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Original article

Surgical treatment of nictitans gland prolapse and cartilage eversion accompanying the nictitating membrane (third eyelid) rotation in cats

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Abstract

The third eyelid rotation associated with the nictitans gland prolapse and third eyelid cartilage eversion is a rarely encountered ocular disorder. The present retrospective study includes the distribution of the relevant deformations in the cartilage and nictitans gland accompanying the third eyelid rotation in the cat according to breed, age, and gender-based differences, as well as the clinical manifestations, surgical therapeutic approach (partial resection of the scrolled cartilage portion combined with the Morgan pocket technique), and the outcome of the procedure, concurrently monitoring whether or not the functions of the nictitating membrane were preserved after the procedure, the likelihood of relapse and the potential complications. A total of sixteen eyes surgically treated with the above-mentioned surgical method that belonged to thirteen cats diagnosed with the nictitans gland prolapse and cartilage eversion accompanying the third eyelid rotation were included in the study. The most common breeds were Persian (38.4%) and British shorthair (38.4%), with five cases from each. Three cats (20%) were bilaterally affected, while there was a unilateral involvement in ten of the cases (80%). Out of the ten cases with a unilateral lesion, the right eye was affected in 6 (60%) individuals, while the left eye was involved in four (40%). Nine cats were male, and four were female. The study was conducted in an attempt to surgically correct the third eyelid cartilage eversion and prolapsed nictitans gland responsible for the nictitating membrane rotation in cats by the partial removal of the everted cartilage combined with the Morgan pocket technique. Follow-ups were performed twice every other week in the postoperative period, followed by a one-time clinical inspection at the end of the first, third, and sixth months.

Key words: cat, everted cartilage, nictitans gland prolapse, third eyelid membrane

Introduction

The third eyelid, known as the nictitating membrane, is a mobile tissue formed by the triangular-shaped folding of the conjunctiva, situated between the globe and the eyelids in the inferomedial canthus of domestic animals (Udegbunam et al. 2012, Allbaugh and Sturh 2013, Ergin et al. 2014, Georgescu et al. 2015, Vani and Lakshmi 2016). It is one of the eye's vasculature-rich structures covered by the bulbar and palpebral conjunctival mucosa. It is connected periorbitally to the eye's inner angle by a fibrous conjunctival fold (Akin and Samsar 2005). It plays an essential role in moistening the ocular surface by producing and distributing tears and mechanically protecting the eyes by clearing debris from the surface (Allbaugh and Sturh 2013, Ergin et al. 2014, Ukwueze et al. 2015, Vani and Lakshmi 2016). This structure, which can be seen freely moving on the edge of the lower eyelid, consists of a T-shaped elastic cartilaginous layer rendering rigidity to the membrane, the nictitans gland, which produces a seromucous secretion, located vertically towards the base of the cartilage, and the lymphoid follicles which are located more vastly on the bulbar surface (Akin and Samsar 2005, Linn Pearl 2016). The third eyelid disorders include foreign body-associated lesions, laceration, inflammation, eversion, protrusion, prolapse of the nictitans gland, neoplasia, and cartilage eversion (Ford and Mazzaferro 2012). Of these, the cartilage eversion and the gland's prolapse, causing the third eyelid's eversion, are extremely rare entities in cats (Mazzucchelli et al. 2012). This condition, which mostly results from the predisposing environmental factors such as injuries and improper suturing, sometimes occurs due to the prolapse of the nictitans gland or the abnormal curvature of the vertical part of the T-shaped cartilage (Rezaei et al. 2019). The precise etiology of the gland's prolapse and cartilage rotation is not clearly understood, although it may be an inherited congenital disorder (Mazzucchelli et al. 2012). The relevant disorders usually occur as a singular entity, yet may be accompanied by each other on some occasions, which are less frequently seen in cats than in dogs (Akin and Samsar 2005). On physical examination, the gland's prolapse and the rotation of the cartilage may appear as a hyperemic mass in the medial canthus (Chahory et al. 2014).

The treatment of choice whether the medical and/or surgical management varies depending on the lesion's characteristics. A medical procedure alone usually fails to treat the lesion. Despite some reported cases indicating these deformations' self-repair, they should be surgically corrected for cosmetic and functional reasons (Rezaei et al. 2019). Therefore, a surgical approach is highly recommended to treat these lesions (Maggs

2013). The surgical techniques proposed for the correction of the third eyelid and the accompanying gland prolapse include Blogg's anchorage technique, modified anchorage technique, Twitchell's technique, and the Morgan pocket method. Furthermore, various surgical techniques have been developed, as in the case of accompanying cartilage eversions, such as temporary nictitans membrane flap technique, excision of the eyelid margin and cartilage resection, resection of the twisted portion of the cartilage, cartilage resection, and homograft (Akin and Samsar 2005, Rezaei et al. 2019).

