



Bilateral Third Eyelid Flap Surgery in a Domestic Shorthair with Severe Acute Bullae Keratopathy

Kyle E Kline, Brittany B Martabano, Lisa Uhl, Kathryn L Wotman and Michala de Linde Henriksen*

Comparative Ophthalmology, Department of Clinical Sciences, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Colorado, USA

***Corresponding Author:** Michala de Linde Henriksen, Comparative Ophthalmology, Department of Clinical Sciences, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Colorado, USA.

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Abstract

Background: A 3-year-old female spayed domestic shorthair was presented to the Urgent Care Service at Colorado State University's Veterinary Teaching Hospital for progressive cloudiness of the right eye after being diagnosed with a corneal ulcer by primary veterinarian two days prior. The patient was on chronic administration of an anti-inflammatory dose of oral Prednisolone (0.5 mg/kg of body weight) for front leg lameness of unknown origin.

Key Findings: Ophthalmic examination revealed a corneal bullae comprising around 30% of the corneal surface of the right eye (OD), moderate keratoconus, and overlying corneal ulceration. An ophthalmic diagnosis of acute bullae keratopathy OD was made. The following day, the left eye (OS) developed acute, marked corneal edema and globular anterior protrusion of the corneal surface consistent with severe feline acute bullae keratopathy.

Significance: Surgical placement of bilateral third eyelid flap and temporary tarsorrhaphy was performed. The third eyelid flaps were removed 28 days post-surgery, revealing complete resolution of the bilateral bullae keratopathy. This case may serve to support an association between chronic steroid therapy and the development of acute bullae keratopathy in predisposed feline patients, such as those with underlying FHV-1 infection. This case report also reveals a good prognosis for severe feline acute bullae keratopathy when a third eyelid flap is being placed. A third eye flap is a surgical procedure that can be performed in emergency and urgent care clinics and should be recommended for these cases.

Keywords: Bullae Keratopathy; Corneal Hydrops; Third Eyelid Flap; Feline; Feline Herpes Virus

Introduction

Feline acute bullae keratopathy (ABK), also known as feline acute corneal hydrops (FACH), is a corneal disease in cats of which the pathogenesis and etiology is largely unknown [1,2]. A single bulla or multiple bullae may develop acutely within a twenty-four to forty-eight hour period, and the condition usually involves extensive corneal edema [1]. Multiple bullae can merge into a single, large bulla which poses the risk for corneal rupture [2]. Clinically, this condition displays distorted edematous corneal tissues with globular anterior protrusion.

Several theories exist regarding the pathogenesis for this condition. One theory is that an underlying condition, such as uveitis or corneal ulceration, leads to an inflammatory process that disrupts the corneal endothelial cells and draws fluid into the corneal stroma [2]. Bullae keratopathy is one of several corneal conditions in cats suspected to be associated with an underlying infection with Feline Herpes Virus-1 (FHV-1), due to this organism's tropism for surface epithelia [3]. This association has not proven to be causal and prior investigations have failed to identify FHV-1 organisms when testing for the virus in feline patients with ABK [4].

Research has indicated a significant association between systemic administration of corticosteroids and/or cyclosporine and the development of bullous keratopathy in cats [5].

While the prognosis for mild forms of this condition with surgical treatment is good, extensive bullous keratopathy is believed to carry a poor prognosis [3]. The current report serves to highlight a case of severe, acute bilateral bullous keratopathy in a feline patient, and to describe the treatment and management of this condition utilizing a third eyelid flap procedure.

Case Summary

A 3-year-old female spayed domestic shorthair was presented to the Urgent Care Service after-hours at Colorado State University's Veterinary Teaching Hospital (CSU-VTH) for acute clouding of the right eye (OD). The cat had been seen two days prior to presentation by a primary veterinarian, who diagnosed a corneal ulcer and prescribed Terramycin® Ophthalmic Ointment (oxytetracycline hydrochloride with polymyxin B sulfate) to be administered topically OD every twelve hours (BID). Due to patient non-compliance, the cat had been receiving this medication inconsistently. Two days later, OD had become progressively cloudier, prompting presentation to CSU-VTH. The patient had a pre-existing carpal joint lameness of unknown origin, which was being managed with chronic administration of Prednisolone 0.5 mg/kg of body weight (BW) by mouth (PO) BID.

