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Case Report

A retrobulbar abscess as an uncommon cause of exophthalmos in a horse

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Introduction

Orbital space infections and abscesses are a relatively uncommon finding in man or other animals. In the horse, a hydatid cyst (Barnett *et al.* 1988) and *Cryptococcus* infection (Scott *et al.* 1974) in the orbital region have been reported, and a single orbital abscess has been described (Hubert *et al.* 1996). Other reported space occupying lesions include retrobulbar neoplasms (Lavach and Severin 1977; van Maanen *et al.* 1996; Colitz *et al.* 2000; Mason *et al.* 2001) and swelling due to trauma (Millichamp 1992), haematoma (Boroffka and van den Belt 1996) or a foreign body (Rebhun *et al.* 1998). Foreign bodies penetrating via the oral, pharyngeal or conjunctival mucosae; extension of peri- or retro-orbital inflammation; or haematogenous spread of aerobic or anaerobic microorganisms have been reported with formation of orbital abscesses in small animals (Ramsey *et al.* 1996; Homma and Schoster 2000; Tovar *et al.* 2005). Disease of the orbit associated with tooth extraction and dental disease has been described in species other than the horse (Allan *et al.* 1991; Ramsey *et al.* 1996; Rosen *et al.* 2000; Zachariades *et al.* 2005).

The clinical signs of orbital space infection reported for the horse include exophthalmos, blepharoedema, chemosis, absence or delay of the pupillary light reflex, resistance to retropulsion of the eye, and abnormal position of the nictitating membrane (Hubert *et al.* 1996). In other species, decrease of visual acuity, purulent ocular discharge, limitation of ocular movement, enlargement of cervical lymph nodes, pain when chewing or opening the mouth, draining sinuses and papilloedema have been reported in orbital disease (Homma and Schoster 2000; Rosen *et al.* 2000; Mason *et al.* 2001; Zachariades *et al.* 2005).

Diagnosis of retrobulbar masses in the horse can be confirmed by ultrasonography (Homco and Ramirez III 1995; Mason *et al.* 2001), computed tomography (CT) (Boroffka and van den Belt 1996) or magnetic resonance imaging (MRI) (Aggarwal *et al.* 2002). Inaccurate diagnosis and insufficient therapy can result in severe complications, such as blindness.

Treatment of a retrobulbar abscess is generally either by administration of broad-spectrum antibiotics alone or antibiotics combined with surgical removal (Rosenthal 1973; Ferguson and McNab 1999; Ikeda *et al.* 2003; Blake *et al.* 2006), although surgical intervention has not yet been described in the horse. In small animals, drainage of the abscess via the pterygopalatine fossa is the most commonly used approach (Rosenthal 1973; Rühli and Spiess 1995; Homma and Schoster 2000; Tovar *et al.* 2005). In man the most common surgical approach is to establish drainage via the paranasal sinus by endoscopic sinus surgery (Ikeda *et al.* 2003).

In this report, we describe the clinical features and treatment of a retrobulbar abscess in a Friesian horse.

Case details

History and clinical findings

A 14-year-old Friesian mare was presented to Utrecht University's Department of Equine Sciences with periorbital swelling around the left eye. During the 2 weeks prior to presentation, the horse had been treated for a bacterial conjunctivitis with a topical corticosteroid and antimicrobials (oxytetracycline, hydrocortisone acetate and polymixin-B-sulphate) and oral NSAID (meloxicam). Unfortunately, despite treatment, the symptoms worsened and the horse became blind in the left eye.

On admission, a severe blepharoconjunctivitis was present in the left eye and there was a slight exophthalmos (**Fig 1**). The orbital mucosa was red and oedematous, an extensive purulent ocular discharge was present (**Fig 2**), and a small defect in the cornea was detected by fluorescein staining. The left eye was negative for a menace response and was also unresponsive to both direct and indirect pupillary light reflex tests. The pupil was dilated but investigation of the fundus by ophthalmoscopy did not reveal any abnormalities. Palpation of the eyelids revealed no foreign bodies or other defects. The

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Fig 1: Frontal view of the head. Note soft tissue swelling at the dorsal and ventral aspect of the left eye.

nasolacrimal duct was patent, and no bacteria were cultured from a sample of the ocular discharge.

