which prevents light being reflected from the retina, so structures behind the lens cannot be seen (Figure 9.6.9).
- Normal PLR unless associated with adhesions between iris and lens
- Progressive loss of vision leading to total blindness in diffuse disease
- Small focal cataracts which are out of the field of vision may not cause any visual impairment – however, these are usually not visible to the naked eye.

Treatment

- Treat associated/underlying conditions (uveitis, pain etc.) if present. However, once a cataract has formed it is irreversible with medical treatment.
- Surgery, the only curative treatment, requires an ophthalmologist and specialist equipment thus is not suitable in field conditions.

In cases of extensive bilateral cataract formation with poor vision the safety of both the animal and the owner must be considered in the management plan.

For more information refer to the article by Matthews (2004) on the lens and cataracts.

Lens luxation

This is usually secondary to uveitis, trauma, cataracts or glaucoma (Brooks 2002) and treatment involves correction of the underlying disease process; it can be congenital. Lens removal is not usually attempted in equids (compared to other species where spontaneous luxation can occur) as damage to the rest of the eye is usually so pronounced that the vision will never return to normal. Diagnosis is difficult as there is usually a lot of inflammation. Uveitis is commonly seen.

Figure 9.6.8 shows a horse with lens luxation – the lens can be seen in an abnormal location in the rostro-ventral globe in this image. This eye also shows corneal striae, the ‘lines’ of corneal oedema.

Diseases of the retina and optic nerve

Definitive diagnosis of these conditions is impossible without an ophthalmoscope. Make an informed decision by linking the history with clinical signs and thinking about the anatomy. This is important in terms of prognosis. If there is access to an ophthalmoscope diagnosis of abnormalities becomes easier once plenty of normal animals have been examined.

Any presentation of a blind/poorly sighted animal with a normal looking anterior eye on visual/pen-torch examination should have retinal/optic disc disease as a differential diagnosis.

Retinal disease

Retinal disease can occur for a number of reasons. However, in working equids it is most likely to be associated with inflammatory episodes, for example acquired retinal detachment secondary to chronic uveitis. Conditions seen may be retinopathies such as chorioretinitis, or retinal detachment (Brooks 2002). Retinal detachment may be uni- or bilateral, partial or complete, and may be subsequent to ERU, trauma or tumours.



Figure 9.6.9 This horse had very little vision in this eye and the other eye was equally affected.

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Clinical signs

- The visible portion of the eye can appear normal although, if retinal detachment has occurred, there is evidence of inflammation (oedema, uveitis) in the anterior segment.
- Blindness (may be acute with retinal detachment), poor night vision
- Dilated pupils or poor/slow PLR
- Poor performance on vision tests
- Fundic examination may show poorly pigmented non-tapetum, decreased size of blood vessels or avascularity around the optic disc and a hyporeflexive tapetum. (Looking at many normal animals will help diagnosis of abnormal cases.)

Treatment

Systemic NSAIDs, e.g. phenylbutazone or flunixin meglumine in cases of chorioretinitis

Remember: Any topical treatment will not reach the back of the eye (the retina).

Treatment is limited and, in the majority of retinal pathological processes, the prognosis is poor.

Optic nerve disease

Damage to the optic nerve can be unilateral or bilateral, and should be considered with all cases of blindness presenting with fixed, dilated pupil(s). The history will also help determine possible optic nerve damage.

Causes

- Head trauma (rearing over backwards, accidents)
- Profuse bleed somewhere else in the body (e.g. haemorrhage after castration)
- Systemic inflammatory disease such as septicaemia
- Guttural pouch disease affecting carotid arteries such as mycosis
- Sequelae to sphenopalatine sinus infections (Barnett et al. 2008)
- Neoplasia

Why do the above causes, especially profuse haemorrhage for any reason, lead to blindness?
The answer is hypoxia.

