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Visual outcome evaluation of complicated perforating corneal injuries after surgical repair in 45 cats

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Abstract: Corneal perforations and lacerations are common causes of blindness. These injuries require immediate treatment to preserve the anatomical integrity of the cornea. The purposes of our study were to demonstrate the common complications of traumatic and nontraumatic penetrating corneal injuries in cats and to assess the visual outcome after surgical repair of these cases. The present study included 45 cats with traumatic and nontraumatic perforated cornea. The cats were treated either by suturing of the corneal defect, conjunctival flap, or treating the associated complications. Regarding the surgical outcomes after a successful conjunctival flap, the corneal integrity and transparency of the eye with the potential for vision were restored in 14 cats, corneal vascularization and granulation tissue in 5 cats, adhesion between the conjunctiva and the cornea in 3 cats, and anterior synechia with corneal fibrosis in 2 cats. Regarding the unsuccessful outcome after conjunctival flap, the eyes lost their vision in 8 cats with collapsed anterior chamber, corneal fibrosis edema, and unresponsive endophthalmitis. The corneal wound healed completely in the 5 cats treated by corneal suturing with variable degrees of corneal edema and fibrosis. Saving the eye with perforated cornea could be achieved when an appropriate and rapid intervention is applied.

Key words: Corneal perforation, corneal laceration, conjunctival flap, cats

1. Introduction

Corneal perforations and lacerations are common causes of blindness. Both human and veterinary patients are commonly subject to corneal injuries which can cause dramatic vision loss [1,2]. These injuries require immediate treatment due to extremely severe pain as a result of abundant sensory innervation [3], a number of potential complications such as secondary bacterial [5,6] and fungal infections [7], and traumatic lens capsule rupture [8]. This immediate treatment aims to preserve the anatomical integrity of the cornea [4]. Corneal perforation occurs due to penetrating or blunt trauma or from progression of a deep or melting corneal ulcer [9]. A corneal perforation is manifested by blepharospasm, serous or purulent ocular discharge, corneal defect, corneal edema, hyphema, shallow anterior chamber, and prolapse of the iris [10].

Corneal perforations and lacerations can cause dramatic eye complications including traumatic lens capsule rupture [8], perilenticular inflammation, lens epithelial proliferation, uveitis, pupillary occlusion and subsequent secondary glaucoma, endophthalmitis, a complete vision loss (blindness) [11,12], and consequently eye enucleation [7]. A combination of medical and surgical therapies [13,14] is essential for treating a corneal perforation. Systemic antibiotics as well as a wide variety of topical antibiotic drops are suggested and should be administered at least 4 times a day. Ointments are contraindicated as they worsen uveitis [13,14]. Several surgical techniques have been developed for repairing, replacing, and regenerating corneal defects including tissue adhesives [15], conjunctival pedicle grafts [16,17], lamellar/penetrating keratoplasty [18] and biomaterial grafts [19].

To the best of the authors' knowledge, no previous articles assessed visual outcome after surgical treatment of corneal perforations and lacerations in cats. Therefore, our study aimed to demonstrate common complications of traumatic and nontraumatic penetrating corneal injuries in cats and to assess the visual outcome after surgical repair of these cases.

2. Materials and methods

2.1. Animals

The present study included 45 cats (45 affected eyes) with perforated cornea. Informed consent was obtained from the owners of all enrolled cats. The data collected from

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each patient included breed, sex, age, affected eye, and duration of the clinical signs. Before inclusion, all cats were subjected to detailed ophthalmic examination including fluorescein staining (Bio-Glo Fluorescein sodium Strips 1 mg; HUB pharmaceuticals, LLC., USA) and indirect ophthalmoscopy (Riester, Germany). The cats were ineligible for inclusion if perforating corneal injury was diagnosed and included either traumatic or nontraumatic perforation (i.e. melting corneal ulcer or deep penetrating corneal ulcer) with the affected eye with the potential for vision. We excluded the cats with superficial corneal ulcer, deep stromal ulcer, descemetocele, or corneal sequestration or those with perforating corneal injury that causes catastrophic damage to the intraocular structures (i.e. injuries that cause blindness) from the study. All the patients were examined and treated surgically by a qualified ophthalmologist between March 2019 and February 2020. All clinical signs, causes, and morphological characteristics of the corneal lesions were evaluated and recorded.

2.2. Surgical procedure

All the cats were premedicated with atropine sulphate (0.04 mg/kg) and xylazine hydrochloride 2% (Xylaject; ADWIA, Egypt) with a dose of 1 mg/kg BW, and anesthetized with ketamine hydrochloride 5% (Keiran; EIMC Pharmaceuticals Co., Egypt) with a dose of 20 mg/kg. Desensitization of the cornea was achieved via instillation of benoxate hydrochloride 0.4% (Benox; EIPICO, Egypt). All surgical procedures were performed under a binocular surgical microscope (12.5x; 66 Vision Tech Co., Ltd. China). The cats were placed in lateral or dorsal recumbency with the head positioned to keep the cornea parallel to the table and the eye looking towards the operating field of the surgical microscope. The surgical preparation of the eyes included thoroughly flushing conjunctival and periocular tissue with diluted (1:50) povidone iodine (Betadine 10; The Nile Co., Egypt) followed by flushing the eye with sterile saline (sodium chloride 0.9%; Union pharma, Egypt). In cats with iris prolapse, the adhesions between the protruded iris and cornea were gently removed, and an iris spatula was used to restore the iris back to its natural location. Using an irrigation cannula, the blood clots in the anterior chamber were carefully removed by gentle flushing with a controlled salt solution [20,21]. The devitalized corneal tissue or fibrin clot were excised in cats with destructing melting ulcer or perforation that was sealed with fibrin clot. In 5 cases out of 45, the corneal wound was located at the peripheral cornea and there was no corneal defect. In these cases, the edges of corneal wound were grasped with a Colibri forceps and were approximated by simple interrupted sutures using No. 7-0 monofilament polypropylene (Prolene; Ethicon, USA) in a simple interrupted pattern. In 40 cases out of 45, there was a well-defined corneal defect and a conjunctival flap was applied. The lens material was found in the anterior chamber of 2 cats in this study and was removed before the application of the conjunctival flap and the anterior chamber was irrigated using saline solution 0.9%.

