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Case Report

Acute Corneal Edema in an Arabian Horse: A Case Report

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ABSTRACT

Introduction: Due to the vulnerable position of the eye, eye injuries are very common in horses. Lack of effective and prompt treatment of eye injuries leads to blindness. Most of the trauma to the horse's eye is the blunt type and usually causes more severe injuries than sharp blows. However, in all these cases, at first, acute uveitis with different severities occurred, which requires quick treatment and can have different consequences.

Case report: A two-year-old male Arabian horse with a history of ocular trauma for 4 days to the right eye was referred to the large animal clinic of the School of Veterinary Medicine, Shiraz University, Iran. All other clinical signs, including temperature, respiratory rate, appetite, and mental state were normal. Ocular examination revealed extensive corneal edema, elevated intraocular pressure (IOP) detected by palpation of the globe, blepharospasm, conjunctival hyperemia, miosis, and epiphora. Eye disorder was diagnosed as acute corneal edema and traumatic uveitis. Treatment included administration of flunixin meglumine for three days, atropine eye drops once a day, latanoprost eye drops once a day, gentamicin, and ciprofloxacin eye drops three times daily, and eye wash with saline 0.9% solution twice a day. The treatment continued for 2 weeks and resulted in complete healing which confirmed the diagnosis. The treated horse had a positive response to the therapy and fully recovered within 20 days. No relapse or complications were observed during the final check-up.

Conclusion: Acute uveitis is a common complication following blunt trauma to the eye and is diagnosed by clinical symptoms. Since this situation could have a devastating consequence on vision, immediate diagnosis and treatment are essential to achieve the desired result. The treatment of these patients is symptomatic treatment based on anti-inflammatory, mydriatic, and antibiotics. Depending on the patient's condition, the use of other drugs, such as intraocular pressure reducers may be helpful and essential to prevent or treat complications, including glaucoma.

1. Introduction

Horses' eyes are susceptible to significant trauma due to their size, prominent position, lateral orientation, natural aggressiveness, and the habit of tossing their heads[1,2]. Many eye injuries can have devastating consequences on vision in case of not immediate and efficient treatment[3].

Three types of ocular trauma in horses are distinguished, including contusion, penetrating, and perforating wounds and ocular trauma is the most common in nature. Blunt trauma, including contusive, penetrating, and perforating wounds generally inflicts more severe eye damage compared to sharp object injury. Compared to

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sharp perforating injuries, blunt trauma causes an abrupt rise in intraocular pressure, which damages intraocular content followed by rapid decompression[4]. Uveitis is a potentially blinding condition. It denotes inflammation of the eye's uveal tract, typically affecting the iris and ciliary body (anterior uveitis) or the choroid and retina (posterior uveitis), however most frequently in horses, all anatomic sections of the uveal tract are inflamed (pan-uveitis)[4].

Uveitis can arise due to corneal disease, trauma, infections such as endophthalmitis, parasites, immune-mediated conditions, heterochromic iridocyclitis with keratitis such as heterochromic iridocyclitis (HIK), equine recurrent uveitis (ERU), and inflammation triggered by neoplasia (systemic and primary ocular)[5-12]. Acute uveitis developed following trauma that took place recently, despite the absence of any previous ocular inflammation or uveitis. The clinical symptoms of acute uveitis commonly include blepharospasm, epiphora, aqueous flare, fibrin clots in the anterior chamber, miosis, vitreous cellular infiltrate, hypopyon or hyphema, and corneal edema[1,4,13].

Diagnosis through clinical presentation and even without a specific traumatizing background is frequently thought to be traumatic[13].

To reduce inflammation, the first step to treat an acute episode of anterior uveitis is aggressive symptomatic therapy. It includes systemic and topical therapy using antimicrobials, corticosteroids, and anti-inflammatory medications[1].

Therefore, the current study aimed to describe acute corneal edema in a horse and its successful treatment and management.

2. Case report

A male Arabian horse, aged 2 years with a history of eye trauma due to being hit by tree branches was referred to the large animal clinic of the School of Veterinary Medicine, Shiraz University, Iran. In clinical experiments, the rectal temperature was 36.6 ^{0}C, the mucous membranes were pink, the heart rate was 35 beats per minute, the respiratory rate was 16 and no abnormality was observed. In the ophthalmic examination of the right eye, conjunctivitis, generalized corneal opacity, hyphema, miosis, blepharospasm, epiphora, positive menace response, and elevated intraocular pressure (IOP) were observed (Figure 1). According to the history and clinical ocular examination, the eye lesion was diagnosed as acute uveitis following the blunt trauma.

