



## Management of Eye Protrusion in Cats with Acute Trauma

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### Abstract

Preventing permanent vision loss and damage to the bulbus oculi in cases of proptosis, which is very important in small animal eye emergencies, and protecting the anatomical structures of the eye. Early intervention is important for protection. In this study, patients with proptosis who had experienced acute trauma. It was aimed to report the treatment and results of cats. Proptosis was diagnosed in 11 of 96 cats (11.45%) who presented to eye emergencies. On examination, all cats had eye. It was determined that the edges of the eyelids were not visible, the bulbus oculi was muffled, the bulbus oculi was hyperemic and edematous, there was a pupillary light reflex in 9 cases, and there was no pupillary light reflex in 2 cases. In the treatment, enucleation was applied in 2 cases, canthotomy and temporary Blepharorhaphy were applied in 3 cases, and temporary Blepharorhaphy was applied in 6 cases. It was determined that there were no postoperative complications in all cases and visual function was observed in all cases except for those who underwent enucleation. As a result, urgent intervention is important to protect the anatomical structures of the eye and maintain visual function in proptosis. The results obtained from this study are satisfactory for cats and their caregivers.

**Key Words:** Blepharorhaphy, cat, eye trauma, protrusion

### Akut Travmalı Kedilerde Göz Çıkıklığının Yönetimi

#### Öz

Küçük hayvan göz acillerinde oldukça önemli olan proptosis olgularında kalıcı görme kaybının ve bulbus okulinin hasar görmesinin önlenmesi ve gözün anatomik yapılarının korunması için erken müdahale önemlidir. Bu çalışmada akut travma geçirmiş proptozisli kedilerin tedavi ve sonuçlarının bildirilmesi amaçlandı. Göz acillerine başvuran 96 kedinin 11'inde (%11.45) proptosis tanısı konuldu. Muayenede kedilerin tamamında göz kapaklarının kenarlarının görünmediği, bulbus okuliye boğumladığı, bulbus okulinin hiperemik ve ödemli olduğu, 9 olguda pupillary ışık refleksinin olduğu, 2 olguda ise pupillar ışık refleksinin olmadığı belirlendi. Tedavide 2 olguda enukleasyon, 3 olguda kantotomi ve geçici blefarorafi, 6 olguda da geçici blefarorafi uygulandı. Tüm vakalarda postoperatif komplikasyon şekillenmediği ve enukleasyon yapılan olgular dışında diğer olgularda görme fonksiyonunun olduğu belirlendi. Sonuç olarak proptoziste gözün anatomik yapılarının korunması ve görme fonksiyonunun devamı için acil müdahale önemlidir. Bu çalışmadan elde edilen sonuçlar kediler ve ilgilileri için tatmin edicidir.

**Anahtar Kelimeler:** Blefarorafi, göz travması, kedi, proptosis

### INTRODUCTION

Proptosis, or forward displacement of the eyeball due to a traumatic cause, is a serious ocular emergency that requires immediate intervention. In a case of proptosis, the eyeball is displaced to the front of the edges of the eyelid and swelling in the deep tissues makes it impossible for the eyeball to return to its normal position (1-5). Proptosis is caused by trauma. It is especially common during blunt trauma such as traffic accidents or hitting a ball. In addition, iatrogenic causes have been reported. It is also known that brachiocephalic breeds are predisposed (3,6,7).

It is important to have a traumatic history in the diagnosis of proptosis. In addition, it has an acute onset. The edges of the eyelids are not visible, patients cannot blink,

and the eyelids cannot protect the cornea. Most of the time, the bulbus oculi and surrounding tissues are edematous and hyperemic. It may be accompanied by hyphema, keratitis and bleeding. Moreover, it has a characteristic clinical appearance (2-4,6,8,9). While proptosis and exophthalmos are used synonymously in human medicine, traumatic displacement of the eyeball is called globe luxation (3).

The prognosis for vision is often not good. The prognosis for keeping the eye in place (saving the eyeball) depends on multiple factors. These factors specifically include globe rupture, intraocular hemorrhage, avulsion of 3 or more extraocular muscles, optic nerve avulsion, and orbital bone and skull fractures. The significant force required to dislodge a globe lodged deep in the orbit often leads to simultaneous

orbital fractures and/or serious damage to the eye (e.g., muscles or optic nerve) (2,3,6,9).