An ultrasonographic examination of the left eye and retrobulbar region was performed using a high definition microconvex ultrasound transducer (ATL-Philips, HDI 3000)[1] (5–8 MHz). A rostral approach was used for ultrasound of the eye and was performed through the upper eyelid which was lowered over the cornea. An area of hyperechoic, ill defined soft tissue swelling was apparent ventral and caudal to the eye, but there did not appear to be any compression of the globe. In addition, a number of small hyperechoic foci were observed in the vitreous chamber. These may have represented either haemorrhage or inflammatory cells or have been caused by degeneration of the vitreous body. Finally, the lens was found to have a rounded hyperechoic rim, consistent with sclerosis of the nucleus.

A preliminary diagnosis of periorbital inflammation of unknown origin was made.

Treatment and diagnostic follow-up

On admission and continuing for a further 18 days, the left eye was topically treated with ciprofloxacin (q. 4 h). At the end of this period the cornea was negative for fluorescein staining. Trimethoprim sulphonamide (30 mg/kg bwt *per os* q. 12 h) was administered for 6 days. After 6 days, the condition had not improved significantly and, since no antibiogram was available at this point, the antibiotic therapy was switched to ceftiofur sodium (2.2 mg/kg bwt i.v. q. 12 h) for a further 9 days. Supportive NSAID treatment consisted of meloxicam (0.6 mg/kg bwt *per os* q. 24 h) during the entire hospitalisation period (18 days total).

A second ultrasonographic examination was performed 10 days after admission because of increased swelling ventral to the eye. The transducer was oriented identically to the first ultrasonographic examination. The soft tissue swelling had increased in size and was now clearly compressing and deforming the globe (**Fig 3**). The swelling consisted of hypoechoic material filled with multiple small echogenic foci and was surrounded by a thick capsule. These foci could represent inflammatory cells, small fibrous strands. Gas was considered less likely due to the moderate echogenicity of the foci and absence of comet tail artefact, but could not be excluded. Applying pressure to the swelling induced swirling of the contents. Colour Doppler ultrasonography failed to identify any blood flow within the mass and the ultrasonographic findings were consistent with abscessation or possibly but, less likely, a haematoma.

A CT examination was performed under general anaesthesia because of the progressive nature of the mass, to evaluate its extent and involvement of adjacent bony structures. Following sedation with detomidine hypochloride (0.01 mg/kg bwt i.v.), general anaesthesia was induced with a combination of midazolam (0.05 mg/kg bwt i.v.) and ketamine (2.2 mg/kg bwt i.v.) and maintained with a slow i.v. infusion of 10% guaiphenesin containing detomidine (15 mg/500 ml) and ketamine (1 g/500 ml). The horse was placed in right

Fig 2: Severe swelling of the eyelids and purulent ocular discharge.

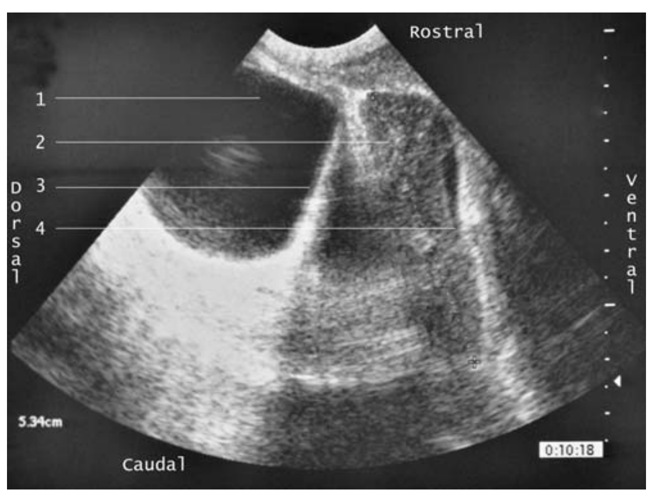

Fig 3: Ultrasonograph of the left orbit: 1, globe; 2, abscess; 3, indention of the eye; 4, capsule of the abscess.

