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Common Ophthalmic Problems in Equines

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Abstract: Ocular disease is a frequent finding in working horses in developing countries. One of the most common problems of ocular conditions seen in equine is conjunctivitis. Corneal ulceration is also common in horses and it is a sight-threatening disease requiring early clinical diagnosis, laboratory confirmation and appropriate medical and surgical therapy. Ocular manifestations of thelaziasis in horses are primarily a summer problem, comparable to the condition in cattle. Ocular manifestations of leptospirosis appear in the form of equine recurrent uveitis. A protozoan parasite that can infect horses is Toxoplasma Gondi. Equine herpes viruses have been repeatedly isolated from eyes of horses suffering from certain forms of keratitis or keratoconjunctivitis. Trauma is a relatively common cause of eye disease in the equine and the cornea is the most common location for eye injuries. A wide variety of tumors have been identified in the orbit of equine. Wounds and ocular injuries are the most frequently recorded health concerns.

Key words: Blindness · Conjunctivitis · Horses · Ocular · Uvietis · Vision

INTRODUCTION

Equidae is the mammalian family comprising the single genus equus consisting of domestic and feral horse, donkey, mule and zebra [1]. The equine population of the world is reported to be 122.4 million with 40 million donkeys, 15 million mules and 43.3 million horses. An estimated 110 million equine lives in developing world, with highest population concentration in central Asia and north and east Africa [2]. The number of equine in Africa is in range of 17.6 million comprising 11.6 million donkeys, 2.3 million mule and 3.7 million horses [3].

An estimated 60 percent of the world's horse population and over 95 per cent of all donkeys and mules are found in developing countries [4]. Ethiopia possesses approximately half of Africa's equine population; according to UN Food and Agriculture Organization. There are over 7 million donkeys, mules and horses in Ethiopia, including 1.9 million horses [5]. In urban towns in Ethiopia, horse-drawn taxi carts are a source of sustainable income for a significant number of Ethiopian families [6] and provide the only affordable transportation service in many towns [7].

These equidae are suffering from different diseases. Among the diseases affecting them, ocular disease is very common. Ocular disease is a frequent problem in working equidae in developing countries. An assessment of the welfare of 4889 working equines carried out in several countries estimated that 66.4 per cent of horses had an ocular abnormality and this was higher in donkeys (86.4 per cent). The eye abnormalities included; conjunctivitis, uveitis, corneal ulceration, kerato-conjunctivitis, orbital tumor, physical trauma and blindness [4].

The aims of this of current study is to highlight the types of ocular problems, pathology of ocular abnormalities in a population of equine in different places and to generate hypotheses regarding the potential risk factors for these abnormalities and treatment.

Equine Vision and Blindness: Equine eyes are designed to detect motion and act as an 'early-warning system' for predators. They have a wide range of vision, greater than 350 degrees due to the positioning of the eyes on the sides of the head with only two 'blind' spots; right in front of the head and right behind the tail [8]. This allows them to see approaching predators even when their heads

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are lowered for grazing, initiating the 'flight' response if necessary. The horse retina is adapted for detection of movement because it contains significant numbers of large-diameter ganglion cell [9].

The equine eye is the largest eye of all terrestrial mammals. Approximate globe dimensions are 42 to 44 mm from the anterior to posterior axis, 45 to 50 mm vertically and 50 to 54 mm horizontally. The globe is composed of three basic layers: the fibrous tunic (the cornea and sclera) that give the eye a constant shape and form; the uvea (the choroid, iris and ciliary body) that modify both external and internal light, provide nourishment and remove waste; and the inner nervous coat (the retina and optic nerve). The three tunics contain the inner transparent media of the eye: aqueous humor, lens and vitreous humor which function to transmit and refract light and keep the globe distended. The iris divides the globe into an anterior and a posterior chamber, which communicate through the pupil [10].

Anatomy of the Eye and Clinical Significance of These Structure

The 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. 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 [11].

The 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. For better diagnosis of corneal ulceration the applied dye is recommended to monitor its exist from the nostril after 5 minutes instead of one minute. 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 [12].

The Nictitating Membrane (Third Eyelid): The gentle pressing of the upper eyelid on to the globe causes eversion of the third eyelid. It can be assessed for the diagnosis of tumours, or granulation tissue from Habronema infection. 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 [13].

Equine Eye Problems: Eye problems are common in equine. Because equine only has two eyes, damage to one of them can be very serious. Although there are many conditions that can affect the equine eye, the most common are conjunctivitis, corneal ulceration uveitis and trauma. Other disorders such as lacerations of the eyelids and neoplasia can also have negative effects on the eye or vision and require prompt treatment [14].

