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Objective—To compare mean healing times after debridement; debridement with grid keratotomy, and superficial keratectomy in cats with nonhealing corneal ulcers.

Design—Retrospective study.

Animals—29 cats with 36 nonhealing corneal ulcers.

Procedure—Medical records of cats with nonhealing corneal ulcers were reviewed. Signalment, duration of clinical signs, ophthalmic abnormalities, and response to various treatment protocols were recorded.

Results—Mean age of affected cats was 7 years, 8 months. Affected breeds included domestic shorthair (17 cats), Persian (9), Himalayan (2), and Siamese (1). Clinical signs were evident for approximately 2 weeks prior to referral. Both eyes were affected in 4 cats. Mean healing time of ulcers treated with superficial debridement was 30 days. Mean healing time of ulcers treated with superficial debridement and grid keratotomy was 42 days. Superficial keratectomy was performed on 2 eyes and resulted in a healing time of 2 weeks. Formation of a corneal sequestrum was evident in 2 of 21 eyes treated with superficial debridement. Formation of a corneal sequestrum was evident in 4 of 13 eyes treated with superficial debridement and grid keratotomy.

Conclusions and Clinical Relevance—Brachycephalic cats appear to be predisposed to developing nonhealing corneal ulcers. The combination of superficial debridement and grid keratotomy did not decrease mean healing time of nonhealing ulcers, compared with superficial debridement alone. Grid keratotomy may predispose cats with corneal ulcers to develop a corneal sequestrum. (J Am Vet Med Assoc 2001;218:733–735)

A nonhealing (indolent) corneal ulcer is a superficial epithelial defect of the cornea, without stromal involvement, that is bordered by nonadherent epithelium.1 Indolent ulcers develop in older dogs with a mean age of 9 years,2 with an apparent predisposition in Boxers.3 Histologic examination of the epithelium of dogs with indolent ulcers revealed degeneration of basal epithelial cells, a thick irregular basement membrane, and a decreased number of hemidesmosomes, preventing both adherence of epithelial cells to the stroma and resurfacing of corneal epithelium.4 Healing time for indolent ulcers treated with topical antibiotic solutions or ointments ranges from 14 to 180 days.2 Various treatments have been suggested to shorten this healing process in dogs. Additional medications that may be used include topical hyperosmotic solutions or ointments,5 epidermal growth factor,6 polysulfated glycosaminoglycans,7 contact lenses,8 or collagen shields.9 Surgical procedures include debridement of loose epithelium, conjunctival pedicle graft placement,10 grid or punctate keratotomy,11 placement of a third eyelid flap, or superficial keratectomy.12 It is believed that grid and punctate keratotomy promote healing of corneal epithelium by exposing stromal type-I collagen beneath the basement membrane to new corneal epithelial cells.1 Contact between the new cells and collagen may promote an effective attachment between epithelia and stroma. The advantage of performing grid or punctate keratotomy rather than superficial keratectomy is that it is an outpatient procedure and does not require general anesthesia.

Nonhealing ulcers have rarely been described in cats.1,8,12 The purposes of the study reported here were to determine whether there were any breed, sex, or age predispositions in the development of corneal ulcers in cats, as well as to determine the rate of healing of ulcers treated with corneal debridement alone, corneal debridement with grid keratotomy, or superficial keratectomy. Complications and sequestrum formation were also recorded for all techniques.

Criteria for Selection of Cases

Medical records of all cats evaluated by the ophthalmology service at the Animal Medical Center (AMC) and the Veterinary Ophthalmology Specialty Practice (VOSP) between 1991 and 1999 in which a diagnosis of nonhealing corneal ulcer was made were reviewed. Slit lamp biomicroscopy and indirect ophthalmoscopy were performed on all cats. Cats that had a superficial corneal epithelial defect surrounded by a loose lip of epithelium without significant stromal involvement (as diagnosed via slit lamp biomicroscopy) were also included in the study. Cats with ulcers of determinable causes (ie, lagophthalmos, keratoconjunctivitis sicca, trichiasis, etc) were excluded from this study.

