Utilization of Enbucrylate Adhesive in the Treatment of a Corneal Ulcer in a Horse

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ABSTRACT

Background: Ulcerative keratitis is a common condition in horses, and may leading to vision loss. The high incidence of corneal ulceration in horses is a consequence of several factors, including the large, prominent, laterally positioned eyes, naturally aggressive physical activity, and ubiquitous exposure to bacterial and fungal pathogens. Many surgical techniques have been proposed for the repair of corneal perforation, including conjunctival flaps, keratoplastic procedures, xenografts and biological grafts. In addition, cyanoacrylate adhesives may be used for the treatment of corneal ulcers up to 3 mm in diameter. Cyanoacrylate adhesives have been used to treat small partial corneal lacerations, descemetoceles, deep stromal corneal ulcers, and recurrent corneal erosions, in both human and veterinary ophthalmology. These adhesives allow not only corneal re-epithelialization, with complete sloughing of the glue, but also negative fluorescein retention. In this report, we describe a case of a deep corneal ulcer in a horse that was treated successfully with cyanoacrylate tissue adhesive.

Case: A two-month-old female Quarter Horse was referred to the Ophthalmology Section of the Veterinary Clinics Hospital of the Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, RS, Brazil, presenting a deep corneal ulcer. The ophthalmic examination revealed ocular discomfort, epiphora, conjunctival hyperemia and a corneal ulcer measuring 3 mm in the left eye of the animal. Surgical repair was performed using an n-butyl-2-cyanoacrylate tissue adhesive. The patient allowed the procedure to be carried out under topical anesthesia alone. The postoperative treatment involved broad-spectrum antibiotic (ciprofl oxacin chloridrate 0.35%) and a non-steroidal anti-inflammatory solution (sodium diclofenac 0.1%), administered six times a day for two weeks. In addition, atropine sulphate 1% was applied once a day for five days to induce pupillary dilation. After three weeks of follow-up, the cyanoacrylate adhesive became dislodged from the corneal bed. A fluorescein test was carried out to evaluate the presence of the corneal defect and there was no evidence of the ulcer. The time required for total resolution of the vascularization, which typically leaves a small leukoma, was six weeks.

Discussion: The objectives of the treatment included prevention of structural loss, which would compromise globe integrity, resolution of any underlying causes and contributory infectious diseases, improving the patient’s comfort by minimizing the development of scar tissue, and maximizing corneal clarity. Although many corneal ulcers are superficial and may heal quickly, a progressive or deep ulcer requires more aggressive therapy. In general, corneal ulcers that involve one-half to two-thirds of the depth of the corneal stroma should be repaired surgically because of the risk of perforation. However, the application of cyanoacrylate adhesives aids corneal healing, by establishing an artificial barrier against polymorphonuclear leucocytes and their enzymes, decreasing stromal melting, and having a bacteriostatic effect on Gram-positive organisms. The choice of surgical method was based on the fact that the adhesive can be applied with topical anesthesia, in its indication for deep ulcers up to 3 mm in diameter, and its advantages in the re-epithelization of the cornea in humans and other animals. In the present case, the use of n-2-butyl-cyanioacrylate offered an effective alternative for the management of a deep corneal defect.

Keywords: equine, horse, corneal ulcer, cyanoacrylate glue.
INTRODUCTION

Bacterial ulcerative keratitis is a common problem affecting horses that may result in serious consequences if left untreated [6,10,14]. The high incidence of corneal ulceration in horses is a consequence of several factors, including the large, prominent, laterally positioned eyes, naturally aggressive physical activity, and ubiquitous exposure to bacterial and fungal pathogens [7,8,15].

Ulcerative keratitis is generally suspected in horses that demonstrate signs such as ocular pain, blepharospasm, epiphora and photophobia [6,10]. These corneal ulcers frequently culminate in loss of the eye as a result of endophthalmitis, anterior chamber collapse and glaucoma, or chronic leakage of aqueous humor, which leads to atrophy of the ciliary body and phthisis bulbi [5,11,15].

The treatment of corneal ulcers in horses may involve medical therapy alone, or a combination of medical and surgical therapy [8,10,17]. Many types of surgical technique have been proposed for the repair of deep corneal ulcers, including conjunctival flaps, keratoplastic procedures, and xenografts [1,8,9,14-17]. Cyanoacrylate adhesive has been used to treat small partial corneal lacerations, descemetoceles, deep stromal corneal ulcers, and recurrent corneal erosions in both human and veterinary ophthalmology [2,3,5,16,18]. However, there are few case reports of its use in horses.