Diagnosis

- History of trauma, surgery or haemorrhage and presenting signs – e.g. sudden-onset blindness
- Slow or absent PLR (Brooks 2002, Barnett et al. 2008)
- Dilated pupils unresponsive to light
- Ophthalmoscopy may show changes to the optic disc, e.g. oedema, or decreased blood supply/avascularity of the optic disc.

Treatment

- If trauma is suspected: High doses of systemic corticosteroids (10-20 mg dexamethasone IV or IM daily) should be used for a strong, fast onset anti-inflammatory response.
- Attempt corticosteroid use even if injury happened a few days ago, however treatment is even less likely to work in this case.
- Treat underlying causes (e.g. sinusitis).

The prognosis for return of vision is usually poor with damage to the retina or optic nerve due to the irreversible nature of most changes.

Parasitic conditions affecting the eyes of working equids

Habronemiasis

See Section 17.5 for more information on habronemiasis.

Habronema infection commonly involves the conjunctiva, eyelids (including the third eyelid) and nasolacrimal system (Rebhun 1996), as well as the skin of the ventrum, genitalia and legs (Down et al. 2009, Paterson 2009).

Owner communication is important in the control of this disease, because the flies that transmit the infected larvae (house and stable flies – *Musca domestica* and *Stomoxys calcitrans*) are attracted to the ocular discharge, dust etc. around the eyes.

Habronemiasis is a common result of neglecting to clean the eyes daily which can have serious welfare consequences including blindness. It can be easily avoided through owner education.

Cause

Intense granulomatous reaction to the larvae of the nematodes *Habronema muscae*, *H. majus* and *Draschia megastoma* that migrate into the conjunctiva and nasolacrimal system

Clinical signs

- Ulcerated nodules around the area of the medial canthus/third eyelid
- Often with secondary corneal abrasions – use fluorescein dye to check.
- Eyelids – granulomatous or ulcerative lesions (Rebhun 1996)
- Nodules are often seen extending down over the nasolacrimal duct (Figure 9.6.10), so examine carefully.
- Diagnose by demonstrating larvae in the exudate.
- Lesions may coincide with peak fly season.

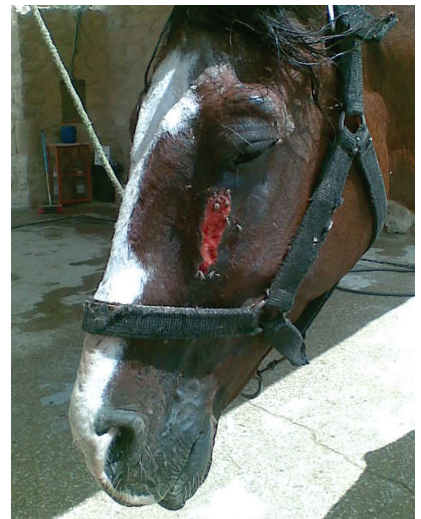


Figure 9.6.10 A horse showing signs of ocular habronemiasis with a lesion extending down over the face below the left medial canthus.

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Treatment

- Systemic ivermectin (0.2 mg/kg, orally). Remember larvae die gradually and further signs of disease may continue to be seen after treatment.
- Control of flies to prevent re-infection
- Debridement of calcareous plaques and nodules (Rebhun 1996)
- Topical antibiotics for secondary infection if required
- Topical or systemic corticosteroid anti-inflammatory drugs (if no corneal abrasions or ulceration are present)
- Nasolacrimal lavage with sterile saline to remove larvae and debris (Figure 9.6.11)

Prevention

Wound management and fly control are essential to prevent the deposition of infected larvae by flies when feeding on the exudate from open wounds (Pusterla et al. 2003).