Enophthalmos: Posterior displacement of the eyeball within the orbit occurs due to changes in the volume of the orbit (bone) relative to its contents (the eyeball and orbital fat). It is caused by senile orbital fat reabsorption, dehydration/hypovolemia, orbital fracture, equine pituitary pars intermedia dysfunction and Horner's syndrome. It occured secondary to loss of orbital contents or due to changes in the bony orbit [15].

Exophthalmos: The normal-sized globe is pushed forwards, usually due to retro bulbar disease, e.g. abscess/tumour in the orbit behind the globe [16]. Exophthalmoses results from dehydration secondary to systemic illness or maladjustment. Other causes include loss of orbital fat from cachexia, trauma, scarring, or congenital microphthalmos [17].

Entropion: Entropion is an inward rolling of the eyelid margin, a common ocular abnormality in foals and requires immediate therapy. This causes the eyelid hairs to rub on the cornea. It most commonly involves the lower eyelid however; both the upper and lower lids may be affected. Entropion is a possible sequela, leading to chronic irritation. The affected orbit is also abnormally flat and small; this becomes more prominent as the animal ages. It may be repaired to prevent corneal ulceration in the neonate by placing sutures at the lid margin to roll out the offending eyelid margin [17].

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 common cause of blindness [18].

Cataracts: Cataracts are opacities of the lens and are the most frequent congenital ocular defect in foals Horses manifests varying degrees of blindness as cataracts mature. Very small incipient lens opacities are common and not associated with blindness. As cataracts mature and become more opaque, the degree of blindness increases [19].

Conjunctivitis: Conjunctivitis is inflammation of the conjunctiva or mucous membrane, which covers the posterior aspects of the eyelids and nictitating membrane (palpebral conjunctiva) and the superficial surface of the sclera (bulbarconjunctiva) [20]. It is the most common eye conditions seen in horses, especially during the summer months. It is a non-specific finding of ophthalmic and often systemic diseases, as the eye has limited ways to react to injury. Infectious and noninfectious diseases of the eyelids, cornea, sclera, anterior uvea, nasolacrimal system and orbit commonly result in conjunctivitis in the horse [21].

Conjunctivitis is often associated with ulcerative keratitis, corneal stromal abscesses, equine recurrent uveitis and obstructed nasolacrimal ducts in horses. Conjunctivitis in the horse may be secondary to trauma to the globe, conjunctival foreign bodies and debris and allergic reactions to dust, hay, sand, dirt, ammonia, pollen, ash and environmental irritants. Equine neonates may develop conjunctivitis from placentitis, septicemia and subconjunctival or episcleral haemorrhages secondary to birth trauma and pneumonia. Conjunctivitis caused by environmental irritants is common among neonates with recumbent foals being especially at risk [22].

Infectious causes of equine conjunctivitis include the parasites Onchocerca cervicalis, Thelazialacrimalis, Habronema megastoma, H. muscae, Draschiamega stoma and Trypanosome spp. Viral causes of conjunctivitis include equine adenovirus, equine herpes virus types 1 and 2, equine infectious anemia, equine viral arthritis and equine influenza type A2. The bacteria Moraxella equi, Streptococcus equis spp. Rhodococcus spp, Actinobacillus spp. and Leptospiraspp and the fungi Aspergillus and Fusarium spp, can cause conjunctivitis in horses. Conjunctivitis can be seen with equine protozoalmyelo-encephalitis (EPM) [21].

Equine conjunctivitis may also be associated with systemic diseases such as polyneuritis equi, vestibular disease syndrome, African horse sickness, epizootic lymphangitis and neonatal maladjustment syndrome. Neoplastic causes equine conjunctivitis such as squamous cell carcinoma (SCC), lymphoma, papilloma, haemangioma, haemangiosarcoma, mast cell tumours, melanomas and multiple myeloma the prevalence of equine ocular SCC increases with age. White, grey-white and Palomino hair colour equine predisposes to ocular squamous cell carcinoma [23].

Uveitis: Uvitis is inflammation of the anterior uvea. It may be unilateral or bilateral. In foals this occurs most often secondary to sepsis associated with Salmonella, E. coli and Streptococcus. Uveitis was used as a negative prognostic indicator in septic foals [24]. Other organisms associated with uveitis in horses include Actinobacillus equuli, adenovirus and equine viral arthritis [25]. The clinical signs include blepharospasm, epiphora, conjunctival and scleral hyperemia, meiosis, variable corneal edema and aqueous flare, fibrin in the anterior chamber, hypopyon and hyphema.