Procedures

Data retrieved from medical records included signalment, duration of clinical signs, ophthalmic examination abnormalities, and response to various treatment protocols prior to referral. Cats with nonhealing corneal ulcers were treated with superficial debridement, superficial debridement and grid keratotomy, or superficial keratectomy. Superficial debridement was performed as previously described.1 It is suggested that the cornea was anesthetized with proparacaine hydrochloride,4 and the
Redundant epithelium was removed with a dry cotton-tipped swab. Grid keratectomy was performed using a 25-gauge disposable hypodermic needle to make perpendicular crosshatches in the exposed superficial stroma and the epithelium surrounding the ulcer. Superficial keratectomy was performed using an operating microscope with the cat under general anesthesia. A microsurgical blade was used to excise the superficial stroma and epithelium under and around the indolent ulcer. Following these procedures, a collagen shield or bandage lens was placed in a few cats.

**Results**

Nonhealing corneal ulcers were diagnosed in 29 cats. Mean age of the cats on initial evaluation at the AMC or VOSP was 7 years, 8 months (range, 6 months to 19 years). Twenty-two cats were castrated males, 6 were spayed females, and 1 was a sexually intact female. Breeds included 17 domestic shorthairs, 9 Persians, 2 Himalayans, and 1 Siamese.

Prior ophthalmic history was available for 15 cats. Mean time to referral was 2 weeks (range, 2 days to 4 months). Oxytetracycline-polymyxin, chloramphenicol, and atropine ophthalmic ointment were the most commonly used medications prior to referral. One cat had been treated with debridement of the ulcer, grid keratotomy, and soft contact lens placement prior to referral.

The right eye was affected in 15 cats, the left eye in 10 cats, and both eyes were affected in 4 cats. Two cats had recurrence of the nonhealing ulcer 14 weeks and 4 years, respectively, after healing of the initial ulcer. One cat was initially evaluated for a nonhealing ulcer in the right eye, and the left eye developed a nonhealing ulcer 6 months later. Two cats had histories of ulceration in the contralateral eye prior to referral; these cats also had corneal fibrosis.

Thirty-six nonhealing ulcers were diagnosed and treated at the AMC or VOSP. Thirty-one (86%) of the ulcers were in the central cornea, 4 (11%) were in the temporal cornea, and 1 (3%) was in the ventral cornea. All cats had evidence of blepharospasm and conjunctival hyperemia in the affected eye. Superficial corneal neovascularization was evident in 11 (38%) cats. Superficial cellular infiltration adjacent to the ulcerated area was evident in 3 (8%) cats.

Abnormalities of the affected eyes included medial canthus entropion (9 eyes), macroblepharon (2 eyes), and each of shallow anterior chamber, prominent lens sutures, incipient anterior cortical cataract, posterior polar cataract, feline central retinal degeneration, and peripapillary chorioretinal scar. Twenty-one (72%) cats had histories of upper respiratory tract infection or recurrent conjunctivitis. One of these cats was tested for feline herpesvirus-1 infection by use of polymerase chain reaction, which yielded negative results.

All 36 ulcers were treated with superficial debridement. A collagen shield was placed in 2 eyes after debridement. Grid keratotomy was performed in 13 eyes. A soft contact lens was placed in 7 of these eyes in which a grid keratotomy was performed. Two eyes were treated with superficial keratectomy at the owners’ request. A collagen shield was placed in 1 cat after surgery.

Eleven cats were treated with gentamicin sulfate ophthalmic solution, 9 with neomycin-polymyxin-B sulfate and bacitracin-zinc antibiotic ophthalmic ointment, 7 with oxytetracycline-polymyxin ophthalmic ointment, and 2 with chloramphenicol ophthalmic ointment. Trifluoroethymidine was used in 5 cats, and atropine was used (topically) in 6 cats.