The conjunctival flap was created in the bulbar conjunctiva using Steven's tenotomy scissors, with the base of the flap being attached to the limbus. The length of the flap was adjusted to cover the corneal defect without tension. The graft was then rotated onto the cornea using 2 pairs of forceps and placed over the recipient site. The flap was then sutured to the borders of the corneal defect using 8-0 polypropylene (Prolene; Ethicon, USA) in a simple interrupted pattern [22].

About 0.5 mL of sterile, nonpyrogenic, high molecular weight, noninflammatory highly purified viscoelastic preparation containing sodium hyaluronate (PROVISC; 0.55 mL 1% sodium hyaluronate, Alcon, Egypt) was then injected to fill the anterior chamber. A temporary tarsorrhaphy suture involving 1/3 of the eyelid to allow monitoring of the surgery site was then applied to reduce the palpebral fissure using 4-0 polyglactin (Coated Vicryl; Ethicon, USA) in a horizontal mattress interrupted pattern. A systemic course of antibiotic was conducted for 7 successive days with ceftriaxone (Ceftriaxone, Sandoz, Egypt) at a dose of 25mg/kg IM. The owners were advised to instill tobramycin (Tobrin; Alcon, Egypt) and tropicamide 1% (Mydriacyl, Alcon, Egypt) for 7 days. Nonsteroidal antiinflammatory eye drops (Epifenac, diclofenac sodium 0.1%, EIPICO, Egypt) was used to control postoperative pain and discomfort. A commercially available Elizabethan collar was used until the tarsorrhaphy sutures were removed 3 weeks postoperatively. The owners were asked to bring their cats for recheck at days 7, 14, and 21 postoperatively. At the end of the study observation period, visual assessment was dependent on the presence or absence of pupillary light reflex, menace response, and dazzle reflex as well as on obstacle test.

3. Results

3.1. Animals

The breeds included in the present study were Persian (n = 20), Himalayan (n = 10), Domestic Short-haired (DSH, n = 10), and Siamese (n = 5). The mean age (±SD) at the initial presentation was 31.86 (±19.28) months (range, 4–72 months). There were 25 females (18 intact and 7 spayed) and 20 intact males. The mean (±SD) duration of clinical signs prior to presentation was 4.82 (±5.55) days (range, 1–27 days).

3.2. Clinical findings and associated complications

Among the presented cats, there were 30 (66.66%) cats with traumatic corneal perforation and 15 cats (33.33%) with nontraumatic corneal perforation as a sequel to corneal ulcer. The left eye (OS) was affected in 28 cats (62.22%)

and the right eye (OD) was involved in 17 cats (37.77%). All causes of traumatic perforation reported in this study were due to fighting with other cats and dogs. The recorded clinical findings in all the patients on the initial presentation were photophobia, lacrimation, blepharospasm, and the prolapse of the nictitating membrane. The stages of corneal healing, corneal edema, and vascularization were variable. In 30 cats with traumatic corneal perforation, the site of injury was at the center of the cornea in 25 cases (83.33%) and in the peripheral cornea in 5 cats (16.66%). The recorded ophthalmic findings in the cats with traumatic perforation were collapsed anterior chamber and corneal vascularization (Figure 1a), hypotony, corneal edema, corneal vascularization and shallow anterior chamber (Figure 1b), iris prolapse, iris inclusion, dyscoria, corneal edema, hyphema and hypotony (Figure 1c and d), disruption of anterior lens capsule and adherence with the cornea (Figure 1e), and disruption of anterior lens capsule and leakage of lens material in anterior chamber (Figure 1f). Table 1 demonstrates the patient's signalment and associated ophthalmic findings of the traumatic corneal perforation in the presented cats. Ophthalmic findings associated with nontraumatic perforation were bullous keratopathy and keratocele and corneal melting (Figures 2a and 2b), iris prolapse, corneal edema, vascularization and corneal melting (Figure 2c) and/or abscessation (Figure 2d), and corneal perforation sealed with fibrin clot (Figure 2e, 2f and 2g). A clear anterior chamber and uveal tissue revealed after the devitalized corneal tissue, keratocele, bullae membrane, and fibrin clot were excised (Figure 2h and 2i). The patient's signalment and associated ophthalmic findings of the nontraumatic corneal perforation in the presented cats are demonstrated in Table 2.

