

A Retrospective Study of Ulcerative Keratitis in 32 Dogs

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KEY WORDS: ulcerative keratitis, corneal ulcer, conjunctival flap, dog

ABSTRACT

This study was performed to analyze risk factors for and treatment results of ulcerative keratitis. The mean age (\pm SD) of 32 dogs with ulcerative keratitis was 3.59 (\pm 2.97) years and the most commonly affected breed was the Shih-tzu (50%). Keratoconjunctivitis sicca (31%) was the predominant cause of ulcerative keratitis. Superficial corneal ulcers (in 44% of animals) treated with medication alone required 5.1-13.4 days for healing and dogs recovered well, without complications. Deep corneal ulcers (56%) treated both by medication and conjunctival flap placement showed significantly better prognoses than did cases treated by medication alone, although long healing periods of 28.4-40 days were required..

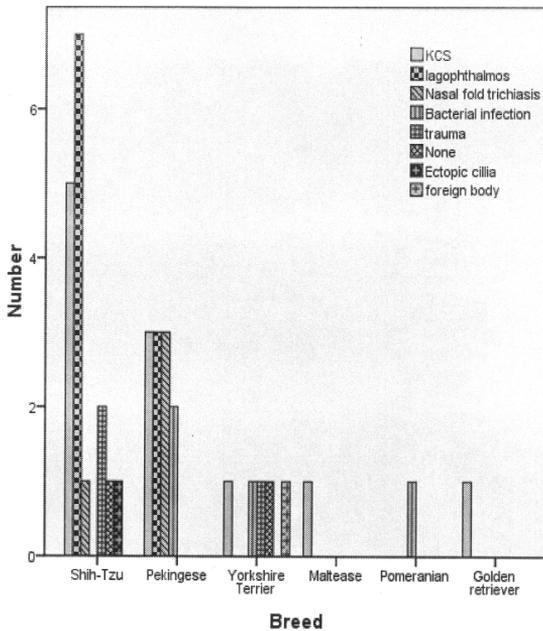
INTRODUCTION

Ulcerative keratitis in dogs is the most commonly encountered ocular disease in veterinary ophthalmology.¹ Fortunately, the condition is among the most treatable of various ophthalmic disorders that can threaten canine vision. Therefore, when

dogs presented with clinical signs of corneal ulcers, we were able to readily access useful treatment modalities.

Ulcerative keratitis can be classified into superficial keratitis, deep corneal ulcer keratitis, descemetocele keratitis, and perforation keratitis, with reference to loss of corneal layers. Etiologies may be congenital, or result from infection, allergy, trichiasis, distichiasis, ectopic cilia, entropion, trauma, a foreign body, or lack of tears.¹⁻³ Canine ocular disease characteristics have been extensively studied and the prevalence of corneal diseases in dogs has been recently reviewed.³⁻⁹ Most studies have reported breed or gender characteristics of individual ocular diseases associated with age or geographic region. Few statistical relationships between ulcerative keratitis in dogs and other factors (age, breed, cause, location and type of corneal ulcer, treatment methods, and healing period) have been documented. Ulcerative keratitis may be treated by medication or using various surgical procedures, depending on corneal stromal lesion severity.^{5,6,10-16} Few reports on recovery rates or treatment-specific healing periods in dogs have appeared.

Figure 1. The relation between the breed and the etiology of the ulcerative keratitis. In the brachycephalic breed, lagophthalmos is the most prevalent reason of the ulcerative keratitis.



In treating corneal ulceration, the most important step is to determine and eliminate the cause, followed by attempts to create an ideal environment for lesion repair, prevention of progression, and surgical treatment to prevent corneal rupture.

The purpose of the present study was to analyze the symptoms, causes, and clinical features of ulcerative keratitis in dogs, to explore treatment methods, to review recovery data, to seek correlations between ulcerative keratitis and other factors and, especially, to determine the effect of conjunctival flap formation on healing of deep corneal ulcers.

MATERIALS AND METHODS

Animals and Ophthalmic Examinations

Clinical data on 32 dogs (36 eyes) were retrospectively reviewed. The animals presented with ulcerative keratitis to the Veterinary Medical Teaching Hospital (VMTH) of the College of Veterinary Medicine of KonKuk University between March 2002 and December 2004. All dogs underwent general clinical examination (history taking, a physi-

cal examination, thoracic radiography, complete blood count [CBC], and serum chemistry) to determine if any systemic disease was present. No specific findings were found. In this work, we analyzed age and breed distribution of ulcerative keratitis.