Of the 36 eyes, 14 were lost to follow-up before healing of the ulcer. Of the 22 eyes in which follow-up examinations were performed (until the ulcer healed), mean healing time was 5 weeks (with 2 reevaluations at the AMC or VOSP). Thirteen eyes were treated with superficial debridement alone. Four of these eyes were debrided again during a subsequent reevaluation because of lack of reduction in ulcer size. Mean time for healing of ulcers that were treated by debridement alone was 30 days (range, 7 to 240 days).

Seven cats that had grid keratotomy performed in addition to debridement returned for reevaluation. One of these cats had grid keratotomy performed 2 months after initial debridement; the ulcer healed 3 weeks later. Superficial debridement was performed in 3 cats during a subsequent reevaluation. Mean healing time of ulcers treated with 1 or more superficial debridements and grid keratectomy was 6 weeks (range, 3 to 9 weeks).

The remaining 2 cats were treated by superficial keratectomy. In 1 cat, surgery was performed immediately after diagnosis of nonhealing corneal ulcer. The other had a history of multiple debridements and formation of a sequestrum. The corneal ulcers in both cats healed within 2 weeks after surgery.

Two cats had a corneal sequestrum prior to debridement or grid keratotomy. One was a Himalayan with a 6-week history of a nonhealing ulcer and was lost to follow-up. The other was a Persian with a 7-month history of recurrent eye problems. This Persian’s sequestrum was allowed to slough naturally. Two years later, another nonhealing ulcer developed in the same eye. The Persian developed a sequestrum 5 weeks after debridement.

Of the 21 eyes treated with superficial debridement, 2 (10%) developed a sequestrum in the area of the nonhealing ulcer. In 1 cat (domestic shorthair), a sequestrum developed 10 weeks after debridement. Another cat (Persian) had a previous history of sequestrum formation in the same eye. The sequestrum was evident in 2 cats (a Persian and a Himalayan) at the time of first reevaluation. One domestic shorthair that was treated for a nonhealing ulcer in both eyes developed a sequestrum 5 and 12 months, respectively, after grid keratotomy was performed.

**Discussion**

Mean age of cats with a nonhealing corneal ulcer in our study was 7 years, 8 months. This is similar to the mean age of 6.5 years recorded for Boxers. However, the age range (6 months to 19 years) in the
cats of our study was wider than that reported for Boxers (2 to 10 years).13

Bilateral development or recurrence of nonhealing corneal ulcers was common in the cats of our study. Four cats had bilateral nonhealing corneal ulcers, and 3 cats had recurrence in the same or contralateral eye. This recurrence in affected and unaffected eyes was similar to that found in dogs.4

Mean healing time of nonhealing corneal ulcers (22 eyes) was 5 weeks from initial evaluation by an ophthalmologist. Grid keratotomy resulted in healing of the corneal ulcers within approximately 6 weeks. In dogs, it has been reported that grid keratotomy may shorten healing time of indolent ulcers to approximately 25 days.1 Grid keratotomy did not appear to decrease the healing time of nonhealing corneal ulcers in the cats of our study.

As in dogs,5,6 superficial keratectomy of nonhealing corneal ulcers in cats results in rapid resolution of the ulcer. However, the disadvantage of performing keratectomy is the need for general anesthesia and specialized equipment such as an operating microscope.

Sequestrum formation was observed in all treatment groups in this study except in the 2 cats treated with superficial keratectomy alone. We found an apparent predisposition for corneal sequestrum formation in Persians and Himalayans, which is consistent with previous reports.11 Of 21 eyes treated with debridement, 2 (10%) developed a corneal sequestrum; 1 of those was in a Persian. Of 13 eyes treated by grid keratotomy, 4 (31%) developed a corneal sequestrum. The 2 cats that developed a sequestrum by the time of first reevaluation were a Persian and a Himalayan. It has been proposed that sequestrum formation may develop as a nonspecific sequela to subacute keratitis.11 Diagnosis testing (eg, polymerase chain reaction) and antiviral treatment may be indicated in such instances.

References