3.3. Surgical outcome

The conjunctival flap covered small-sized defects (Figures 3a and b) and large defects (Figures 3d and c) successfully with the sutures placed deeply in the corneal stroma without penetrating the cornea completely. The mean (±SD) recheck time after the initial presentation was 7.95 (±0.96) days with a range of 6–10 days. The graft sites were fluorescein dye-negative and all the sutures remained intact in 32 cats (80%) out of 40 cases treated with the conjunctival flap. Failure of the graft was observed in 8 cats (20%) with corneal melting and keratomalacia; these cats were treated by eye exenteration. The menace response and dazzle reflex were present in all the cases (32 cats) with successful flap and there were moderate signs of

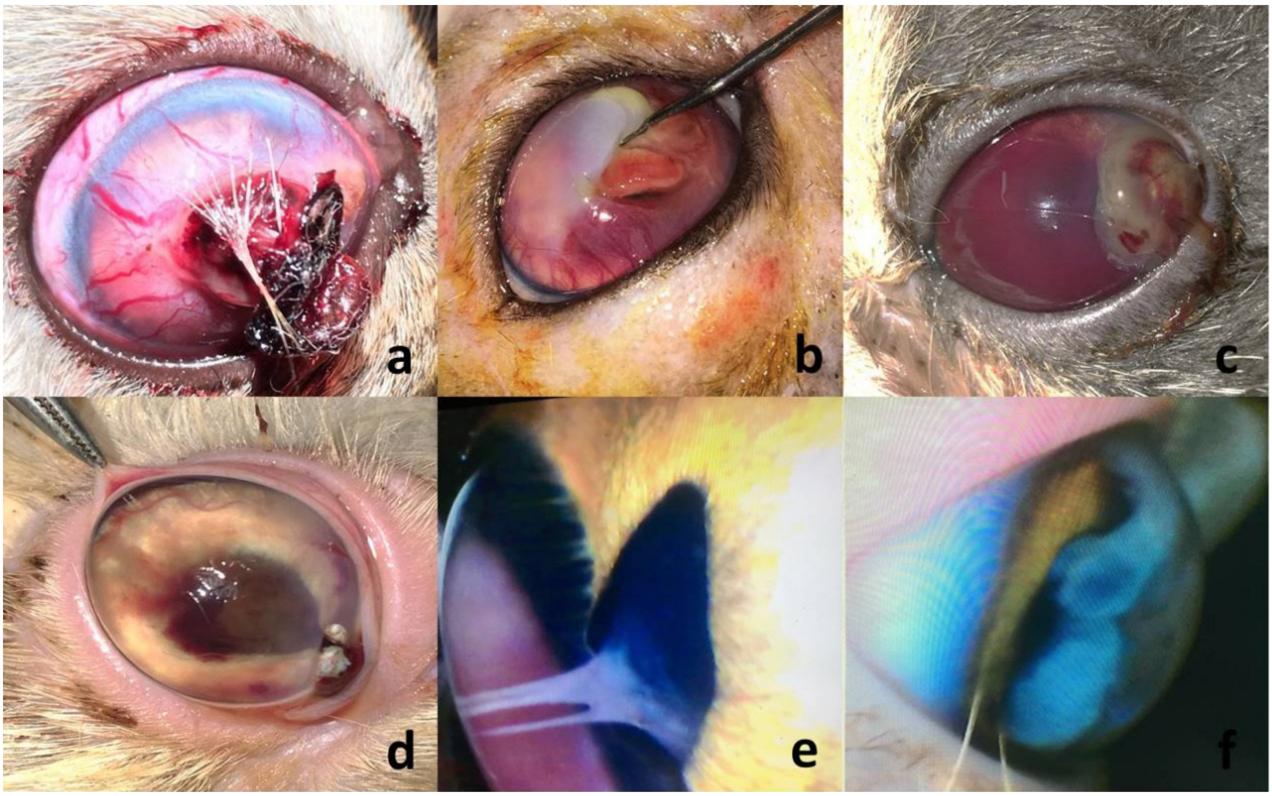

Figure 1. Photograph showing the clinical presentation of traumatic perforations in cats with corneal vascularization and collapsed anterior chamber (a), corneal edema and vascularization (b), iris inclusion and hyphema (c), iris inclusion and dyscoria (d), disruption of the anterior lens capsule and adhesion with the cornea (e) and leakage of the lens material in the anterior chamber (f).

Table 1. The patient's signalment, duration of clinical signs, and associated ophthalmic findings of traumatic corneal perforation in 30 cats.

No.	Breed	Age (month)	Sex	Duration (days)	Affected eye	Ophthalmic findings
1	Persian	36	F	3	OS	Iris prolapse, iris inclusion, Dyscoria, corneal edema and hypotony
2	Persian	48	F	2	OS	
3	Persian	52	F	2	OS	
4	Persian	6	F	1	OS	
5	Persian	72	F	1	OS	
6	Persian	36	F	2	OS	
7	Persian	48	F	1	OS	
8	Persian	32	M	1	OS	
9	Persian	12	M	2	OS	
10	Persian	36	M	5	OD	Collapsed anterior chamber and corneal vascularization
11	Persian	36	F	6	OD	
12	Persian	24	F	10	OS	Disruption of anterior lens capsule and adherence with the cornea
13	Persian	6	M	3	OS	Disruption of anterior lens capsule and leakage of lens material in AC
14	Himalayan	12	M	2	OS	Iris prolapse, iris inclusion, dyscoria, corneal edema and hypotony
15	Himalayan	16	M	2	OS	
16	Himalayan	18	F	3	OS	
17	Himalayan	72	F	1	OS	Disruption of anterior lens capsule and leakage of lens material in AC
18	Himalayan	24	F	4	OS	
19	Himalayan	24	M	17	OD	Hypotony, corneal edema and shallow AC
20	DSH	60	M	2	OS	Hyphema, corneal edema and collapsed AC
21	DSH	60	M	3	OS	
22	DSH	36	F	7	OS	
23	DSH	30	M	2	OS	
24	DSH	36	F	2	OS	
25	DSH	12	F	3	OD	
26	DSH	6	F	2	OD	Disruption of anterior lens capsule
27	Siamese	24	M	2	OS	Iris inclusion, dyscoria, hyphema, corneal edema, and hypotony
28	Siamese	24	M	1	OD	Hyphema, corneal edema and corneal vascularization
29	Siamese	42	M	3	OD	
30	Siamese	4	F	2	OD	