Aggressive treatment is essential as uveitis has the potential to cause blindness. The proper treatment of uveitis requires the use of systemic antibiotics and NSAIDs and topical corticosteroids (such as prednisolone acetate 1% or dexamethasone 0.1%). Topical steroids should be administered as frequently as q 4 h, depending on the severity of the uveitis. Topical atropine reduces painful ciliary muscle spasm and treats uveitis by stabilizing the blood-aqueous barrier and it is administered every 24 to 12 hour. In some cases, tissue plasminogen activator can be injected into the anterior chamber to dissolve fibrin [17].

Equine Corneal Ulceration: Horses frequently suffer from corneal ulcers or ulcerative keratitis because of the large size of their eyes and the laterally prominent position of the globe. The active movement of the head may increase exposure of the corneas to bacterial and fungal pathogens. Racehorses often develop ulcerative keratitis after running, especially racing, because of corneal contact with foreign bodies such as materials of track surface kicked up by other horses. In severe ulcer cases, the animals can be blind because of large corneal scars or concurrent uveitic side effects such that the functional vision required for racing purposes is impaired [26].

Equine corneal ulceration is very common in horses and is a sight-threatening disease requiring early clinical diagnosis, laboratory confirmation and appropriate medical and surgical therapy. Ulcers can range from simple, superficial breaks or abrasions in the corneal epithelium to full-thickness corneal perforations with iris prolapse. The prominent eye of the horse may predispose to traumatic corneal injury [27].

Horse corneas demonstrate a pronounced fibro vascular healing response. The unique corneal healing properties of the horse in regards to excessive corneal vascularization and fibrosis seem to be strongly species specific. Many early cases of equine ulcerative keratitis are presented initially as minor corneal epithelial ulcers or infiltrates, with slight pain, blepharospasm, epiphora and photophobia. Corneal ulcers in horses should be aggressively treated no matter how small or superficial they may be. Infection should be considered likely in every corneal ulcer, no matter how small; in the horse Fungal involvement should be suspected if there is a history of corneal injury with vegetative material, or if a corneal ulcer has received prolonged antibiotic and/or corticosteroid therapy without improvement [27].

Parasite That Can Causes Ophthalmic Problems in Equine

Onchocerca Cervicalis: Microfilaria has long been thought to be a major cause of ERU. *O. cervicalis*is spread by *Culicoide* spp. and causes dermatitis in horses. It is thought that the microfilariae migrate along vessels through subcutaneous tissue to the eyelids, then into the conjunctiva, cornea and uvea. The routine use of broad-spectrum anthelmintics has markedly decreased *O. cervicalis* as a major cause of uveitis [28].

Thelazia Lacrymalis: *T. lacrymalis* occurs on the surface of the cornea and conjunctiva, under the nictitating membrane in the lacrymal gland and its ducts and in the ducts of the third eyelid gland [29]. It has been found occasionally in the aqueous humor of the eye. *T. lacrymalis* is a parasite of buffalo, camel, dog and equine species, especially horses. It has also been reported from cattle [30]. Thelaziasis in horses is primarily a summer problem, comparable to the condition in cattle [31]. The importance of *T. lacrymalis* in causing follicular conjunctivitis, ulcerative keratitis and ophthalmia has been documented [32]. The clinical signs exclude secondary infections with other pathogens; usually resolve rapidly after the removal of the worms [33].

The diagnosis of the disease may be accomplished by irrigating the eyes with saline and examining centrifuged sediment for the first stage larvae and detecting larvae in the blood of infected horses and donkeys [34].

Treatments include mechanical removal of worms under local anesthesia, irrigation of the eye with dilute solutions of topical antiseptics such as iodine or boric acid and treatment of any corneal ulceration to suppress the development of opacity [31].

Bacteria That Causes Ophthalmic Problem in Equine

Leptospira: Ocular manifestations of leptospirosis appear in the form of equine recurrent uveitis (ERU), also referred as moon-blindness or periodic ophthalmia. Leptospira-associated uveitis forms an important subset of ERU cases and Leptospira spp. is considered as the most common infectious cause of ERU [35].

ERU is characterized by bouts of inflammation of the vascular tunic or uvea of the eye alternating with symptom-free intervals of low or no inflammation. ERU has a worldwide prevalence of around 10% and is a major cause of blindness in horses While Appaloosa breed and horses with MHC-I haplotype are considered to be at increased risk of developing ERU Leptospira-associated equine uveitis is a painful condition that develops weeks to months after systemic leptospirosis [35].