The present study aims to restore the rotated third eyelid and the accompanying deformations of the everted cartilage and prolapsed gland back to its normal anatomical position maintaining its functions in cats. Therefore, we applied combined surgical techniques, including resecting the rotated cartilage and embedding the prolapsed gland with the Morgan pocket method using the third eyelid's inner approach.

Materials and Methods

Animals

A total of sixteen eyes of thirteen cats (Table 1) with different etiologies presented to the surgery clinic of the Istanbul University-Cerrahpaşa, Faculty of Veterinary Medicine, between May 2012 and March 2020, with the complaint of pinkish protruding mass located in the medial canthus either unilaterally or bilaterally, were included in this study. Patient history such as breed, age, gender, the affected eye, etiology, duration of the lesion, and whether or not any treatment was applied, and clinical and ophthalmologic examination findings were noted. The nictitans gland prolapse and cartilage eversion associated with the third eyelid rotation was detected in sixteen eyes. Ten cats revealed unilateral (n=6 right, four left), and three had bilateral involvement. Nine cats were male, and four were female. The ages of cats ranged from 4 months to eight years with an average of 2.1 years. Physical and hematological examinations (complete blood count) of all patients were performed, and serum biochemical profiles and serological tests (Feline Immunodeficiency Virus (FIV), Feline Leukemia Virus (FeLV), feline infectious peritonitis- FIP) were obtained before the surgical procedure. All owners ensured the anesthesia protocol consent before surgery.

Ophthalmic examination

All patients in the study were subjected to a detailed ophthalmic examination, including menace response,



Fig. 1. A four-month-old Persian cat with sudden swelling and redness and ocular discharge on the left eye.

