

Review Article

Management of Orbital Diseases

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Orbital diseases are common in dogs and cats and can present on emergency due to the acute onset of many of these issues. The difficulty with diagnosis and therapy of orbital disease is that the location of the problem is not readily visible. The focus of this article is on recognizing classical clinical presentations of orbital disease, which are typically exophthalmos, strabismus, enophthalmos, proptosis, or intraconal swelling. After the orbital disease is confirmed, certain characteristics such as pain on opening the mouth, acute vs. chronic swelling, and involvement of nearby structures can be helpful in determining the underlying cause. Abscesses, cellulitis, sialoceles, neoplasia (primary or secondary), foreign bodies, and immune-mediated diseases can all lead to exophthalmos, but it can be difficult to determine the cause of disease without advanced diagnostic imaging, such as ultrasound, magnetic resonance imaging, or computed tomography scan. Fine-needle aspirates and biopsies of the retrobulbar space can also be performed.

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Introduction

As it can be caused by a variety of disease processes, orbital disease can be subtle (chronic) or acute in its presentation. The orbit is a confined space without capacity to expand; thus, clinical signs can be primary or secondary. Primary signs include decreased retrobulbar protrusion, exophthalmos, or strabismus. Secondary signs such as chemosis, lagophthalmos, exposure keratitis, conjunctival hyperemia, increased intraocular pressure, scleral indentation, or third eyelid protrusion can also be present¹ (Fig 1).

Trauma-related diseases of the orbit, such as proptosis, retrobulbar hemorrhage, abscesses, or orbital fractures, may present acutely to the veterinarian. Sometimes patients with orbital disease, whether acute or more chronic, may present on an emergency basis because of intense pain, noticeable facial and periorbital swelling, inability to blink or fully open the mouth, third eyelid protrusion, epistaxis, facial asymmetry, or decreased appetite and lethargy. Although these signs may be nonspecific, they often accompany orbital issues.

It is important to be able to accurately diagnose orbital disease as it can commonly be mistaken for conjunctivitis or other causes of a “red eye.” If orbital disease is not recognized or certain orbital problems are misdiagnosed, appropriate treatment may not be initiated and infections and tumors can worsen.

Orbital Anatomy

Understanding orbital anatomy is important in the diagnosis and treatment of orbital diseases. The orbit is a complex structure that contains the eye and retrobulbar soft tissues. It contains muscle, fat, nerves, blood vessels, and the bony orbit.² Any alteration in any of these structures can lead to a change in eye position or motility.³ Dogs and cats have an incomplete bony orbit,

which means that the lateral wall and floor of the orbit are not bony. The lateral orbital wall is made up of the lateral orbital ligament that attaches the zygomatic process of the frontal bone to the frontal process of the zygomatic bone.¹ In species with an incomplete bony orbit, the masticatory muscles also play a role in support of the orbit and globe.^{3,4}

The orbit is closely related to the masticatory muscles, nasal cavity, paranasal sinuses, mouth, and zygomatic salivary gland.³ The relationship of the orbit to these structures in the head is extremely important when investigating clinical orbital disease because dental disease, facial fractures, inflammatory muscle diseases, head and periocular infections, and neoplasia can greatly affect globe position.

Clinical Signs and Approach to Exophthalmos

Orbital diseases result in alterations in orbital volume, which typically leads to some degree of exophthalmos (increased orbital volume) or enophthalmos (decreased orbital volume).⁵ Exophthalmos is the most common presentation associated with space-occupying masses or abscesses. The 2 main presentations of retrobulbar swelling are intraconal and extraconal, the latter being more common. The classical presentation of extraconal swelling is exophthalmos because the globe and normal orbital structures are displaced. Extraconal swelling can also cause lateral, medial, dorsal, or ventral deviation (strabismus) in eye position. Clinical signs of orbital disease can be relatively nonspecific, but the history and duration of disease as well as evidence of painful swelling vs. nonpainful swelling can be helpful to distinguish orbital inflammation (abscess or cellulitis) from orbital neoplasia (Fig 2).

The first step in the clinical approach is to determine if the eye is truly exophthalmic.



Fig. 1. Exophthalmos and third eyelid elevation in a mixed-breed dog with a tooth root abscess. (Image courtesy of Ellen Belknap.)

Distinguish Exophthalmos From Other Causes of a “Red Eye”

- *Observe the eyes from a distance and from above the patient's head.* Look for the eye to extend beyond the orbital rim (Fig 3).
- *Retropulse the globes!* They should retropulse the same as each other. When retropulsing, use index fingers and gently press on the closed upper eyelids of both eyes at the same time. Depending on the breed of dog (dolichocephalic > mesaticephalic > brachycephalic or cat), the eye should significantly or slightly retract in the orbit when pressed gently (Fig 4).
- *Examine for vision.* Occasionally, with exophthalmos, the eye would be blind due to optic nerve compression or involvement or a retinal detachment (severe extraconal swelling can sometimes cause focal retinal detachments). However, vision is usually normal with exophthalmos and is typically absent in cases of buphthalmos and chronic glaucoma.
- *Examine for third eyelid elevation.* Approximately half of the exophthalmic globes have subtle or severe third eyelid elevation, which is rarely present with buphthalmos.
- *If possible, examine the tissue posterior to the last upper molar.* You may see or palpate swelling behind the last molar. Reluctance to open the mouth due to pain may require sedation or general anesthesia to examine (Fig 5).

