Wow, that's one nasty eyeball - how to figure out what's going on in the orbit.

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❖ Anatomy of the Orbit

The function of the orbit is to protect the globe. In humans the orbit is completely encased by bone. In animals, portions of the orbit are not composed of bone. The muscles of mastication border the orbit ventrally, caudolaterally, and caudomedially. The zygomatic salivary gland and the medial pterygoid muscle are parts of the orbital floor.

The orbit of dogs and cats are composed of the following bones: lacrimal, zygomatic, frontal, sphenoid, palatine, and maxillary. In other species the bones composing the orbit may vary slightly. The lacrimal, zygomatic, frontal, sphenoid, and palatine are always present, but the maxillary, ethmoid, and temporal bones are variable.

The bony structure of the orbit in animals can be divided into two categories: open or closed, based on whether the orbital rim is or is not completely composed of bone. Carnivores (cat, dog) have an open orbital structure that sacrifices some protection of the globe for the ability to open their jaws wider. Herbivores (horse, cow, etc.) have a closed orbit that provides better protection for the globe.
The orbital rim of dogs and cats is composed of the frontal, lacrimal, and zygomatic bones. The lateral aspect of the orbital rim is formed by a thick ligament, the supraorbital ligament that connects the frontal and zygomatic bones.
Supraorbital ligament in a dog

Multiple foramina are present within the orbit through which many important vessels and nerves pass. The largest nerve within the orbit is the optic nerve which enters the orbit through the optic foramen with the internal ophthalmic artery. Also present within the orbit are the maxillary artery and nerve, the ethmoidal vessels and nerve, CN III, IV, the ophthalmic and maxillary branches of CN V, CN VI, and the supraorbital vessels and nerves.

The lacrimal gland is present within the dorso-lateral aspect of the orbit. The 3rd eyelid occupies the medio-ventral aspect of the orbit. Orbital fat fills dead space and cushions the globe. The extraocular muscles – dorsal, medial, lateral, and ventral rectus muscles; dorsal oblique and ventral oblique muscles; retractor bulbi surround the globe.

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Function</th>
<th>Innervation</th>
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<tbody>
<tr>
<td>Dorsal rectus</td>
<td>Rotate globe dorsally</td>
<td>III (oculomotor)</td>
</tr>
<tr>
<td>Medial rectus</td>
<td>Rotate globe medially</td>
<td>III</td>
</tr>
<tr>
<td>Ventral rectus</td>
<td>Rotate globe ventrally</td>
<td>III</td>
</tr>
<tr>
<td>Lateral rectus</td>
<td>Rotate globe laterally</td>
<td>VI (abducens)</td>
</tr>
<tr>
<td>Dorsal oblique</td>
<td>Rotate dorsal globe medially and ventrally</td>
<td>IV (trochlear)</td>
</tr>
<tr>
<td>Ventral oblique</td>
<td>Rotate ventral globe medially and dorsally</td>
<td>III</td>
</tr>
<tr>
<td>Retractor bulbi</td>
<td>Retract globe</td>
<td>VI</td>
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</tbody>
</table>

As there is a limited amount of space, **any change in orbital volume can effect the position of the globe.** This change in position is noted during the examination as either enophthalmos or exophthalmos. One must also remember that the orbit is very close to the oral and nasal cavities, tooth roots, and paranasal sinuses. Any disease process affecting these areas may extend into the orbit as well.
**Examination of the Orbit**

- **Steps for a complete examination of the orbit**
  - Visual inspection of the globes and adnexa with attention to the position of the globes and 3rd eyelids
  - Retropulsion of both globes
  - Palpation of the orbital rim and walls of the paranasal sinuses and nasal cavity
  - Assess ease of opening mouth
  - Observe for any nasal discharge or change in airflow from either nostril
  - Assess vision in both eyes
  - Assess papillary light responses in both eyes
  - Perform a complete ophthalmic exam
  - Perform a complete oral exam with special attention to the area caudal to the last upper molar; often facilitated by general anesthesia

