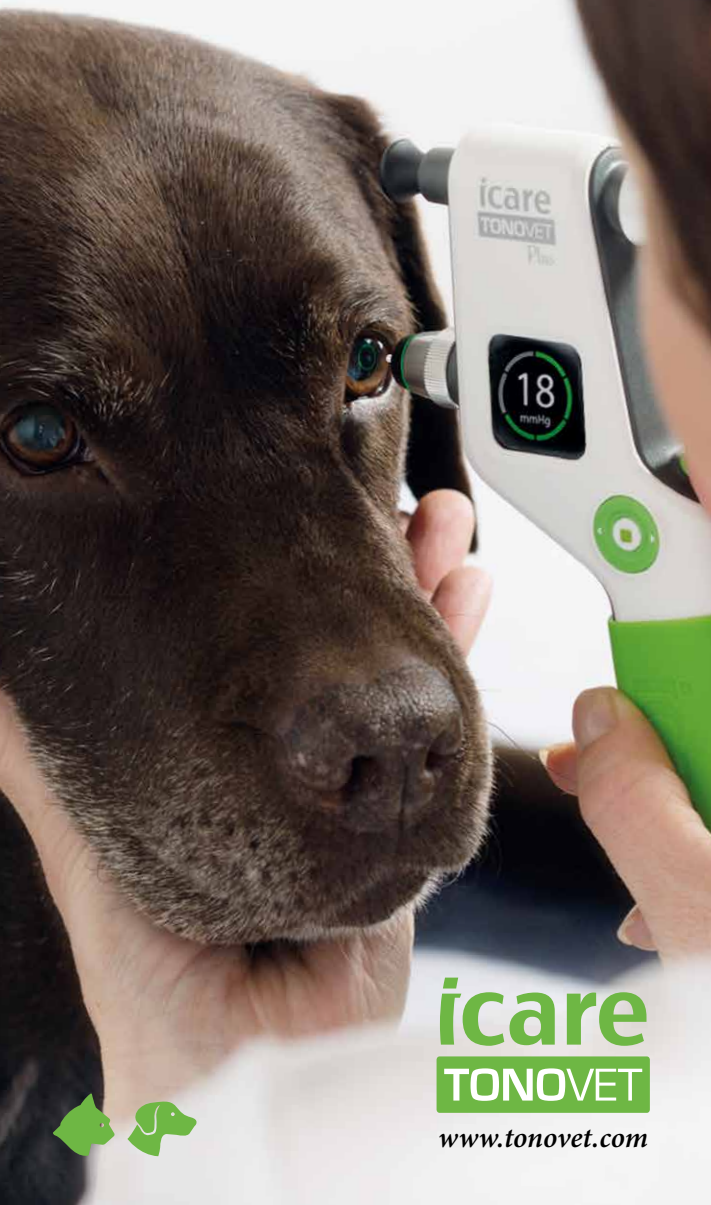


# RED EYE? EMERGENCY OR NOT?

*A short guide to recognition and  
first aid of glaucoma and uveitis*



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# APPROACHING THE RED EYE

Redness of the eye is a very common presenting sign in animals with eye problems of various types. Additional findings can help in making the diagnosis. Glaucoma and uveitis are both potentially blinding conditions that are not uncommon in dogs and cats. A thorough eye examination, including tonometry, enables prompt recognition of these conditions.

In addition to taking a good history, a thorough eye examination is the key to diagnosis and successful management of ocular disease. A basic examination can be done with relatively simple instrumentation.

This short, practical guide is designed to assist veterinary health care professionals in **basic** examination and management of patients presenting with eye disease.

*Ophthalmic examination should be done in a systematic manner, in the following order:*

- "Arms-length" then direct inspection of eye symmetry, eyelids and ocular surface with a bright light source
- Neuro-ophthalmic testing<sup>\*</sup>
- Schirmer Tear Test (STT)
- Tonometry
- Close examination of the eye, from front to back with magnification<sup>\*\*</sup> (including fluorescein staining)
- \* Menace response, dazzle reflex, palpebral reflex, pupillary light reactions
- \*\* Thorough evaluation of the lens and fundus requires pupillary dilation

If the integrity of the ocular surface appears compromised (e.g.. a deep corneal ulcer, bleeding from the eye, etc.) some of the steps above that involve direct contact with and manipulation of the eye may need to be skipped.

Additional diagnostic procedures may be indicated as determined by the findings of the basic examination.

## TONOMETRY

### INTRAOCULAR PRESSURE (IOP) RANGES \*

These ranges are intended to serve as general guidelines only and should always be interpreted in the context of other findings.