- *Check intraocular pressure.* Exophthalmos can sometimes cause mildly elevated intraocular pressure (20–30 mm Hg), but this is usually in severe cases. Exophthalmic globes should not have classical signs of glaucoma, such as diffuse corneal edema, mydriatic pupils, and buphthalmos (Fig 6). If still unsure of buphthalmos, measure horizontal corneal diameter of both eyes. If the globe is of normal size, it should not differ more than 1 mm from the fellow eye.¹
- *Determine whether exophthalmos is intraconal or extraconal.* If there is inflammation or a mass in the extraconal area, the globe is likely to be either exophthalmic or have strabismus depending on the severity and location of the swelling. The patient is also more likely to have third eyelid elevation. If swelling is within the intraconal area, the globes are deviated directly along the direction of the orbital axis and it is rare to have third eyelid involvement.
- *Always try to open the mouth.* If the swelling or mass is inflammatory (abscess or cellulitis or necrotic tumor), the patient experiences extreme pain when the ramus of the mandible comes in contact with the pterygoid muscle. It is good to inform pet owners that this may be painful and that the mouth should be opened slowly (Fig 7).

Causes of Exophthalmos

Retrobulbar Abscess or Cellulitis or Foreign Body

Orbital cellulitis and retrobulbar abscesses are usually characterized by acute onset, variable degrees of exophthalmos, extraconal swelling, periorbital swelling, fever, and pain.⁶ These cases commonly present emergently because of the acute swelling and pain associated with them. The typical presentation is unilateral exophthalmos, third eyelid protrusion, serous or mucopurulent discharge, and episcleral vessel congestion.⁵ Pain is typically present on palpation of the orbit or periorbital tissue and when attempting to open the mouth. A fluctuant swelling behind the last molar is also a common finding. Commonly cited causes of orbital abscesses or cellulitis are abscessation of molar teeth,⁷ hematogenous spread, foreign body migration through the conjunctiva or the oral mucosa,⁸ or trauma to the oropharynx.⁶

Other less common causes of retrobulbar abscess or cellulitis are extensions from otitis externa or media or interna,⁹ bone,¹⁰ sinus,^{11,12} nasal cavity,⁵ and salivary gland infections.¹³

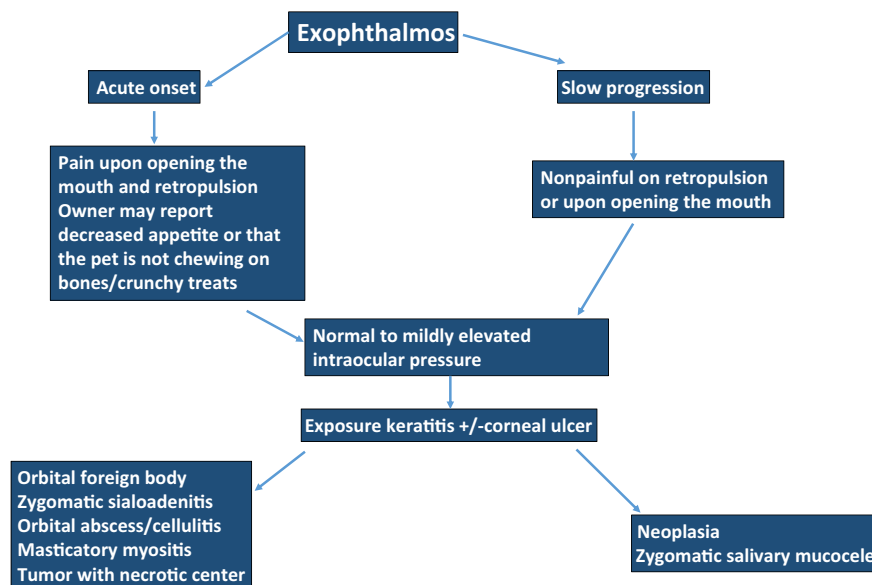


Fig. 2. Clinical signs of exophthalmos.



Fig. 3. Dorsal view of exophthalmic patient in Fig 1. Note the obvious asymmetry between the oculus dexter (OD) (right eye) and oculus sinister (OS) (left eye). (Image courtesy of Ellen Belknap.)

The relationship between orbital cellulitis and abscesses is unclear. Although retrobulbar abscesses can progress to orbital cellulitis or vice versa, these 2 diseases may occur separately. The exophthalmos is generally more severe with abscesses and tends to be unilateral, whereas masticatory muscle myositis (MMM) or extraocular muscle myositis are typically bilateral in presentation.¹⁴

Advanced imaging such as ultrasonography, computed tomography (CT), and magnetic resonance imaging (MRI) (see the section [Diagnostic Imaging](#)) can be helpful to further differentiate cellulitis vs. abscess vs. neoplasia and can help define if there is a foreign body. There have been reports of orbital abscesses that failed to resolve with medical therapy or were misdiagnosed as tooth root abscesses that were eventually found to have foreign bodies with advanced imaging.^{15,16} Sampling fluid or purulent material for cytologic evaluation and culture (see section [Other Laboratory Tests](#)) can also improve therapy.

Before surgical therapy, the clinician should attempt to differentiate between orbital cellulitis and abscess because cellulitis may not require surgical drainage.³ Indications for surgical drainage include presence of a foreign body or draining tract, a fluctuant swelling behind the last molar, or signs consistent with an organized abscess on diagnostic imaging^{4,5,14} (Fig 8). If none of these signs are present, a conservative approach may successfully treat the cellulitis. Conservative



Fig. 4. It is important to retropulse the globes in patients where exophthalmos is suspected. The eyes should retropulse similarly in the same patient.



Fig. 5. Note the hyperemic swelling behind the left upper arcade. This patient presented for moderate exophthalmos that was diagnosed and treated successfully as retrobulbar cellulitis.

therapy consists of systemic antibiotic therapy, systemic nonsteroidal anti-inflammatory drugs unless contraindicated, pain medications, lubrication of the exophthalmic globe, and soft foods.

If surgical drainage is employed, general anesthesia is recommended, and the following technique is suggested to avoid complications:

1. Make a 1-cm long incision through the oral mucosa just caudal to the last upper molar with a 15-scalpel blade.
2. Insert a pair of closed straight mosquito hemostats to the jaws and gently open them and remove them with the jaws still open to ensure that you do not entrap important orbital tissues in the hemostats. If purulent material is obtained, make sure the airway is protected. Failure to locate the exudate may mean that the inflammation is due to cellulitis and that there will not be any drainage of purulent material. Leave the incision open to drain.
3. Place a temporary tarsorrhaphy with stents if exposure keratitis is noted at initial examination, if fluid is flushed into the orbit, or if the abscess is drained with hemostats. The tarsorrhaphy is typically removed at the 1-week recheck examination when swelling has subsided.

