Is it Exophthalmos, Buphthalmos or Proptosis? How do I Know? How Do I Treat?

Ron Ofri, DVM, PhD, DECVO
Koret School of Veterinary Medicine
Hebrew University of Jerusalem, Israel

Veterinarians who are confronted by an unsymmetrical appearance of the globe may have difficulties determining whether they are looking at a case of proptosis (an eye that is protruding outside the orbit, usually due to trauma), exophthalmos (an eye that is pushed forward relative to its normal position, but is still in the orbit) or buphthalmos (an enlarged, glaucomatous globe). This talk will help you diagnose and treat proptosis and exophthalmos, and differentiate them from buphthalmos.

I. Traumatic proptosis - how do I treat? What prognosis can I give the owner?

A. Prognostic Indicators

Owners of pets with traumatic prolapse of the globe will want to know whether the eye can be salvaged. This question actually has two components, as in some cases vision may be salvaged, while in other cases the eye will be blinded, but the globe can be salvaged cosmetically (i.e., not be enucleated). Criteria that will help the clinician answer these questions include:

1. What is the skull conformation? Traumatic prolapse is common in brachycephalic dog breeds, due to the shallow orbit and poor lid closure. Therefore, in these breeds minimal trauma may cause prolapse. However, frequently there will be no additional injuries to the eye, skull or body. On the other hand, in cats and in mesocephalic and dolichocephalic dogs, the eye is situated in a deep orbit and is protected by tight lid closure. In these animals, traumatic prolapse is frequently accompanied by other intraocular or bodily injuries, and the prognosis is poorer.

2. Duration of prolapse. As with every medical emergency, prognosis depends on quickly obtaining medical attention. This is especially true in prolapse, as the lids can not close over the globe, leading to corneal exposure and desiccation. Depending on the duration of the prolapse, animals may present with corneal ulceration, necrosis or perforation.

3. Intraocular injury. Hyphema is a bad prognostic indicator, as it implies trauma to the uvea or globe rupture. Clinicians should recall that even if the anterior part of the eye looks intact, rupture may be present posteriorly. Retinal detachment and lens luxation may also result from trauma and be obscured by hyphema. An ultrasound examination may aid in imaging intraocular injuries. At the same time, the patient should be examined for traumatic injuries to the skull and other organs.

4. Pupils. Formerly, it was postulated that mydriasis carries poor prognosis for vision and miosis has favorable prognosis. Today, it is recognized that pupil size is not a reliable vision prognostic indicator. However, pupillary light reaction (PLR) is an important sign. If the pupil can not be seen (due to hyphema), the consensual PLR should be checked.

5. Strabismus and extraocular muscles. Many prolapse cases present with strabismus due to rupture of extraocular muscles. The medial rectus muscle is the most vulnerable to rupture, and therefore most patients will present with lateral strabismus. Following recovery, the initial cosmetic appearance may be displeasing, due to excessive visible (medial) conjunctiva. However, with time it may become pigmented, and less visible. Excess conjunctiva may also be covered through medial tarsorrhaphy (canthoplasty). Surgical re-attachment of the muscles is more challenging due to muscle size and fibrosis. Clinicians should remember that ciliary arteries, which supply blood to the anterior segment of the eye, are carried in the extraocular muscles. Therefore, rupture of too many muscles will result in ocular ischemia.

Overall prognosis for vision is rather poor, with only 20% of dogs reportedly remaining visual. However, prognosis for cosmetic salvage is better. Unless prognostic indicators are very poor, you should attempt globe replacement at presentation. In most cases, enucleation should not be considered as initial therapy, and can always be discussed at later stages.

B. Treatment

Owners who telephone regarding traumatic ocular prolapse should be instructed to keep the cornea moist, using water, moist gauze, vaseline, ophthalmic lubricants, etc. Upon presentation, conduct the
prognostic tests described, including ophthalmic examination, fluorescein staining, PLR test, and possible ultrasound evaluation. The cornea should be washed, cleaned and lubricated. As noted, the skull and other organs should also be checked.

After the patient has been stabilized and anesthetized, the lids should be rolled/pulled out over the equator, using muscle/strabismus hooks, forceps, etc. The globe is pushed back into the orbit using gentle pressure. A lateral canthotomy may be required to facilitate replacement. A temporary tarsorrhaphy is performed to maintain lid closure. Depending on the size of the animal, 2-4 horizontal mattress sutures, using 2-0 to 4-0 non-absorbable monofilament material (e.g., nylon) are used, with stents for tension relief. Ideally, all sutures should be pre-placed, and then tied together. Make sure that the suture passes through the lid margin (meibomian gland openings) and not through the palpebral conjunctiva. If post-operative topical therapy is possible, leave a small opening at the medial canthus for applying drugs. Compresses (to reduce swelling) and an Elizabethan collar should be applied.

