Medical and surgical treatment of severe corneal alkaline burn in a cat

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Abstract: Chemical burns of cornea are among the most critical and urgent ocular emergencies. Especially alkaline materials penetrate rapidly into the cornea and cause serious complications in anterior segment structures. Therefore, early and timely intervention is crucial in ocular alkaline burns. A three year old female tabby cat which was referred to the university clinics with severe ocular pain, blepharospasm and lacrimation in both eyes was evaluated in this case report. The owner noticed that the animal fell into a lime pit a few hours ago. Eyes were washed thoroughly for 20 minutes with saline solution. Topical anesthetic was used for ocular examination. Both eyes had severe corneal edema, superficial perilimbal vascularization and mucopurulent conjunctivitis. Schirmer's test values were 8 mm in the left eye, 5 mm in the right eye. Fluorescein staining was positive in both eyes. Cyclopentholate HCl 1%, lomefloxacin, acetylcystein opthalmic solutions were used in both eyes. The left eye had improved dramatically, four weeks following the initial presentation and was normal in appearance; however, the right eye had chronic keratitis and corneal vascularization. Corneal scar debrided with a corneal blade and bulbar conjunctival pedicle graft was sutured to the wound. The globe was protected by third eyelid flap. The flap was removed from the eye after one week. After four weeks following the operation, lesion was noticed to be healed.

Keywords: alkaline burn, cat,conjunctival pedicle graft, cornea

Şiddetli kornea alkali yanığı olan bir kedide medikal ve cerrahi sağaltım

Öz: Korneanın kimyasal yanıkları en kritik ve acil göz lezyonları arasında yer alır. Özellikle alkalik maddeler korneaya hızlı penetre olarak, ön segment yapılarında ciddi komplikasyonlara neden olur. Bu nedenle, erken ve zamanında müdahale gözün alkali yanıklarında kritiktir. Bu olgu sunumunda, her iki gözünde şiddetli ağrı, blefarospazm ve göz yaşı akıntısı şikayetleri ile fakülte kliniklerine getirilen 3 yaşlı, dişi tekir kedi değerlendirildi. Alınan anamnezle, hayvanın birkaç saat önce kireç kuyusuna düştüğü öğrenildi. Gözler 20 dakika süreyle serum fizyolojik solüsyon ile yıkandı. Göz muayenesi için topikal anestezik damlatıldı. Her iki gözde şiddetli korneal ödem, yüzeysel perilimbal neovaskülarizasyon ve mukopurulent bir konjunktivitis dikkati çekti. Schirmer test değerleri sağ göz için 5 mm, sol göz için 8 mm olarak ölçüldü. Fluorescein boya her iki gözde pozitif sonuç verdi. Sağaltımda %1'lik siklopentolat HCl, lomefloksasin ve asetilsistein damla kullanıldı. Sol göz 4 haftada hızlı bir şekilde iyileşirken, bu süre sonunda sağ gözde kronik keratit ve korneal vaskülarizasyon oluştu. Korneal skar operatif müdahale ile debride edilerek bölgeye pediküllü bulbar konjunktiva grefti kaydırıldı. Gözü korumak için 3. göz kapağı flebi yapıldı ve flep 1 hafta sonra uzaklaştırıldı. Dört hafta sonra lezyonun iyileştiği görüldü.

Anahtar kelimeler: alkali yanık, kedi, kornea, pediküllü konjuktiva grefti

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Introduction

Chemical burns can cause severe injury to the external and internal structures of the eye. There are two general types of chemical burns to the cornea: acidic and alkaline. Clinical signs for each type include edema, opacity, loss of corneal epithelium, pain, and rapid dissolution of the corneal stroma. Later, there is severe corneal ulceration and anterior uveitis (3). The severity of chemical injury is related to the type of chemical, the pH of the solution, and the duration of exposure (9, 11). Alkaline chemicals include ammonium hydroxide, potassium hydroxide, sodium hydroxide, calcium hydroxide, and magnesium hydroxide. Substances in a home that contain these compounds include lye, cement, lime, ammonia, sparklers and flares. In general alkalines, especially lime, tend to penetrate into the eye more effectively than acids (3).

Alkaline substances are lipophilic. Saponification of cell membrane fatty acids causes cell disruption and death. The damaged tissues stimulate an inflammatory response, which damages the tissue further by the release of proteolytic enzymes. Because of these, treatment for chemical burns of the cornea should start immediately (3).