A diverse array of bacteria has been associated with orbital abscesses or cellulitis. Because bacterial infection is the most common, systemic antibiotic therapy is a mainstay of treatment and should be instituted at proper dosages for a total of at least 2–3 weeks.⁵ In a study of 34 patients, approximately 50% of patients with abscess or cellulitis had positive culture results. The most commonly isolated bacterial genera were both aerobic and anaerobic: *Staphylococcus*, *Escherichia*, *Bacteroides*, *Clostridium*, and *Pasturella*.¹⁷ Infections were purely aerobic in 55% of dogs, mixed aerobic and anaerobic in 35%, and purely anaerobic in 10% of cases with positive culture results.¹⁷ In the same study, 71% of cats had positive culture results and the most frequent bacterial genera isolated were *Pasturella* and *Bacteroides*. Most cats (60%) had purely aerobic infections, 20% had mixed infections, and 20% had anaerobic infections. Aerobic bacteria had the highest percentage susceptibility to amikacin, ceftiofur, gentamicin, imipenem, ticarcillin, and trimethoprim-sulfamethoxazole. These isolates had the lowest percentage susceptibility to ampicillin, clindamycin, erythromycin, and penicillin. Purely anaerobic infections were found rarely. Based on this study, it was recommended to use cephalosporins, extended-spectrum penicillins, potentiated penicillins,



Fig. 6. (A and B) Note the corneal edema and pigmentation OS in (A), which is buphthalmic with chronic glaucoma. (B) An elevated nictitating membrane is present OD and the globe is exophthalmic in this 2 year old labrador retriever with retrobulbar lymphoma.

and carbapenems as a first line of defense for treatment of orbital abscesses or cellulitis.¹⁷

Secondary problems can also result from orbital abscesses and cellulitis. Lagophthalmos is common, which leads to corneal ulceration and exposure keratitis.¹⁸ There have also been reports of more severe and rare complications reported with orbital abscesses, such as bacterial osteomyelitis,⁶ empyema in a cat,¹⁹ and central nervous system infection in a dog related to *Staphylococcus intermedius* retrobulbar abscess that was initially misdiagnosed as MMM and treated with immunosuppressive doses of steroids.¹⁴ These complications highlight the importance of early diagnosis and proper therapy.

Retrobulbar Neoplasia

Although retrobulbar neoplasia is not considered to be an emergency, many issues that accompany it may lead to presentation



Fig. 7. This skull illustrates how the ramus of the mandible contacts the soft tissue floor of the orbit when the mouth is opened.

on an emergency basis. Numerous orbital neoplasms have been described in small animals, which can be primary, metastatic, or from local extension of tumors from the paranasal sinuses, oral cavity, or cranium.^{7,20–23} The most common tumors found in the orbit are adenocarcinoma arising from the third eyelid, salivary gland, lacrimal gland, or nasal cavity, undifferentiated carcinoma, fibrosarcoma, osteosarcoma, meningioma, squamous cell carcinoma, lymphoma, multilobular osteochondrosarcoma, and neurofibrosarcoma^{21,22,24} (Fig 9). On average, in studies that have evaluated tumor types, approximately 88%–95% of these tumors are malignant and have a poor prognosis.^{21,24}

Large-breed dogs have been reported to have orbital neoplasia more commonly than small-breed dogs.²⁵ There is no sex predilection, but neoplasia of the orbit is more likely to be present in older patients (average 8.2–10 years old), whereas inflammatory disease is more likely in younger dogs (average 7 years old).^{24–26} The most common clinical signs associated with retrobulbar neoplasia have been reported to be a slower onset of nictitating membrane elevation, unilateral exophthalmos, exposure keratitis, and conjunctival hyperemia. Although most orbital tumors are nonpainful, there are reports of tumors having purulent drainage and pain, most likely due to extension into the bony orbit or necrosis and inflammation.^{3,24,27} In a study, 36% of dogs with orbital neoplasia had at least one clinical sign that is normally associated with orbital inflammatory diseases.²⁴ Usually vision is unaffected, but some patients are blind in the affected eye due to optic nerve involvement or retinal detachment from pressure on the globe. Secondary exposure keratitis, nasal discharge or epistaxis, and possible facial deformities are also sometimes present (Figs 10 and 11).

Diagnosis of orbital tumors is aided by ultrasonography, CT, and MRI (see the section [Diagnostic Imaging](#)) and a definitive diagnosis can be accomplished through fine-needle aspirate for some tumor types (lymphoma), or a biopsy with either ultrasound or CT guidance. If tru-cut biopsy is not practical, a biopsy can be performed via exenteration or lateral orbitotomy.^{3,28} If neoplasia