The adhesive is usually applied on an outpatient basis, requiring little or no sedation, and it is well tolerated. The application of cyanoacrylate adhesives establishes an artificial barrier against polymorphonuclear leucocytes and their enzymes, decreases stromal melting and confers anti-microbial protection [4-6,13]. A case is reported here in which an n-butyl-2-cyanoacrylate tissue adhesive was utilized successfully to treat a deep corneal ulcer in a horse.

CASE REPORT

A two-month-old female Quarterhorse was referred to the Veterinary Ophthalmology Section of the Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, RS, Brazil.

The history revealed epiphora and blepharospasm seven days previously. On examination, the horse presented in good clinical condition. Topical anesthesia with tetracaine chloride 10% and phenylephrine 0.1% was administered before the ophtalmic examination. Use of a portable slit lamp revealed severe blepharospasm, photophobia, epiphora, conjunctival hyperemia and a large deep central corneal ulcer of about 3 mm in the left eye (Figure 1). Clinically, miosis and aqueous flare were observed.

Figure 1. Appearance of the deep corneal ulcer in the left eye of the horse.

The diagnosis of a corneal ulcer was based on these clinical signs and fluorescein staining of the cornea. The entire ulcer was stained with fluorescein and the defect appeared to involve most of the stromal thickness. The patient allowed the procedure to be carried out with topical anesthesia alone. A lid speculum was used to increase the exposure of the cornea and prevent accidental gluing of the lids or nictitating membrane. The ulcer was debrided with sterile cotton swabs, and a thin layer of an n-butyl-2-cyanoacrylate tissue adhesive was applied uniformly to cover the entire ulcerated area, using an insulin syringe with a needle. Within a few seconds, adhesive polymerization occurred and the cornea was flushed with sterile salt solution. Subsequently, a subconjunctival injection of gentamicin was administered by injection into the upper bulbar conjunctiva. The horse was treated with flunixin meglumine at a dose of 1.1 mg/kg, IM, every 12 h for three days.

The medical treatment included a broad-spectrum antibiotic solution containing ciprofloxacin 0.35% and a non-steroidal anti-inflammatory solution of sodium diclofenac 0.1%, which were applied six times daily for two weeks after the procedure. Atropine sulphate 1% was applied once a day for five days to stimulate pupillary dilation. The horse was followed up at weekly intervals for six months.
On the first day after surgery, the eye was visual and the n-butyl-2-cyanoacrylate had adhered to the cornea (Figure 2). The anterior chamber showed minimal inflammation and there was little ocular pain. In 72 h, the condition of the eye remained stable, with no evidence of infection, inflammatory reaction or ocular discomfort. After three weeks, the cyanoacrylate adhesive became dislodged from the corneal bed. Following this, a fluorescein test was carried out and there was no evidence of the ulcer; just a few superficial vessels were observed in the cornea. The time required for the total resolution of vascularization, which typically leaves a small leukoma, was six weeks (Figure 3).

**DISCUSSION**

Ulcerative keratitis can present with a variety of clinical signs. This ocular lesion is usually suspected in horses that demonstrate signs such as ocular pain, blepharospasm, epiphora and photophobia, miosis, serous to mucoid ocular discharge, and corneal edema, as well as the loss of corneal epithelium, stroma, or both, corneal vascularization, aqueous flare, hypopyon, or both, and keratomalacia or corneal melting [7,8,10,12,16]. In this case, a corneal ulcer was diagnosed on the basis of the clinical signs and fluorescein staining of the cornea; no evidence of corneal necrosis or melting was observed.

Corneal ulcers in horses can be treated with medical therapy alone, or by combining medical and surgical therapy [7,10,17]. The objectives of the treatment include prevention of structural loss, which will compromise the integrity of the globe, resolution of any underlying causes and any contributory infectious diseases, improving the patient’s comfort, minimizing the development of scar tissue, and maximizing corneal transparency [5,10,13,18]. Although many corneal ulcers are superficial and may heal quickly, progressive or deep ulcers require more aggressive therapy. As a rule, corneal ulcers that involve one-half to two-thirds of the depth of the corneal stroma should be repaired surgically because of the risk of perforation [12,18]. After the surgical procedure, appropriate topical treatment may involve drugs such as antimicrobials, anticollegenase, anti-inflammatory and mydriatic agents [7,8].