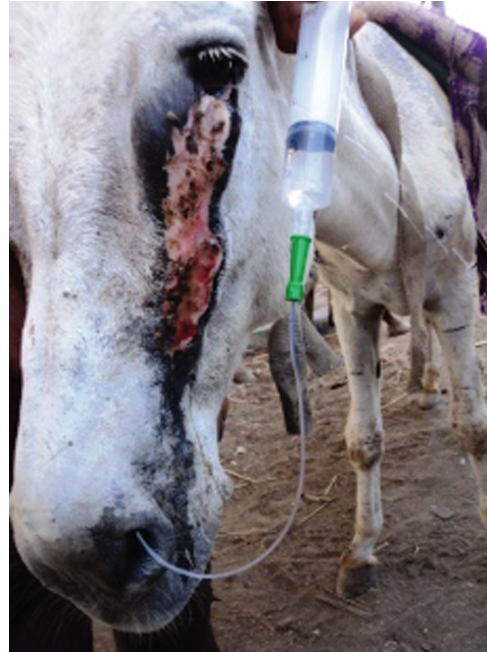


Figure 9.6.11 Habronemiasis with lesions overlying the nasolacrimal duct; the duct has been catheterised for flushing from the nasal puncta.

Prognosis

Good if the cornea is not severely damaged and re-infestation is prevented; healing of corneal lesions is reported at between 5 and 18 days (Pusterla et al. 2003).

Onchocerciasis

See also Section 17.5.

Cause

Microfilariae of the nematode *Onchocerca cervicalis* are spread between animals by the female biting midges *Culicoides* spp. (Moore et al. 1983). The adults tend to collect in the ligamentum nuchae, whilst microfilariae reside in the dermis (Marques and Scroferneker 2004). Ocular onchocerciasis is the result of aberrant migration and invasion of the eye (Attenburrow et al. 1983); it is seen in approximately 50% of cases with cutaneous onchocerciasis (Moore et al. 1983).

Clinical signs

- Conjunctival and corneal hyperaemia and chemosis (inflammation – keratitis) leading to uveitis (Attenburrow et al. 1983)
- May get loss of pigment and inflammation at the junction between the cornea and bulbar conjunctiva – depigmentation of the lateral limbus
- Small nodules and corneal opacities on the cornea

- Photophobia
- Epiphora (Moore et al. 1983)
- Can result in retinal inflammation and lead to blindness
- Severe cases develop corneal opacity.
- Microfilariae are rarely identified. (Conversely microfilariae have been identified in clinically normal horses: Moore et al. 1983.)

Diagnosis – from ocular lesions, and possibly identification of microfilariae

Treatment

- This depends on the stage of disease (acute or chronic) and the presenting ocular signs. After ensuring that there is no corneal ulceration (fluorescein test), administer topical corticosteroids and systemic NSAIDs – for anti-inflammatory and analgesic effects. Start this treatment 2 days prior to parasiticide treatment (e.g. ivermectin) and continue for a few days after it to minimise the inflammatory process sparked by the killed parasites.
- Dead microfilariae stimulate greater immune reaction and damage than live ones, hence use NSAIDs before and during anthelmintic treatment.
- Systemic ivermectin (0.2–0.5 mg/kg PO or SC) 2–3 days after NSAIDs are started

Prevention

Educate owners as to the importance of midge control to reduce infection rates and transmission.

This may include stabling during the peak biting times (just before sunset) and insecticide treated shelters (Moore et al. 1983).

Prognosis

Good for conjunctivitis. Corneal lesions and uveitis may be chronic or recurrent.

Thalaziasis

Cause

The eye worm (*Thelazia* spp.) is common in horses and cattle. *Thelazia lacrymalis* is commonly found in equids.

Life cycle and transmission

- The face fly (*Musca autumnalis*) is a vector for *Thelazia* spp. (Moore et al. 1983). It feeds on lacrimal secretions on the host's face. Infective larvae pass from the fly to the host during feeding and commonly invade superficial structures such as the cornea, conjunctival sac and bulbar aspect of the third eyelid, or more deeply into the conjunctiva, lacrimal gland and duct (Moore et al. 1983).