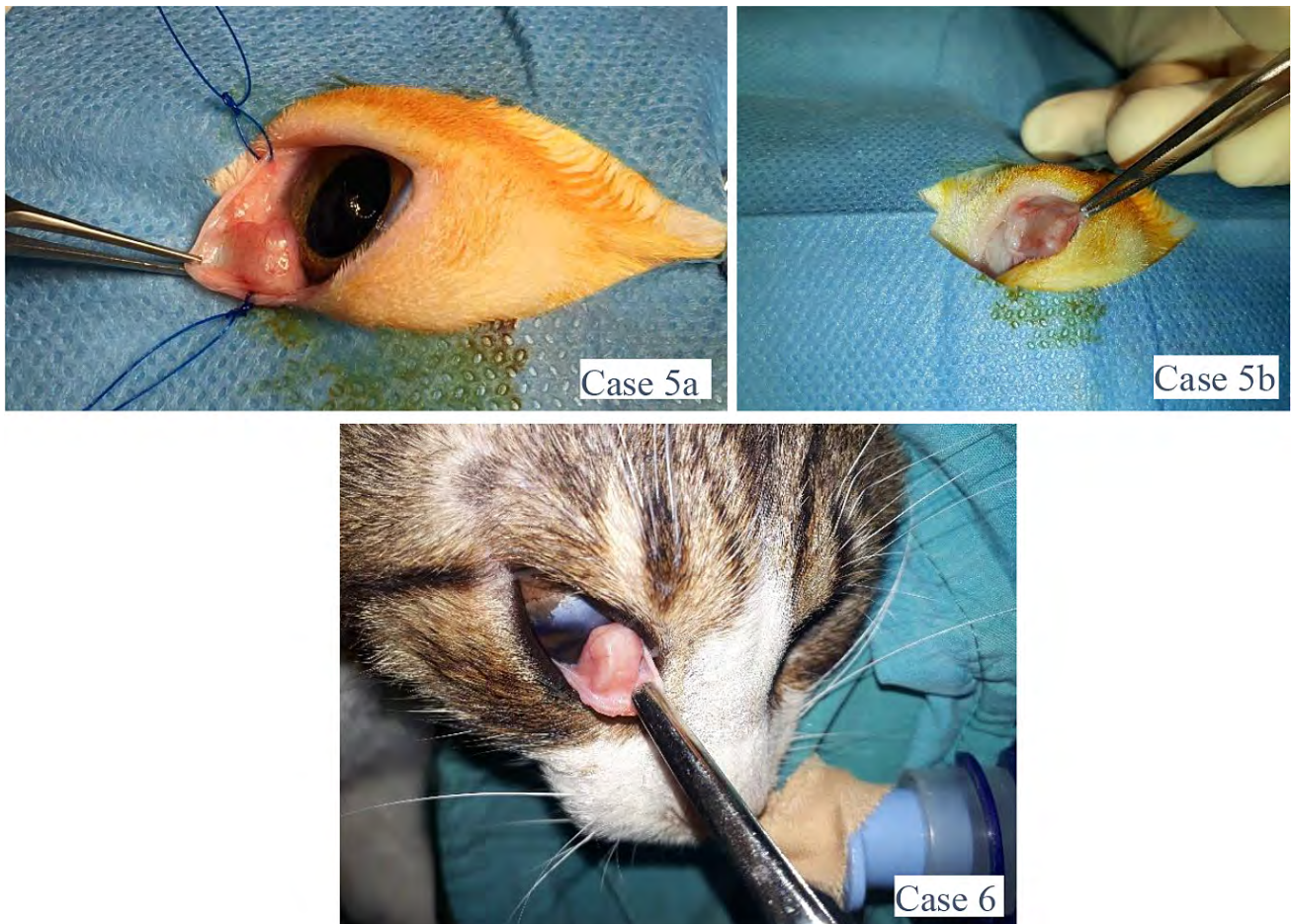


Fig. 2. Clinical features of the scrolled cartilage and the prolapsed third eyelid gland in two separate cases.

direct and indirect light reflex, pupillary light reflex, fluorescein test, Schirmer's (dry eye test) test, intraocular pressure measurement, and indirect ophthalmoscopy. Intraocular pressure was measured by a tonometer. The ophthalmologic examination was performed after the administration of topical anesthetic eye drops. The diagnosis of the third eyelid's cartilage eversion and pro-

lapse of the gland was established based on the anamnesis and clinical and ophthalmologic examination findings. Palpation of the nictitating membrane was performed to confirm a third eyelid disorder (Fig. 1). Everted cartilage was identified by the occurrence of a yellowish mass right beneath the conjunctiva on the bulbar surface of the third eyelid (Fig. 2).



Fig. 3. Follicular hypoplasia on the bulbar surface of the third eyelid. First conjunctival incision was made to the gland prolapse on the bulbar surface.

Preparation for surgery

Tobramycin-dexamethasone suspension eye drop (Tobradex®, Alcon, Turkey), fusidic acid viscous fluid (Fucithalmic®, Abdi Ibrahim, Turkey) were prescribed three times and twice a day, respectively, for 3-5 days before surgery. All surgical procedures were performed under general anesthesia in a single session. The cats were premedicated with xylazine HCl (Basilazin 2%®, Bavet, Turkey) by IV route at a dose of 0.5-1mg/kg. Eyelids were shaved and painted with betadine solution. General anesthesia was induced with 5mg/kg ketamine-HCl (Ketasol®, Richter Pharma, Austria) and maintained with isoflurane (2-2.5%) after endotracheal intubation. All patients were administered Ceftriaxone (Novosef®, Zentiva, Czech Republic) 20-30 mg/kg IV and meloxicam (Bavet Meloxicam®, Bavet, Turkey) 0.1-0.2mg/kg SC thirty minutes before surgery. The ocular surface was irrigated with a 0.05% betadine solution. The surgical procedure was performed in the lateral position.

Surgical procedure

The surgical procedure was performed by the method previously described by Georgescu et al. (2015) in a dog.



Fig. 4. First conjunctival incision was made from the part of the gland close to the third eyelid membrane.

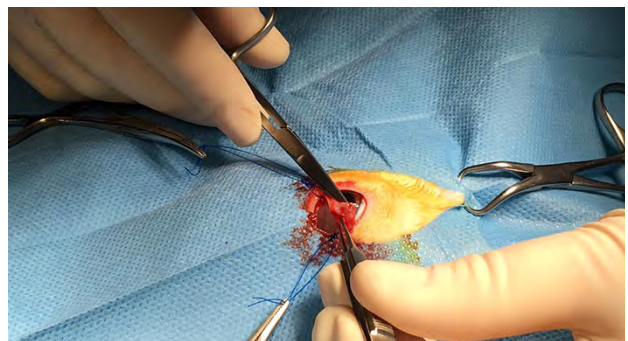


Fig. 5. Blunt dissection and excision of the rotating part of the third eyelid cartilage.

The correction was performed by excising the rotating portion of the cartilage and embedding the prolapsed gland with the Morgan pocket method in the cases with the nictitans gland prolapse and cartilage eversion accompanying the third eyelid rotation. Initially, the surgical field was bordered with sterile drapes. The third eyelid's free edge was grasped with two stay-sutures assuring that the cartilage's horizontal arm is fixed with no tissue damage. Topical phenylephrine hydrochloride drops 2.5% (Mydrin®, Alcon, Turkey) were applied twice (1-2 drops at each time) in a 15-minute interval during the procedure to minimize the potential risk for hemorrhage. The third eyelid was pulled laterally to expose the bulbar conjunctiva. The third eyelid's bulbar surface was favored both for a smooth dissection of the cartilage from the underlying conjunctiva and embedding the prolapsed gland with the Morgan pocket technique. Two parallel incisions were made to the dorsal and ventral portions of the prolapsed gland on this surface. Blunt dissection was performed on the dorsal incision using scissors to release both sides of the cartilage covered by the conjunctiva, and then the folded portion of the cartilage was excised (Figs. 3, 4, 5). After removing the cartilage, the ventral incision was expanded to the dorsal incision, and the concurrently



Fig. 6. Appearance of rotatory cartilage after excision.