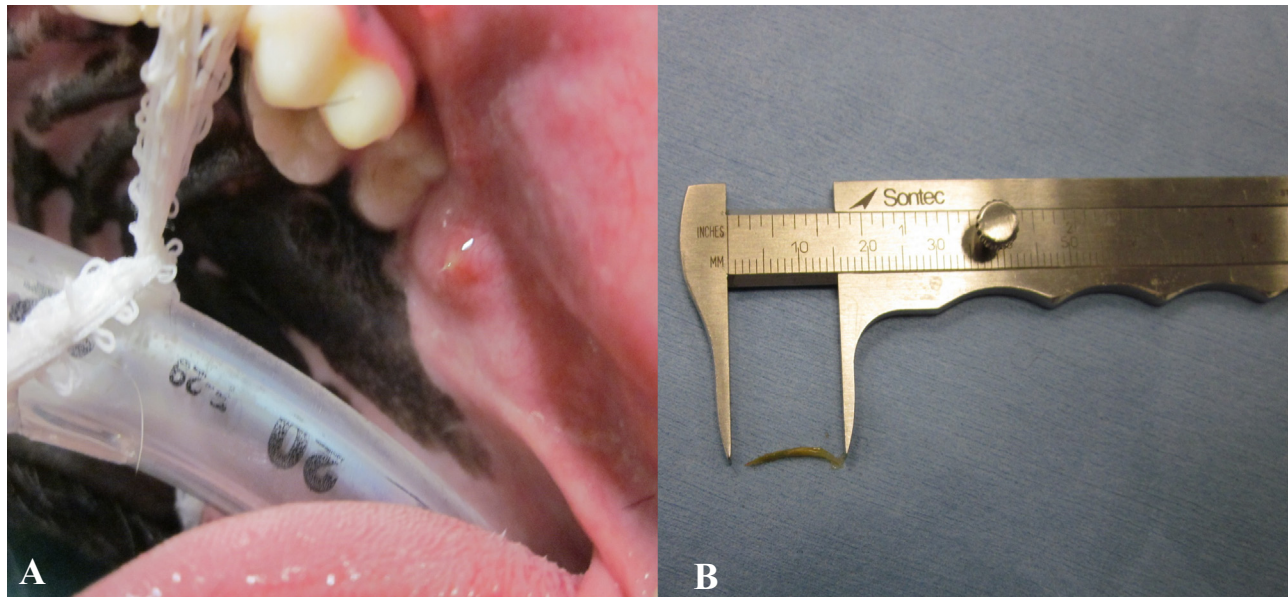


Fig. 8. (A and B) A 4-year-old Border collie that presented with severe, acute swelling of OD. Upon examination of the oral cavity a small piece of plant material was extracted when an incision was made behind the last upper molar to allow for drainage of an orbital abscess. A copious amount of purulent material was extracted when a pair of hemostats was inserted into the incision.

is suspected, further diagnostic imaging and laboratory work are recommended to look for evidence of metastatic disease.

Surgical treatment is usually recommended for orbital tumors in all tumor types, except lymphoma. Because most orbital tumors are invasive and malignant, retention of the globe is often not possible. If the neoplasm is invasive, exenteration or radical orbitectomy may be required, but if the tumor type is amenable to sparing the globe, a lateral orbitotomy with tumor removal would be appropriate therapy³ (Fig 12). Depending on tumor type, radiation therapy, chemotherapy, or immunotherapy may be recommended following surgery.

Zygomatic Salivary Gland Disease

Even though zygomatic salivary gland disease is rare in dogs, it should be considered in any dog presenting with periorbital swelling, exophthalmos, or protrusion of the nictitating membrane. The most common salivary gland diseases that affect the zygomatic gland and cause exophthalmos are salivary mucocele, sialoadenitis, or, rarely, neoplasia.

A mucocele is defined as a cavity in either the subcutaneous or submucosal tissues created by mucoid saliva.²⁹ The zygomatic

salivary gland is in the ventral orbit with 1 major and 2-4 minor ducts opening opposite the first maxillary molar.³⁰ Zygomatic salivary mucoceles usually cause slight dorsal displacement of the globe owing to the ventral location of the salivary gland. Mild exophthalmos and decreased ability to retropulse the globe are also present. Other signs may be present, including chemosis, protrusion of the nictitating membrane, and pain upon opening the mouth.^{31,32} The etiology is unclear, but zygomatic mucoceles have been associated with trauma from penetrating wounds,³³ postoperative complications from tooth extraction,³⁴ duct obstruction due to inflammation and fibrosis,³⁵ or sialoliths.³³

Orbital ultrasound, CT, and MRI can aid diagnosis of a zygomatic salivary mucocele. On ultrasound, a retrobulbar cavity lesion is suggestive of a salivary mucocele or retrobulbar abscess.²⁶ MRI can reveal an enlarged zygomatic salivary gland that appears hypointense on T1-weighted images and hyperintense on T2-weighted images compared with adjacent muscle.³¹ Treatment is typically surgical via a modified lateral orbitotomy with removal of the zygomatic salivary gland and cystic lesion.³¹



Fig. 9. Orbital squamous cell carcinoma in a 12-year-old domestic short-hair cat.



Fig. 10. Orbital and maxillary multilobular osteochondrosarcoma in a 9-year-old mixed-breed dog. Not the periorcular swelling, third eyelid protrusion, and exophthalmos on the right side of the face.



Fig. 11. A mixed-breed dog with nasal and orbital tumor. Note the exophthalmos and epistaxis from the left nostril. Nasal tumors often cause unilateral epistaxis and spread locally to the orbit.

Zygomatic sialoadenitis is defined as inflammation of the zygomatic salivary gland, which causes enlargement and often sialocele formation.³⁶ It is uncommon in dogs and usually occurs secondary to a hematogenous infection, ascending infection from the mouth, immune-mediated disease, or secondary response to regional inflammation.³⁷ In a case series, most affected dogs were medium- or large-breed males with a mean age of 8 years and the disease was unilateral. Retrobulbar masses were identified via



Fig. 12. Lateral orbitotomy to perform excisional biopsy of orbital mass in a 9-year-old mixed-breed dog. Mass is being lifted from orbit with a periosteal elevator.

ultrasonography in 9 of 10 orbits examined and zygomatic salivary gland origin was detected in 4. Sialoceles were detected in 7 of 11 affected salivary glands via fine-needle aspirates with ultrasound guidance. CT findings included gland enlargement and hypodensity on unenhanced images. MRI findings in affected dogs included gland enlargement, T1-weighted hypointensity, T2-weighted hyperintensity, and increased contrast enhancement.³⁶

Salivary gland tumors can cause exophthalmos, but are uncommon in dogs and cats. Carcinoma and adenocarcinoma are the most common histopathologic types of tumor and can be locally invasive. They have also been reported to metastasize. It is difficult to obtain clean margins with surgical resection of these tumors, so radiotherapy is usually recommended as adjunctive therapy.³¹