Figure 1. Blepharospasm, epiphora, and extensive corneal edema are the main symptoms of acute uveitis. A 2-year-old male Arabian horse

Figure 2. 3 days following treatment with no blepharospasm and epiphora A 2-year-old male Arabian horse

Figure 3. Reduction of corneal edema during the fifth day of treatment in a 2-year-old male Arabian horse

The horse was treated with phenylbutazone (dosage 2.2 mg/kg) once daily for 3 days. The treatment was followed by IV injection of Flunixin meglumine 5% (0.5mg/kg, iv) twice a day for 3 days (Figure 2). To reduce inflammation, an Atropine sulfate ophthalmic solution of 1% once daily for a week was used as a pain relief to reduce discomfort by relaxing ciliary muscles[4,12]. To reduce intraocular pressure by increasing uveoscleral outflow, Latanoprost ophthalmic solution of 0.005% once daily was used (Figure 3). Additionally, Ciprofloxacin ophthalmic solution 0.3% every 8 hours, Gentamicin ophthalmic solution 0.3% every 8 hours to prevent secondary bacterial infections, and eye wash with saline 0.9% to prevent bacterial colonization and remove secretions were taken[11]. These medications continued for 2 weeks and stall rest was recommended to avoid day sunlight and stress (Figure 4 and Figure 5). Although the treated horse responded well to the therapy and made a full recovery in 20

Figure 4. Seventh day of treatment in a 2-year-old male Arabian horse

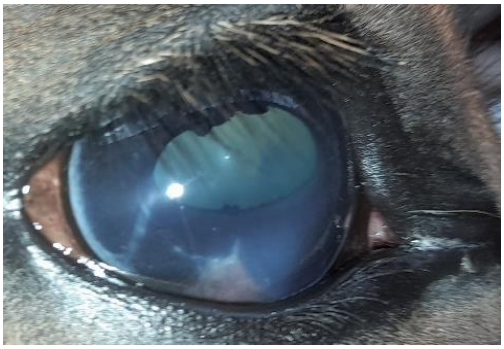

Figure 5. 20 days after treatment in A 2-year-old male Arabian horse

Figure 6. Last follow up, 4 months after treatment showed permanent corneal edema at the igureperiphery in a 2-year-old male Arabian horse

days after 4 months of treatment slight corneal edema at the periphery was observed (Figure 6).

3. Discussion

Trauma to the eye may entail mechanical interference with the ocular vasculature or subsequent response to inflammatory mediators generated by ruptured cell membrane phospholipids. The phospholipids provide a source of arachidonic acid, which is converted into prostaglandins, thromboxanes, leukotrienes, and other substances that may cause tissue injury and trigger vascular reactions. Clinical uveitis, a potentially blinding disorder that significantly affects the horse industry economically, can be triggered by physical injuries and exposure to free radicals, tissue hypoxia, and alterations in pH levels. These factors can also lead to vascular injury on a cellular scale, resulting in the development of clinical uveitis[14].

All typical clinical symptoms of acute uveitis are caused by uveal tract injury and the consequent breakdown of the blood-queous barrier. The release of inflammatory mediators leads to the collapse of the blood-ocular barriers and an increase in vascular permeability. Additionally, these mediators induce spasms in the ciliary body and iris sphincter muscles. The liberation of inflammatory mediators' results in the breakdown of the blood-ocular barriers, contraction of the ciliary body and iris sphincter muscles, heightened vascular permeability, and impairment of corneal endothelial function. Protein, fibrin, and possibly cells are then released into the aqueous humor, causing frequent clinical symptoms in patients with acute anterior uveitis. Blepharospasm, epiphora, aqueous flare, fibrin clots in the anterior chamber, miosis, vitreous cellular infiltrate, hypopyon or hyphema, and mildly edematous cornea with the most obvious opacity near the periphery are acute anterior uveitis consequences[1,4,13].

However, due to the rise in IOP accompanied by endothelial dysfunction, which may have led to bullous keratopathy and made the cornea prone to ulceration extensive corneal edema was seen in the study of this horse. The anterior chamber of most acute uveitic eyes is typically shallow and hypotensive IOPs range from 5 to 12 mmHg. The horse, however, had elevated IOP[4,15], which could be the result of the accumulation of inflammatory cells, blood, and byproducts in the aqueous humor which may obstruct the trabecular meshwork or uveoscleral region, resulting in elevated IOP and secondary glaucoma[4].

Early inflammation suggests vascular congestion since blood vessels are abundantly present throughout the uvea's tissues. The congestion leads to episcleral vascular hyperemia, causing the dilation of nearby episcleral blood vessels and resulting in the characteristic "red eye" appearance of the uveitic eye[4].

Miosis leads to eye and periocular discomfort due to the spasm of the iris sphincter muscle (ciliary spasm). This spasm also hinders the iris from adjusting to the surrounding light, causing sensitivity to light (photophobia) and excessive tearing (secondary epiphora)[4,16].

Additional anomalies that could be observed in such cases consist of dislocation or displacement of the lens, cataracts, hemorrhage in the choroid, impaired retinal function caused by lack of oxygen and essential nutrients typically provided by the choriocapillaris, detachment of the vitreoretinal, damage to the optic nerve, injuries to the cornea, and fractures in the orbital region[4,17].