Fig. 7. The second conjunctival incision was made from the part of the prolapsed gland close to cornea.

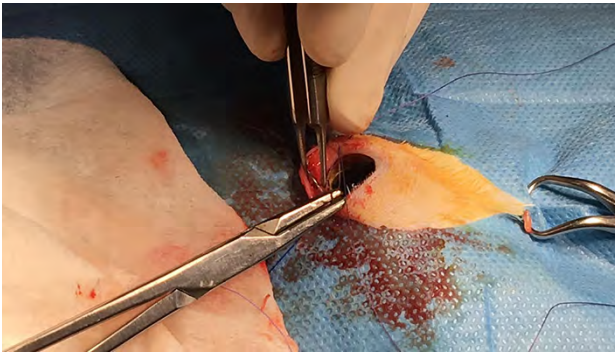


Fig. 8. After resection of the cartilage, embedding of the prolapse gland by the morgan pocket method.

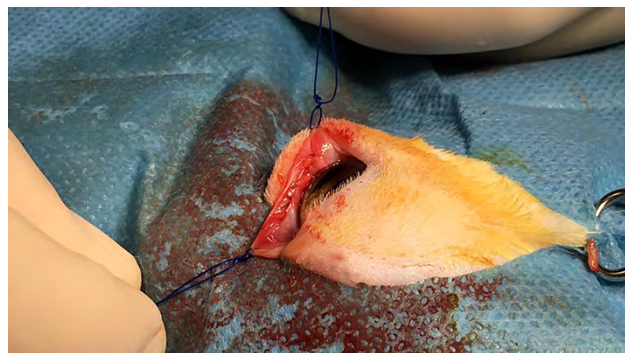


Fig. 9. Conjunctival incisions were closed with using absorbable sutures with simple continuous suture.

protruded hyperplastic gland was repositioned by the Morgan pocket method (Figs. 6, 7). The prolapsed gland was embedded and fixed in the pocket, followed by a subconjunctival dissection (Figs. 8, 9). Closure of the incisions was achieved by continuous suturing using vicryl 5-0 (Polyglactin 910) sutures. The suture's initial and final stitches were left on the third eyelid's palpebral surface to prevent corneal contact. The same procedure was performed in the cases with bilateral eye involvement on both eyes in a single session.

Postoperative management

In the postoperative period, an Elizabethan collar was used for 10-14 days to prevent self-injury. All the animals were treated with amoxicillin trihydrate-potassium clavulanate (Synulox® Zoetis, Turkey) twice a day orally at a dose of 12.5mg/kg for seven days. Topically, tobramycin-dexamethasone (Tobradex®, Alcon, Turkey), sodium hyaluronate (Dryex®, Abdi Ibrahim, Turkey), and Fusidic acid (Fucithalmic, Abdi Ibrahim, Turkey) were administered three times, and twice a day, respectively, for 2-3 weeks except for three cats which had developed preoperative and postopera-

tive corneal lesions such as corneal ulcer and necrosis. Further procedures like keratectomy and corneal debridement were performed, and a temporary flap was placed in two cats with other disorders. Ophthalmic steroids were avoided in these cases, and topical ofloxacin (Exocin®, Allergan, Ireland) and sodium hyaluronate were prescribed for four weeks in the postoperative period. In all animals sutures were removed after one month, and all the cats were examined twice at 10-day intervals. No recurrence was noted, and the surgical procedure cosmetically proved entirely satisfactory (Fig. 10). Follow-up visits were performed at the first, third and sixth months in the patients with full recovery.

Results

Persian 5 (38.4%) and British shorthair 5 (38.4%) specific breeds were found, respectively. The other 3 cases (23%) were domestic short-haired. The gender distribution was recorded as nine (69.2%) males and four (3.7%) females. The ages of the patients ranged from 4 months to 8 years, with an average of 2.1 years. Three cats (23%) were less than one year old, nine



Fig. 10. Case 9 appearance of the immediately after surgery.



Fig. 11. Clinical appearance of 2 weeks after surgery, there was no recurrence.

Table 1. Distribution of cats with cartilage eversion and gland hyperplasia according to breeds.