The early signs of the disease include meiosis, blepharospasm, lacrimation, photophobia, oedema of the eyelid, swollen conjunctiva and corneal edema. As the disease progresses, aqueous flare and hypopyon may also be seen. A good prognosis is contingent on an early therapeutic intervention during this phase of the disease. The acute phase is followed by a period of low inflammation Subsequent recurrences of inflammation are marked with much severe inflammatory response resulting in serious injury to ocular components. Secondary cataract, anterior or posterior attachment of iris, lens luxation, vitreous exudates and retinal detachment are seen as a result of a pronounced inflammatory insult to the eye components [36]. A thick hyaline membrane adjacent to the posterior aspect of the iris and the eosinophilic linear cytoplasmic inclusion bodies in the non-pigmented ciliary epithelial cells are considered pathognomonic for ERU. Diagnosis of Leptospira-associated recurrent uveitis is based on the presence of classical signs of uveitis, a history of recurrence and seropositivity by (MAT) microscopic agglutination test. There is no specific test available exclusively for the

Fig. 1: An ocular squamous cell carcinoma in a working equid [46].

diagnosis of leptospiral uveitis. If leptospirosis is suspected; systemic therapy can be initiated with an appropriate antibiotic. Little is known about antimicrobial susceptibility of *Leptospira* spp. There are no standardized methods for testing this condition in equine. Studies from other animal species indicate that the bacterium is susceptible in vitro to doxycycline, penicillin, ampicillin, ox tetracycline, streptomycin, cefotaxime, erythromycin and fluoroquinolones [37]. Moreover, the administration of oral doxycycline resulted in steady state serum concentration; however it did not result in appreciable concentration of the drug in the aqueous or vitreous of normal eyes [38]. Enrofloxacin at 7.5 mg/kg administrated intravenously resulted in aqueous concentration above the MIC of *Leptospira* spp. and might be the best option for treatment of horses with suspected acute leptospirosis with ocular involvement. However, it is important to note that antibiotic treatment has never been shown to prevent recurrence [39].

Protozoan Parasite That Can Couse Ophthalmic Problem in Equine.

Toxoplasma Gondi: Toxoplasma Gondi is a protozoan parasite that can infect horses although clinical disease is rare. Few case reports have demonstrated elevated titers to Toxoplasma in horses with chorio-retinitis and in one horse with optic nerve atrophy [28]. However, one study in India revealed no correlation between positive titers and ocular lesions and also another study in horses with ERU didn't reveal any correlation with positive titers [40].

Viral Causes of Ophthalmic Problem in Equine

Equine Viral Keratoconjunctivitis: Equine herpes viruses have been repeatedly isolated from eyes of horses suffering from certain forms of keratitis or kerato conjunctivitis Although they are the viruses most often considered as being the causative agent of corneal disease; adenoviruses and other viruses have also been incriminated [41]. Equine adenoviruses (EAdV) have been isolated from ocular samples taken from several eyes of foals showing signs of keratoconjunctivitis [42]. Superficial punctate or linear corneal opacities with or without concomitant conjunctivitis are the clinically manifest forms of keratitis which is often associated with viral etiology [41]. The three distinct forms of viral keratopathies are the superficial punctate keratitis (SPK), the ulcerative viral keratitis and the macular keratitis. However, it has been suggested that each form merely represents a different stage of the same disease [41].

A combination of topographic and etiologic classification seems to be appropriate for general clinical use [43].The classifications of keratitis according to anatomical location are as follows: superficial; Interstitial; deep; and ulcerative (considered an independent group due to the frequent involvement of all corneal layers).

Orbital Tumours: A wide variety of tumors have been identified in the orbit of horse including neuro endocrine tumors lymphoma, osteoma and melanoma [44]. The most common ocular tumor seen in equid is squamous cell carcinomas (SCC) [45]. The next most common are sarcoids, followed by small numbers of melanomas, papillomas and schwannomas/neurofibromas (nerve sheath tumours) [46].

The clinical evidence of retro bulbar masses is usually restricted to an insidious onset of progressive unilateral exophthalmos, distension of the supraorbital fossa, normal vision, exposure conjunctivitis, keratitis and carcinoma development can occur. Concurrent pressure induced damage to the orbital bone can extend to the point of bony destruction and sinus involvement. In a few cases the frontal lobes of the cerebral cortex was involved. [47].

Tumors in the orbit itself are a serious diagnostic and therapeutic challenge. Diagnosis is constrained by the lack of effective simple imaging methods and therapy is a

challenge because of the inaccessibility of the retro bulbar structures. The advent of better quality ultrasound facility and in particular (MRI) magnetic resonance image and (CT) computed tomography scan diagnostics has improved the imaging of the orbital structures enormously and improved the identifyication of various neoplastic and non-neoplastic space occupying masses in the equine orbit [48].