DSH: Domestic shorthair; M: Male; F: Female; OD: Optic dexter (right eye); OS: Optic sinister (left eye); AC: Anterior chamber

ocular pain or discomfort. In these cases, there was also no evidence of aqueous leakage from the corneal suture or the conjunctival flap. In the 5 cases with perforating corneal injury that were treated by corneal suturing, the sutures remained intact with no evidence of aqueous leakage and variable degrees of corneal edema around the suture line. Hyphema was resolved in 6 cats out of 10 diagnosed in this study and remnants of blood clots were observed in the anterior chamber in the other 4 cats. For the cats with persistent hyphema, an additional eye drop containing dexamethasone (Tobradex, Alcon, Egypt) was advised. Ocular discharges ranging from serous to

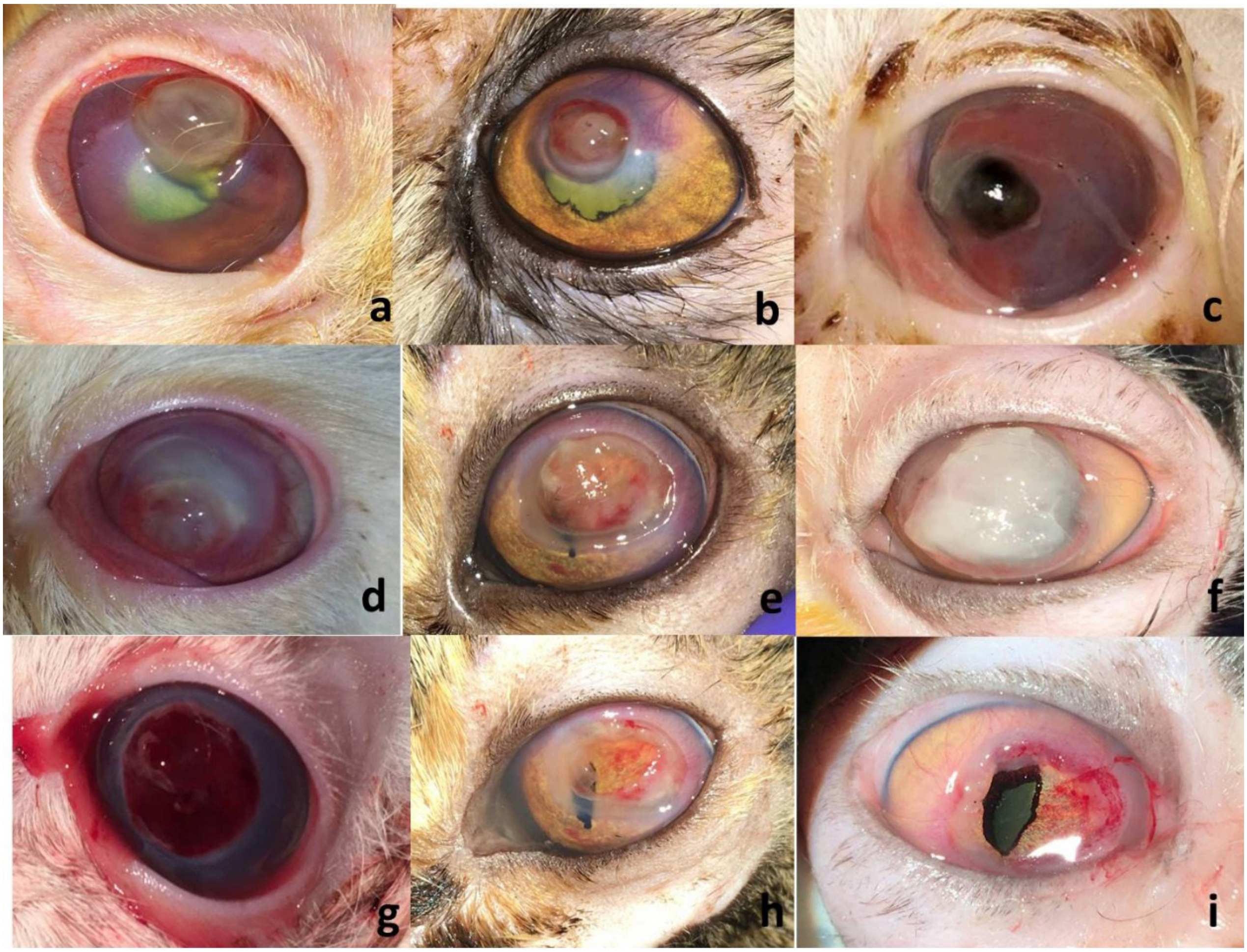

Figure 2. Photograph showing the clinical presentation associated with nontraumatic perforations in cats. (a and b) rupture of the Descemet's membrane with bullae formation accompanied by corneal vascularization, edema and melting (c) corneal perforation with iris prolapse and corneal melting, (d) large keratocele, corneal melting, abscessation and neovascularization, (e, f, and g) corneal perforation sealed with fibrin clot with variable degrees of corneal edema and vascularization, (h and i) intraoperative photographs representing the clinical appearance after excision of the devitalized corneal tissue, fibrin clot, keratocele, or the bullae membrane.