Breeds	N	Affected eye	%	Age rate (%)
Persian	5	6	38,4	2.9
British Shorthair	5	7	38,4	2.1
Crossbreed	3	3	23,1	1.2
Total	13	16		

(69.2%) were 1-4 years old, and one cat was over five years old. As a result of clinical and ophthalmological examinations, 16 eyes of 13 patients (10 cases (76.9%) unilateral and 3 cases (23%) bilateral) had nictitans gland prolapse and cartilage eversion associated with third eyelid rotation. The affected eye was on the right side in six (60%), and on the left side in four cases (40%). All cases were referred to the surgery clinic with complaints of sudden swelling and redness in the eyes, color change in the eyelid and blepharospasm. Detailed ocular examination revealed unilateral or bilateral ocular discharge, conjunctival hyperemia, distortions of varying severity in the vertical part of the third eyelid cartilage and protrusion in the gland just below it. In general, cartilage rotation was mostly seen at the junction of the horizontal and vertical parts of the cartilage and its sharp ends. In some cases, follicular conjunctivitis was due to chronic inflammation on the bulbar surface of the rotated third eyelid (Fig. 11). In addition to the defects in the structures of nictitans membrane, corneal ulcers in one case and other concurrent lesions such as symblepharon and corneal necrosis were observed in two cases. It was observed that the lesions in three cases were due to concurrent corneal disease. It was accepted that the patient older than 5 years developed these lesions after chronic inflammation due to corneal ulcer. In 10 cats, five British Shorthair, three Persian and two Domestic short-haired cats between the ages of 4 mont-

hs and three years, it was determined that deformations that did not show signs of other primary ocular disorders, except for third eyelid lesions, developed spontaneously. One of the cases with bilateral involvement was a male Persian cat with non-concurrently occurring lesions in both eyes, in which the initial lesion had been detected to have developed in the right eye, and after a month, the left eye was also involved. Both eyes were already affected in two separate cases when the patients were referred to the clinic.

The same procedure was performed in all cases with the third eyelid deformations for the surgical treatment. A long delay was particularly avoided between the patient's referral and the surgical procedure, and thus surgical intervention was arranged within one day to two weeks, depending on the patient's situation. The surgical approach included removing the everted cartilage portion and embedding the prolapsed gland by the Morgan pocket method. The outcome of all patients with cartilage and gland deformations was favorable, and no recurrence was noted in terms of glandular hyperplasia and cartilage eversion. The success rate of our combined technique was 100%. In two cases with corneal defects, a temporary third eyelid flap was applied after corneal debridement, and the corneal lesions were monitored to have healed after one month. In all cases, the stitches on the nictitating membrane's palpebral surface were removed one month after surgery. Only one

case developed corneal erosion five days after surgery, with a postoperative complication rate of 6.2%.

Discussion

The third eyelid that appears to be an inconspicuous tissue is one of the eye's functionally essential structures. It comprises of the nictitans gland, cartilage, and lymphoid follicles (Ford and Mazzaferro 2012, Linn Pearl 2016). The nictitans gland is one of the lacrimal structures of the eye generating 30-40% of the aqueous component of the normal tear film. It is located at the third eyelid base, particularly right beneath the T-cartilage's vertical portion, which is a concealed tissue structure unless no pathological condition has developed. The third eyelid cartilage is a hyaline cartilage with an elastic component in cats (Williams et al. 2012, Georgescu et al. 2015, Sağlıyan and Günay 2018). The T-shaped cartilage consists of two arms, horizontal and vertical, which elicit rigidity and a small concavity to the nictitating membrane during its movements on the ocular surface (Williams et al. 2012, Georgescu et al. 2015, Linn Pearl 2016). The third eyelid disorders may be listed as inflammation, foreign body-associated injury, laceration, protrusion, eversion, hypertrophy of the nictitans gland, cartilage eversion, and neoplasia.

Eversion of the third eyelid cartilage and the gland's prolapse are common in dogs, yet rarely seen in cats. Nevertheless, the coexistence of gland and cartilage protrusion is rare in cats and dogs, with cats being extremely rarely affected (Maggs 2013). In the study, the third eyelid rotation in the cats was accompanied by the gland's prolapse and cartilage eversion. Similarly, the third eyelid rotation accompanied by the gland prolapse and cartilage rotation was previously reported in a German shepherd dog (Rezaei et al. 2019). Antonia et al. (2014) also reported that the third eyelid gland prolapse in dogs had progressed with the third eyelid rotation. However, the reported studies concerning these disorders in cats are quite limited and are more like brief communications describing incidentally encountered spontaneous lesions, unlike in their canine counterparts described in several studies as both separately and co-occurring entities. Therefore, the relatively low number of feline cases is considered insufficient to propose age, gender, and breed predispositions in this species.

