

Enucleation Only Has One “I”

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Introduction

Proptosis of the eye is a sudden expulsion of the globe from its bony orbit to a position rostral from the eyelids. It is considered an emergency in all species. Proptosis requires immediate veterinary attention for pain management, physical examination, and possible vision saving intervention. Proptosis of the eye in cats is rare, but when it does occur, it is most commonly due to motor vehicle trauma or bite wounds to the orbit². Craniofacial trauma and contralateral blindness are common concurrent maladies seen. The prognosis for vision returning to a replaced proptosed eye in the cat is grave³ and therefore typically results in enucleation, or, rarely, owner elected euthanasia if the patient's quality of life is compromised.

Along with loss of vision, there are also other important sequelae seen with proptosis, especially in the cat. Because of the force required to proptose the globe, head trauma is also commonly associated with the diagnosis and the patient should be observed for an increase in intracranial pressure and cerebral ischemia. Hyperventilation will reduce intracranial pressure but will also cause ischemia due to the reduction in cerebral blood flow as indicated by the equation $CPP = MAP - ICP$. Careful positioning and handling of the patient should be used to prevent sudden changes in blood pressure and intracranial pressure¹³. Cats have the propensity to develop sarcomas post-trauma, including enucleation and post-injection. Therefore, post-operative monitoring is recommended following proptosis or enucleation. Ocular sarcomas are locally invasive and may affect the optic nerve, optic chiasm, and contralateral optic nerve⁷. Owners should monitor for swelling of the surgical site and neurological signs for the remainder of the pet's life following enucleation, as sarcomas have been noted as soon as 5 years post-operatively⁶. Fibrosarcomas are the most common diagnosis, but osteosarcomas or undifferentiated sarcomas may occur¹.

Alternatively, if the globe is replaced following proptosis, long-term side effects include: permanent strabismus, blindness, ulcerative keratitis, lagophthalmos, neurotrophic keratitis and phthisis bulbi. Other complications associated with enucleation include orbital pneumatosis^{8,11}, infection, dehiscence, and conjunctival mucocele¹⁴.

Prognosis for sight in the affected eye depends on the duration and severity of the proptosed eye. Cats are very sensitive to optic nerve damage and one-sided eye injury can affect the other eye's vision. The prognosis is better if the prolapse is mild, the duration is short, the pupil miotic, extraocular muscle damage is minimal, and the fundic examination is normal¹². Hyphema is the second most common finding and is also a poor prognostic indicator in proptosed eyes^{15,16}. If direct or indirect pupillary light responses do not return within one week, there is likely permanent ocular damage. Blindness occurs in almost 100% of cats in the proptosed globe, further supporting enucleation in most cases^{9,10,11}.

There are three techniques described for enucleation which are the lateral, subconjunctival, and transpalpebral approaches. With each technique, care should be taken to gently dissect the globe from the orbit with minimal traction for vessel ligation⁴.

History and Presentation

Penny is an approximately 4-year-old neutered male domestic shorthair cat who was adopted as a young stray by his current owner. He received one set of vaccines when he was neutered as a kitten. He presented to Animal Emergency and Referral Center on August 25, 2019 approximately 20 minutes after being hit by a car after darting out the house front door. On presentation, the right eye was protruding from the orbit and subconjunctival hemorrhage was noted. He was open mouth breathing and epistaxis was noted bilaterally. He was also

intermittently weight bearing on his right front. He appeared slightly obtunded leaving consideration for head trauma, pain, or the traumatic shock from his vehicular encounter. He weighed 5.88 kg and had a temperature of 100.2 degrees Fahrenheit. Penny had a heart rate of 200 beats per minute with a capillary refill time of less than 2 seconds and a respiratory rate of 60 breaths per minute. On auscultation, no crackles or wheezes were noted. Though he was open mouth breathing, he was able to close his mouth on his own.