All dogs received general ophthalmic examinations using direct ophthalmoscopy (Welch Allyn®, Skaneateles Falls, NY), slit lamp biomicroscopy (SL-15; KOWA Inc., Tokyo, Japan), the Schirmer tear test (Color Bar™ instrument; Eagle Vision, Inc., Memphis, TN), applanation tonometry (Tono-Pen® VET; Medtronic SOLAN, North Jacksonville, FL), and fluorescein dye (Fluorets®; Chauvin, France) staining.

Treatment

Ofloxacin (OTRA eye drops; Binex., Seoul, Korea) were applied four times daily as a topical antibiotic.

Clavamox (Clavamox®; 12.5 mg/kg; Pfizer, Exton, PA) was used twice daily as a systemic antibiotic. Pharmacologic mydriasis was treated with topical 1% (v/v) atropine (OcuTropine Eye Drops; Samil Pharm Co. Ltd., Seoul, Korea) in efforts to decrease pain. Topical flurbiprofen (Ocufen™ Liquifilm® Eye Drops; Allergan, Westport, Ireland) and Carprofen (Rimadyl®; 2.2 mg/kg, bid po; Pfizer, Exton, PA) were used as anti-inflammatory agents. Acetylcysteine (5% w/v; Mucomist; BoRyung Pharm, Seoul, Korea) was topically employed when necessary; the material has mucolytic and anticollagenic properties. Cyclosporine (2% w/v; CIPOL-N Soft Cap; Chong Kun Dang, Seoul, Korea) was used to stimulate tear production during treatment of corneal ulcers. Such ulcers were evaluated every 1-2 hr initially and rechecked within 72 hr. Fluorescein staining was employed during rechecking. Elizabethan collars were used to prevent eye self-trauma until the ulcers were healed. In the present study, debridement, tarsorrhaphy, and conjunctival flap construc-

tion were used as surgical treatments of corneal ulceration. One case of ulceration with defined suppurative endophthalmitis was treated by enucleation. If a dog showed a deep corneal ulcer (loss of two-thirds of the stroma, descemetocoele, or perforation), the conjunctival flap treatment method was usually employed.

Evaluation and Analysis of Medical Records

Among medical record data, we analyzed age, breed, affected eye, etiology, healing rate, and duration of corneal ulceration, with reference to treatment methods. Corneal ulcerations were divided into epithelial ulcers, superficial stromal corneal ulcers (loss of one-third of the stroma), deep stromal corneal ulcers (loss of two-thirds of the stroma), descemetocoele, and corneal perforation. All comparisons were analyzed using the t-test and Fisher's exact test. A P value <0.05 was considered significant. All analyses were performed using SPSS (SPSS 12.0 KO for Windows) (SPSS, Inc., Chicago, IL).

RESULTS

The mean age of dogs was 3.59±2.97 years (mean±SD). Ulcerative keratitis was seen mainly in dogs under 3 years of age (47%, 15 dogs); disease frequencies in animals aged 3-6 years, 6-9 years, and 9-12 years were 28% (9 dogs), 14% (5 dogs), and 9% (3 dogs), respectively among the total 32 dogs. Corneal ulceration thus decreases remarkably as dogs age. In the present study, six breeds (Shih-Tzu, Pekingese, Yorkshire Terrier, Maltese Terrier, Pomeranian, and Golden Retriever) were represented. Of these (total 32 dogs), the Shih-Tzu (50%, 16 dogs), Pekingese (25%, 8 dogs), and Yorkshire Terrier (16%, 5 dogs) showed the highest ulcer frequencies. The Maltese Terrier, Pomeranian, and Golden Retriever frequencies were all low, at 3% (1 dog). Keratoconjunctivitis sicca (KCS) was the commonest cause of ulcerative keratitis (31%); other etiologies were lagophthalmos (28%), bacterial infection (11%), nasal fold trichiasis (11%), and trauma (8%) (P=0.002). In brachy-

cephalic breeds, however, lagophthalmos was the most prevalent cause of ulcerative keratitis and KCS was the next commonest etiology (Fig. 1). No other breed-specific etiological pattern was found (Fig. 1).