- **Findings often associated with orbital disease**
  - **Exophthalmos**: a normal sized globe which is displaced rostrally within the orbit. The globe is being pushed forward. This must be differentiated from buphthalmos in which the globe itself is enlarged and proptosis in which a sudden forward displacement of the globe (i.e. traumatic incident) traps the eyelid margins behind the equator of the globe. Compare the size of both globes. If one is enlarged then buphthalmos, not exophthalmos is present. Also look for the eyelid margins. If they are not visible, the globe is proptosed.
  - **Strabismus**: deviation from the primary gaze position (eye central within orbit and looking straight ahead). The eye is now looking or displaced dorsally, medially, laterally, ventrally, or some combination thereof.
  - Eyelid swelling
  - Conjunctival hyperemia (redness), chemosis (swelling), or hemorrhage
  - **Elevated 3rd eyelid**: a space occupying lesion fills the space usually occupied by the 3rd eyelid and displaces it
  - **Exposure keratitis**: as the globe is pushed forward the lids can no longer completely blink over the cornea and the central region of the cornea becomes dried out and develops an area of ulceration
  - Pain on opening mouth or palpating the periorbital area
Diagnostic Testing for Orbital Disease

- **Diagnostic imaging**
  - Skull radiographs
  - Dental radiographs
  - Orbital ultrasound
  - CT
  - MRI

- **Clinical pathology**
  - CBC
  - Serum chemistry profile
  - Cytology of fine needle aspirates
  - Histopathology of biopsy samples
  - Culture and sensitivity

Conditions Affecting the Orbit

- **Orbital Abscesses / Cellulitis**

  Inflammatory diseases of the orbit are seen frequently in small animals, especially the dog. This type of lesion is seen infrequently in large animals.

  - **Signalment:** usually young animals (mean age of 4 years)
  
  - **History:**
    - Often noted to be “stick chewers”
    - **Acute** onset
    - Owners may note anorexia and painful around mouth

  - **PE:**
    - **Unilateral** exophthalmos
    - Elevated 3rd eyelid
    - Congested episcleral vessels due to stasis of blood flow
    - Globe itself is usually normal
    - +/- serous to mucopurulent ocular discharge
    - Palpation of globe, periorbital area and opening of the mouth are usually **VERY PAINFUL**!
    - Examine caudal to the ipsilateral last molar (often requires sedation for a thorough exam due to the pain) and may see a fluctuant swelling and/or hyperemia of the oral mucosa.
• **Additional Diagnostics:**
  o Ocular ultrasound: see hypoechoic area caudal to the globe
  o Dental radiographs: can see lysis of tooth roots, radiolucent areas if tooth root abscess
  o CT/MRI: usually not required, but if non-responsive or complicated case can use to identify foreign bodies, orbital fractures, etc.

• **Treatment:**
  o **#1 establish drainage**
    - Incise caudal to the last upper molar with a #15 Bard Parker blade- just incise the oral mucosa
    - Insert **closed** hemostats
    - Advance with caution slowly through the pterygoid muscle and withdraw (this area is highly innervated and vascularized)
    - May not see tremendous drainage – does not mean it is not an abscess
    - Collect samples for culture and sensitivity (aerobic and anaerobic) and cytology
  o Broad-spectrum systemic antibiotics pending results of C&S. Often use amoxicillin/clavulanic acid or cephalosporins initially.
  o Hot packs over the periorbital area if tolerated
  o Soft food
  o NSAIDs as needed for pain and inflammation, ex. carprofen or meloxicam
  o Lubrication of globe (if lagophthalmos present)- antibiotic ointment (if ulcer present) or petrolatum based ointment every 6-8 hours
  o E-collar to prevent rubbing
  o Usually start to respond in 2-3 days

• **Prognosis:** very good

• **Complications:** Foreign body or unresolved dental disease, etc. will cause recurrence.
Orbital trauma

Usually these animals have been hit by a car. Cats are often the victims. Other head and eye injuries as well as multiple other systemic injuries may be present. Cleanse the eye and keep it moist (sterile KY jelly or antibiotic ophthalmic ointment) while you first stabilize the patient.