Pathophysiology

The bony orbit is incomplete in both dogs and cats as opposed to horses, cattle, sheep, and pigs¹⁰. The lateral aspect is composed of a dense collagenous lateral orbital ligament that spans from the frontal process of the zygomatic bone to the zygomatic process of the frontal bone^{1,6,10}. Cats have a shorter optic nerve, a deeper orbit, and a shorter supraorbital ligament than dogs^{3,4}, meaning that it requires more force to displace the globe rostral as opposed to dogs, especially brachycephalic breeds⁹. The optic chiasm is located closer to the posterior aspect of the globe in cats as compared to dogs which could indicate why a small amount of traction on the optic nerve can cause blindness⁵. Further complicating a proptosis, once the eye is proptosed, the eyelids contract behind the globe applying more pressure to the optic nerve and venous return which is more severe in the cat⁹. Pressure from the proptosed eye on the optic chiasm and contralateral optic nerve may result in bilateral blindness⁵. Iatrogenic bilateral blindness may also result from excessive traction during enucleation due to this limitation¹⁴. It is therefore contraindicated to place traction on the proptosed eye^{4,5}. A retrospective study conducted by Donaldson, et al. revealed a progressive optic nerve atrophy on the contralateral side post-enucleation which demonstrated damage had occurred to the optic chiasm due to traction placed on the proptosed eye⁵.

Diagnostic Approach/Considerations

After presentation and initial examination, Penny received pain medication. Radiographs were then performed. Due to Penny's stress, only a one view cranial radiograph was obtained but did not reveal any obvious cranial fractures. A neurological exam revealed a lack of conscious proprioception in the right front and was suspected to be possible brachial plexus damage. Once radiographs were taken, it was discovered that Penny's lameness was due to a scapular fracture. On ocular examination, the right eye was noted to be mydriatic and direct and indirect pupillary light responses were absent. The left eye was also mydriatic but pupillary light responses and menace were present.

An aFAST and tFAST scan were done which did not reveal any free fluid. Urine was obtained which revealed a urine specific gravity of 1.050, most likely due to dehydration. A blood glucose and total protein were obtained and read 277 mg/dL and 5.5 gm/L respectively. Penny's blood pressure was obtained and found to be 147/128 (135 mmHg).

A 22 gauge catheter was placed in Penny's right saphenous vein and a 120 mL bolus of Plasmalyte was administered followed by a rate of 45 mL/hr. He was also given Methadone at 0.2 mg/kg IV every 6 hours for pain.

Treatment and Management

Penny was slightly distressed on presentation. The decision to perform an enucleation was sought by hospital staff very soon after Penny's presentation and it was deemed unnecessary to prolong any suffering in the face of obtaining diagnostic information. Penny's owner was strongly considering euthanasia due to the grave prognosis of sight in his proptosed eye, but she was reassured that cats can do well with one eye or even completely blind. Additional

diagnostics such as tonometry and fundic exam were considered but ultimately decided against due to patient pain and stress consideration.

After initial evaluation and before radiographs were taken, Penny received Methadone intravenously at 0.2 mg/kg for pain. After radiographs were taken, Penny was placed in an oxygen kennel while the operating room was prepared. Though Penny was open mouth breathing, his lungs auscultated with no crackles or wheezes noted and no free fluid was noted on tFAST or radiographs. Therefore, it was deemed that he was holding his mouth open either due to congestion from the bilateral epistaxis or due to trigeminal nerve damage. Penny was observed for hyperventilation and his blood pressure was monitored as markers for possible increases in intracranial pressure. Penny was deemed stable, and thus, surgery was pursued at that time.

