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Corneal stromal sequestration in a dog

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Abstract

A case of corneal sequestrum in a 9-year-old Shih Tzu is reported. On the ophthalmic examination a brown-pigmented ulcer with mild edema and corneal vascularization was present. The brownish plaque was facing an inferior palpebral tumor. A superficial keratectomy followed by a grid keratotomy and removal of the palpebral mass were performed. Histological findings revealed an inflammatory cell infiltration underneath the acellular stromal layers. No melanin granules were observed. No vascular infiltration was present within the necrotic stroma. The surgical area healed and no recurrence has been reported by the owners at the time of writing. To the authors' knowledge, this is the first report of a corneal sequestrum in a dog.

Key Words: corneal stromal sequestration, dog, keratectomy, ulcerative keratitis

INTRODUCTION

Corneal sequestration was described in the cat for the first time in 1964.[1] This lesion has been reported many times since this date and is nowadays a common corneal disorder in cats. It was apparently specific to the feline species, but corneal sequestra have recently been described in horses.[2,3] Corneal necrosis is characterized by a pigmented lesion that is usually in the central or paracentral corneal stroma. The intensity of the discoloration is variable; it ranges from a slightly brownish coloration to a well-defined black lesion.[4–6] The cause and mechanism of coloration remain unclear. Lesions often extend down to mid-stroma. The deeper layers are generally not concerned, but if they are, a perforation may occur. This phenomenon is rare.[4–6]

The most common clinical signs accompanying this lesion include epiphora, blepharospasm, and photophobia.[5] These irritative signs are seen in most, but certainly not all, cases. Corneal vascularization and interstitial keratitis may also be present.[4–7] To our knowledge the pathogenesis is still unknown.[4] The sequestrum may naturally slough, but the time taken for this to take place can vary from a few days to several months. Therefore, keratectomy is usually recommended when discomfort appears. A protective tissue can be added (conjunctival pedicle graft, corneoconjunctival transposition, small intestinal submucosa graft) or not.[4–6,8]

To our knowledge, corneal necrosis has not been reported in dogs. This report describes clinical and histopathological features of a corneal sequestration in a dog.

CASE REPORT

A 9-year-old intact male Shih Tzu was presented for ophthalmic examination. The owner reported development of tearing and discoloration of the OS 2 weeks earlier. The referring veterinarian diagnosed an ulcerative keratitis of the OS. Topical neomycin-polymyxin and artificial tear supplement were prescribed. After 10 days, the ulcer was still present, with no sign of healing, and the dog showed signs of discomfort.

General physical examination revealed a dog in good health. On ophthalmic examination, the OS demonstrated moderate blepharospasm, mild conjunctivitis and the presence of a palpebral mass (1×2 mm) situated on the inferior palpebral limbus. Menace, palpebral and pupillary light reflexes were normal in OU. Schirmer tear test readings were 15 mm wetting/min in OU. IOP was 17 and 19 mmHg by applanation tonometry in the OD and OS, respectively. Slit-lamp biomicroscopic examination of the left cornea revealed a moderate edema and a corneal superficial ulcer surrounded by superficial and deep stromal vessels. The epithelium edge around the ulcer was undermined in some areas. The ulcer bed and the stroma underneath were pigmented. The surface of the ulcer stained faintly with fluorescein. Its size was around 4 mm in diameter and oval, and it affected the ventral cornea, facing the palpebral mass (Fig. 1). No ectopic cilia or foreign bodies were observed. The anterior chamber was normal, but corneal modifications prevented from visualizing the lens and fundus. No significant

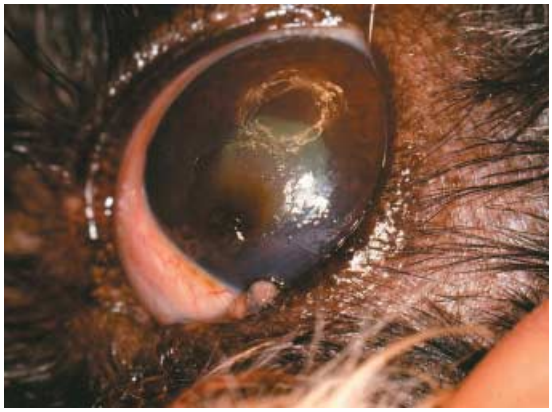

Figure 1. The OS of a 9-year-old Shih Tzu. A dark brown corneal sequestrum is present facing a palpebral mass, surrounded by superficial vascularization and a moderate edema.

ophthalmic abnormalities were revealed by the examination of the OD.