To diagnosis and prognosis, due to an almost infinite list of probable causes the exact reason for acute uveitis should be determined by laboratory tests and thorough ocular and physical examination, and then the therapy will be focused[4]. Fluorescein stain uptake will be negative in these cases unless a horse has suffered a secondary corneal ulcer[4]. The clinical presentation is used to diagnose acute uveitis due to trauma as described by Gilger et al.[4]. Acute uveitis has no background of inflammation compared to ERU[1].

Depending on the severity of the initial insult, uveitis might vary in severity after trauma. Ocular ultrasonography is strongly advised to assess the prognosis. Whether the inflammation is mostly contained to the anterior segment the likelihood of regaining eyesight is often favorable. The prognosis for vision recovery is poor, in case other abnormalities are seen by ultrasonography (such as cataract development, hyperechoic material in the vitreous from a potential hemorrhage, or cellular infiltration), or by evidence of retinal detachment[1].

Long-term adverse sequelae for uveitis include

corneal scarring, permanent corneal edema, cataract formation, glaucoma, vitreal degeneration, and retinal degeneration[4,13].

To control inflammation from topical corticosteroids, dexamethasone, and prednisolone eye drops are among the most widely used treatments for uveitis. However, these drugs can intensify the infection, cause melting of the cornea by collagenase, delay epithelization, and possibly the potentiation of calcific band keratopathy. Taking drugs in the presence of corneal lesions or suspected is prevented. As an alternative, non-steroidal anti-inflammatories, such as diclofenac, bromfenac, and flurbiprofen eye drops can be used. Although they do not aggravate the infection, might delay epithelization. NSAIDs are less potent than corticosteroids and may be used as an alternative in cases where corticosteroids are contraindicated[1]. Systemic anti-inflammatories should be utilized as uveitis can impact the choroid, an area that topical medications cannot effectively treat to achieve therapeutic concentration. Flunixin meglumine is one of the most potent ocular anti-inflammatories. In acute cases, intravenous injection of flunixin meglumine (0.25-1 mg/kg) within 15-30 minutes, significantly improved. Reducing photophobia, flare, and pain, which facilitates the examination and use of other medications, for this purpose, the dosage of 0.5-1.1 mg/kg twice a day for 3-7 days has brought positive results[14]. It is advised to utilize dexamethasone and prednisolone systemically solely for severe instances in individuals with no positive response to alternative anti-inflammatory medications[1].

In these cases, usage of mydriatics and cycloplegics, such as topical atropine is recommended to reduce the spasm of the ciliary bodies and cause mydriasis to reduce pain, posterior synechia formation is inhibited. The physical repositioning of the iris serves to reduce congestion and thereby decrease leakage of protein and cells from the iris's vasculature[14]. Topical atropine can be absorbed systemically and reduce gastrointestinal motility, as a result, these patients should be monitored for colic symptoms, and small quantities of atropin need to be applied[18].

Nevertheless, given that it plays a crucial role in the treatment of uveitis, which is the primary cause of glaucoma in horses, the administration of this treatment to horses with secondary glaucoma is challenging[19].

Topical antibiotics are indicated in cases of traumatic uveitis as prophylaxis, and a systemic antibiotic is recommended in case of an active bacterial infection[14].

In the present studied case, unlike most uveitic cases, the IOP was increased, which made the management and treatment of the patient more challenging. To manage the elevated IOP, analogs of prostaglandin F2α, which increase uveoscleral outflow and induce miosis, or carbonic anhydrase inhibitors, which reduce aqueous humor production may be used. Regarding, the increase in IOP in uveitis, which results from a disruption in the outflow of aqueous humor, latanoprost was administered to reduce IOP. To enhance the recuperation process and prevent any unnecessary stress, it is imperative to ensure that the animal is shielded from any potential triggers, including training sessions, adverse weather conditions, and transportation. Hot and wet compresses are applied to the eyelids and orbital region to help alleviate pain and remove accumulated discharge and medications from the eyelids[14].

4. Conclusion

Acute uveitis is a common complication following blunt trauma to the eye and is diagnosed by clinical symptoms. Since this situation could have a devastating consequence on vision, immediate diagnosis and treatment are essential to achieve the desired result. The treatment of these patients is symptomatic treatment according to anti-inflammatory, mydriatic, and antibiotics. The utilization of additional medications, such as intraocular pressure reducers, may prove beneficial and essential in the prevention or treatment of complications like glaucoma, depending on the patient's condition.

Declarations

Competing interests

The authors declare that there is no conflict of interest.

Authors' contributions

Ali Hajimohammadi diagnosed the case and supervised the case process. Ali Hazeri Baghdadabad and Mohammad Salahlou wrote the manuscript and conducted the treatment. Pouriya Almasi revised the manuscript. Seyed Ali Arefkashfi, Maedeh Rouintan, Fatemeh Zahiri, and Faezeh Falahatnezhad collect data and follow up on the treatment. The authors read and approved the final manuscript.

Authors' relationships and activities

Authors are responsible for disclosing all relationships and activities that might bias or be seen to bias their work.

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Availability of data and materials

The data of the current study are available by a reasonable request.

Ethical considerations

The authors have checked plagiarism, publication consent, misconduct, data fabrication or falsification,

double publication or submission, and redundancy.

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