Purpose of this case report was to evaluate clinical findings, medical and surgical treatments and postoperative outcomes of a cat with severe corneal alkaline burn. This case showed the importance of early intervention of corneal alkaline burns. Also, implementation of medical treatment with conjunctival graft was important to shorten the recovery time of the cornea.

Case Description

A three year old female tabby cat was referred to the university clinic with severe ocular pain, lacrimation and blepharospasm in both eyes. The owner noticed that the animal fell into a lime pit a few hours ago. Eyes were irrigated with 1 liter of saline solution for 20 minutes in the clinic. The cat required proparacaine hydrochloride (Alcaine 5%, Alcon, USA) as a topical anesthetic drop before it would allow an adequate ocular examination. Bilateral severe complete corneal edema was seen in each eye. Also both eyes had mucopurulent conjunctivitis (Figure 1).

Schirmer's test was performed and the values were 8 mm for left eye and 5 mm for right eye. Fluorescein staining was applied to detect injury involving the cornea. It was positive on both whole corneal surfaces. Intraocular examination could not be performed because of the severity of corneal edema.

After clinical examination, pupils were dilated with cyclopentholate HCl (Siklopleji n 1%, Abdi Ibrahim, Turkey). Cyclopentholate HCl, lomefloxacin (Okacin, Alcon, USA) as broad spectrum antibiotic drop and acetylcystein eye drop (Brunac, Arz Ilacları, Turkey) were applied topically in each eye twice daily for 7 days. Elizabethan collar was applied during treatment. During 15 days following the initial presentation, sterile hypertonic saline solution was administered three times daily. Artificial eye drops were used 7-8 times daily for 10 days, 4-5 times daily for the following 10 days, and 3 times daily for 15 days. On 6th day of initial presentation, 0.1% dexamethasone phosphate eye drop (Onadron, I.E. Ulagay, Turkey) was used twice a day for 10 days. After administration of Lomefloxacin eye drop, oxytetracycline ointment was used for 7 days.

Four weeks following the initial presentation, the left eye had improved dramatically (Figure 2a); however, keratitis and corneal vaskularization was developed in right globe (Figure 2b).

Corneal scar debrided with a 3 mm angled corneal blade and a thin, pedicle bulbar conjunctival graft was sutured to the corneal wound surface of the right eye. The third eyelid was sutured over the globe for 1

Figure 1. Bilateral severe complete corneal edema and mukopurulent discharge in both eyes before treatment.

Figure 2a. Four weeks following the initial presentation, mild keratitis on the left eye

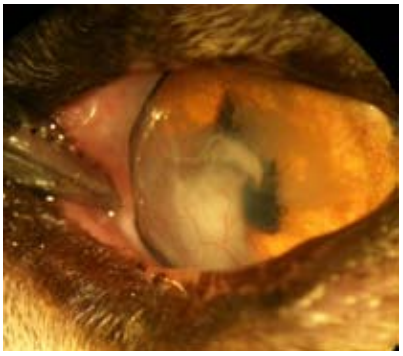

Figure 2b. Corneal vascularization on the right eye

week after surgery. The conjunctival surface adhered to the area where corneal epithelium was missing in approximately 2 weeks. Two weeks following the operation, conjunctival graft was cut from the base of it with the use of Stevens tenotomy scissors. The ulcer had healed on the 2nd week but there was significant neovascularity of the cornea.

Because there was no evidence of corneal epithelium breakdown on the operated eye, topical dexamethasone phosphate was begun one drop q6h for 10 days, then one drop q12h for 10 days. Three months after the operation, the most prominent corneal vessels had resolved to small vessels on the superior aspect of the right cornea that were visible only by slit lamp.

Discussion and Conclusion

Chemical burns affecting the cornea can be among the most severe ocular emergencies in cats. The clinical findings present immediately following a chemical injury are related to the area of involvement, depth of penetration, and relative toxicity of substance. The depth of corneal penetration can be estimated by evaluating the loss of stromal clarity. The depth of conjunctival penetration can be assessed by direct observation of vascular ischemia and/or necrosis of limbal and bulbar conjunctiva. The area of involvement can be accurately assessed by the extent of fluorescein staining. (3, 7, 11). In this case, depth of corneal penetration and conjunctivitis were assessed by both fluorescein staining and slit-lamp examination.