	UVEITIS	NORMAL IOP	BORDERLINE	GLAUCOMA
DOG	< 10	10 - 20	20 - 25	> 25
CAT	< 10	10 - 20	20 - 25	> 25
RABBIT	< 15	10 - 20	20 - 25	> 25
HORSE	< 15	15 - 25	25 - 30	> 30

Tonometry should be performed in both eyes. Values of IOP should be within 5mmHg between healthy eyes of the same subject.

Care must be taken to avoid artifactually altering IOP by excessive restraint of the patient, e.g. by putting pressure on the neck or eye ball.



*"To date, only one hand-held tonometer, the TonoVet (Icare Oy), is calibrated for veterinary species, including dogs, cats and horses."*

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DECREASED IOP < 10 mmHg	NORMAL IOP 10 - 25 mmHg	INCREASED IOP ≥ 25 mmHg
<b>UVEITIS*</b>  Low IOP values may be normal in elderly or very young animals	<b>KCS</b> (KERATOCONJUNCTIVITIS SICCA) • Check STT  <b>KERATITIS, CORNEAL EROSION OR ULCER</b> • Fluorescein stain	<b>GLAUCOMA**</b>  <b>FALSE HIGH READING</b> • Jugular compression • Eyelid stretching • Globe compression • Animal excitement → Correct and repeat
	<b>MECHANICAL IRRITATION</b> • Look for foreign bodies, aberrant cilia or trichiasis e.g. ectopic cilia, entropion	<b>ORBITAL SPACE OCCUPYING LESIONS</b> • Increased scleral show • Third eyelid protrusion • Anterior displacement (exophthalmos) and/or deviation of globe (strabismus) (view from above)
	<b>CONJUNCTIVITIS</b>	

<sup>\*</sup> in association with other signs of uveitis  
<sup>\*\*</sup> in association with other signs of glaucoma

# GLAUCOMA

Glaucoma is a progressive disease that affects the retinal and optic nerve tissues of the eye. It is associated with elevated intraocular pressure (IOP) in veterinary patients.

Normal IOP depends on a balance between aqueous humor production by the ciliary body processes of the eye and aqueous humor outflow through the drainage structures of the filtration angle.

## Causes of glaucoma

Based on the presence or absence of previous or concurrent ocular diseases, glaucoma can be classified as being either **primary** or **secondary**.

Primary glaucoma is caused by structural and functional abnormalities in the filtration angle of the eye. It is most often diagnosed in dogs, but can be seen occasionally in cats as well. Based on the location of the changes, it can be further classified into **primary closed angle glaucoma (PCAG)** and **primary open angle glaucoma (POAG)**. **Congenital glaucoma** is relatively rare, and is usually associated with multiple ocular abnormalities.

Of the primary glaucomas in dogs, PCAG is the more commonly recognized form. The underlying changes are mainly within the trabecular meshwork of the filtration angle and its opening, crossed by the pectinate ligament. Abnormalities in these structures can be visualized using a special lens, in a procedure called gonioscopy. This specialized examination can be used in screening dogs and assessing their risk of developing PCAG.

In POAG changes within the trabecular meshwork are not visible on gonioscopy during clinical examination. Genetic research has led to major advancements in our understanding of POAG in dogs in recent years and genetic tests are commercially available to diagnose or screen for this condition in some breeds.



Normal iridocorneal angle with pectinate ligament seen through a goniolens.



Severely abnormal iridocorneal angle with abnormal pectinate ligament seen through a goniolens.

Photos courtesy of Dr. James Oliver, UK

FORM OF GLAUCOMA	UNDERLYING CAUSES
Primary	<ul style="list-style-type: none"><li>• Angle closure glaucoma</li><li>• Narrow angle opening +/- goniodysgenesis</li><li>• Open angle glaucoma</li></ul>
Secondary	<ul style="list-style-type: none"><li>• Primary lens luxation</li><li>• Cataract</li><li>• Lens induced uveitis</li><li>• Intumescent (swollen) lens [e.g. in diabetic dogs]</li><li>• Secondary lens luxation</li><li>• Uveitis</li><li>• Inflammatory cells and debris</li><li>• Synechia</li><li>• Fibrovascular membranes</li><li>• Intraocular neoplasia</li><li>• Ocular melanosis</li><li>• Multiple uveal cysts</li><li>• Vitreal prolapse / lens instability</li></ul>
Congenital	<ul style="list-style-type: none"><li>• Multiple anterior segment abnormalities</li></ul>