Temporary tarsorrhaphy is preferred for treatment purposes. Although there is permanent damage to vision, the cosmetic result is usually satisfactory. In addition, user satisfaction is generally high and vision can be preserved/regained, even if only slightly. However, appropriate case selection is critical to ensure that it is cosmetically acceptable to the cat owner (2-4,6). Alternatively, if the patient is unsuitable in terms of prognosis or the owner is unwilling, enucleation should also be considered as a treatment option (2-4,6,10).

This study aimed to report the treatment and results of acutely traumatized cats (*Felis catus*) with protrusion.

## MATERIAL AND METHODS

The animal material of the study consisted of only 11 cats with proptosis among the cats (96 cats) whose eyes and surrounding areas were affected among the cats brought to Dicle University Veterinary Faculty Surgery Clinic with acute trauma in the last two years (2022-2023). Traumatized cats were first evaluated for life-threatening conditions, and ABC (airway, breathing and circulation) evaluation was performed as an emergency intervention for each cat. Evaluation of hypovolemia and hypoxemia was also performed (as previously reported Parlak et al. (1). Following these rapid evaluations, an intravenous (IV) catheter was placed in the cephalic vein in the front extremity. Subsequently, prognosis was evaluated using "the modified Glasgow coma scale (mGCS)" (1,11,12). According to this scale, each animal was rated as severe (score 3–8), guarded (score 9–14), or good (score 15–18) by adding each score in three categories, including motor and brainstem reflexes and level of consciousness. A systemic hemogram was also performed.

During trauma management and patient monitoring, the cat's head was elevated at an angle of approximately 30° from body level to maximize venous drainage from the brain and minimize the increase in intracranial pressure (ICP). In addition, care was taken not to apply pressure to the jugular vein, as this would cause an increase in ICP. Initially, cats were provided with supplemental oxygen (50-80 ml/kg/min) for 10-15 minutes with a mask or oxygen tent. As previously described (1) one-third of the shock dose (15-20 ml/kg/h) of 0.9% sodium chloride (NaCl) or lactated Ringer's solutions was administered by IV infusion for 15-30 minutes, depending on the severity of the cat's clinical condition. During these procedures, the trauma-affected state of the thorax and possible pulmonary edema were considered. Suspect cats with increased ICP were administered mannitol (1 g/kg, IV, over 15-30 minutes), an osmotic diuretic.

In all cats included in the study, criteria such as the bulbus oculi luxating outside the eyelids, being stuck between the eyelids, the eyelid edges not being fully visible, the eyelids not being on the cornea, the cornea being vulnerable, the bulbus oculi being swollen and hyperemic (Figure 1). was kept. Lubricating antibiotic cream (Terramycin® 5 mg, Pfizer, Turkey) was used to prevent the cornea from drying out in the cats included in the study. In addition, after the vital

functions of the cats were stabilized, the eye and surrounding tissues were examined (integrity of the structures forming the eye, presence of hyphema, vision status, etc.). Patients were evaluated in terms of pupillary light reflex and threat response.



**Figure 1.** Images of the cases (a and b). The edges of the eyelids cannot be clearly defined, the bulbus oculi appears to be stuck between the eyelids, and it appears to be edematous and hyperemic.

Among the cats included in the study, it was decided to enucleate the eye in 2 cats where the eye and surrounding tissues were seriously damaged and the pupillary light reflex was absent, and to reject proptosis in 9 cats.

After 0.02 mg/kg medetomidine was administered IV to each cat, a short-term induction was achieved by administering 4 mg/kg IV propofol. Then, after intubation, anesthesia was continued with sevoflurane.

The periorbital tissues and bulbus oculi were washed with sterile saline before returning the prolapse bulb to its previous position and performing any surgical procedure. The protruding bulbus oculi was rejected and an attempt was made to place it in the orbital fossa. Lateral canthotomy was performed in cases that were not rejected (4 cases). After the bulbus oculi was placed in place, the canthotomy area was closed with stitches according to the procedure. Blepharorrhaphy was performed by applying U stitches to the lower and upper eyelids. During Blepharorrhaphy, the stitches were not passed through all layers of the eyelid to prevent the thread from damaging the cornea. The lower and upper eyelids were brought together by passing the meibomian gland through the gaps. Additionally, a flexible sponge was placed between the thread and the eyelid to prevent the thread from cutting the eyelids while knotting the sutures. A small opening was left in the medial canthus area for medication administration.