There are various classification schema for grading the severity of ocular chemical injuries, but the Hughes classification system, later modified by Ballen and Roper-Hall, is commonly used in the acute stage in human due to its greater simplicity (Table 1). This system recognizes the correlation between the loss of corneal clarity and degree of limbal ischemia with the ultimate prognosis. (5, 8, 11) Severe ocular chemical burns (Grade III and IV) are difficult to treat and the course of healing often takes several months (6). In this case report, anterior segment structures could not be examined due to severe corneal opacity; ischemic necrosis of the limbus and conjunctiva was determined by slit-lamp examination. These findings was considered that grade of alkaline burn injury might be IV. According to the classification system, prognose is dismal in human patients with grade IV injury. For all that, in this case, at the end of the 4th postoperative week left cornea was healed completely and right cornea was healed partially.

Table 1. Modified Hughes Grading of Ocular Chemical Injury Severity

Grade of Injury	Clinical Findings	Prognosis
Grade I	No corneal opacity No corneal ischemia	Excellent
Grade II	Cornea haziness, but visible iris details Ischemia <1/3 of limbus	Good
Grade III	Significant corneal haziness to obscure iris details Ischemia 1/3 to ½ of limbus	Guarded
Grade IV	Cornea is opaque, no view of iris or pupil Ischemia >1/2 of limbus Ischemic necrosis of proximal conjunctiva and sclera	Dismal

* *This table was taken from reference Kosoko, 2009*

The management in both acid and alkaline damages are similar, but long-term prognoses are different (5). Common goals of management should include the removal of the chemical agent; control of pain, intraocular pressure, and inflammation; prevention of infection; and promotion of ocular epithelial healing (5, 6). In this case, sterile balanced saline solution was used to remove of the alkaline agent; cyclopentholate HCl was administered for relaxing the muscles of iris and preventing it from having painful spasms (10). Tetracycline plays an important role to inhibit metallo-proteinases independently of their anti-microbial properties. But some drugs such as gentamicin, neomycin and tobramycin are toxic to the epithelial cells (1, 2, 6). Lomefloxacin was preferred as a broad spectrum antibiotic therapy at the beginning of the treatment. Drug was found to be very effective on preventing bacterial infections. After one week, antibiotic was replaced with oxytetracycline in order to avoid bacterial resistance to fluoroquinolone antibiotics (lomefloxacine).

Alkaline induced corneal lesions result in deep ulcers. Collagenase activity is responsible for the rapid evolution of corneal melting and effective management requires blockage of lytic enzyme activity. Acetylcysteine, EDTA, blood serum are among the most used anticollagenase substances. In this case, acetylcystein eye drop was administered to support the healing of the corneal epithelium by blocking the collagenase activity (10).

Lime particles retained in the superior fornix provide a continuous reservoir of alkaline after injury and may result in severe injury if they are not identified and removed. So, especially in alkaline corneal burns, essential part of treatment is rapid irrigation and dilution of the chemical with a neutralizing solution for as long as 20-30 minutes (5, 11). Water is commonly recommended as an irrigation fluid. However, it is hypotonic to the corneal stroma and intraocular milieu. The corneal tissue is diluted by rinsing with water and this is accompanied by an increased uptake of additional water and diffusion of the corrosive into the deeper layers of the cornea (6). Kuckelkorn et al. (2002) recommend the use of irrigation fluids with higher osmolarities for initial rinsing in order to prevent water influx into the cornea and to enable the mobilisation of water and the dissolved corrosives out of the burnt tissue. There are many researchs to find irrigation fluids with an osmolarity similar to the corneal stroma (6). Sterile, lactated Ringer's and balanced saline solutions are suitable for irrigation in human eyes (4, 6). In

this case, sterile balanced saline solution was preferred as an irrigation solution.

If there is reduced tear production and the eye is not surgically flapped, then artificial tear drops and eye lubricants can be useful and necessary (2). In this case, according to Schirmer's test results, Na hyaluronate was preferred as an eye lubricant because of its tissue compatibility and density.

In regard to the control of inflammation, topical corticosteroids may be required for reducing inflammatory cell infiltration and stabilizing polymorphonuclear leukocytes after the corneal epithelium has healed (5, 9). In this case, corticosteroids could not be used due to loss of corneal epithelium in the first six days of treatment. During this period, sterile hypertonic saline solution was administered to reduce corneal edema. After re-epithelization, corticosteroid eye drop was used to reduce inflammatory cell infiltration and edema. With the use of steroids, it was noticed that there was a decrease in the corneal opacity.

This case showed the importance of early intervention of corneal alkaline burns. Also, implementation of medical treatment with conjunctival graft was important to shorten the recovery time of the cornea. eatments and postoperative outcomes in a cat with severe corneal alkaline burn.

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