Clinical signs

- May be asymptomatic

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- Epiphora, photophobia, and blepharospasm
- Conjunctivitis – The larvae cause local irritation and inflammation, resulting in mild to severe conjunctivitis.
- Keratitis (Moore et al. 1983)
- Uveitis/corneal ulceration – The conjunctivitis can lead to more severe conditions such as uveitis and ulceration.
- Inflammation and potential obstruction of the lacrimal duct

Diagnosis

- Identification of the adult worm on the cornea or in the conjunctival sacs

Treatment

- The larvae can be mechanically removed from the surface of the eye: after applying topical local anaesthetic, tweezers can be used to carefully remove the larvae.
- Flushing of the nasolacrimal duct and conjunctival fornices may remove some parasites (Moore et al. 1983).
- Concurrent use of topical antibiotics, and systemic or topical NSAIDs. If no corneal ulceration is present topical steroids can also be useful to minimise inflammation.
- Ivermectin is largely ineffective. Fenbendazole at a dose rate of 7.5–10 mg/kg given daily for 5 days has been effective in killing adult worms (Wescott 1987).

Prevention

- Fly control

Setaria (intraocular filariasis)

Setaria spp. are commonly found in the peritoneal cavity of equids where they are non-pathogenic and do no harm. Occasionally aberrant migration occurs and larvae migrate into the anterior chamber resulting in marked ocular pathology. The infective microfilariae are transmitted by blood-sucking insects such as mosquitoes (Moore et al. 1983).

Clinical signs

- Larvae may be visible wriggling around the anterior chamber (Figure 9.6.12).
- Ocular pain, epiphora, photophobia, miosis, hypopyon, aqueous flare and corneal oedema
- Signs of intra-ocular irritation (uveitis) which can lead to corneal opacity and blindness



Figure 9.6.12 Aberrant migration of *Setaria* spp.; worm visible in the anterior chamber.

Treatment

- Systemic ivermectin is reported as over 80% effective in treatment at a dose rate of 0.2–0.5 mg/kg, although medical treatment will not remove dead intraocular parasites.
- Anti-inflammatory treatment – systemic and topical
- Treatment of concurrent ocular disease, e.g. uveitis
- Surgical removal can be curative but involves making an incision and removing the parasite from the aqueous humour. See details below and refer to the paper by Marzok and Desouky (2009) for more details.
- *S. equina* and *S. digitata* have been identified in equid eyes (Marzok and Desouky 2009, Moore et al. 1983, Shukla et al. 2010).

Surgical removal

It is absolutely essential to provide antibiotic cover topically after the procedure (e.g. gentamicin eye drops). This should not be an ointment as a full-thickness corneal lesion will result from the procedure. Systemic and (topical) NSAIDs are also essential (e.g. phenylbutazone or flunixin meglumine systemically, and diclofenac sodium eye drops) to minimise inflammation, uveitis, and provide pain relief. The procedure must be carried out aseptically to avoid secondary bacterial infection.

- Sedate the animal (e.g. xylazine and butorphanol), perform local nerve blocks (auriculopalpebral and retrobulbar) and apply topical corneal anaesthesia (lignocaine hydrochloride).
- With good restraint and a sterile scalpel, make a small sharp nick (3 mm) on the cornea at the dorsolateral-corneoscleral junction of the affected eye (at the 1 o'clock position: Shukla et al. 2010). This will open the anterior chamber and the worm will come out along with forceful oozing of aqueous humour from the eye. Lavage the anterior chamber with sterile saline to flush out stubborn larvae.
- Replace humour with sterile isotonic solution, if required. However, it should refill the anterior chamber within hours.
- Ensure good topical antibiotic cover is provided and analgesics to minimise pain (see above).
- Recovery takes 1–2 weeks after the procedure and careful monitoring is needed for this time to ensure that any complications are identified without delay.
- 10% formalin can be used to preserve worms for transport to a laboratory for morphological identification.