mucopurulent were observed in almost all of the operated cats. The mean (±SD) time of the second recheck after the initial presentation was 15.75 (±1.07) days with a range of 14–18 days. The stability of the corneal flap was observed in 32 cases and continued to the second recheck (Figures 4a and 4b). All the signs of ocular discomfort and ocular discharges were decreased. The sutures were removed in the cases treated with corneal suturing and variable degrees of corneal fibrosis/edema were observed.

The mean (±SD) time of the third recheck after the initial presentation was 21.75 (±1.03) days with a range of 21–24 days. At the third recheck, the conjunctival flaps were trimmed using a Colibri forceps and tenotomy scissors and the portion of the graft that was not attached to the cornea was elevated and resected.

Regarding the surgical outcomes after a successful conjunctival flap, the corneal integrity and transparency of the eye with the potential for vision were restored in 24 cats. These cats showed variable degrees of corneal scarring (Figures 5a, 5b, 5c and 5d) in 14 cats (14/32%, 43.75%), corneal vascularization and granulation tissue (Figure 5e) in 5 cats (5/32, 15.62%), adhesion between the conjunctiva and the cornea (Figure 5f) in 3 cats (3/32, 9.37%), and anterior synechia with corneal fibrosis (Figure 5g) in 2 cats (2/32, 6.25%). Regarding the unsuccessful outcome after conjunctival flap, the eyes lost their vision in 8 cats (8/32, 25%) with collapsed anterior chamber, corneal fibrosis edema (Figures 5h and 5i), and unresponsive endophthalmitis.

The corneal wound healed completely in the 5 cats treated by corneal suturing with variable degrees of corneal edema and fibrosis.

Regarding the vision outcome of cats enrolled in this study, the vision was restored in 29 eyes (64.44%) and was

Table 2. The patient's signalment, duration of clinical signs, and associated ophthalmic findings of nontraumatic corneal perforation in 15 cats.

No.	Breed	Age (month)	Sex	Duration (days)	Affected eye	Ophthalmic findings
1	Persian	48	F	2	OS	Corneal melting, corneal edema, and vascularization
2	Persian	32	F	6	OS	
3	Persian	54	M	3	OS	
4	Persian	72	M	3	OD	
5	Persian	24	F	1	OD	
6	Persian	18	F	15	OD	Perforation sealed with protruding fibrin clot
7	Persian	12	F	4	OD	
8	Himalayan	12	M	1	OS	Perforation with bullous keratopathy/keratocele and corneal melting
9	Himalayan	36	M	15	OD	
10	Himalayan	24	M	5	OS	Iris prolapse, corneal edema and vascularization
11	Himalayan	30	F	4	OD	
12	DSH	36	F	27	OD	Perforation sealed with protruding fibrin clot
13	DSH	12	F	1	OD	Corneal melting, corneal edema, and vascularization
14	DSH	8	M	17	OD	
15	Siamese	72	M	15	OS	Perforation sealed with protruding fibrin clot and corneal edema

DSH: Domestic shorthair; M: Male; F: Female; OD: Optic dexter (right eye); OS: Optic sinister (left eye); AC: Anterior chamber

lost in 16 eyes (35.55%). The summary of surgical and visual outcomes of all the cats enrolled in this study is demonstrated in Table 3.

4. Discussion

Corneal perforations and lacerations are serious corneal defects that lead to anatomical and functional impairment of the eye. Corneal perforations occur commonly in all species and may occur due to penetrating or blunt trauma or from progression of a deep or melting corneal ulcer [9]. Corneal perforation and prolapse of the iris are negative prognostic events which significantly lower the chances of saving vision and the eye. When the cornea is perforated, aqueous humor spills out, causing collapse to the anterior chamber, hyphema, hypotony, and infectious endophthalmitis [23]. Among the cats presented in this study, there were 30 cats (66.66%) with traumatic corneal perforation and 15 (33.33%) with nontraumatic corneal perforation as a sequel to corneal melting. All causes of traumatic perforation reported in this study were due to fighting with other cats and dogs. This was similar to other studies which incriminated cat claw injuries [24] and corneal melting [9] as common causes of corneal perforation in dogs and cats.

The recorded clinical findings in all the patients on the initial presentation were photophobia, lacrimation, blepharospasm, prolapse of the nictitating membrane, iris inclusion, corneal melting with devitalized corneal tissue, corneal perforation sealed with fibrin, and corneal perforation sealed with clotted aqueous [10]. Moreover, corneal perforations result in chronic leakage, prolonged hypotony, and a collapsed anterior chamber, all of which may contribute to endophthalmitis, anterior peripheral synechia, cataract formation and severe intraocular hemorrhage [25].