Pre-operatively, Penny received an injection of Convenia (cefovecin sodium) at 8 mg/kg subcutaneously once. Penny was placed under anesthesia using Alfaxalone at a rate of 3 mg/kg intravenously, intubated, and was maintained using Isoflurane gas in 100% oxygen. Sterile ophthalmic lubricant was placed on the right eye and the surrounding area was clipped and surgically prepared using dilute povidone iodine solution. Two 3-0 Biosyn stay sutures were placed partial thickness in the upper and lower lid and a lateral canthotomy was performed in order to replace the globe into the orbit using gentle pressure. A temporary tarsorrhaphy was then performed using three 3-0 Biosyn sutures in a horizontal mattress pattern with the suture end left long to enable lid manipulation. A number 15 scalpel blade was used to make an elliptical incision approximately 5 mm away from the eyelid margins. While holding the suture ends placed during the tarsorrhaphy, blunt dissection was done of the conjunctiva and musculature using Metzenbaum scissors. The medial and lateral canthal ligaments were difficult to transect

and were therefore incised for release. Care was taken to ensure the medial aspect of the orbit as well as glandular structures such as the gland of the third eyelid and the lacrimal caruncle were fully removed. Ligation of the optic nerve and vessels was achieved using curved Crile hemostats followed by caudal placement of two 3-0 Biosyn sutures using a circumferential technique. The optic nerve and vessels were then transected, and the globe was freed from its orbit. No bleeding was noted and the orbit was then flushed with sterile saline and closed in a three-layer fashion. The subcutaneous tissue was closed using a simple interrupted pattern while the subcuticular was closed using a simple continuous pattern. Several suture patterns may be considered for skin closure. In this case, the eye lids were closed using a horizontal mattress pattern. Care was taken not to pull the sutures excessively tight. IV-line tubing may be used to string the suture through as an aid in tension relief but was not used here. After completion, an ice pack was applied. Penny recovered well and was returned to his kennel uneventfully. An Elizabethan collar was then placed, and Penny was recovered from surgery without complication in an oxygen kennel. That same night, he was transferred to a regular kennel without incident.

Case Outcome

Penny did well post-operatively. His incision site was iced every 6 hours. An Elizabethan collar was sent with Penny to protect the surgical sight. He received Onsior (robenacoxib) orally every 24 hours for post-operative pain and inflammation. Penny was not yet eating, therefore, transdermal Mirtazapine was applied to alternating ears for appetite stimulation. A Velpau sling for Penny's fractured scapula was applied in an attempt to not only see if it would heal but to also evaluate how he would do on three legs in the event amputation was pursued. Penny was released on August 26, 2019 to his referral veterinarian for continuing care. The enucleation site was moderately swollen and a mild hemorrhagic discharge was noted. Penny continued to

intermittently hold his mouth open but no respiratory distress was noted, therefore it was suspected that trigeminal nerve damage was not currently present and Penny was suffering from congestion from his epistaxis. Visual assessment was difficult possibly due to pain medication or fear and stress Penny was most likely enduring from his encounter with a car. Penny's owner was concerned for his scapular fracture and unknown sight outcome and still considered euthanasia. The hospital staff discussed with her that cats can do well with only three legs and without vision if kept in the house. Penny's owner elected to give him a chance with the Velpau sling as it would simulate ambulation on only three legs. Penny was later released into his owner's care where he remained on cage rest with instruction to return for bandage changes and evaluation.

In conclusion, cats are at greater risk for blindness than in dogs as a result of proptosis because of their shorter optic nerve and orbit anatomy. Proptosis in a cat most commonly follows some type of trauma such as hit by car or dog attack which causes a great amount of force on the orbit and globe. Some owners do not want to care for a blind cat making euthanasia highly considerable for owners. In the event enucleation is pursued, care must be done not to place traction on the eye which will cause bilateral blindness. Additionally, the patient must be stabilized before pursuing surgery to ensure the patient is safe to undergo general anesthesia. Owners should be informed that despite great care taken during surgery to remove a proptosed eye, the initial injury may have already exerted enough force to damage both optic nerves causing blindness.

During a follow-up phone call in November, Penny's owner states that he has healed well from his scapular fracture and she believes he has regained some sight in his left eye. He walks with a slight limp but appears happy and dons his winter jacket with pride around the house.

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