Prevention

- **Mosquito control** Fly repellents, fly masks/fringes/rugs, keeping equids away from standing water, stabling equids at dawn and dusk
- Proximity to other animals that attract flies, such as water buffalo, may also be a risk factor (Shukla et al. 2010).

Miscellaneous conditions which can present as eye problems

Tumours

The most common ocular tumour seen in equids are squamous cell carcinomas (SCC) see Figure 9.6.13 (Kaps et al. 2005). The next most common are sarcoids (Dugan 1992), followed by small numbers of melanomas, papillomas, and schwannomas/neurofibromas (nerve sheath tumours) (Dugan 1992, Moore et al. 2000).

Differential diagnosis

May include habronemiasis (see earlier). Intraocular melanomas are reported in grey-coloured adult horses (Moore et al. 2000) with an average reported age of 9 years. SCC are reported as more common in horses with non-pigmented eyes (e.g. Albinos) with an average age of 8–10 years (King et al. 1991).

Diagnosis

This can be by fine-needle aspirate or excisional biopsy which treats (by removal) and diagnoses at the same time (Dugan 1992).

Treatment

This will depend on the size, location, nature of the tumour, available treatment and patient considerations of working equids and their owners. Reported treatments are: surgical removal, cryotherapy, hyperthermia, irradiation, chemotherapy, immunotherapy, radiotherapy, laser treatment, and enucleation (Dugan 1992). In severe, invasive cases and moderate cases with poor prognosis, enucleation may be considered in working equids.

Recurrence

This may be around 50% after surgical excision (Schwink 1987).

Prognosis

This will depend on the size, location, presence of metastases (check regional lymph nodes and salivary glands) and rate of recurrence after therapy.

See Section 15.3 for more information on tumours of the equine skin.

Lacrimal histoplasmosis

- Caused by the fungus *Histoplasma farciminosum* and reported as more common in donkeys. It is described in more detail in Section 15.3 under Epizootic Lymphangitis (with photographs).
- Clinical signs of the ocular form of the disease are conjunctivitis, signs of eye pain, blepharospasm, ocular discharge, and inflammation extending to the eyelids and around



Figure 9.6.13 An ocular squamous cell carcinoma in a working equid.

the tear duct (Heragy 2002, Powell et al. 2006). Secondary bacterial infection leads to a purulent unilateral nasal discharge from the affected nostril, and a characteristic area of dermatitis from the canthus of the eye spreading towards the nostrils which must be differentiated from habronemiasis (see above).

- **Treatment** Local and systemic anti-fungal drugs, antibiotics if secondary bacterial infection, flushing nasolacrimal ducts; surgical excision may be considered (Heragy 2002).

Tooth root abscess

A large bony swelling below the eye may be a tooth root abscess, as the roots of the maxillary cheek teeth are embedded in the maxillary sinus. Check the cheek teeth for cracks, poor alignment or a foul smell (see Chapter 10).

Trauma

Blunt trauma to the face can cause a bone fracture or chip (sequestrum). Small infected sequestrae may be surgically removed under standing sedation and local anaesthetic (Chapter 7).

Case study – Ophthalmic habronemiasis

9.7

Location Jordan

Attending veterinarian Dr Murad Farajat

History

A 7-year-old bay local-breed stallion presented with a history of extended exudative nodules over the nasolacrimal duct. The horse first presented with a skin lesion around the medial canthus of the left eye. This lesion was first noticed by the owner 3 weeks previously; he had done nothing until it became worse when he decided to bring the horse to the veterinary clinic. The horse was last de-wormed one year previously. The owner had no other horses.