In the present study, superficial corneal ulcers including the epithelium only (22%) or with corneal stromal defects involving less than one-third of the cornea (22%) occurred in 44% of dogs. Deep corneal ulcers involving over two-thirds of the stroma (22%), descemetocoele (26%), and corneal perforation (8%), occurred in 56% of animals.

Superficial corneal ulcers treated with medication took 5.1-13.4 days to heal and nine eyes with deep corneal ulcers, treated with conjunctival flap construction, took 28.4-40 days to heal. All eyes with superficial corneal ulcers recovered within 3 weeks; these were treated with medication alone. However, deep corneal ulcers did not heal properly with use of medication alone. Conjunctival flap construction was an effective treatment for deep corneal ulcers. The recovery rate from superficial corneal ulcers was 100% and that from deep corneal ulcers 55% in the present study (Table 1). With medication alone, the recovery rate was 71%, although the recovery rate was 100% after surgical treatment (except for the single enucleation case) (Table 1). These recovery rates are statistically significant (P=0.002).

Superficial corneal ulcers healed relatively well, without complications. But most deep corneal ulcers treated without surgical intervention did not heal satisfactorily, and some animals lost vision (Table 1) because of severe corneal scarring. Ulcerative keratitis caused by KCS should be treated continuously. With use of the conjunctival flap method, all corneal ulcers healed well and prognoses were good even in dogs with descemetocoele or corneal perforation; the results were statistically significant (P=0.02).

DISCUSSION

In this study, ulcerative keratitis occurred most frequently in dogs under 3 years of age. Animals of this age are in their

Table 1. Outcomes of treatment of the corneal ulcer in dogs

Treatment method	Recovered/ Non-recovered	Area/depth of corneal ulcer				Perforation (n=3)
		Epithelium (n=8)	1/3 stroma (n=8)	2/3 stroma (n=8)	Descemetocoele (n=9)	
Medication (n=24)	Recovered	17	8	7	2	0
	Non-recovered	7	0	0	5	2
Conjunctival flap (n=10)	Recovered	10	0	1*	0	7
	Non-recovered	0	0	0	0	0
Enucleation (n=2)		0	0	1	0	1
Total	Recovered	8	8	2	7	2
	Non-recovered	0	0	6	2	1

Recovered, Corneal ulcer is healed and the eye preserve vision and; Non-recovered, Corneal ulcer is not healed and the eye loses vision.

*: Not conjunctival flap but tarsorrhaphy is performed.

most active life period, so corneal traumatic injury is most prevalent. The frequencies of ulcerative keratitis in Shih-tzu and Pekingese breeds were higher than in other breeds, consistent with previous findings.^{1,4} The Shih-tzu and Pekingese are the most popular breeds in Korea, and both suffer disproportionately from lagophthalmos. In fact, lagophthalmos is the most frequent cause of ulcerative keratitis in the brachycephalic breeds. Regular checking and control of brachycephalic eyes is important. Lagophthalmos in brachycephalic breeds must be properly treated to prevent ulcerative keratitis. In the present study, the most common cause of ulcerative keratitis was KCS; this differs from previous findings that showed trauma and distichiasis to be of prime importance. In cases of superficial ulcerative keratitis, simple medication afforded good control. With ulcers affecting one-third of the corneal stroma, some affected eyes showed small corneal scars after healing, but these were insufficiently severe to affect vision. With deep corneal ulcers, many affected eyes lost vision because of complications, even though the animals recovered in 4-6 weeks. In cases of deep ulcerative keratitis, we could not effectively control symptoms with medication alone. However, many owners did not want (expensive) sur-

gical intervention. In such cases, the medication-alone results were poor.

Conjunctival flap construction is effective for control of deep corneal ulcers, although a long healing period is required. The conjunctival flap permits healing after debridement of devitalized epithelium. For treatment of deep stromal corneal ulcers, a combination of medication and conjunctival flap construction is recommended.

In the present study, superficial corneal ulcers healed relatively well without complications. However, most deep corneal ulcers treated without surgical intervention healed poorly, and some animals lost vision. The results suggest that a combination of medication and conjunctival flap construction must be recommended for treatment of deep stromal corneal ulcers.

ACKNOWLEDGEMENTS

J. Y. Kim and H. J. Won contributed equally to this work as the co-first authors.

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