The cat was transferred to CSU-VTH's Ophthalmology service at presentation due to the severity of its ocular disease OD. A neuro-ophthalmic examination revealed that the cat was visual to both eyes (OU) indicated by positive menace response, positive dazzle reflex, positive direct and indirect pupillary light reflex, and positive palpebral reflex OU. Ophthalmic examination OD revealed mild serous discharge, mild hyperemia, a nasal corneal bullae comprising 30% of the corneal surface, and moderate keratoconus. OD stained positively with fluorescein stain (FUL-GLO® sterile fluorescein sodium ophthalmic strips, Akorn Inc., Lake Forest, IL, United States) indicating associated overlying corneal ulceration (Figure 1A and 1B). Slit-lamp biomicroscopy displayed no evidence of aqueous flare within the anterior chamber. Fundic examination OD could not be performed due to corneal opacity. The left eye (OS) was normal on ophthalmic examination apart from the presence of a posterior suture line cataract (Figure 1C). Intraocular pressure (IOP) was measured to be 20mmHg OD and 24mmHg OS (normal reference value: 10-25mmHg) [6] using TonoVet® rebound tonometer (Jorgensen Laboratories Inc., Loveland, Colorado, United States). The patient was given an ophthalmic diagnosis of acute bullous keratopathy OD. A recommendation was made for third eyelid flap to be placed OD to stabilize the right cornea, which the cat's owner elected to proceed with.



Figure 1: A) and B) Right eye (OD) on presentation. Note presence of bulla leading to moderate keratoconus OD and surrounding corneal edema. The eye has been fluorescein stained indicating associated overlying corneal ulceration. C) Left eye (OS) at presentation. Note clear cornea with no evidence of corneal hydrops. A posterior suture line cataract can be appreciated in the lens (white arrow).

Due to a high risk for perforation, the patient was hospitalized in CSU's Intermediate Care Unit (IMCU) overnight. A complete blood cell count and serum chemistry profile were unremarkable. The cat was maintained on intravenous (IV) fluid administration at a maintenance rate of 1.8 ml/kg BW/hour with Lactated Ringer's Solution (Vetivex® Veterinary Fluids, Dechra, Overland Park, KS, United States), and was administered topical antibiotic (Ofloxacin 0.3% ophthalmic solution; Akorn, Lake Forest, IL, United States) one drop OD q6 hours, Buprenorphine (Buprenorphine Pwd, Medisca Inc., Las Vegas, NV, compounded at CSU-VTH in Fort Collins, CO, United States) 0.01 mg/kg IV q8 hours, and Dexamethasone SP (Dexamethasone Sodium Phosphate Inj., VetOne, Boise, Idaho, United States) 0.08 mg/kg IV q24 hours for previously diagnosed arthritis.

Ophthalmic exam 24 hours following presentation showed the corneal bulla OD had progressed to cover 40% of the corneal surface (Figure 2A). OS was found to have mild blepharospasm and moderate mucoid discharge with a clear cornea and anterior chamber, however the cornea rapidly deteriorated over the following 3 hours. OS developed severe marked corneal edema and globular anterior protrusion of the corneal surface consistent with feline acute bullous keratopathy comprising 90% of the corneal surface (Figure 2A and 2B). The severity of the bullous keratopathy OS precipitated concern for globe rupture, and surgical stabilization for OS with a third eyelid flap was pursued in conjunction with the right eye.

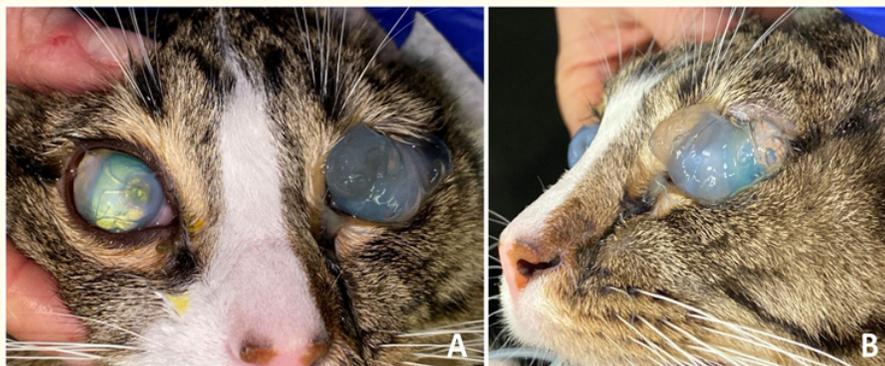


Figure 2: Patient prior to surgical procedure with severe bilateral bullous keratopathy (A: Both eyes; B: Left eye). Note the large stromal bulla protruding outwards bilaterally. Absent corneal vascularization confirms the acute nature of this disease process.