Clinical findings

The horse was showing signs of pain including blepharospasm, reluctance to allow examination, discomfort and rubbing. An ulcerative lesion, present around the medial canthus of the left eye, extended down over the nasolacrimal duct. The lesion had bloody and slightly purulent discharge, no corneal ulceration was present; flies were attracted to the discharge (see Figure 9.7.1). A thorough ocular examination was performed in good light, then, using a pen torch, in a dark place. Pupillary light reflex (PLR), a fluorescein test, menace response and vision testing were completed. The diagnostic procedures were performed with standing sedation: butorphanol tartrate IV and romifidine hydrochloride IV. The PLR was present and normal which indicated that there was no problem with the oculomotor nerve nor within the brain itself. The horse responded normally to the menace response. The fluorescein test was negative indicating no ulcer.

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Diagnosis

The diagnosis of ocular habronemiasis was made on the basis of history, clinical signs and location of the lesion.

Treatment

Treatment aimed to decrease the lesion size, reduce inflammation, reduce pain, and prevent recurrence. The treatment was performed initially by using systemic ivermectin orally, primarily to kill adult nematodes in the stomach. Further treatment included topical antibiotic for secondary infection, and nasolacrimal lavage by nasolacrimal catheter flushing daily with sterile saline to remove larvae and debris (Figure 9.7.2). Topical ivermectin (systemic ivermectin paste used as topical ointment) was applied to the extended skin nodules, flunixin meglumine was given as pain relief/anti-inflammatory administered daily IV, as were diclofenac sodium eye drops to reduce eye pain every 6 hours and gentamicin eye drops every 6 hours. Other therapies included debridement of the wound, wound dressing and application of fly repellent daily.

Outcome

In general, the prognosis was good and, after 7 days of treatment, the lesion around the medial canthus of the eye showed progressive healing and the horse was responding well to treatment and follow-up. After 4 weeks the extended lesion was healed. Follow-up was carried out at the owner's home. The eye was washed daily by the owner with a clean, wet cloth to remove the dust and dirt that can cause further complications; this was also an opportunity for the owner to look at the eye carefully. The use of fly repellents and eye fringes, as well as appropriate de-worming, was recommended to reduce the incidence of habronemiasis. Proper removal and disposal of manure is essential for the reduction of incidence and prevention of recurrence of habronemiasis as manure provides a suitable environment for the intermediate host, maggots of the flies *Musca* and *Stomoxys*, to develop (Watson and Friedman 2007).

Discussion

In this report, a case of ophthalmic habronemiasis has been described. Many of the previous findings and treatments for habronemiasis that have been reported suggest that the probability is high for habronemiasis lesions to be resolved spontaneously following the end of fly season. Lesions usually appear during hot and warm weather, probably related to high fly activity, and regress in wintertime (Higgins and Snyder 2005). The disease is sporadic. Some lesions may become chronic



Figure 9.7.1 Cutaneous lesion of habronemiasis overlying the nasolacrimal duct.



Figure 9.7.2 Tubing inserted into the nasolacrimal duct (at the nasal end) for flushing.

and will not heal easily, and persistent ocular irritation may be seen even during the seasons without flies. Some reports recommended surgical intervention initially (Down et al. 2009). However, this case responded well to intensive medical care and surgical intervention should be reserved for cases where it is needed later.

The use of topical ivermectin using oral or topical ivermectin in the form of an aqueous cream base has been reported as being effective. Also an ophthalmic form of oral ivermectin made of 50% injectable ivermectin with artificial tears has been reported by Pascoe and Knottenbelt (1999).

In this case, diagnosis was based on history, clinical signs and location of lesions. Some other reports recommend that histopathological examination of biopsies is currently the method of choice for confirming the diagnosis (Rebhun 1996). Many treatments for ophthalmic habronemiasis have been reported. All the reports state that ivermectin was used to kill the larvae and adult worms in the stomach (Pusterla et al. 2003). In our report, ivermectin was used topically in combination with systemic ivermectin. Surgical intervention has been described for some cases in other reports, mainly for the condition related to persistence of degenerated larvae in the lesion.

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9.8

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