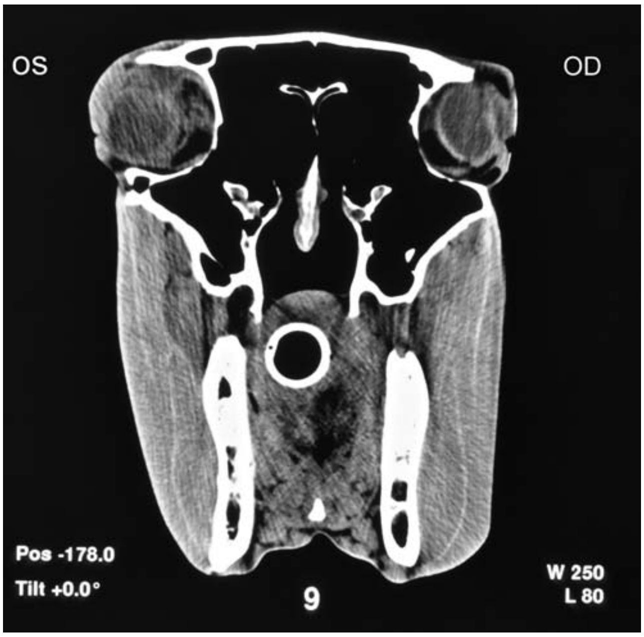

Fig 4: CT scan of the head, transverse scan at the level of the orbit. Marked soft tissue swelling is present at the medial aspect of the eye, causing exophthalmos.

lateral recumbency with its head positioned in the gantry of a single slice helical CT unit (Philips Secura)[1]. Images were taken contiguously at 10 mm and additional 5 mm slices intervals through the orbital region. The images revealed a soft tissue swelling at the ventrocaudal aspect of the globe that extended medially into the orbit and had caused attenuation of the surrounding musculature. No lysis of adjacent bony structures was apparent (**Fig 4**).

With the horse still under general anaesthesia, the abscess was punctured with a Bier cannula (2.0 x 150 mm). The cannula was inserted transpalpebrally ventromedial to the globe, and dorsal to the orbital rim. Purulent fluid (40 ml) was removed and submitted for bacteriological and cytological examination.

Bacteriological culture revealed a heavy growth of β-haemolytic *Streptococcus equi* ssp. *zooepidemicus*, which was sensitive to penicillin, trimethoprim sulphonamide and ceftiofur sodium. Cytolological examination of the purulent material revealed a large number of leucocytes, but no neoplastic cells.

As described above, a CT scan was performed on Day 14 of treatment and was immediately followed by ultrasound guided puncture of the orbital mass to remove the accumulated fluid and decompress the orbit. The horse was treated for 3 weeks with procaine-penicillin (20,000 iu/kg bwt i.m. q. 24 h).

The appearance of the horse improved significantly after puncture of the abscess and antibiogram directed antibiotic treatment. The swelling, redness and purulent discharge decreased, although there were no signs of recovery of vision. Three months later, information obtained by a telephone interview revealed that the horse was still blind in the left eye, but the clinical signs of retrobulbar inflammation were absent.

Discussion

Knowledge of orbital anatomy is essential to understanding the clinic signs of orbital infection. The bony orbit of the horse can be classified as 'enclosed', not 'open' as in dogs and cats, because the horse possesses a complete bony orbital rim (Ramsey *et al.* 1996; Barnett *et al.* 2004). Structures adjacent to the orbital cavity include the frontal, lacrimal, zygomatic, temporal and sphenoid bones. The caudal portion of the orbit also contains the ethmoid foramen (with the ethmoidal artery, vein and nerve), optic foramen (with the optical nerve and internal ophthalmical artery), orbital fissure (through which pass the trochlear, oculomotory, ophthalmic and abducens nerves), and the round foramen (with the maxillary nerve). In addition, the orbital cavity contains the globe, lacrimal gland, retrobulbar fat and muscle tissue responsible for eye movements.

The orbit is lined by a fibrous connective tissue sheath, known as the periorbital sheath (*periorbita*), that is closely associated with the periosteum of the orbital bones. The periorbital sheath is attached to the optic and orbital foraminae and continues rostrally to form the orbital septum in the tarsus of the eyelids. The orbit can be divided into a preseptal (or extraorbital) and a post septal (or intraorbital) region, where the orbital septum marks the anatomical border (**Fig 5**). The floor of the orbit is composed of soft tissues. The frontal sinus is located dorsomedial, and the maxillary ventrally, to the medial aspect of the orbit. The bony plate between the maxillary sinus and the orbit is very thin (Wissdorf *et al.* 1998; Budras *et al.* 2003; Barnett *et al.* 2004).