Post-operative therapy includes systemic antibiotics, and (depending on the animal's state) systemic steroids (to control secondary uveitis and possible optic neuritis, and to reduce orbital tissue swelling). If an opening was left at the medial canthus, topical antibiotics and atropine should be administered. After 10 days it is possible to begin removing sutures. It is better to remove one suture at each visit, rather than all at once. Check the eye for keratoconjunctivitis sicca, corneal ulceration, keratitis and function of the facial and trigeminal nerves. Appropriate medical therapy, including antibiotics, ocular lubricants and/or topical steroids should be provided. If lagophthalmos is still present when all sutures have been removed, do not hesitate to replace them.

II. Exophthalmos – What is pushing this eye? What should I do about it?

A. Differentiating between exophthalmos and buphthalmos

Exophthalmos is a normal-sized globe that is being pushed forward by a space occupying lesion in the orbit, most commonly a retrobulbar abscess/cellulitis or neoplasia; myositis of the extraocular muscles, and salivary cysts/mucoceles are also possible (though rare) causes of exophthalmos. Buphthalmos, on the other hand, is a normally-positioned globe that is enlarged due to elevated intraocular pressure (IOP), i.e., glaucoma. However, despite differences in globe size and causes, clinicians may find it difficult to differentiate between the two syndromes, as both present with an asymmetric appearance of the globe.

Some tests, such as ultrasound or tonometry (discussed later), may provide a definitive diagnosis. However, frequently it may be possible to differentiate between exophthalmos and buphthalmos during examination, without resorting to other instrumentation. Signs that clinicians should evaluate include:

1. Glaucoma and buphthalmos may present as either a unilateral or a bilateral disease. However, in most cases exophthalmos will present as a unilateral problem. Therefore, bilateral presentation usually indicates that the primary problem is glaucoma.
2. A history of acute vs. chronic, progressive presentation is not helpful in differentiating between exophthalmos and buphthalmos, as both presentations are possible in both syndromes. However, once the clinician has established the presence of exophthalmos, the history may help in determining the primary cause. A majority of retrobulbar tumors present with progressive exophthalmos, while a majority of retrobulbar abscesses present with acute exophthalmos.
3. Amount of visible conjunctiva. In exophthalmos the eye is pushed forward, and therefore excessive conjunctiva is visible. In buphthalmos, the eye is stretched but remains in its normal position inside the orbit. Therefore, excess conjunctiva is usually not visible.
4. Observe the animal from the top of the head. For the reasons just explained, exophthalmos may be readily visible from the top, as the lids are pushed forward. In buphthalmos, they should be in normal position.
5. Evaluate the position of the third eyelid. This is normal in most cases of glaucoma (though severe pain may sometimes cause exophthalmos and passive elevation of the third eyelid). The third eyelid is usually elevated in exophthalmos, as the space occupying retrobulbar mass usually pushes against the third lid, causing its elevation.
6. Estimate the diameter of the cornea. It is normal in exophthalmos, and increased in buphthalmos due to stretching of the globe. This examination sounds a little "far fetched", but in fact it is a very sensitive test. In many cases you will be able to detect even a slight
increase in corneal diameter, especially in unilateral cases, when you can compare the two corneas.

7. Perform a retropulsion test. Use 2 fingers to gently push on the globe, through the upper eyelid. In buphthalmos, the eye may feel hard but it will sink readily into the orbit. In exophthalmos, there will be resistance to the retropulsion, caused by the presence of a retrobulbar, space occupying mass. Note that this test is not a measurement of IOP, but of resistance.

8. Check for evidence of pain. Glaucoma, retrobulbar abscesses and retrobulbar tumors are all potentially painful diseases (though a retrobulbar tumor may be less painful in the initial stages). However, in retrobulbar disease causing exophthalmos there is an increase in the amount of pain when the clinician attempts to open the patient’s mouth. This is because opening the mouth causes the ramus of the mandibula to press against the retrobulbar mass. Therefore, the animal may yell or struggle. In glaucoma, opening the mouth will not affect the degree of pain.

9. If you succeeded in opening the mouth, look behind the last upper molar. It will be normal looking in glaucoma. Retrobulbar disease may sometimes present with a draining fistula or changes in the color or consistency of the soft palate.

10. Are there unique signs associated with either syndrome? For example, striae keratopathy or corneal edema are associated with glaucoma, but not with causes of exophthalmos. On the other hand, mandibular lymph nodes may be enlarged in many cases of exophthalmos (caused by either a retrobulbar tumor or abscess), but will be normal-size in glaucoma. Vision and the presence of PLR are not reliable differential signs, as optic nerve damage may occur in all diseases.

All of the above tests can be performed without any special instrumentation, and in many cases they are sufficient for a tentative diagnosis. However, two tests can give a conclusive answer:

1. Tonometry, or measurement of IOP. Pressure will be normal in exophthalmos and elevated in glaucoma. However, remember that tonometry measures IOP in the anterior chamber. In cases of 360° (annular) posterior synechia, it is possible that the animal is suffering from elevated IOP in the posterior chamber and buphthalmos, but tonometry will be normal. Also, because of loss of scleral elasticity in old age, buphthalmos may persist even after IOP has been lowered, as the sclera does not readily contract.