Conjunctival grafts are most widely used for the surgical treatment of serious corneal defects [26] as they act as a biological layer with defensive and analgesic effects [27]. Conjunctival tissue, however, persists at the graft site, resulting in permanent corneal opacity, which can impair vision if a large graft is required [27]. Furthermore, conjunctival grafts have limited tectonic support. It is an important feature when lesions include a wide area of the cornea because lack of structural support can contribute to severe corneal deformation [16,28]. In viewing the results of this study, after a successful conjunctival flap, the corneal integrity and transparency of the eye with the potential for vision were restored in 24 cats. These cats showed variable degrees of corneal scarring (14/32%, 43.75%), corneal vascularization and granulation tissue (5/32, 15.62%), adhesion between the conjunctiva and the cornea (3/32, 9.37%), and anterior synechia with corneal fibrosis

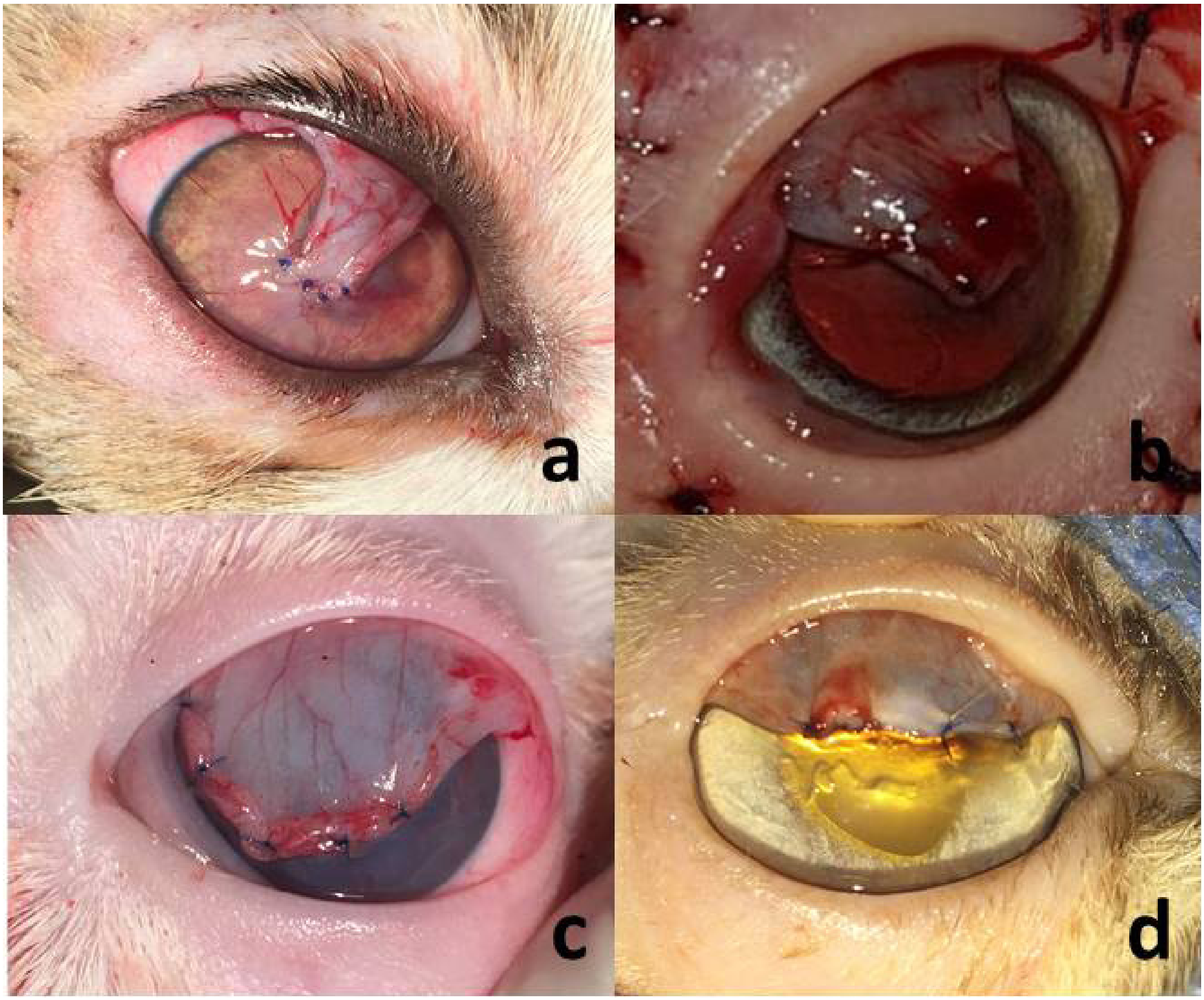

Figure 3 (a, b, c, and d). Photograph demonstrating some of the conjunctival flaps used to close the corneal defects.