Status of Ocular Disease in Ethiopia: There are few published studies investigating ocular disease in Ethiopian horses. Wounds and ocular injuries were the most frequently recorded health concerns in Gondar [49] and ocular injuries due to ill-fitting blinkers and tack were reportedly common [50]. A survey of 250 carthorses found 21 percent had an ophthalmic condition, with greater than 60 per cent of these involving the right eye [51]. Oocular infections were observed in 5.4 percent of 241 randomly selected cart horses examined in the middle Rift Valley region of Ethiopia [52]. Ocular disease represented 5 per cent of cases presenting for non-routine problems to the veterinary clinics of Society for Protection of Animals Abroad (SPANA). A similar percentage (5.4 per cent) of donkeys presented with ocular disease to Donkey Sanctuary clinics, with the most common pathologies being medial canthal wounds due to habronemiasis and fly strike, conjunctivitis and corneal ulcers, scars and opacities generally attributed to trauma [53].

A number of risk factors for ocular disease were found, including increased age of the horse, longer duration of ownership, the right eye versus left eye and town within which the animal resided. The prevalence of eye disease was significantly higher in the right eye compared with the left and the reasons for this are not clear. Since a whip injury was identified as the specific reason by six owners, a possible explanation includes whip use by predominantly right-handed drivers. Foreign bodies, such as stones flicking up from the road when traffic passes the cart are another possible cause for this asymmetrical distribution [53].

Trauma is a relatively common cause of eye disease in the horse [10]. Cornea is the most common location for eye injuries [54], possibly due to its large surface area and prominent vulnerable position. Getachew, *et al.* [53] reported that trauma was a common cause of ocular pathology in donkeys in Ethiopia. Severe trauma and inflammation within the eye has the potential to result in phthisis bulbi.

Often head collars which have adornments placed near the eye or may be poorly maintained which could contribute to the risk of ocular trauma and this may be an additional area to address within an ocular health education initiative. However, infectious disorders of the eye, such as fungal or bacterial keratitis, may also lead to the same end result if not managed correctly [55].

The findings that increased age and increased duration of ownership were associated with increased risk of ocular abnormalities may be due to increased exposure to risk factors over the working lifetime of the horse. Alternatively, it may be due to a reduced ability to sell animals with abnormal eyes and, therefore, increased retention of horses with ocular abnormalities. One concern is that end-stage eyes may devalue the horse, therefore lowering purchase price. A lower price may make a purchase seem more attractive to aless affluent purchaser and this aspect has socioeconomic as well as welfare implications [56].

The difference in prevalence between towns is an interesting finding and the reasons for this were not explained by other variables, such as age of the horse. The trade route (purchase and sales) of horses in this area of Ethiopia is predominantly unknown. However, it appears that horses change hands regularly and the majority (90 per cent) is purchased from markets [6]. It is possible that the more southern towns of Modjo and Nazareth represent horse populations further along the trade route, which may explain the higher prevalence in these towns. Additionally, there may be particular climatic, environmental or husbandry practices (including harness design and equipment) that increase the risk of eye disease within these towns, such as vectors of infectious disease that may lead to an increased chance of chronic eye disease in poorly managed eyes.

Regional variations in fly populations, including *Glossina*, *Stomoxys*, *Tabanus* and *Haematopota* species have been reported in Ethiopia [57]. Some of them are intermediate vectors for conditions, such as habronemiasis [58] and Thelazia infections [59].

CONCLUSION AND RECOMMENDATION

Equidae is the mammalian family comprising the single genus equus consisting of domestic and feral horse, donkey, mule and zebra. These equidae are suffering from different diseases. Among the diseases affecting equine, the ocular disease is very common. Ocular disease is a frequent problem in working equidae in developing countries. The most common ocular

problems of equidae are conjunctivitis, uveitis, corneal ulceration, orbital tumor, physical trauma, internal parasitic diseases such as onchocercacervicalis and thelezialacrimalis, bacterial diseases particularly leptospirosis, protozoal parasitic diseases mainly toxoplasmosis and viral diseases specifically viral keratoconjunctivitis which is commonly caused by herpes virus and adenovirus. A number of risk factors for ocular disease were found, including increased age of the horse, longer duration of ownership, the right eye versus left eye and town within which the animal resided

Based on the above conclusion the following recommendations are forwarded;

- ✓ The risk of ocular abnormalities should be reduced by decreasing exposure to risk factors during working time
- ✓ Mechanical removal of the adult parasites with fine forceps or cotton swabs using local anesthesiashould be applied
- ✓ Attention should be given to the welfare of the animal
- ✓ Vaccination of the equines.

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