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Effective examination of the equine eye is a critical issue for the general practitioner because of the special requirements for safety and welfare of the horse. A riding horse for example should not have any significant visual impairment if the rider is to remain safe. At the same time the horse possibly exhibits the widest variations in the normal clinical appearance of the eye of all the species. Whilst overt pathology is usually very easy to identify because of the ease of examination of the large equine eye, possibly the biggest difficulties faced by a clinician will be determining the significance of the more subtle variations that occur in normal eyes and the milder changes that result in significant pathology. Additionally many ophthalmic conditions are to all intense and purposes untreatable and so whilst a diagnosis may be achieved, the options for therapy are rather more limited. It is certainly true that many horses perform perfectly well with significant eye disease – not only do they adapt very well to progressive changes but the kind of work that they are required to perform, may mean that the visual efficiency is not vitally important. For example there are some dressage horses that are virtually blind. They can survive well in a protective environment and rely heavily on the rider information – in effect the rider is acting as a guide-animal for the horse.

Figure 1: A normal eye. Note the pigment variation. This could be viewed as a normal variant if we assumed that a normal eye had to be single pigmented.

In spite of the difficulties a practitioner is required by ethic to protect humans from the threat of injury or worse by giving proper sensible guidance about the horse’s vision. It would be very easy to simply state that all horses with any visual / ocular abnormality should under no circumstances be ridden. This would result in a high proportion of horses being condemned out of hand and quite unnecessarily. However, if a practitioner considered that an individual animal had insignificant pathology and enough vision to cope with the demands placed upon it, and the horse then fell, there might be some justifiable criticism. Of course the horse may have fallen for other reasons but because of the perceived importance of vision, the eye could be blamed. In that circumstance the veterinarian needs to protect him/herself from other opinions that could result in litigation.

Recognizing an abnormality is therefore not the only issue. It’s the interpretation of the changes that become the main objective. There are several options:

a) A normal eye free of any pathology or non-pathological variations. Whilst it is easy to expect that most horses will have normal eyes, in fact, most have some detectable variations and the truly “normal” eye as defined by a classical description is probably not very common.

b) An eye with normal variations but with no significance at all to the horse or its vision. This category is possibly the commonest of the findings. Variations can occur in any of the ocular structures. Furthermore there are variations that are breed related with some horses having noticeably different anatomy and sizes of the eye. For example many
horses have a degree of microcornea – they show the white of the eye, but are still completely normal visually. Similarly persistence of papillary membranes, slight lenticular opacities relating to the remnants of the hyaloid artery and variations in the pigmentation of the fundus are common.

c) An eye with pathological changes. This category also has some options:
   a. Pathology with no significance. An example might be an old corneal scar. This category of course has to be very carefully used because many different conditions present with a similar clinical appearance and some of those might be of significance to the horse and its owner.
   b. Pathology with certain significance (whether to vision or to any other function of the eye). For example where obvious lens opacity (cataract) is seen the clinician can immediately establish that there is pathology of significance. Of course the extent of the pathology might in many cases such as lenticular opacities, be proportional to the overt severity of the disease but in some cases even minor pathology may be of great importance. For example evidence of iris adhesions (posterior synechiae) is always significant because of the high prevalence of the various forms of uveitis that occur in the horse.

![Figure 2. Pathology of certain significance. In this case the infiltrative and proliferative intra-epithelial carcinoma is obvious. This lesion would be expected to deteriorate and there may be systemic implications.](image)

c. Pathology of equivocal significance. Unfortunately it is impossible to estimate the visual acuity of the horse. Most horses adapt very well to progressive visual losses and so the practitioner might well be presented with a horse that has advanced pathology that has been performing perfectly well up to that point (and indeed might continue to do so!). In other cases localized areas of retinal pathology may be detected and it becomes a major challenge to provide sensible guidance on the safety and welfare of the horse. Variations it may be very difficult. However, there is no such thing as a non-emergency painful eye and there is no such thing as a ‘cold’ in the eye. The importance of the eye cannot be overstated and as a result the practitioner will always be clear and unequivocal in his / her statements about the safety of the horse with respect to the rider, and the prognosis for the eye.