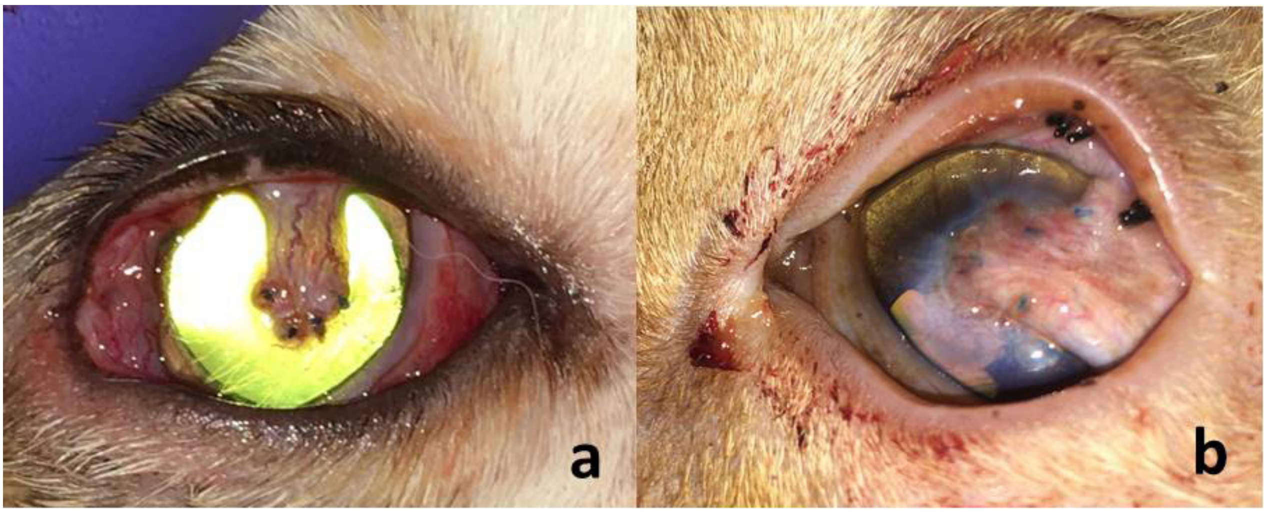

Figure 4 (a and b). Photograph showing the stability of the conjunctival flap.

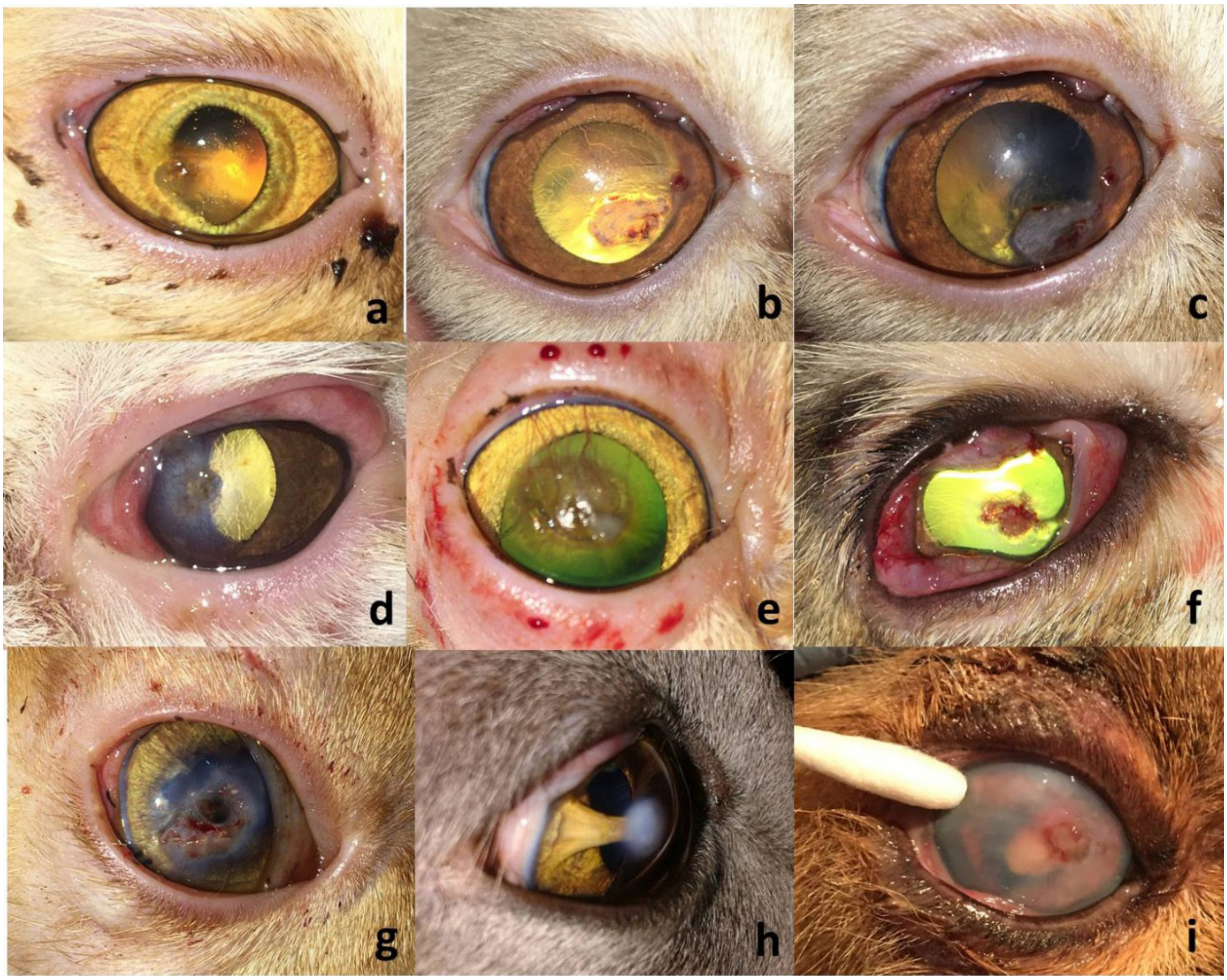

Figure 5. Photograph showing surgical repair outcome with the restoration of the corneal integrity, clarity, and transparency (a, b, c, d, e, and f) with minimal (a), moderate (b), and large (c, d) scarring at the graft site which may accompanied by corneal vascularization (e), (f) representing the encountered adhesion between the conjunctival graft and cornea, (g) Anterior synechia and collapse of the anterior chamber with variable degrees of corneal fibrosis and scarring (h, i).