In this case, the choice of surgical method was based on the fact that the adhesive can be applied with topical anesthesia, and general anesthesia was not necessary. In addition, the excellent results obtained in previous studies in humans, dogs and cats motivated us to utilize the adhesive [2-7,18]. The concomitant medical therapy involved the topical use of broad-spectrum antibiotics in order to prevent bacterial contamination. In addition, topical atropine sulphate 1% was used to dilate the pupil and help to decrease the pain associated with secondary uveitis. This mydriatic should be used to effect, and horses should be monitored closely because it has been shown to cause gastrointestinal stasis and abdominal pain [7,8]. However, this complication was not observed in this case. In order to assist in pain control and reduce secondary anterior uveitis, systemic flunixin meglumine was also administered.

The surgical repair of corneal ulcers is used to strengthen the cornea and prevent rupture, to remove infected and/or degenerative tissue, as well as helping
to eliminate bacterial or fungal infections by supplying blood to the cornea [1,5,8,14,17]. Ulcers greater than half the depth of the cornea are at risk of rupture. Furthermore, rapidly melting or rapidly progressing ulcers often require surgery to prevent the loss of the eye and vision. For both indications, possible methods of surgical repair include conjunctival grafts, xenogenic freeze dried collagen, frozen corneal allografts, sliding or free autografts, and fresh allografts [1,8-10,14,15,17]. The type of surgery performed depends on the depth, location and infection status of the ulcer. In addition to these possibilities, tissue adhesives can be used to provide support for the lesion, establish an artificial barrier against polymorphonuclear leucocytes and their enzymes, and decrease stromal melting [5,12,16,18]. In addition, previous studies have shown that an isobutyl-cyanocrylate tissue adhesive also has anti-infection properties, being bacteriostatic for Gram-positive organisms [2,4,7,16,17].

The adhesive polymerizes at room temperature, and after few seconds in contact with water to allow solidification, creates a rigid and rough plate on the bed of the corneal lesion [18]. This implies that a foreign body reaction occurs which, with eyelid movement, induces transient postoperative discomfort [6,11]. In this case, ocular irritation was noted for a few days but the application of a therapeutic soft contact lens was not carried out; this could have been used to relieve the patient’s discomfort [3,5,6]. The adhesive can be applied with an insulin syringe as was done in this case [2,8,16]. Thus, we used a small amount of glue to avoid toxic effects and to maintain a smooth and thin surface [13,16]. Application of the adhesive to conjunctiva, sclera, or skin would be expected to lead to greater tissue reaction than application to corneal epithelium and stroma [5]. In order to avoid this, in our case, after administration of topical anesthesia, a lid speculum and an insulin syringe were used to prevent accidental gluing of the lids or nictitating membrane, and to spread the adhesive on the ocular surface [2,5,16,17]. The procedure is usually performed on an outpatient basis, requires little or no sedation, and is well tolerated [2,16,17].

The latest cyanoacrylate adhesives incorporate an alkyl side chain with improved biocompatibility [16,18]. Tissue histotoxicity, which occurs through the accumulation of breakdown products, is therefore less prevalent with the butyl derivates or those with longer side chains [4,16]. With the cyanoacrylate type of adhesive, the tissue toxicity increases with the size of the lesion [16]; with corneal application, the major risk of toxicity of cyanoacrylate glue to the corneal endothelium and lens occurs when there is direct contact with these structures [5,16]. Therefore, cyanoacrylate adhesives are indicated only for treatment of ulcers up to 3 mm in diameter, to avoid this kind of corneal lesion [5,11].

Healing was defined as corneal re-epithelialization, with complete sloughing of the glue, and negative fluorescein retention, which was observed in this case 21 days after surgery, similar to other studies [2,6,18]. Thus, the utilization of an n-butyl-2 cyanoacrylate tissue adhesive, associated with medical treatment, may be considered an effective alternative in the treatment of deep corneal ulcer in horses.

SOURCES AND MANUFACTURERS
1 Anesthesis eye drops, Allergan, SP, Brazil.
2 Kowa SL15, Kowa Company Ltd, Japan.
3 Fluorescein strips, Ophthalmos, SP, Brazil.
4 Histoacryl, Braun, Melsungen, Germany.
5 Garamicina 40 mg/mL, Schering-Plough, SP, Brazil.
6 Banamine, Schering-Plough, SP, Brazil.
7 Cloxan, Allergan, SP, Brazil.
8 Still, Allergan, SP, Brazil.
9 Atropine eye drops a 1%, Allergan, SP, Brazil.

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REFERENCES