There are several basic aspects that the practitioner needs to understand.

i. EMBRYOLOGICAL DEVELOPMENT: It is probably impossible to examine the eye properly without the basic knowledge of the anatomy and embryological development of the eye. Knowledge of the embryological development of the eye is critical because there are many normal variations that occur which arise directly from minor or even major embryological variations.

ii. ANATOMY: The anatomy of the eye is well described classically in most textbooks but as stated above a truly 'normal' eye is in fact less common that it might be! It is probably impossible to repair an upper eyelid laceration without good anatomical
knowledge of the muscles and nerves that are involved in the injury. Such an injury may be repaired in a crude way and in many cases nature corrects the inadequacies of the surgeon quite well. However, given the importance of the upper lid to the blink response and to the health of the cornea, careful reconstruction gives the horse the best possible chance of returning to a truly normal state. Similarly, repair of the cornea requires detailed knowledge of its construction so that sutures can be placed correctly.

iii. PHYSIOLOGY AND FUNCTION: The eye of the horse probably has no significant physiological differences from other species but is undoubtedly more liable to certain inflammatory changes. These often relate to the especial immunological privileges of the internal ocular structures. The eye can in many cases be viewed as an isolated entity with its own immunological and functional systems. Circulation of the aqueous for example is quite unique in horses with aqueous drainage through an unconventional route. This has significance because although glaucoma in horses is rare when it occurs there is invariably severe ocular pathology. However, and somewhat surprisingly, the horse can tolerate elevations of intraocular pressure better than many other species and so whilst late presentation may occur, the options for therapy are still available in many cases.

Before embarking on any ophthalmic examination the fractioned MUST have a suitable set of equipment. Equipment need not however, be sophisticated. A good ophthalmoscope with a Finhoff transilluminator and a quality pen torch are probably all that is needed. In addition disposables such as saline, swabs, Fluorescein and Rose Bengal stains and local anesthetic solutions (both for direct topical application and for regional nerve blocks) and sedatives are required. It is helpful in many cases to induce mydriasis and, in diagnostic as opposed to therapeutic circumstances this should always be done with tropicamide rather than atropine. Topical antibiotic solutions and creams should be carried at all times.

Thereafter the horse must be suitably restrained and must in fact be amenable to examination. It is impossible to give any sensible advice regarding eye disease or injury without being able to carry out a proper and thorough clinical examination. It is important to remember that there are some systemic diseases with ocular signs and some ophthalmic diseases that have systemic signs and so a full clinical assessment must be performed.

Because of the significance of even minor changes in the eye clinical examination MUST be detailed and very logical. Clinicians will inevitably establish a protocol that works for them individually but the critical issue is that all the structures must be specifically and completely examined as far as is possible. The value of the specific ophthalmic examination goes beyond ophthalmic disease. For example ataxic or weak horses may have Equine Motor Neuron Disease and in this circumstance retinal pathology may be visible. It is important to remember of course that many injured or inflamed / diseased eyes are very 'fragile' and liable to irretrievable further injury. Strenuous handling during attempts to examine a painful eye is dangerous and counterproductive. In these circumstances regional nerve blocks (motor and sensory) and sedation can be extremely helpful.

Ocular emergencies are common in horses although there is a general lack of awareness amongst owners (and regrettably amongst some veterinary surgeons as well) of what actually constitutes an ocular emergency! As a general rule all ophthalmic pain should be viewed as an emergency because many causes have a profound effect on the subsequent state of the eye and of vision.

Trauma involving any of the ocular or adnexal structures is always a major ocular emergency and this is for the most part appreciated by owners – even trivial trauma can have a catastrophic effect on the prognosis for the eye and for vision.