Eversion of the third eyelid cartilage is a less common condition than the gland's prolapse in animals. The junction of the T-shaped cartilage's vertical and horizontal portions is indicated as the most affected area due to structural weakness (Rezaei et al. 2019). Large breed dogs were the most affected breeds (Bryla and

Tomczak 2011, Georgescu et al. 2015), and the eversion occurred unilaterally, usually inward, and yet outward in some cases during the first years of life (Ramani et al. 2010, Allbaugh and Sturh 2013). In the present study, the cartilage was observed to have rotated outwards from the junction of the cartilage is vertical and horizontal parts, as was previously reported in the literatures (Allbaugh and Sturh 2013, Rezaei et al. 2019). Based on the patients' age distribution, three (23%) cats were younger than one year old, nine (69.2%) were between one and four years of age, and one cat was over five years old. The majority of cats (69.2%) ranged from one to four years of age. The underlying cause of cartilage eversion is not fully understood. Although several studies are available describing the cartilage rotation in dogs, there are only a few studies (Chahory et al. 2014, Rezaei et al. 2019) concerning this condition in cats. Several researchers (Ramani et al. 2010, Williams et al. 2012, Allbaugh and Sturh 2013, Georgescu et al. 2015) reported that growth abnormalities of the anterior cartilage and/or conjunctiva play a crucial role in the etiology of cartilage rotation. Malformation of the third eyelid under the influence of unequal forces in large breed dogs with endophthalmitis is also one of the suggested causes (Allbaugh and Sturh 2013). It is assumed in cats that tensional forces increasing along the cartilage's depths leads to the third eyelid rotation.

Some authors suggest that either loosening the gland's connection with the surrounding tissues induces the gland prolapse, leading to cartilage rotation or the adjacent gland's protrusion occurring due to some pathological conditions in the eye and its attachment organs (Allbaugh and Sturh 2013). In the study, the etiologic causes were unable to be defined in some cases. While the deformation was assumed to be caused by chronic inflammation due to concurrent corneal defects in three cases, the spontaneous occurrence was suggested for the rest. Nevertheless, the gland prolapse accompanying cartilage rotation was not excluded in the etiology.

The third eyelid cartilage reveals anatomical and histological differences in cats and dogs (Williams et al. 2012, Georgescu et al. 2015). Physically, it is seen as a bulging tissue in the inner angle of the eye, resembling a prolapsed gland (Ramani et al. 2010, Bryla and Tomczak 2011). The cartilage eversion is easily distinguished by the presence of shiny cartilage convexity prominent on the conjunctiva (Allbaugh and Sturh 2013, Georgescu et al. 2015). Although this condition does not directly cause ocular lesions, it disrupts the third eyelid position and functions, adversely affecting tear distribution and triggering secondary conjunctivitis and corneal lesions. The cartilage eversion was reported

to be a concurrent finding in a Birman cat with the gland hyperplasia (Linn Pearl 2016). The relevant condition was also reported in two other studies indicating that the third eyelid rotation was associated with the gland prolapse in one Birman and two Persian cats (Chahory et al. 2014). In the study, the gland prolapse and cartilage eversion were observed in all cases. Breed predilection was compatible with those of the previous studies. A study by Chahory et al. (2004) supported the theory of breed predilection indicating that this deformation was highly likely to have occurred due to the gland's prolapse in certain cat breeds. Another study also reported that cartilage eversion was mostly seen in British shorthair (British blue) cats (Williams et al. 2012).

The surgical treatment of cartilage eversion includes resection of the third eyelid margin, correction of the everted cartilage, relocation of the prolapsed gland, removal of the entire cartilage or removal of the scrolled portion of the cartilage followed by homotransplantations (Allbaugh and Sturh 2013). Temporary nictitating membrane flap and partial or total resection of the eyelid margin and cartilage are the methods applied in cartilage eversion's surgical management. Formerly, a temporary third eyelid flap was preferred to avoid surgical intervention, but its success rate was relatively low (Allbaugh and Sturh 2013). Total resection of the eyelid margin and cartilage method may cause complications such as the necrosis of the cartilage margin (Allbaugh and Sturh 2013). Resection of the third eyelid's free edge together with the cartilage resulted in the protrusion of the cartilage's free edge into the connective tissue, inducing inflammation, which rendered the procedure inefficacious (Allbaugh and Sturh 2013). In this deformation, the most commonly used surgery method consists of the surgical removal of the everted part of the cartilage, in which the surgical approach is attempted from both the palpebral and bulbar parts of the eyelid. The palpebral approach reveals less likelihood of traumatic corneal damage, and the bulbar approach is more straightforward, generating fewer tissue adhesions. In the study, the correction of cartilage eversion and gland prolapse was performed from the third eyelid's bulbar face to more effortlessly reach both the gland and the cartilage. The eyelid shortening has also been reported after the excision of the cartilage's rotating portion, which develops due to the resection of a large part of the third eyelid cartilage and removal of the third eyelid's middle section (Rezaei et al. 2019). Moreover, total or partial removal of the cartilage adversely affects the third eyelid's stability, leading to gland prolapse, which necessitates additional surgical intervention (Allbaugh and Sturh 2013). It was reported that removing the third eyelid cartilage caused a loss in membrane tension and