In enucleated cases, the upper and lower eyelids were temporarily sutured following routine preparations such as shaving and disinfection. Then, a circular incision was made around the orbit and the subcutaneous tissues were bluntly dissected. Then, the bulbus oculi and its appendages were distinguished from orbit. For the optic nerve, 1 ml of lidocaine was injected and cut and the eyeball was taken out. The subcutaneous and skin were sutured with atraumatic 2/0 polyglactin 910 (Vicryl Coated, Ethicon, Türkiye).

In cases of postoperative rejection of the bulbus oculi, ciprofloxacin (1 drop 5 times a day, Siprogut 0.3%, Bilim İlaç

San. ve Tic. A.Ş., Türkiye), hyaluronic acid and carbomer gel (1 drop 4 times a day, Thealoz Duo Gel, Thea, France) was recommended until the stitches were removed (15 days). It was also recommended to wear an Elizabeth collar during this period. In the postoperative period, meloxicam (single dose 0.2 mg/kg subcutaneous, Bavet Meloxicam, Bavet, Türkiye) and amoxicillin, clavulanic acid (8.75 mg/kg subcutaneous once a day, Synulox, Zoetis, Türkiye) were prescribed for one week. The animals were followed up with postoperative checks and skin stitches were removed on the 15th day. It was recommended to wear a collar on the cat during this period.

## RESULTS

According to the 2-year data obtained from the study, the distribution of cases with proptosis (n=11) was found to be 11.45% among cases (n=96) in which the eye and its surroundings were affected in acute trauma.

When the etiology was examined, it was determined that the source of acute trauma was a traffic accident (4 cats), other animal attacks (4 cats) and falling from a height (1 cats). All animals were adults and their ages ranged from 1 to 6 years (mean 3.09). In terms of gender, there were 7 males and 4 females. Their average body weight was determined as 3.87 kg. Cats with proptosis varied as 7 mix breed, 1 Van cat, 2 Persians and 1 Siamese breed (Table 1).

**Table 1.** Information on cats with acute trauma-induced proptosis

Case	Source of trauma	mGCS total score	Eye with proptosis	IOP (mmHg)		Treatment
				Left eye	Right eye	
1	Animal attack	4 Severe	L	48	10	Enucleated
2	Traffic accident	5 Severe	R	8	42	Enucleated
3	Traffic accident	9 Guarded	L	38	12	Replacement and temporary blepharorrhaphy
4	Fall from height	9 Guarded	L	26	4	Lateral canthotomy + replacement and temporary blepharorrhaphy
5	Traffic accident	15 Good	R	6	32	Replacement and temporary blepharorrhaphy
6	Traffic accident	12 Guarded	R	4	26	Replacement and temporary blepharorrhaphy
7	Animal attack	14 Guarded	R	12	40	Lateral canthotomy + replacement and temporary blepharorrhaphy
8	Unknown	15 Good	L	26	6	Replacement and temporary blepharorrhaphy
9	Animal attack	16 Good	R	8	36	Lateral canthotomy + replacement and temporary blepharorrhaphy
10	Animal attack	18 Good	R	11	28	Replacement and temporary blepharorrhaphy
11	Unknown	15 Good	L	40	12	Replacement and temporary blepharorrhaphy

L=Left, R=Right, mGCS: modified Glasgow coma scale, IOP: intraocular pressure

In all cases, the edges of the eyelids were not visible and the cornea was vulnerable. Additionally, the bulbus oculi was hyperemic, swollen, and there were sub-tissue hemorrhages in some parts of the sclera and dryness of the cornea (Figure 1). While 9 of the cats evaluated within the scope of the study had a pupillary light reflex, 2 of them did not have a pupillary light reflex and the cornea was not transparent in these cases. Threat reflex could not be evaluated in all cases.

During post-operative follow-up, it was determined that the patient owners were cosmetically satisfied. It was learned that visual function was present in the cases where the bulbus oculi was rejected and that there were no post-operative complications in all cases included in the study.