Owners will often attempt their own treatments on their horses when they are presented with a painful eye and it is important that an accurate and honest history is obtained. Painful conditions
that have been neglected or mistreated for even 12 – 24 hours may be irretrievable. The evidence of eye disease or injury is often not visible from the outside either because the eye is closed or because there is a profuse ocular discharge or because there is no outward evidence of the pain.

There are many signs associated with an ocular emergency. One of the first responses to a painful eye is lacrimation and blepharospasm. The eye will usually be withdrawn into the socket and so presents with a degree of enophthalmos. This might in turn result in entropion. The attending clinician may be drawn to the entropion without considering if this was primary or secondary. Additionally the following may be detected:

a) Obvious trauma to the eyelids or periorbital skin
b) Scleral bruising
c) Obvious traumatic corneal damage or corneal ulceration
d) A closed lacrimating eye
e) Blood in the lacrimation
f) A purulent discharge from a closed eye.
g) Eye irritation / rubbing
h) A focally or diffusely cloudy cornea
i) An enlarged or shrunken eye
j) Blood in the anterior chamber
k) Pus in the anterior chamber
l) Sudden onset blindness
m) A sudden onset of exophthalmos (with or without buphthalmos)
The primary objective for the clinician is to establish the diagnosis without exacerbating the injury. One of the major difficulties with ocular emergencies is that the first response of the horse is to close the eye. Blepharospasm can be impossible to overcome simply by manual manipulation. Indeed in any painful eye any attempt to force the eyelids apart may be catastrophic. Therefore one of the mainstays of investigation of the painful eye is a combination of sedation (using an opioid analgesic (e.g. butorphanol) and an alpha-2 adreno-receptor agonist (e.g. detomidine or romifidine) and auriculopalpebral regional nerve block. The value of these techniques cannot be overstated and so it is important to be confident about their execution. Topical analgesia can also be useful but selection of an appropriate ophthalmic preparation (such as proxymetacaine, proparacaine or amethocaine) is essential if local toxicity is to be avoided.

Figure 3: A suggested protocol for investigation of a painful or diseased eye.
Clinical examination must be directed towards a diagnosis. Sometimes this is obvious (such as eyelid lacerations) but many ophthalmic emergencies will require careful examination in an ordered fashion. Clinicians must be aware that multiple conditions can co-exist either as a result of the same cause or secondarily. Thus a painful eye may be subjected to repeated rubbing and so there may be eyelid damage or even secondary globe damage.

1. If the damage is limited to the periorbital skin and is free of complicating factors such as involvement of the nasolacrimal ducts or the bony orbit, the wound can be treated in a standard fashion. In the absence of a history of a traumatic incident, bruising and superficial grazing around the eyes of a horse should be viewed with some suspicion because this type of injury may suggest colic or recumbency from other reasons. Blunt trauma to the periorbital skin is often accompanied by swelling and oedema of the conjunctiva (chemosis).

- Skin lacerations are important because the blink and menace responses depend on skin flexibility. Therefore injuries that involve the periorbital muscles must be treated very carefully to reconstruct the normal anatomical function as far as possible.
- Bruising should be managed by cold compresses (STRICLY ONLY WHEN THERE IS NO CONCURRENT OPHTHALMIC PROBLEM).
- Damage to the orbital bone is relatively common and this will need to be dealt with either by reduction and fixation or by removal of bone fragments that are likely or certain to be non-viable.

2. Eyelid lacerations have a critical implication for the maintenance of normal corneal health. Full thickness lacerations and injuries that involve the eyelid margin itself, in particular should be managed very carefully so that as far as a possible no skin is removed. Injuries that result in skin deficits require a high degree of surgical skin to reconstruct both the normal sweep of the eyelid and its muscular function.

- The upper eyelid is responsible for over 70% of the blink movement and so damage to this area is more critical in the long term.
- Any defects of the eyelid margin will inevitably have implications for corneal health. Ulceration, areas of corneal dryness and abnormalities of the pre-corneal tear film will likely have serious long-term effects.