Proptosis

Although several types of orbital disease present on an emergency basis, not many are more serious than a proptosis. Proptosis can be differentiated from exophthalmos by observing the position of the eyelid margins. With proptosis, the eyelids are folded behind the globe and are trapped compared with visible, mobile eyelid margins with exophthalmos. Proptosis is considered to be an ophthalmic emergency because the eye develops progressive exposure keratitis over time,³ the lids continue to swell due to venous stasis behind the globe, which causes clinical signs to worsen, and the chance of saving vision decreases significantly. More than half of the dogs that had their globe replaced in a study of 84 dogs with proptoses remained blind in the replaced eye. Certain prognostic indicators of proptosis were identified in this study and have become standard ways to evaluate patients with proptosis and decide whether to enucleate the globe at presentation³⁸ (Fig 13) (Table 1). If there is any doubt as to whether the eye can be saved, replacement should be attempted (Table 2).

If the globe is replaced, there are potential long-term sequelae. It is common for lateral strabismus to be present lifelong due to disinsertion of the medial rectus muscle, which inserts the closest to the limbus (5 mm) and therefore is easily torn. Blindness, lagophthalmos, chronic keratitis, retinal degeneration, optic nerve degeneration, keratoconjunctivitis sicca, and phthisis bulbi have also been reported.³⁸

Myositis

Swelling of the muscles of mastication adjacent to the orbit, specifically the pterygoid muscles, often leads to exophthalmos. Because of the absence of a lateral orbital wall, this swelling causes pressure on the globe.³⁹ Cases of eosinophilic myositis of the muscles of mastication present acutely and may be painful, making it difficult to differentiate these cases from retrobulbar abscesses.^{40,41} In addition, both of these conditions often occur in young, large-breed dogs and result in difficulty opening the jaw.⁴² A distinguishing feature is that abscesses tend to be unilateral, whereas myositis tends to be bilateral. Definitive diagnosis of MMM can be made with a muscle biopsy and detection of antibodies against 2M fibers.^{41,42} The treatment of MMM is immunosuppressive, so it is very important not to mistake MMM for an abscess, as the treatment of MMM would cause worsening of an abscess and possibly systemic infection.

Extraocular muscle myositis, presumably an immune-mediated disease, may also cause acute intraconal exophthalmos.^{3,40,41} This disease is the most common in young golden retrievers (usually less than 1 year), with females overrepresented. Other characteristic clinical signs include chemosis and retraction of the eyelids without protrusion of the third eyelid (Fig 14). Recognition and treatment is

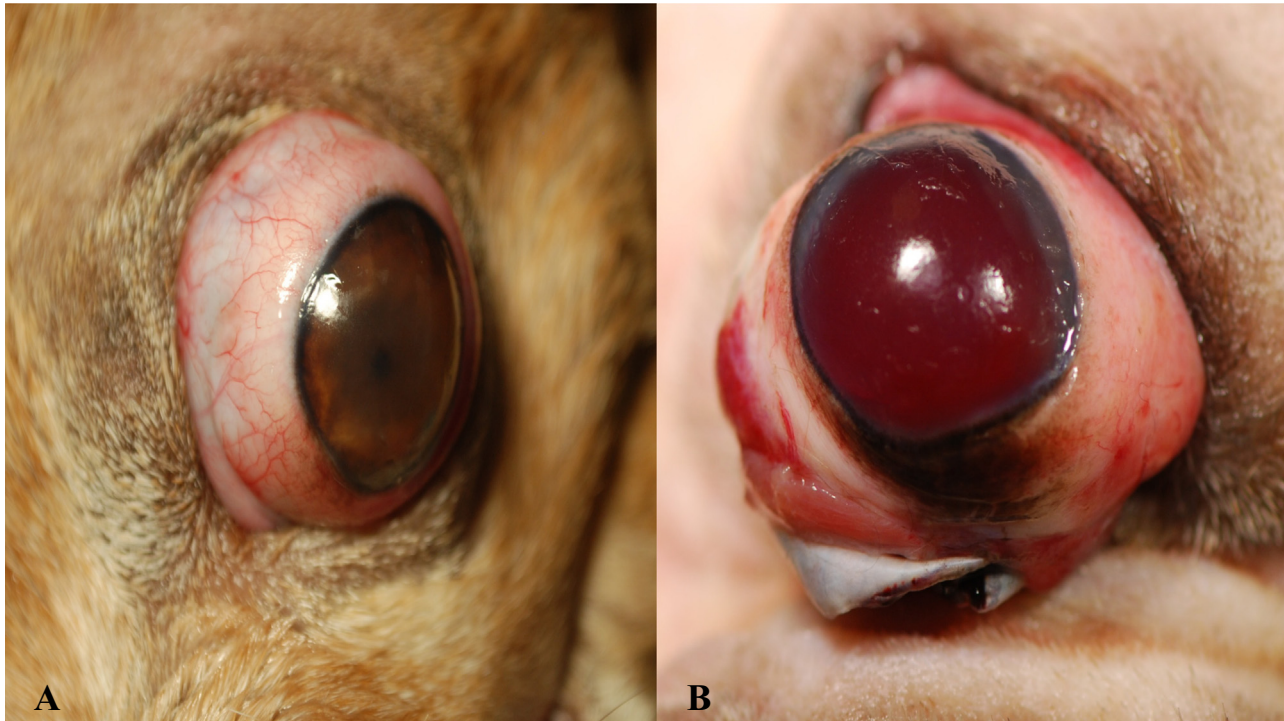


Fig. 13. (A) Proptosis in a 4-year-old female, spayed Chihuahua with dog bite trauma. The eye had been proptosed less than 2 hours. Note that there are no extraocular muscles torn. On examination, the patient attempted to retract the globe when menace response was performed. (B) Proptosis in a 5-year-old FS Pekingese with dog bite trauma. Note hyphema, several torn extraocular muscles, and a puncture wound in the ventral sclera. This eye was enucleated upon presentation because of the poor prognosis.