The cat was premedicated with Buprenorphine 0.02 mg/kg IM, Dexmedetomidine (Dexdomitor®, Zoetis US, Parsippany, NJ, United States) 7 mcg/kg IM and Alfaxalone (Alfaxan®, Jurox Inc., North Kansas City, MO, United States) 0.2 mg/kg IM. General anesthesia was induced with 2.3 mcg/kg Alfaxalone IV and maintained with inhalation isoflurane. The patient was positioned in dorsal recumbency with both eyes sterilely prepped with an antiseptic povidone-iodine solution (Betadine® VetOne, Boise, Idaho, United States). For the third eyelid flap OD, two horizontal mattress sutures were placed using 4-0 Nylon monofilament non-absorbable suture (Ethicon, Bridgewater, New Jersey, United States) from the dorsolateral fornix of the superior palpebra and into the cartilage

of the anterior side of the third eyelid and back to the fornix of the superior palpebra where the suture was *tightened* with a surgeon knot (Figure 3). Bishop-Harmon tissue forceps were used to extend the third eyelid OD in a dorsolateral direction, covering the cornea. Care was made not to penetrate the nictitans bulbar surface to avoid suture contact with the cornea. A lateral temporary tarsorrhaphy was placed using a horizontal suture pattern with 4-0 Nylon suture. For the third eyelid flap OS, one horizontal mattress suture was placed in the same fashion as OD. Due to the severity of bullae keratopathy OS, the third eyelid flap did not cover the protruding cornea. A lateral temporary tarsorrhaphy was placed with one horizontal mattress following by a simple in-

errupted suture (medial), using 4-0 Nylon suture (Figure 3). The cat recovered uneventfully from anesthesia and was discharged the same day. Postoperative medical therapy included topical Ofloxacin 0.3% ophthalmic solution one drop OU q6 hours, topical 5% hypertonic saline ophthalmic ointment (Muro 128®, Bausch and Lomb, Bridgewater, NJ, United States) OU q6 hours, topical hyaluronic eye lubricant (I-drop® Vet, I-MED Pharma Inc., Dollard-Des

Ormeaux, Quebec, Canada) one drop OU q6 hours, Buprenorphine 0.069 mg/kg PO BID, Gabapentin (Stokes Pharmacy, Mount Laurel Township, New Jersey, United States) 11.6-23.3mg/kg PO BID, Prednisolone (Lloyd Inc, Shenandoah, IA, United States) 1.16mg/kg PO q24 hours and oral Famciclovir (Macleods Pharmaceuticals, Plainsboro, NJ, United States) 250 mg or 58.1 mg/kg PO BID due to suspected underlying FHV-1 infection.



Figure 3: Placement of third eyelid flaps. This procedure can be performed within the setting of an emergency clinic. Two horizontal mattress sutures using 4-0 Nylon monofilament non-absorbable suture were placed from the dorsolateral fornix of the superior palpebra (A) and into the cartilage of the anterior side of the third eyelid (B) and back to the fornix of the superior palpebra where the suture was tightened with a surgeon knot (white arrows) (C). Bishop-Harmon tissue forceps were used to extend the third eyelid in a dorsolateral direction, covering the cornea. A lateral tarsorrhaphy was placed OU using a horizontal suture pattern with 4-0 Nylon suture. Both eyes with third eyelid flap covering the cornea can be appreciated in Figure 3D (right eye) and Figure 3E (left eye).

On recheck examination four days post-surgery, the third eyelid flap was in place OD with minimal serous discharge. The patient still had a positive menace response and dazzle reflex through the third eyelid flap OU indicating vision. There was evidence of protrusion of the globe under the tarsorrhaphy OS. As a result, the medial tarsorrhaphy suture was removed OS for further assessment, which revealed the cornea was less edematous with no evidence

of globe rupture. Under general anesthesia, the third eyelid flap OS was released by cutting the suture that was tied from the third eyelid through the periorbital skin dorsal to the eye. It was then re-sutured as described above to cover the entire cornea.

The cat was rechecked multiple times post-surgery to evaluate comfort and placement of the third eyelid flaps. The patient was found to be visual with no evidence of discomfort in either eye (ab-

sent blepharospasm or epiphora) at each recheck. Both third eyelid flaps were released on day 28 post-surgery. Topical analgesia (Proparacaine 0.5% ophthalmic solution; Sandoz Inc., Princeton, NJ, United States) was applied to each eye prior to cutting the suture that was tied from the third eyelid through the periorbital skin dorsal to the eye. The third eyelid flap OD had developed two areas of symblepharon between anterior aspect of the third eyelid flap and superior conjunctiva (Figure 4A). These areas were trimmed with Westcott scissors to allow the third eyelid fall back in correct anatomical position (Figure 4B). Release of the flaps revealed full

resolution of the corneal bullae keratopathy OU (Figure 4C and 4D). Each eye received administration of 1 drop topical Ofloxacin 0.3% ophthalmic solution. Positive fluorescein stain uptake OS indicated a small superficial corneal ulceration 2x2mm in diameter. The patient was continued on the same medical therapy protocol as previously described. A follow-up 40 days post-surgery was performed over email due to restrictions for in-hospital appointments due to the COVID-19 virus pandemic taking place at the time. The patient was reportedly doing well at home, and her eyes appeared clear and comfortable.