3. Corneal Damage or disease

- Inflammation or traumatic damage to the cornea is invariably associated with pain. It is therefore seldom possible to identify the problem without further diagnostic tests.
- Sedation and an auriculo-palpebral block are almost obligatory. In any case strong attempts to open the eyelids in a horse with conjunctival swelling, blepharospasm and lacrimation will usually be fruitless and in any case may result in serious exacerbation of the problem.
- There is the additional complication of reflex uveitis that accompanies almost all forms of corneal injury and inflammation.
- Conjunctival foreign bodies are rare in horses but do cause severe blepharospasm and lacrimation of acute onset. Careful examination of the surface of the cornea. There is usually some evidence of ulceration or alteration of the pre-corneal tear film. Sometimes they are very difficult to identify and
- Corneal foreign bodies are also rare and cause severe pain (often with a profound reflex uveitis and/or hyphaema (haemorrhage into the anterior chamber)
- Corneal lacerations are an absolute emergency. Even partial thickness lacerations can deteriorate dramatically within hours to a non-resolvable problem. Surgical reconstruction may be possible but the prognosis will depend on whether there is concurrent damage to other ocular structures. Many cases involving full thickness lacerations of the cornea (and perforating ulcers, see below) are “saved” by prolapse of the iris into the defect. This restores intra-ocular pressure and prevents ingress of infection. Under no circumstances should a piece of prolapse iris be cut of
without a plan for the repair of the cornea. This type of injury MUST be managed under general anaesthesia. A few cases manage well with the prolapse and in spite of the inevitable anterior synechiae some sight is often retained. Repair of conjunctival lacerations (and serious deep ulcers) is a specialist procedure and the horse should be referred immediately for treatment.

- Corneal ulceration is a common event in horses. The major problem is the threat of collagenolytic ulceration in which collagenase / proteinase enzymes are released from bacteria or from effete macrophages and neutrophils. Emergency medication for corneal ulceration must include both topical antibiotic) e.g. gentamicin drops) and some anti-collagenase compound. The latter can be afforded simply by collecting EDTA plasma from the horse and instilling this every hour into the conjunctival sac. Alternative anti-collagenase drugs include 1% acetylcysteine and galardin. Most corneal ulcers will heal very quickly but any can deteriorate within hours. There is no such thing as a slight or trivial corneal ulceration! Surgical management of deep or extensive ulcers is often required. Conjunctival flap grafts are a very useful technique for saving the eye although of course they inevitably leave a dense leukoma.

4. Intra-ocular inflammatory disease
All intra-ocular pain should be considered as an emergency.

- Corneal oedema can be pain free but is often accompanied by mild ocular pain. The mild pain quite often belies the severity of the problem. Corneal oedema can be caused by local factors including endotheliitis, anterior lens luxation (a characteristic pattern of oedema is usually seen), or alterations in the aqueous (see below, uveitis).
- Uveitis is a common problem in horses (either traumatic, reflex or recurrent). The outcome of cases is dependent on the cause and severity and the speed with which the diagnosis is made and effective treatment instituted. An accurate history and careful clinical examination may establish the cause and clearly this will have a significant implication on the outcome. Any case of uveitis (regardless of cause) should initially be managed with parenteral flunixin meglumine. Topical steroids are also very useful but must not be used unless the possibility of corneal ulceration has been categorically eliminated!

5. Globe enlargement
Glaucoma is rare in horses because of the wide drainage of aqueous but where it does occur it is an absolute emergency because any significant increase in intra-ocular pressure that lasts for more than a few hours will result in

6. Orbital pain
- Inflammatory foci in the orbit cause severe pain and if the eye is to be saved a detailed clinical and ultrasonographic examination must be performed.