usually based on clinical signs, but a muscle biopsy showing lymphocytic or plasmacytic inflammation can be diagnostic.⁴² Extraocular muscle myositis is treated with systemic corticosteroids, with the dosage slowly tapered as resolution occurs. Other immunosuppressive drugs, such as azathioprine, have been used in resistant cases.^{3,42} If it goes untreated, it may eventually result in enophthalmos and restrictive strabismus due to muscle necrosis, which can lead to functional blindness.⁴²

Hemorrhage

Retrobulbar hemorrhage occurs because of trauma, vasculitis, or coagulopathy and can manifest as exophthalmos.^{5,43} Retrobulbar and subconjunctival hemorrhage have been reported as the only presenting clinical sign in a case of brodifcoum toxicosis.⁴³ Other acquired coagulopathies, such as severe liver disease, immune-mediated disease, disseminated intravascular coagulation, anticoagulant therapy, or low dietary vitamin K, can cause subconjunctival or retrobulbar hemorrhage in dogs.⁴³ A good patient history and general physical examination are key elements

Table 1
Prognostic Indicators for Proptosis

Favorable Prognosis	Unfavorable Prognosis
Positive direct or consensual pupillary light reflex (a negative reflex is not necessarily poor prognosis)	Non-visible pupil (corneal desiccation or hyphema)
No extraocular muscles avulsed	Scleral rupture
Brachycephalic breed	Greater than 3 extraocular muscles avulsed
Short duration	
Vision on presentation	
Normal posterior segment	

in evaluation of retrobulbar hemorrhage and additional laboratory testing of parameters such as complete blood count, serum chemistry, and clotting times are also indicated.

Other

There are unusual causes of exophthalmos that should be considered if more common causes have been differentiated.

Table 2
Proptosis Management

Proptosis Replacement

After deciding that a good prognosis for globe retention is present, replacement of the globe is attempted under general anesthesia. Perform *lateral canthotomy*. This allows for eyelids to be unfolded around the globe with little pressure on it. The cornea, which is already compromised, can be damaged if an instrument is used to press the eye back into place. A temporary tarsorrhaphy is performed; 2–3 simple interrupted sutures are placed through stents of IV tubing with nonabsorbable suture. It is *very important* that these sutures *do not* pass the full thickness through the palpebral conjunctiva. The suture should enter the stent, enter the skin approximately 5–8 mm from the superior lid margin, pass through the subcutaneous tissues, and exit the lid margin (almost through meibomian gland duct openings). It should enter the inferior lid margin at the same location, enter the stent, and go back through inferior, then superior margin—tying the knot on the stent. An exit point on the conjunctival side of the eyelid should not be present.

Posttarsorrhaphy Management

The eyelids would be closed at this point; if there is space at the medial canthus and a corneal ulcer was present before the globe was replaced, an antibiotic drop can be given at the medial canthus. Broad-spectrum oral antibiotics and E-collar for 1–2 weeks. Anti-inflammatory dose of steroids or nonsteroidal anti-inflammatory medications (NSAIDs) orally for 7 days. Staged removal of the tarsorrhaphy sutures, starting medially, to protect globe until swelling completely subsides.

IV, intravenous; NSAID, nonsteroidal anti-inflammatory drugs.



Fig. 14. Extraocular muscle myositis in a young dog. Note the exophthalmos without strabismus. It is bilaterally symmetric. (Photo courtesy of Ellen Belknap.)

Nodular granulomatous episcleritis,⁴⁴ parasitic migration,⁴⁵ and fungal infections¹² have been reported to cause retrobulbar disease and were diagnosed with biopsies of the orbit.

Fungi, such as *Aspergillus* spp.,¹² *Blastomyces dermatitidis*,⁴⁶ and *Cryptococcus* spp.⁴⁷ have also been found in the orbit in dogs and cats. Treatment of these diseases may employ systemic antifungal medications or local infusion of antifungals.

Ocular onchocerciasis can manifest as firm subconjunctival swellings which can lead to strabismus, third eyelid elevation, and decreased ability to retropulse the globe (Fig 15). Although rare, onchocerciasis has been reported in Europe and more commonly in the western United States and seems to have an affinity for the subconjunctival space.⁴⁵

Calvarial hyperostosis syndrome, a non-neoplastic, proliferative disease of the flat bones, has also been reported to cause exophthalmos in a young springer spaniel. This case was diagnosed with a CT-guided biopsy and was surgically biopsied with a sinusotomy. This disease is thought to be rare and self-limiting.²⁸

Vascular anomalies of the orbit are uncommon and may be congenital or associated with trauma.^{48,49} Nonpainful, intermittent exophthalmos in a young dog is the most common presentation. Swelling of the conjunctivae or periorcular tissues may be present and the exophthalmos may worsen with compression of the jugular vein.⁴⁹ The eye may pulsate and a bruit may be ausculted. MRI or CT with contrast may be helpful with diagnosis.⁴⁹ Treatment may not be possible depending on the severity of the anomaly, but coil embolization has been successfully performed in a case of a congenital orbital varix in a 10-week-old dog.^{48,49}

Diagnostic Imaging

Ultrasound

B-scan ultrasonography of the orbit is a practical first choice for imaging the retrobulbar soft tissues, as it is the least expensive, is the most widely available modality, and does not typically require the patient to be anesthetized or sedated.²⁶ It can also be used to guide more advanced diagnostics, such as fine-needle aspirates of lesions.⁵⁰ Usually orbital ultrasound is performed with a 10–12-MHz probe with a 3–4-cm focal range.⁵¹ It is placed directly on the topically anesthetized corneal surface using a preservative-free artificial tear gel as a coupling medium.