- **Orbital hematoma**
  
  - **PE:**
    - Skin lacerations
    - Orbital fractures
    - Subconjunctival hemorrhage
    - Marked exophthalmos
    - Lagophthalmos
    - Central corneal dessication

  - **Additional diagnostics:**
    - Radiograph the skull to identify fractures
    - Palpate the orbital rim and zygomatic arch
    - Ocular ultrasound if hyphema prevents visualization of the globe
      - Look for lens luxation, vitreal hemorrhage, retinal detachment
      - If scleral rupture is noted, enucleation is the only option

  - **Treatment:**
    - 3rd eyelid flap or temporary tarsorrhaphy to protect globe from exposure
    - Topical and systemic antibiotics
    - Systemic corticosteroids. May use topically if NO CORNEAL ULCER.
    - Hot compresses if tolerated

  - **Prognosis:** If severe intraocular hemorrhage risk of $2^0$ glaucoma or phthisis bulbi

- **Orbital fracture**

  Usually the frontal, temporal, or zygomatic bones are involved

  - **PE:**
    - Exophthalmos or enophthalmos
- Strabismus
- Hemorrhage
- Pain
- Lacerations
- Facial asymmetry
- SQ emphysema and crepitus if the paranasal sinuses are involved

- **Additional diagnostics:**
  - Radiograph the skull to identify fractures
  - Palpate the orbital rim and zygomatic arch
  - Ocular ultrasound if hyphema prevents visualization of the globe
    - Look for lens luxation, vitreal hemorrhage, retinal detachment
    - If scleral rupture is noted, enucleation is the only option
  - CT for better definition of small fractures

- **Treatment:**
  - If small, non-displaced fracture leave it alone and keep patient quiet
  - If large or unstable fracture, surgically reduce the fracture
  - Topical and systemic antibiotics
  - Systemic anti-inflammatory medication
  - Pain management
  - Cold compresses if tolerated

- **Prognosis:** If severe intraocular hemorrhage risk of 20° glaucoma or phthisis bulbi

- **Orbital foreign body**

  May enter through the conjunctiva or the oral cavity

- **PE:**
  - Acute onset
  - **Unilateral**
  - Exophthalmos or enophthalmos
  - +/- Hemorrhage
  - Variable pain

- **Additional diagnostics:**
  - Radiograph the skull to identify associated fractures, visualize pellets
  - Ocular ultrasound may help to identify foreign body, assess the globe
CT/MRI to locate foreign body. Possibility that a metal foreign body might migrate if MRI performed.

- **Treatment:**
  - Determine other structures have been involved – brain, oral cavity, and nasal passages all in close proximity
  - Depending on location and type of foreign body determines whether or not it is removed.
  - If pellets often leave – usually non reactive
  - If globe has been ruptured, enucleation is the only option

- **Prognosis:** Depends on the foreign body and what other structures were damaged

➤ **Orbital Neoplasia**

Orbital neoplasia is the most common cause of orbital disease across species. The animals are usually seen at an advanced stage of the disease. The lesions can be primary and originate from the structures within the orbit (fibroma, meningioma, osteosarcoma) or may secondary due to metastasis or extension from adjacent tissues (lymphosarcoma, extension of nasal adenocarcinoma). The lesions are usually primary and malignant.

- **Signalment:** usually older animals (mean age of 9.5 years)

- **PE:**
  - **Slowly progressive**
  - **Unilateral** exophthalmos, occasional enophthalmos
  - Elevated 3rd eyelid
  - Usually **NOT PAINFUL**
  - Cannot retropulse the globe or markedly decreased
  - +/- serous to mucopurulent ocular discharge
  - Ophthalmoscopic exam: may see indentation of caudal portion of the globe
  - Often visual, unless the mass originates from the optic nerve or meninges in which case they lose vision early

- **Additional Diagnostics:**
  - Ocular ultrasound: May see the indentation of the globe
  - Fine needle aspirate/ biopsy of lesion to determine tumor type – look in mouth
  - CT/MRI to localize lesion and determine extent
  - General PE and thoracic radiographs to determine extent of disease
• **Treatment:**
  - Euthanasia: often extensive involvement before present for Rx.
  - Local excision if small mass
  - Exenteration (removal of all orbital contents) or radical orbitectomy to remove the mass +/- radiation therapy +/- chemotherapy.
  - Enucleation or exenteration may also be performed as a palliative measure
  - Palliative radiation therapy

• **Prognosis:** usually guarded