Orbital abscesses can be divided into 3 types: subperiosteal, preseptal and post septal. Subperiosteal abscesses occur between the bony walls of the orbit and the orbital sheath; they may displace the orbit, restrict ocular motility and cause

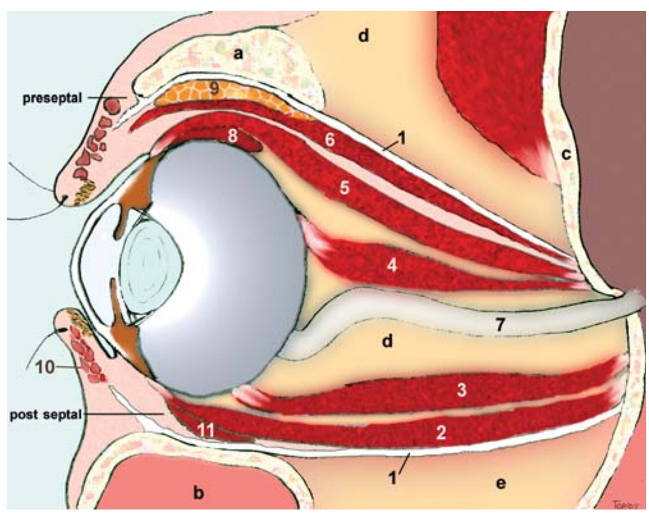

Fig 5: Anatomy of the equine eye. 1, Periorbital sheath; 2, ventral rectus muscle; 3,* retractor bulbi *(ventral part); 4,* retractor bulbi *(dorsal part); 5, dorsal rectus muscle; 6,* levator palpebrae superioris*; 7, optic nerve; 8, dorsal oblique muscle; 9, lacrimal gland; 10,* orbicularis oculi*; 11, ventral oblique muscle; a, zygomatic process of frontal bone; b, caudal maxillary sinus; c, sphenoid bone; d, intraperiorbital fat; e, extraperiorbital fat.

eyelid oedema, chemosis and proptosis (Zachariades *et al.* 2005). A displaced periosteum was not distinguishable on the CT scan made in the current case, so the diagnosis of an abscess in the subperiosteal region is not plausible.

Preseptal cellulitis is an inflammatory oedema of the eyelids that is thought to reflect impeded drainage through the ethmoid vessels, and may or may not extend posteriorly (Zachariades *et al.* 2005).

Post septal infection is a potentially lethal condition involving the contents of the orbit. In man it is usually associated with the more severe signs of swollen eyelids, proptosis, conjunctiva chemosis, visual impairment, ophthalmoplegia, leucocytosis, fever and marked systemic toxinaemia (Zachariades *et al.* 2005). In the current case the abscess was present in the post septal region.

In man, cases of orbital cellulitis most usually develop as a complication of paranasal sinus infection. In a large survey, 91% of paediatric and 50% of adult orbital cellulitis patients had radiographically confirmed sinus disease (Ferguson and McNab 1999). Orbital infection arising from dental problems has also been described in man, dogs and cats (Allan *et al.* 1991; Ramsey *et al.* 1996; Rosen *et al.* 2000; Zachariades *et al.* 2005). However, because the cranial anatomy of the horse is very different to that of the species listed above, tooth root infections are very unlikely to lead to orbital disease; orbital infection secondary to sinusitis has not been reported in horses. It has been described in horses that retrobulbar tissues can be affected by invasion or impingement by neoplasia originating from the maxillary sinus (van Maanen *et al.* 1996). In the current case the CT scan did not reveal any signs of sinus disease. However, in many instances the definitive cause of orbital inflammation cannot be determined, and in the current case no obvious cause of the retrobulbar abscess was identified; haematogenous infection was considered as the most likely possibility.