Superficial keratectomy was performed under general anesthesia. About 0.3 mm of the corneal stromal thickness was excised with a 1-mm nonulcerated margin. The entire brown-pigmented area was removed. Then a grid keratotomy with a diamond knife was performed, followed by a nictitans flap. At last, the palpebral mass was removed. The nictitans flap was left in place for 2 weeks. Postoperative treatment consisted of topical neomycin–polymyxin q8 h for 1 month and oral marbofloxacin 2 mg/kg q24 h daily for 8 days.

Fifteen days after surgery, the corneal defect was healing and epithelialization progressed. Two months later, the underlying cornea was normal. The surgical palpebral wound granulated and 2 weeks later it had completely healed. No recurrence has been reported by the owners at the time of writing.

Histopathologic findings

The section of cornea was immediately fixed in 10% neutral buffered formalin, routinely processed and embedded in paraffin for histological examination. Sections were cut at 3 µm and stained with H&E and periodic acid-Schiff. Microscopically, there was a desiccated region characterized by acellular stromal collagen with neither keratocyte, nor inflammatory cell. The depth of this necrotic stroma was variable and ranged from one-tenth to one-half thickness of the histological section. The deeper stromal layers were infiltrated by inflammatory cells, predominated by neutrophils, as well as a normal keratocytic population. The corneal epithelium was normal over the cellular stroma and absent over the acellular area. There was no sign of granulation or epithelialization. Histological findings thus revealed a superficial stromal mummification associated with a deeper inflammatory reaction (Figs. 2 and 3). The histopathological analysis of the palpebral mass was declined by the dog's owner due to financial problems.

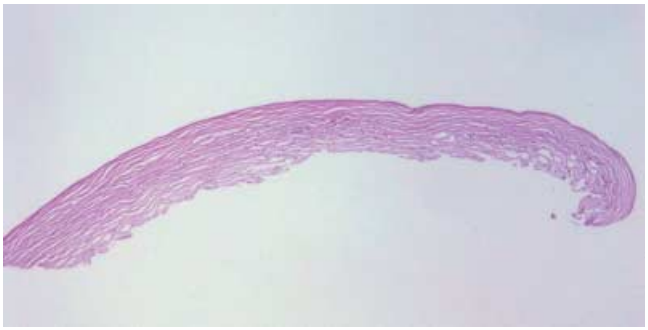

Figure 2. Microscopic appearance of the large and deep keratectomy section, showing the ulcerated lamellar stroma; presenting punctuate blue nuclei are visible only in the deeper area. H&E, ×40.

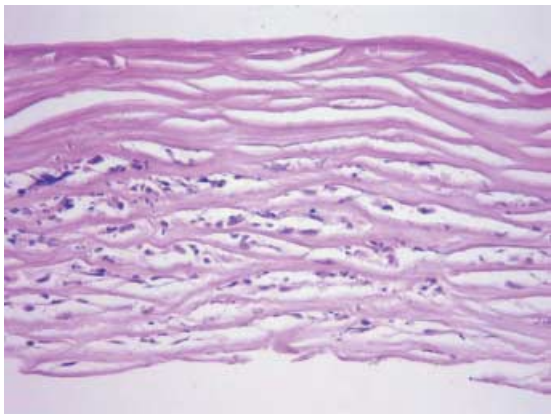

Figure 3. Higher magnification of the central area of the keratectomy section showing the complete acellular superficial layers of the denuded collagen stroma. Nuclei and nuclear debris of inflammatory cells (predominately neutrophils) and nucleated keratocytes are present in the deeper layers. H&E, ×400.

DISCUSSION

In dogs, refractory ulcer may be primary or secondary to eyelash abnormalities, entropion, facial nerve paralysis, lagophthalmos, keratoconjunctivitis sicca, tear film mucin deficiencies, or neurotrophic keratitis.[9] Neither ectopic cilium nor entropion were found by biomicroscopy. Keratoconjunctivitis sicca was excluded due to the normal Schirmer tear test. No nerve abnormalities were detected on general examination, and discomfort excluded a neurotrophic keratitis. Tear film break up times have not been carried out, but fluorescein staining was apparently not abnormal around the ulcer. The slit-lamp examination did not reveal any stromal edema. Shih Tzus, as brachycephalic dogs, are often presented with ulcerative keratitis. The ulceration is usually recurrent and is located in a central or paracentral corneal position.[10] The corneal ulcer described here was ventral and covered by the inferior eyelid. Therefore, the authors thought that the corneal ulceration was due to the rubbing of the inferior palpebral mass, even if a primary refractory ulcer could not be excluded due to the persistence of the

entire lesion although a topical antibiotic therapy associated with an artificial tear supplement. The referring veterinarian reported that the initial treatment had no effect on the lesion. Even if Shih Tzus are not predisposed to recurrent corneal erosion syndrome[9] the slit-lamp examination showed a small nonattached lip of epithelium around the ulcer.