2. Imaging. An ultrasound is very useful for imaging of retrobulbar masses in cases of exophthalmos. It can also be used to measure the axial length of the globe, and determine whether it is normal or enlarged. Advanced imaging techniques, such as CT or MRI, may yield additional diagnostic information in cases of exophthalmos.

B. Retrobulbar cellulitis/abscess

1. Pathogenesis
It is believed that most common cause of retrobulbar abscess is foreign body penetration through the oral cavity, as the animal chews sticks or other objects. Hematogenous spread of micro-organisms from other infected organs, or from adjacent tooth roots or nasal sinuses, is also believed to be a common cause. However, in many cases the cause remains unknown. Pasteurella and Aspegilus spp are commonly isolated from dogs and cats, respectively. But once again, in many cases no organism is isolated.

The disease process will usually begin as orbital cellulitis, which is characterized by clinical signs that are less noticeable. After localization occurs and an abscess forms, clinical signs, including pain, become much more significant.
2. **Clinical signs & diagnosis of retrobulbar abscess**

   In addition to the aforementioned clinical signs that generally characterize exophthalmos, retrobulbar abscess has a few clinical signs that are almost pathognomonic. The disease is characterized by acute onset and by severe pain. The pain is caused when the condyle of the mandible presses on the abscess whenever the animal opens its mouth. This leads to refusal to eat and great resistance to opening the mouth for examination. It is often necessary to sedate the animal in order to open its mouth. Once the mouth has been opened, it is often possible to see a red swelling, or even an open draining tract, in the oral mucosa, behind the last upper molar tooth (Figure 4). If no gross lesion is visible in the oral cavity, it is possible to use imaging techniques, such as ultrasound or CT (Figure 5), to image the retrobulbar space. This may also demonstrate foreign bodies, or allow to perform guided fine needle aspirations for cytological diagnosis.

3. **Treatment & management of retrobulbar abscess**

   Treatment of a retrobulbar abscess requires general anesthesia. This is because the patient must be intubated to avoid aspiration of exudate when the abscess is drained. Make an incision in the mucosa behind the last upper molar tooth (unless an open draining tract is present), and slowly inset a pair of curved hemostats. These are used to blindly explore the orbit and open pockets of exudate (Figure 6). One must never close the hemostats while they are in the orbit, as this could lead to crushing of the orbital vessels or optic nerve and blindness. Instead, the hemostats are inserted closed into the tract; they are opened in the orbit, withdrawn while open, closed in the oral cavity and re-inserted into the orbit in the closed position.

   If a pocket of exudate is encountered, copious amounts of exudate will flow out. This can be collected for cytology, and culture & sensitivity. In cases of retrobulbar cellulitis, no massive drainage of exudate will be seen. However, the very act of establishing a draining tract is usually sufficient to achieve a cure.

   After creating a draining tract, the clinician should gently flush the orbit with saline and antibiotics. The wound is not sutured. Systemic antibiotics are administered for 10-14 days, and the animal fed soft food. Hot packs, and lubrication of the cornea to prevent desiccation, should be considered. However, dramatic, and most rewarding, improvement is usually observed within 1-2 days. If the animal does not respond to therapy, or in case of recurrence, surgical exploration for a foreign body may be required.

C. **Retrobulbar tumor**

   As with any other organ, tumors in the orbit can be primary, or metastasis from nearby or distant regions. In dogs, most tumors are primary, with meningioma being the most commonly diagnosed tumor. In cats, a majority of retrobulbar tumors are secondary. In both species, however, the majority of tumors are malignant.

   1. **Clinical signs & diagnosis**

      As noted, retrobulbar tumors share a number of signs with retrobulbar abscesses. However, in contrast to retrobulbar abscesses, retrobulbar tumors are usually very slowly progressive, and non painful (at least in the initial stages). Furthermore, patients with retrobulbar tumors are 10-11 years old, on average, significantly older than patients with retrobulbar abscesses.

      A retrobulbar tumor can cause deformation of the posterior part of the globe. This deformation can be visualized ophthalmoscopically, or using an ultrasound. In addition to exophthalmos, the tumor can also cause deviation of the globe, with the direction of the deviation hinting at the location of the mass. However, ultimate localization relies on ultrasonography, CT or MRI imaging. The final diagnosis is usually made by guided fine needle aspiration and cytology.

   2. **Treatment and prognosis**

      Solitary tumors discovered in early stages may be removed surgically. In such cases, the best surgical approach is usually orbitotomy, and it may be possible to preserve the globe and vision. Advanced cases may require radical orbitectomy, combined with radiation therapy and/or chemotherapy. However, most tumors are discovered in advanced stages, and due to their malignant nature they carry a very poor prognosis. One retrospective study reported a mean survival time of 1 month in cats and 10 months in dogs, with 35% of patients euthanized at the time of diagnosis.