Orbital disease was detected via ultrasound in 86% of 50 dogs with exophthalmos or strabismus. Of the small percentage of dogs that did not have evidence of disease ultrasonographically, 71% were eventually diagnosed with inflammatory disease

(cellulitis)²⁶ (Fig 16). Abscesses and neoplasia were equally likely to have a mass effect in the orbit (indent the globe). A cavitory lesion was noted in 75% of cases with zygomatic salivary gland mucoceles, 50% of abscesses, and 12% of tumors. The presence of orbital bone lesions or a mass on the medial side of the orbit suggested neoplastic disease; however, the echotexture of lesions did not correlate with histopathologic findings²⁶ (Figs 17 and 18).

There are some limitations of ultrasound, including inability to assess tumor type or extent of the tumor.²⁵ In a study that evaluated ultrasonography of the orbit, granulation tissue and orbital abscesses were misdiagnosed as neoplasia based on ultrasound alone.² Foreign bodies in the orbit are difficult to image via ultrasound if they do not shadow. Plant materials can absorb water and appear to have the same echotexture as those of surrounding structures.² It is also not possible to see the extent of lesions with ultrasound alone.

Computed Tomography

Compared with radiography and ultrasonography, MRI and CT provide more accurate imaging of the orbit due to their cross-sectional nature, their ability to image tissues beyond the bony margins (nasal and cranial cavities), and their superior spatial and contrast resolution.²⁶ CT can identify the extent of the disease of the eye and orbit and help differentiate among neoplasia, vascular anomalies, noninfectious inflammatory, and infectious diseases.⁵²

With CT, the retrobulbar fat provides excellent image contrast that allows the extraocular structures and cortical bone to be easily observed.⁵² CT is also very sensitive for detecting mineralization within soft tissues, which has been reported in several tumor types. It has also been suggested that CT is the best way to evaluate orbital trauma, specifically orbital fractures. It is also helpful for surgical planning.

Typically, image slice thickness for orbital CT examinations are 1–3 mm. Administration of intravenous contrast medium has been recommended for cases of inflammatory disease or when intracranial extension of the disease process is suspected. Interpretation of CT images is based on the presence of productive or lytic bony changes, degree and location of soft tissue swelling, deviation or shape change of the globe, alterations in density, and presence of contrast enhancement. Extension into the nasal cavity or the calvarium and presence of osteolysis are also important differentiating criteria for orbital neoplasia or fungal disease.^{2,12,52}

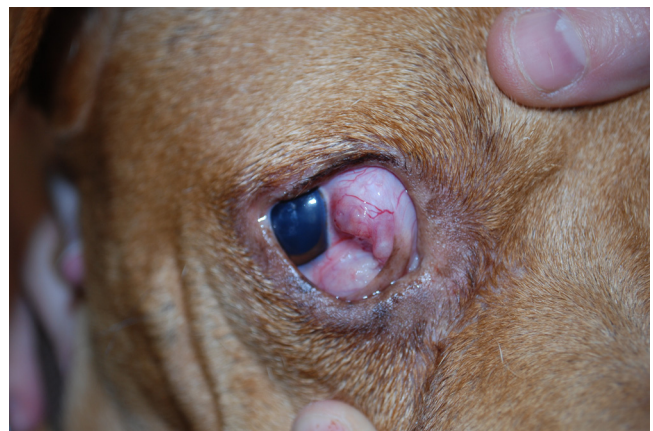


Fig. 15. Onchocerciasis in a 4-year-old mixed-breed dog from the southwestern United States. Note the medial episcleral nodule that causes severe lateral strabismus.

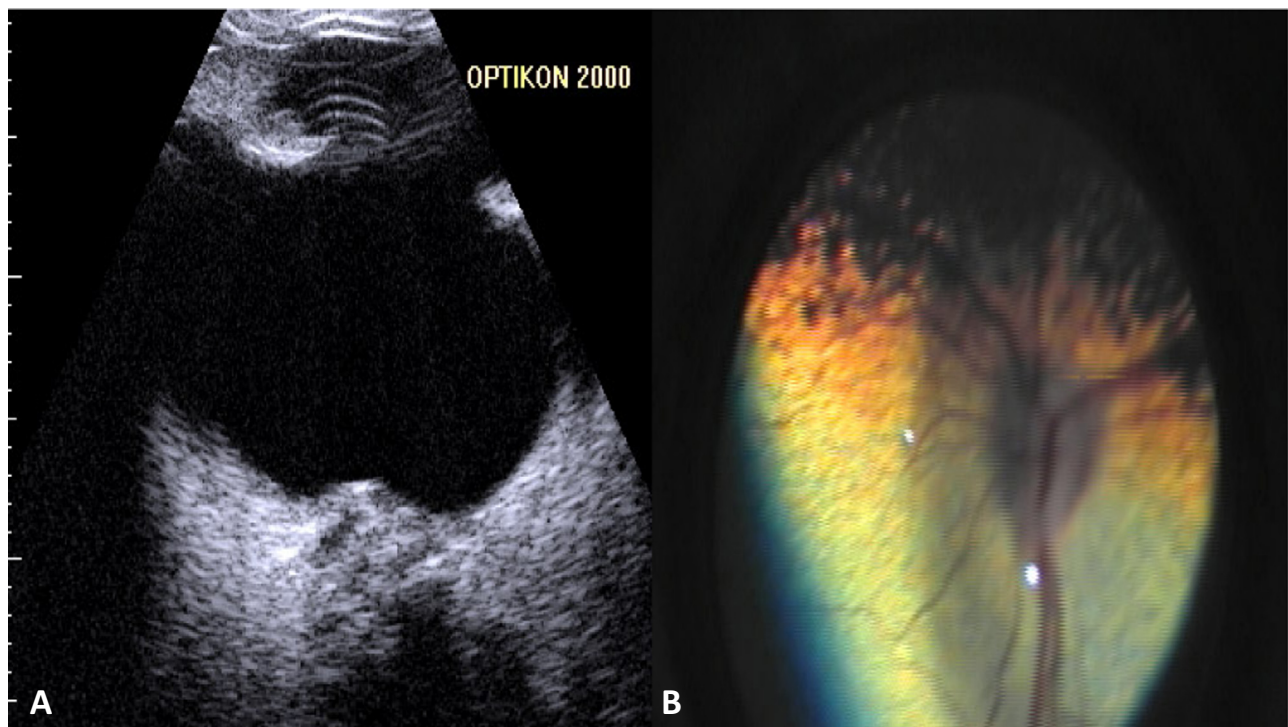


Fig. 16. (A) Ultrasound of optic nerve mass indenting the globe at the level of optic disc. (B) Indentation and shadowing can also be seen via fundic examination (Image courtesy of Ellen Belknap).