rigidity rendering a less healthy eye surface with impaired tear film clearance (Linn Pearl 2016). On the other hand, homotransplantation of the excised cartilage was shown to be a more promising technique by alleviating the functional imbalances on the bulbar surface (Allbaugh and Sturh 2013). Despite the high therapeutic efficacy of the relevant procedure, it requires precise instrumentation (Allbaugh and Sturh 2013), and leads to prolonged surgery and recovery, with additional costs (Allbaugh and Sturh 2013). Thermal cautery was proposed as another correction method for cartilage eversion in dogs, complications of which, yet rare, were reported to be heat-related disorders causing local irritation on the conjunctival surface (Allbaugh and Sturh 2013). However, the everted cartilage's thermal cautery was unable to be performed concurrently with the surgical repositioning of the protruded gland in the study (Allbaugh and Sturh 2013). A few reported studies are currently available describing the surgical treatment of the third eyelid disorders in cats (Williams et al. 2012). The surgical correction was achieved in the presented study by removing the everted cartilage portion and embedding the prolapsed eyelid gland. Eyelid shortening was noted, as was mentioned in the literature (Rezaei et al. 2019) yet no complications were monitored on the ocular surface. Corneal erosion occurred in one single case, which was assumed to be non-associated with potential irritation that might have had developed due to the suture material or any other undefined conditions.

The nictitans gland hyperplasia or prolapse, referred to as "cherry eye", is one of the most common third eyelid disorders in dogs (Mazzucchelli et al. 2012, Udegbunam et al. 2012, Vani and Lakshmi 2016), yet rarely seen in cats (Dehghan et al. 2012, Williams et al. 2012, Maggs 2013, Chahory et al. 2014, Ukwueze et al. 2015). This lesion may develop unilaterally or bilaterally, leading to deformations in the third eyelid cartilage or even cartilage rotation on some occasions (Mazzucchelli et al. 2012). Its clinical manifestation in cats is similar to that in dogs (Chahory et al. 2014). The disorder is considered to have a congenital or hereditary origin with individual breed predisposition in dogs; however, reported data concerning the cat is insufficient to establish a breed predilection in this species (Chahory et al. 2014). Nevertheless, several previous studies pointed out a predilection in Burmese cats (Williams et al. 2012). Moreover, it was reported that the condition was rarely seen in Domestic shorthair, Persian, and other cat breeds (Chahory et al. 2014). Chahory et al. (2014) demonstrated cherry eye in three cats of Burmese, Persian, and Domestic shorthair breed. In the present study, the condition was mostly observed in the Persian and British shorthair followed by Domes-

tic shorthair cats, respectively, which supported the likelihood of a breed predilection, as was suggested in previous studies. The prevalence of the lesion in some cat breeds is associated with a genetic predisposition, and it is considered that the higher incidence in Persian and British shorthair cats was due to the anatomical features of these brachycephalic breeds with more shallow orbits. Besides, the adorable looks of these breeds undoubtedly play a significant role in the owners' demand for enjoying their company as pets rather than other breeds, which, as a result, leads to a population increase in indoor brachycephalic cats in Turkey.

Despite the several theories suggested for the disorder's causative factors, including congenital or hereditary defects, connective tissue weakness between the glands and the eyelids, secondary inflammation, and rotation of the third eyelid or cartilage, the etiology of the lesion is currently not fully elucidated. The gland hyperplasia was also associated with the cartilage eversion (Schoofs 1999, Dehghan et al. 2012, Ukwueze et al. 2015, Singh et al. 2017). In the study, all cases manifested cartilage eversion in addition to the third eyelid gland hyperplasia. Three separate cats had other disorders such as symblepharon, corneal ulcer, and corneal necrosis. However, it was unable to be established whether gland prolapse was followed by cartilage eversion or vice versa. The ocular findings suggest that the lesion is not congenital, yet might have originated from other lesions such as trauma, conjunctivitis, or a tumoral mass.

