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RESEARCH PAPER

Corneal abrasion and microbial contamination in horses following general anaesthesia for non-ocular surgery

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Abstract

Objective To evaluate the incidence of corneal abrasions/ulceration and microbial contamination in horses undergoing general anaesthesia.

Study design Prospective, observational, clinical study.

Animals A total of 40 client-owned healthy horses scheduled for elective non-ophthalmic procedures.

Methods Conjunctival sac swabs were taken, fluorescein dye applied and digital images recorded from both eyes of the horses after pre-anaesthetic medication and 24 hours after recovery from general anaesthesia. A paraffin-based bland ophthalmic ointment was applied on the ocular surface intraoperatively following collection of a sample into a sterile container. All samples underwent aerobic, anaerobic and fungal culture. Subject demographics, chronology of ophthalmic ointment use, anaesthesia duration, recumbency after induction, during surgery and recovery, fluorescein uptake and culture results were recorded. Descriptive statistics were performed.

Results Complete data were collected from 34 horses; six (17.6%) developed mild unilateral generalized fluorescein uptake consistent with corneal abrasions. Recumbency on the operating table was the only risk factor significantly associated with corneal abrasions. A total of 11 bacterial species were identified; *Staphylococcus* spp. (15 eyes) and *Micrococcus* spp. (eight eyes) were the most frequently isolated bacteria. Two fungal species were isolated postoperatively (*Aspergillus* spp., *Saccharomyces* spp.) in two eyes. Ointment contamination was recorded in two cases (5%) but cross-contamination was not recognized.

Conclusionsand clinical relevance Incidence of corneal abrasion/ulceration in horses undergoing general anaesthesia and contamination rate of ophthalmic solutions are similar to those previously reported in dogs.

Keywords anaesthesia, corneal abrasion, horses, morbidity, risk factors, topical lubrication.

Introduction

Corneal abrasion is the most common ophthalmic complication in people undergoing general anaesthesia for non-ocular surgery (Grixti & Watts 2013). Incidence varies between 0.056% (Roth et al., 1996) and 44% (Batra & Bali 1997) depending on surgical population, prophylactic measures employed and method of assessment (Grixti & Watts 2013). In dogs, the incidence of anaesthesia-associated iatrogenic corneal disease is reported as varying between 1.9% (Park et al., 2013) and 19.1% (Dawson & Sanchez 2016) depending on the severity of the lesion considered. General anaesthesia obtunds or abolishes the protective palpebral reflex, causes lagophthalmos and decreases tear production in both humans (Moos & Lind 2006) and equine (Brightman et al., 1983).

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The resulting degradation of the precorneal tear film, coupled with the risks of mechanical trauma from surgical drapes or instruments, chemical trauma from contact with skin preparation solutions or direct irritant effect of inhalant anaesthetics, can result in corneal insult (White & Crosse 1998). Horses have laterally situated, prominent eyes, which, coupled to the factors mentioned above, may make them susceptible to suffering corneal damage as a result of undergoing general anaesthesia.

In human medicine, various methods of protecting the ocular surface during general anaesthesia have been recommended, including eyelid taping, insertion of hydrophilic contact lenses and instillation of paraffin-based ointments, aqueous solutions or viscous gels onto the corneal surface. None of these methods, however, has been recognized as completely effective and free of potential adverse effects (White & Crosse 1998; Kocaturk et al., 2012). In veterinary medicine, corneal application of a bland ophthalmic ointment, usually supplied in a multiuse container, is commonly employed; however, microbial contamination of multiple application containers is well recognized in human medicine and has been associated with corneal infections and perforations (Rahman et al., 2006; Kim et al., 2008). To the authors' knowledge, the incidence of anaesthesia-associated corneal damage or efficacy of ocular protection strategies has not been reported in horses.

The primary aim of our study was to evaluate the incidence and potential risk factors for corneal abrasion in systemically healthy horses undergoing general anaesthesia for elective surgical procedures and administered a bland, paraffin-based ophthalmic ointment for corneal protection. We also sought to ascertain whether microbial contamination of the ophthalmic ointment occurred and whether this had an impact on the naturally occurring ocular microflora of these horses.

We hypothesized that the incidence of corneal abrasion would be similar to or greater than previously reported in humans and dogs and that microbial contamination of the ointment would occur leading to cross-contamination.

Material and methods

The study received ethical approval from the Veterinary Research Ethics Committee of the University of Liverpool, UK (VREC342), and informed owner consent was obtained for all animals. Horses were deemed eligible for inclusion in the study if they were systemically healthy, older than 1 year, undergoing inhalational general anaesthesia for elective non-ocular procedures, without history of ocular disease and not on any antimicrobial treatment. Following administration of pre-anaesthetic medication, samples were taken from the conjunctival sac of both eyes using a dry cotton swab and placed in Amies transport media with charcoal (Deltalab, Spain). Care was taken to avoid contacting the eyelid, vibrissae, eyelashes and corneal surface with the swab. Immediately after, fluorescein dye (Fluorescein Sodium 1%; Bausch & Lomb, UK) was applied on the corneal surface, the presence of abrasions/ulceration was visually evaluated and digital images were recorded for both eyes. General anaesthesia was induced, and once the horse was positioned on the operating table, a preservative-free, paraffin-based bland ophthalmic ointment (Lacri-Lube; Allergan, Ireland) was applied to the ocular surface, as is routinely performed at this institution, after first collecting an approximately 2 cm length of sample into a sterile container. Care was taken not to touch the cornea to avoid direct mechanical trauma by the applicator tip. Ointment was not reapplied during the procedure. Anaesthetic protocol was at the discretion of the anaesthetist and prophylactic antimicrobial treatment at the discretion of the surgeon responsible for the case. Conjunctival swabs, fluorescein staining and digital imaging were repeated 24 hours after the horses regained standing following anaesthesia. All procedures for data collection were performed by DB or SS, and all digital images were reviewed at the end of data collection by SS.

Samples were either transported to the laboratory immediately or stored at 4 °C for no more than 24 hours. All analyses were performed by the microbiology laboratory of the University of Liverpool. Bacterial culture was performed on 5% sheep blood agar (Thermo Scientific, UK) incubated aerobically and anaerobically for up to 7 days at 37 °C. Sabouraud dextrose agar with chloramphenicol (Thermo Scientific) was used for fungal culture with incubation at 37 °C for 7–10 days (yeast and fungi). Bacterial cultures were identified using a biochemical identification kit (API; Biomerieux, France).

Demographic data, type and length of procedure, length of recovery, recumbencies (at induction, intraoperatively and in recovery), details of ointment used (tube number, duration of use and number of horses on which it has been used), incidence of corneal abrasions or ulcers and culture results were recorded.

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