(2/32, 6.25%). This was in agreement with the results of a previous study that utilized the conjunctival flap for repair of corneal defects with and without an cellular submucosa implant in 73 canine eyes [29].

Various surgical procedures have been used previously for the management of corneal perforation and keratomalacia. In a different study, Dulaurent et al. [17] utilized bovine pericardial (BP) graft for surgical repair of melting corneal ulcer in dogs and corneal sequestrum in cats with a high success rate. Moreover, the possibility of the pericardial graft to be infected with the organism responsible for keratomalacia has been reported [17] with possible development of secondary calcification as reported in a human study [30]. Furthermore, amniotic membrane transplantation (AMT) was used in a previous human study and was proven to be an effective technique for repair of corneal perforations [30].

At the first and second recheck following the surgery, moderate reduced to mild signs of ocular pain or discomfort with ocular discharges were reported in almost all of the cats. This may be attributed to the intense inflammatory response to suture material along with the trauma created during fixation of the conjunctival flap to the cornea.

In our study, we selected monofilament polypropylene to suture the cornea owing to its nonirritant, noncapillary, and inertness characteristics. The corneal sutures were firmly inserted in the stroma down to the Descemet's membrane without completely perforating the cornea [10]. Moreover, temporary tarsorrhaphy was used to give the underlying graft and cornea physical protection, as stated in previous studies [26].

The graft was trimmed at the end of the study observation period to sever the blood supply to the graft,

Table 3. Summary of surgical and visual outcomes of all cats enrolled in this study.

<table>
<tr><th>Type of corneal perforation</th><th>Surgical technique</th><th>Surgical outcome</th><th>Number of cats</th><th>Visual outcome</th></tr>
<tr><td rowspan="7">Traumatic corneal perforation</td><td rowspan="5">Conjunctival flap (25 cats)</td><td>Variable degrees of corneal scarring</td><td>14 (56%)</td><td>The eyes were visual</td></tr>
<tr><td>corneal vascularization and granulation tissue</td><td>1 (4%)</td><td>The eyes were visual</td></tr>
<tr><td>Adhesion between the conjunctiva and the cornea</td><td>3 (12%)</td><td>The eyes were visual</td></tr>
<tr><td>Anterior synechia with corneal fibrosis</td><td>2 (8%)</td><td>The eyes were visual</td></tr>
<tr><td>Collapsed AC, phthisis bulbi, corneal fibrosis</td><td>5 (20)</td><td>Vision loss</td></tr>
<tr><td rowspan="2">Corneal suturing (5 cats)</td><td>Corneal vascularization edema and fibrosis</td><td>3 cats (60%)</td><td>The eyes were visual</td></tr>
<tr><td>Corneal vascularization, fibrosis, and dyscoria</td><td>2 cats (40%)</td><td>The eyes were visual</td></tr>
<tr><td rowspan="3">Nontraumatic corneal perforation</td><td rowspan="3">Conjunctival flap (15 cats)</td><td>Graft failure, endophthalmitis and the eye was treated by exenteration</td><td>8 cats (53.33%)</td><td>Vision loss</td></tr>
<tr><td>Corneal vascularization and granulation tissue</td><td>4 cats (26.66%)</td><td>The eyes were visual</td></tr>
<tr><td>Endophthalmitis and the eye was treated by exenteration</td><td>3 cats (20%)</td><td>Vision loss</td></tr>
</table>

allowing the corneal attachment to atrophy and undergo fibrosis, thus minimizing scar formation [31].

The use of viscoelastic preparation containing sodium hyaluronate to rapidly fill and restore the anterior chamber and to prevent intraocular adhesions was beneficial in our study [31].

The success or failure of each graft depends on the appropriate surgical procedure, the immune response of the host, and the severity of the subsequent inflammation [10]. The success features of the graft include successful host cell migration and differentiation, regulated cell proliferation to prevent excessive scarring, and a graft resorption profile inversely proportional to the rate of host tissue regeneration [32]. Collapsed anterior chamber was reported in 8 cats (25%) in this study owing to the leakage of the aqueous humor and the failure of the graft to preserve the anterior chamber. These eyes lost their vision due to phthisis bulbi and corneal fibrosis and unresponsive endophthalmitis. Conjunctival graft failure has various causes, such as poor surgical technique, including insufficient recipient site debridement, inappropriate suture positioning, excessive graft tension or thickness, and excessive graft size, which overlaps the edge of the ulcer without achieving epithelial-to-epithelial apposition [23,32]. In the present study, the failure of the graft was observed in 8 cats (8/40, 20%) with corneal melting and keratomalacia, which was attributed to the large defect and to the devitalized corneal tissue.

This study produced encouraging results in which the vision was saved in 29 eyes (64.44%) and was lost in 16 eyes (35.55%). This could be achieved when an appropriate and rapid intervention is applied and when the loss of corneal tissue is not too large to the graft to overcome the loss.

In conclusion, saving the eye with perforated cornea even with persistent scars were acceptable by all the owners. Thus, prompt rapid referral to the veterinary ophthalmologist is highly recommended.

Conflict of Interest

The authors have no conflict of interest.

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