The age distribution is different in cats than in dogs (Chahory et al. 2014). The condition is common, especially in young dogs under two years of age (Dehghan et al. 2012, Mazzucchelli et al. 2012, Ukwueze et al. 2015, Singh et al. 2017), while the age range of cats varies (Singh et al. 2017). A few available reported studies describing the condition in cats pointed out the likelihood of congenital ocular anomalies as the underlying cause in two kittens (Chahory et al. 2014), whereas a higher prevalence was noted in adult cats aged 1-4 years (Ford and Mazzaferro 2012). Chahory et al. 2014 indicated that the three cats with "cherry eye" were between 2.5 and 6 years old, with the lesions being unilateral in two cases (right and left eye) and bilateral in one case (Chahory et al. 2014). The ages of the cats included in the present study and the lesion site were compatible with those in the previous reports. The majority of the cats were adult animals, while three were younger than one year old of age. The age range differed from 4 months to eight years. The lesions were unilateral in ten cases (76.9%) and bilateral in three (23%) cases. The age range of Persian and British breeds in which the lesion developed spontaneously ranged between 4 months and four years.

Several surgical techniques have been described to treat the third eyelid gland prolapse in veterinary surgery, varying from removing the gland and fixing it within the surrounding tissue to embed the prolapsed gland. The most commonly applied techniques are partial (Udegbunam et al. 2012) and total extirpation of the gland. However, surgical removal of the prolapsed gland has some disadvantages such as a significant reduction in tear production. According to some studies, removing the third eyelid gland resulted in a decrease in tear production by 40-50% in dogs and 15-26% in cats (Ford and Mazzaferro 2012, Mazzucchelli et al. 2012, Williams et al. 2012). Such complications inspired the development of alternative surgical procedures such as repositioning the gland rather than its extirpation. A number of techniques have been described to replace and fix the prolapsed gland to its normal anatomical position. Two common methods, such as anchoring techniques and embedding in pockets, are used for gland repositioning (Akın and Samsar 2005, Sağlıyan and Günay 2018) aimed either at fixing the gland with sutures or inserting the gland in a pocket, respectively, so that tear production remains intact. Embedding techniques proved to be highly efficacious in avoiding tear production-related complications; however, decreased eyelid movements, re-prolapse of the gland, cysts formations were also reported in dogs after the procedure, which even necessitated subsequent gland removal (Georgescu et al. 2015, Ukwueze et al. 2015). Furthermore, these methods were reported to have caused tissue damage on the eyelid's bulbar surface and glandular ducts (Georgescu et al. 2015). On the other hand, it was also reported that embedding methods did not injure the third eyelid gland ducts (Georgescu et al. 2015). The Morgan pocket method has been introduced as a preferential choice in recent studies for the disorder's surgical management, which was shown to have no adverse impact on tear production, unlike other methods (Deghedan et al. 2012). Deghedan et al. (2012) applied the Morgan pocket method in twenty-eight dogs with the third eyelid gland hyperplasia indicating the procedure's high success rate, with only one case of recurrence, which was associated with the prolonged course of the deformation and the rupture of the absorbable suture material. The authors also reported that Polydioxanone (PDS) absorbable suture was used for the closure of the incision to reduce the potential risks for postoperative inflammation (Deghedan et al. 2012). In the present study, the Morgan pocket method was preferred in the prolapsed gland's surgical treatment because it is functionally active and the ducts are least damaged. Vicryl suture 5-0 polyglactin 910 recommended for gland embedding due to its long absorption time was used in all the animals, and no postoperative comp-

lications, such as the rupture of the suture material or inflammation, were observed.

In cats with cartilage eversion and the third eyelid gland prolapse, it is more practical and efficacious to remove the curved part of the cartilage and correct the prolapsed gland's position by embedding with the Morgan's pocket technique. The high success rate and applicability of the procedure offer a favorable outcome without any deformations. The partial removal of the everted cartilage combined with the Morgan pocket technique is considered a highly reliable surgical treatment procedure due to low recurrence and complication rates. However, total removal of the cartilage reduces the third eyelid's rigidity, which in return affects the third eyelid's disposing capacity of the tear film residues and its other functions, such as covering, protecting, and cleansing the ocular surface. Besides, removing only the cartilage's shifted part leads to the third eyelid shortening, increasing the suppression tension on the cartilage margins, which may ultimately result in marginal necrosis.

Conclusions

A partial removal technique was performed in the presented cases due to almost full rotation of the cartilage hampering the incision's likelihood of facilitation in repositioning the rotating cartilage, even though the previously suggested correction method is removing only the distorted cartilage's middle portion. Briefly, the present study describes repositioning the scrolled third eyelid gland and removing the cartilage's everted portion in cats, with the third eyelid rotation, by a combined Morgan pocket method, which is commonly used for such eyelid disorders in dogs. It can be deduced that the surgical procedure revealed a successful outcome with no incidents of recurrence, tear duct injury, and any other ocular functional damages.

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