Diagnosis of retrobulbar abscessation can be made by invasive methods including exploratory orbital surgery, orbital venography or arteriography, sialography, dacryocysto-rhinography, orbital pneumography or optic thecography (Davidson and Kraft 1994). Fine needle aspiration biopsy (FNAB) is a minimally invasive surgical technique that is often sufficient to obtain the desired information (Boydell 1991). On the other hand, examination of suspected retrobulbar lesions is more easily performed by noninvasive imaging techniques, such as ultrasonography (Morgan 1989; Boroffka and van den Belt 1996; Mason *et al.* 2001), CT (Flood *et al.* 1982) or MRI (Aggarwal *et al.* 2002). Ultrasonography is the most widely available of these imaging modalities and most horses tolerate orbital ultrasonography very well such that general anaesthesia is rarely necessary. For these reasons, ultrasound is the usual technique of first choice for imaging orbital soft tissues in the horse.

In the current case, there was some uncertainty about the nature and extent of periorbital material, and the possible bony involvement by using ultrasonographic examination alone. Full evaluation of the mass was also prevented by the fact that the eye is enclosed into the bony orbit allowing ultrasound evaluation just from the rostral aspect of the eye. The CT scan under general anaesthesia was performed to clarify this process. An orbital abscess will usually appear on a CT scan as a discrete collection of purulent material within the soft tissues of the orbit (Flood *et al.* 1982). Subsequently, ultrasound guided puncture confirmed that the material was pus.

In case of orbital cellulitis, removal of the initiating factor(s), establishment of drainage and administration of systemic antibiotics are critical to successful treatment (Blake *et al.* 2006). Because orbital infections in the horse are rare, it is difficult to predict likely bacterial causes. Treatment with a broad-spectrum antibiotic is therefore advised while awaiting the results of bacterial culture and antibiotic sensitivity, which can be used to design more specific antibiotic therapy. Ultrasound-guided puncture of the orbital abscess to extract purulent material is important to decompress the region and reduce the severity of secondary symptoms.

In the current case, microbiological investigation revealed a *Streptococcus equi* ssp. *zooepidemicus* infection, which is a common pathogen in the horse. Reviewing the medical literature, it is evident that in man *Staphylococcus aureus*, *Streptococci* (*pneumoniae*, *pyogenes*), and *Haemophilus influenzae* are the bacteria most commonly responsible for orbit infections (Ikeda *et al.* 2003; Blake *et al.* 2006).

In man, surgical intervention usually involves sinus surgery with or without drainage of the abscess (Ferguson and McNab 1999; Blake *et al.* 2006). The need for surgery is determined using the Goodwin-Souliere protocol: surgery is indicated if symptoms progress over 24 h, fail to resolve within 72 h initiating antibiotic treatment, or if decreased visual acuity or orbital motility are noted (Goodwin *et al.* 1982; Souliere *et al.* 1990). In man, surgical management of orbital subperiosteal abscesses was most commonly by external ethmoidectomy and external frontal sinusectomy to establish drainage, until endoscopic sinus surgery was introduced (Ikeda *et al.* 2003; Blake *et al.* 2006). In small animals, drainage via the pterygopalatine fossa is a common approach (Rosenthal 1973; Rühli and Spiess 1995; Homma and Schoster 2000; Tovar *et al.* 2005). If vision does not return, enuculation would be considered. In horses, no routes for surgical intervention have been described; in the case presented here, drainage via the puncture needle proved to be sufficient. The reason a Bier cannula was used to drain the abscess was the low risk of obstruction of the cannula by orbital tissue during insertion, because of the presence of a stylet.

In the present case the fluorescein positive cornea ulceration was a result of the poor eyelid function due to the swelling. Ipsilateral keratoconjunctivitis sicca (KCS) is a common complication of an orbital abscess and may or may not resolve after resolution the abscess. Exophthalmos can result in an exposure keratitis with corneal ulceration of varying severity (Ramsey *et al.* 1996). In extreme cases, if the condition is not controlled the infection can spread to the intracranial region and result in death (Blake *et al.* 2006). Possible post inflammatory sequelae of retrobulbar cellulitis or abscesses, include atrophy or fibrosis of retrobulbar tissues and may result in enophthalmos, restricted ocular motility and blindness (Ramsey *et al*. 1996). The blindness in this case can be explained by the development of optic neuritis or pressure necrosis.

It is concluded that a retrobulbar abscess in the horse is rare and is characterised by relatively unspecific clinical signs, but should be included in the differential diagnosis of exophthalmos. The condition can be treated successfully. However, a quick and adequate diagnosis alone is not enough to prevent vision loss; quick and adequate treatment is necessary.

Manufacturer's address

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