## DISCUSSION AND CONCLUSION

Proptosis is a serious condition. It is surgery to reposition the eyeball as quickly as possible to save the eye and prevent permanent vision loss. However, the prognosis varies de-

pending on the condition and severity of the case, it is considered poor (3,5). The proptosis patient is a trauma patient and the patient's general condition may not be suitable for surgery. Therefore, trauma management should be definitely taken into consideration. Therefore, the general condition of the patient should be made suitable for anesthesia and surgery and the operation should be planned without delay. As a matter of fact, in this study, the general condition of the trauma patient was first evaluated. After the general station of patient was stable, anesthesia and surgery were performed. It should not be forgotten that a patient who has an eye emergency due to a traumatic cause is ultimately a trauma patient (3,13). The patient should be evaluated according to the major trauma protocol, and ABC (airway, breathing and circulation) criteria should be completed quickly. It is also important to evaluate hypovolemia and hypoxemia (1). In this study, in addition to these evaluations, the "modified Glasgow coma scale (mGCS)" was used to determine the prognosis. In determining the treatment option,

the condition of the affected external eye muscles and the severity of the lesions in other structures forming the eye were taken into account. In cases where enucleation was performed, the decision was made according to the scale results.

Proptosis is frequently encountered among eye emergencies in small animal clinics. It is easily distinguished from exophthalmos and buphthalmia, which appear as bulging eyes. While the eyelid margins are visible in exophthalmos and buphthalmia, in proptosis the eyelids are tucked behind the eyeball. In lagophthalmia, the patient can blink even though the eyelid closure is not complete. However, it is not possible to clip the gas caps in proptosis (2,3,13). In this study, differential diagnosis was made according to these criteria.

Attacks by other species, such as dogs, have been reported as common causes of traumatic ocular proptosis in cats. Additionally, blunt trauma such as falling from height and traffic accidents have been mentioned as sources of trauma. The cause of the cases in this study was trauma, as previously reported (2,5). It was observed that the main sources of trauma were animal (dog) attacks, traffic accidents and falls from height. On the other hand, traumatic proptosis can occur in cats of any breed (2). Our cases were seen to be more affected by mix breed cats, and this was attributed to the fact that mix breed cats generally live on the street and are more exposed to trauma.

Proptosis caused by traumatic attacks is a surgical emergency and globe replacement should not be unnecessarily delayed (2-5,13,14). Treatment of proptosis has two purposes; the first is to maintain and preserve vision, and the second is to ensure facial aesthetics (5).

Therefore, a surgical procedure to save the eye should often be considered instead of enucleation (9). Possible complications associated with proptosis include permanent strabismus, congestive glaucoma, avulsion of the optic nerve, ulcerative keratitis, keratoconjunctivitis sicca, neuroretinal degeneration, phthisis bulbi (8,9). In this study, instead of eye enucleation, the bulbus oculi was placed back into the orbital fossa in 9 proptosis cases, and no negative complications were reported in the postoperative period.

Enucleation is a preferred condition in cases of proptosis where eye structures are seriously damaged or when the patient's caregivers do not accept the patient's postoperative care conditions (9). Mitchell (15) reported in a study that in enucleated animals, blindness may occur in the healthy contralateral eye as a complication, and this is due to excessive pulling of the optic nerve during the enucleation process. In this study, enucleation was performed in 2 cases and no complications were encountered.

In proptosis, the bulbus oculi is swollen and edematous due to compression between the eyelids. Therefore, it can be difficult to reject (8,9). If there is difficulty in placing the eyeball back into the orbit, lateral canthotomy may be required. It is recommended to close the eyelids with a temporary tarsorrhaphy after direct replacement or replacement after lateral canthotomy (2,3,11). In this study, the general condition of cats with proptosis (11 cats) who were trauma patients was stabilized, then enucleation was performed in

2 of them, replacement and temporary Blepharorrhaphy in 6 of them, and lateral canthotomy + replacement and temporary Blepharorrhaphy in 3 of them under general anesthesia. Tarsorrhaphy is recommended in many studies, but the procedure performed is actually Blepharorrhaphy. Because, as a concept, tarsorrhaphy is the temporary closure of the eye by suturing the third eyelid, while blepharorrhaphy is the temporary or permanent closure of the eye by suturing the lower and upper eyelids.

The clinical results obtained in this study, which aimed to evaluate trauma management, proptosis treatment and outcomes in cats with eye proptosis that had undergone acute trauma, were satisfactory. As a result, reposition of the eyeball should not be delayed in cats with proptosis, and if replacement is not directly possible, it should be performed by lateral canthotomy. Additionally, the eyeball should be protected with temporary Blepharorrhaphy. Even if there is permanent loss of vision, cosmetic comfort will be satisfactory.

#### AVAILABILITY OF DATA AND MATERIALS

The data that support the findings of this study are available on request from the corresponding author (BEK).

#### CONFLICTS OF INTEREST

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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