Figure 4: Third eyelid flap OU were released on day 28 post-surgery. (A) The third eyelid flap OD had developed two areas of symblepharon between the superior palpebral conjunctiva and the anterior portion of the third eyelid (white arrows). (B) Topical analgesia and betadine solution was applied to OD and the two areas of symblepharon was released with a Westcott scissors. (C) The cornea of the right eye showed mild edema and fibrosis medially with few superficial poorly perfused vessels extending from the dorso-lateral limbus 4-5mm axially. Two areas of symblepharon between the anterior portion of the third eyelid and superior conjunctiva had to be surgical removed before the right side third eyelid was released (white arrows) (D) The cornea of the left eye displayed mild diffuse edema. There was superficial vascularization from 3:00-4:00 (mild) and 9:00-10:00 (dense) extending 3-4 mm axially with perivascular mild to moderate edema and fibrosis.

The oral steroid the patient was receiving for chronic lameness in the right-carpal joint was tapered and discontinued 19 days post-surgery. The patient was evaluated further for progressive, erosive, proliferative monoarthritis. The history, signalment, diagnostic results, and response to steroids were most consistent with Feline Periosteal Proliferative Polyarthrititis (FPPP), an uncommon immune-mediated disorder which has shown to be associated with retroviral infections in cats [7-9]. An FeLV/FIV SNAP ELISA, *Coccidioides immitis* antibody AGID test, and quantitative real-time PCR for exogenous FeLV were performed which were all negative. Serology performed for FeSFV displayed a titer of 32 (normal reference interval <1:4) [10]. Reports of patients with FPPP have shown to be positive for antibodies against FeSFV [7,8], however FeSFV is a widespread retrovirus in cats and the association between this virus and FPPP is still uncertain [9]. Although there is no specific treatment to target FeSFV, the arthritis that is suspected to result from chronic antigenic stimulation and immune-complex deposition is often managed with immunosuppressive therapy and analgesia [9]. It was elected to keep the patient off of oral steroids, and to consider initiation of a different immunosuppressant medication. The cat was provided Buprenorphine 0.2 mg/kg PO q8-12 hours as needed for long-term pain management.

Discussion and Conclusion

This case report illustrates the use of a third eye flap to resolve a severe manifestation of bullous keratopathy OU in a cat. The third eyelid flap was tolerated well by the patient and promoted complete resolution of severe bullae keratopathy OU. This procedure can be performed within the emergency clinic, and this case serves to highlight the importance of attempting the third eyelid flap even on patients with severe forms of this condition.

The third eyelid flap procedure has been described in the literature as an efficacious treatment for feline ABK by acting as a pressure bandage over the bullae and to support the cornea throughout the healing process [11]. One retrospective analysis has demonstrated success in treating 90.5% of feline acute corneal hydrops eyes (or 89.5% of patients) with a third eyelid flap [12]. A successful third eyelid flap procedure provides the patient with a chance for an increased field of vision once the bullous keratopathy is healed and the flap is released, in comparison to a conjunctival graft procedure where vision will be permanently affected by the conjunctival graft. Symptomatic therapy with hypertonic sodium chloride ointment can be used to reduce edema and limit rupture of the bullae. Topical antibiotics should be incorporated to medical

treatment protocols if bullae rupture and there is positive fluorescein stain uptake [3]. The use of topical mydriatics and analgesics may also be indicated due to secondary signs of anterior uveitis [1,11].

It is suspected that an underlying FHV-1 infection may have predisposed this patient to the development of bullous keratopathy OU. The condition may have been secondary to progression of corneal ulceration OD, and perpetuated by chronic administration of oral steroid, poor patient compliance for drug administration, and lack of wearing an E-collar. This case may therefore serve to support an association between chronic steroid therapy and the rapid development of acute bullous keratopathy in predisposed feline patients, such as those with underlying FHV-1 infection.

Even after successful treatment, there is a risk for bullae to recur in the same location or in new locations within the cornea [3]. The authors of the current report therefore recommend regular long-term eye examinations in affected patients, and administration of topical hypertonic sodium chloride if corneal edema is de-

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