Histological examination revealed stromal necrosis associated with epithelial erosion. The epithelial edge did not have a loose lip, as the authors thought at the ophthalmic examination: the margin was frank. These findings had no characteristics of a refractory ulcer. The absence of granulation or epithelialization was unusual. Superficial ulceration due to a rubbing tumor usually presents a healing process, even if it is minimal. Histopathologic findings were original. The ulcerated lesion was devoid of cells and a neutrophilic population infiltrated the deeper unaffected stroma. This histopathologic description is similar to the feline sequestration one. Feline corneal mummifications are characterized by an acellular stromal plaque with degenerative collagen surrounded by an inflammatory response including neutrophils or lymphocytes preferentially and less commonly macrophages and giants cells.[4]

A dog's stromal ulcer that is not epithelialized is usually positive for the fluorescein test.[9] In this case report, the uptake of fluorescein in the corneal ulceration was faint, similar to corneal necrosis in cats and horses, which faintly stain, despite of the loss of the corneal epithelium.[2,6] The soluble dye is probably unable to penetrate the sequestrum surface.[11]

In dogs, melanin pigmentation of the anterior stroma may occur with an ulcerative keratitis. This pigmented migration is associated with a chronic inflammatory response and progresses from the peripheral cornea to the central one.[9] The cornea described here had no sign of black pigmentation resulting from an active keratitis. There was a chronic inflammation characterized by superficial and deep vascularization and stromal inflammatory cell infiltration, but no sign of pigment cell migration. The brownish area was well-delimited, within the anterior stromal tissue exposed by ulceration. No diffuse pigmented migration from the corneal limbus was observed.

In cats and horses, the nature of sequestrum pigmentation is not understood. The brownish pigment seems to be water-soluble but does not seem to be melanin.[3,4] However, Featherstone *et al*. recently established that coloration might be caused by melanin particles.[12] A discoloration due to iron, not coming from blood, has also been described,[13] but the presence of iron has not been detected in another study.[12] Moreover, the analyses of tear film revealed no particular sign that can explain this pigmentation.[12,14]

In cats, there is no sex incidence.[4–6,15,16] In many studies, Persians are the most represented breed[6,15,16] and bilateral corneal sequestra mainly occur in brachycephalic breeds, simultaneously or not.[6,17] An inherited factor has been suggested.[4,5] Moreover, the brachycephalic conformation that predisposes to lagophtalmos may participate in the pathogenesis.[4,6,16] The sequestrum described here affected a Shih Tzu. The authors could just note that the corneal necrosis appeared in a brachycephalic breed, due to the originality of the case.

The etiology of feline corneal mummification is unknown. Several predisposing factors have been suggested such as eyelash abnormalities, entropion, herpes infection, keratoconjunctivitis sicca, primary corneal ulceration, and tear film abnormalities.[4,5] Sequestra seem to be consecutive to ocular irritation. When entropion is associated, the sequestrum is not located in a central area as usual, but faced to the entropion. The irritating factor may influence the corneal location.[6,15] Corneal insult might be an initiating factor of corneal necrosis. Corneal stromal dystrophy has also been suggested.[4,17] The ventral corneal necrosis reported here is certainly a consequence of the corneal insult caused by the rubbing tumor.

Medical treatment is generally unsatisfactory. Time to sloughing is variable and ocular discomfort frequently requires surgery.[4,5,16] Superficial keratectomy is performed and can be followed by conjunctival graft, small intestinal submucosa graft or corneoconjunctival transposition.[4,6,16] A discoloration of grafts can occur,[6,8,16] especially with protective procedures that do not provide a sufficient blood supply;[6] thus, the use of submucosal material is not recommended.[6,8] Conjunctival flap and corneoconjunctival transposition seem to be the best way, if the surgeon decides not to perform a keratectomy alone, especially with deep ones.[6,18,19] The difference in the rate of recurrence between surgeries using a keratectomy alone and surgeries using extra tissue is variable. Featherstone *et al*. showed that there was no significant difference between these two techniques;[6] and other studies reported a lower recurrence rate with a conjunctival pedicle graft[19] or a corneoconjunctival transposition.[18] However, removing the entire pigmented lesion, if its depth allows it, assures a weak recurrence rate.[6] A keratectomy prior to a grid keratotomy was carried out here. The whole brownish plaque was removed. A grid keratotomy was performed to promote healing, as it is recommended for refractory superficial corneal ulcer in dogs,[9,20,21] and a nictitans flap was used to protect the exposed stroma.

On the basis of the histological findings, a diagnosis of corneal sequestration was made in a Shih Tzu. The acellular stromal layers were surrounded by corneal vascularization and inflammatory cell infiltration existed below the brown ulcer. This brachycephalic dog's brownish lesion was facing an irritating palpebral mass. This description is amazingly similar to a feline corneal sequestrum. To the authors' knowledge, this is the first report of a corneal sequestrum in a dog.

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