Magnetic Resonance Imaging

MRI has played an important role in investigation of orbital disease in humans and in animals for several decades and the technology has improved through the years.⁵² Compared with CT, MRI offers superior soft tissue resolution and contrast. Despite the supposed low sensitivity of MRI for changes in cortical bone, in a study of 25 cases of orbital disease, osteolysis was clearly detected via MRI. In the same study, wooden foreign bodies and their surrounding tissue reactions, which were not seen with other imaging modalities, were visible with MRI.⁵² Therefore, MRI is thought to be a valuable diagnostic tool even when CT or ultrasonography is unrewarding. Disadvantages of MRI compared with other modalities include longer data acquisition time and less precise detection of cortical bone and soft tissue mineralization, as well as the need for a metal scan and general anesthesia.

Other Laboratory Tests

Cytologic Examination

Fine-needle aspiration of the orbit is helpful, especially in the presence of infection or exfoliative tumors, such as lymphoma,^{27,53} but often yields inconclusive results. Because it can be easily and safely performed with CT or ultrasound guidance, it is often employed before biopsy. Even if a cytologic diagnosis is made, it does not yield information about the extent of the lesion or involvement of adjacent structures, so MRI or CT is a good complement.²

Orbital Biopsy

Orbital biopsy can be performed with a tru-cut biopsy under CT or ultrasound guidance or via surgical means. The orbit is a

difficult place to sample owing to several important structures that one needs to avoid. A free-hand technique using a CT scanner and barium markers on the skin has been described and can guide biopsies of several organs including the retrobulbar space.⁵⁴ Although more invasive, a lateral orbitotomy can also be used to perform a biopsy or exploratory surgery of the retrobulbar space.¹³

Conclusion

Many diseases of the orbit result in true emergencies, such as retrobulbar hemorrhage, zygomatic sialoadenitis, myositis, proptosis, and retrobulbar abscess or cellulitis. These diseases must be addressed in a quick manner to prevent complications such as loss of the globe, blindness, pain, or systemic illness. Because causes of orbital disease are difficult to differentiate, any orbital disease may present on emergency and it is important to be able to recognize



Fig. 17. A 8-year-old beagle initially referred for possible tooth root abscess. A tumor was suspected and diagnostic imaging was recommended.

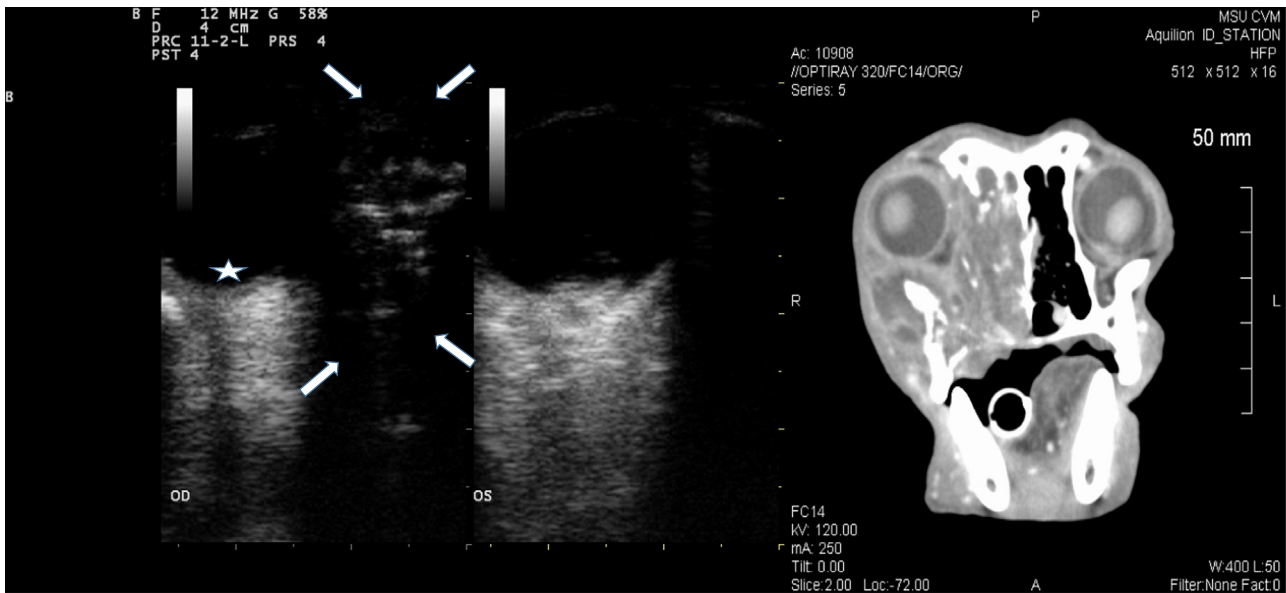


Fig. 18. Diagnostic imaging of patient in Fig 17. (A) A destructive orbital mass (arrows) is seen on the medial side of the right eye (star) using B-mode ultrasonography with a 12-megahertz probe. Borders could not be defined. (B) CT revealed invasion of mass into the calvarium. CT-guided aspirate confirmed an undifferentiated carcinoma. (Photos courtesy of Erin Brinkman.)

exophthalmos and delineate the cause to make the correct treatment recommendations and give appropriate prognosis to the client.

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