Some Diagnostic Procedures for Ocular Disease Investigation

1. CHEMICAL RESTRAINT: An effective examination may be impossible due to either temperament or pain. It is often physically impossible to open the eyelids of a horse with significant ophthalmic pain. Chemical restraint is often very useful. The α2-adrenoreceptor agonist drugs (e.g. romifidine / detomidine) are particularly useful and can be combined with butorphanol to allow examination.

2. CORNEAL ANALGESIA: Proxymetacaine, proparacaine and amethocaine are available in single dose ampouletes. The effect is maximal after 5 min. - lasts 10 minutes max - do not assume longer effect.

Do not use lignocaine - it is acidic irritant and has a poor efficacy.
Do not use lignocaine with adrenaline!
3. **AURICULO-PALPEBRAL NERVE BLOCK** (branch of CN VII): Blepharospasm arising as a result of ocular pain or examination can be abolished or reduced by this. The block produces a paralysis of the upper lid.

A-P block does is a motor block (facial Nerve) not induce analgesia of the eye or the periorbital skin!

Auriculopalpebral block MUST be used in all cases if there is any (even remote) possibility of rupture or significant damage to the globe. Otherwise combinations of i.v. sedative and topical analgesia are usually sufficient to allow examination.

**Procedure:**

i. 4 - 6 ml 2% lignocaine hydrochloride or bupivicaine/mepivicaine. Nerve runs superficially - can be felt over highest point of zygomatic arch

ii. 23 g x 15 mm needle inserted subcutaneously. 10 - 15 minutes ⇒ full effect.

Other sites are also possible - illustrated here.

![Figure 1: Locations for auriculo(-palpebral) nerve blocks](image)

- Frontal Nerve block: Desensitises the upper eyelid (useful for sutures and for placement of subpalpebral lavage systems). 3- 4 ml 2% lignocaine into supraorbital foramen, into supraorbital process of frontal bone or along the central portion of the dorsal orbital rim.

- Orbital block can be useful to minimised eyelid movement e.g. during ophthalmic surgery. 10-ml lignocaine instilled into back of orbit via 19g x 5-cm needle. **The protocol for an orbital block demands careful consideration.**

4. **FLUORESCIN STAINING:** Fluorescein can be used to demarcate extent and depth of corneal ulceration. Also tests patency of naso-lacrimal duct.

(NB - normal horses up to 30 minutes, eye ⇒ nose - c.f. dog/cat/cow - 5 min.).

Best to moisten the “Fluoret” strip with local anaesthetic (see above) before instilling into eye. Excess dye can be wiped or flushed from eye with normal saline. Dye take up by ulcerated corneal stroma is rapid (2 - 3 minutes) and persists for up to 30 minutes BUT **some deep ulcers fail to stain or to retain the stain.**
5. **ROSE BENGAL STAINING**: This is a vital stain and it will stain healthy epithelial cells in areas of the corneal surface where the mucus content of the precorneal tear film has been disrupted i.e. where the epithelial surface is exposed. It is therefore a specific indicator of abnormal tear film production or distribution and is not a specific indicator of epithelial necrosis. Of course where there is epithelial necrosis the mucus tear film will be poorly or non-adherent to the abnormal epithelium and so the stain will be retained within the affected area. The substance is itself mildly irritant.

6. **ULTRASONOGRAPHY**: VERY USEFUL TECHNIQUE. Using 10 / 12.5 / 18 / 22 MHz sector scanner (or 7.5 MHz linear scanner) a good image can be obtained of the orbital structures. Especially useful non-invasive, non-painful procedure if blepharospasm present. The probe can be placed over the closed eyelids or directly on the cornea (local anaesthesia sometimes necessary) and can give a better image. Scanners of higher power and linear configuration can also be used but provide less information in some cases.

**USEFUL REFERENCE MATERIALS**
- Practitioners Guide to Equine Ophthalmology D.E. BROOKS Media USA
- Equine Veterinary Journal Ophthalmology Supplement I
- Equine Veterinary Journal Ophthalmology Supplement II