## Dog breeds predisposed to primary glaucoma

- Afghan Hound
  - Akita
  - Alaskan Malamute
  - Australian Cattle Dog
  - Basset Hound
  - Beagle
  - Border Collie
  - Boston Terrier
  - Bouvier Des Flandres
  - Cairn Terrier
  - Cardigan Welsh Corgi
  - Chihuahua
  - Chow
  - Cocker Spaniel
  - Dachshund
  - Dalmatian
  - Dandie Dinmont Terrier
  - English Springer Spaniel
  - Flat Coated Retriever
  - Giant Schnauzer
  - Great Dane
  - Maltese
- Manchester Terrier
  - Miniature Pinscher
  - Norfolk Terrier
  - Norwegian Elkhound
  - Norwich Terrier
  - Pembroke Welsh Corgi
  - Petit Basset Griffon Vendeen
  - Poodle
  - Saluki
  - Samoyed
  - Scottish Terrier
  - Sealyham Terrier
  - Shar Pei
  - Shih Tzu
  - Siberian Husky
  - Smooth-Coated Fox Terrier
  - Tibetan Terrier
  - Welsh Springer Spaniel
  - Welsh Terrier
  - West Highland White Terrier
  - Whippet
  - Wire-haired Fox Terrier

Secondary glaucoma is frequently seen in both dogs and cats. The underlying cause is sometimes easily determined (e.g. a luxated lens in the anterior chamber or a mass within the eye), but in other cases, very careful evaluation is needed to determine the cause. Of the many etiologies of secondary glaucoma, anterior lens luxation is one of the most important to recognize, as emergency surgery is generally indicated to remove the lens.



Acute anterior lens luxation in a dog



Glaucoma secondary to ocular melanosis in a Cairn Terrier

# CLINICAL SIGNS OF GLAUCOMA

Clinical signs of glaucoma depend on the cause, severity and duration of the disease. Ideally, glaucoma patients should be identified in the early phases of the disease before signs of visual disturbance and pain are evident. Unfortunately, our animal patients are often only diagnosed when the IOP rises to a level that is painful and can rapidly lead to irreversible vision loss.

Signs of glaucoma are typically much more subtle in the cat, therefore glaucoma is often not diagnosed in this species until it reaches a very advanced state.



Relatively acute, congestive glaucoma with relatively mild conjunctival and episcleral congestion in a dog.



Acute, congestive glaucoma with corneal edema on a dog.

## Acute congestive glaucoma

- Elevated IOP
- Pain (blepharospasm, tearing)
- Redness (episcleral congestion + conjunctival hyperemia)
- "Cloudiness" (corneal edema)
- Distended episcleral vessels
- Dilated, unresponsive pupil
- Optic disc (if visible): swelling or cupping
- Impaired vision



Buphthalmic lens luxation in a dog.

## Chronic Glaucoma

- Elevated, normal or even low IOP
- Buphthalmos
- Moderate to severe hyperemia and congestion of conjunctival and episcleral vessels
- "Cloudiness" (corneal edema)
  - +/- corneal neovascularisation
  - +/- pigmentation
- Haabs striae (tears due to stretching appear as streaks in Descemet's membrane of the cornea)
- Lens instability (subluxation/luxation)
- Retinal degeneration
- Optic disc cupping and degeneration
- Intraocular hemorrhage



Chronic glaucoma in the right eye of a cat.

# EMERGENCY TREATMENT OF ACUTE CONGESTIVE GLAUCOMA

Whether glaucoma is primary or secondary in origin, the main goal of treatment is to lower IOP and thus relieve pain and preserve vision.

IOP should be monitored hourly until reduction to about 20 mmHg (or preferably below). Immediate referral to a specialist is strongly recommended, even if the acute crisis responds to emergency treatment. Generally, re-checks are recommended weekly to every few months, depending on the individual case.

MEDICATION	MECHANISM OF ACTION	DOSING	SPECIAL NOTE
<b>Prostaglandin analogues</b> <ul style="list-style-type: none"><li>• Latanoprost</li><li>• Bimatoprost</li><li>• Travoprost</li></ul>	<ul style="list-style-type: none"><li>• Increases aqueous outflow</li></ul>	<ul style="list-style-type: none"><li>• 1 drop q 12 h</li><li>• Onset of effect within 60 min</li></ul>	<ul style="list-style-type: none"><li>• Dog (highly variable effects in cats)</li><li>• Contraindicated in patients with anterior lens luxation</li></ul>
<b>Mannitol [20%]</b>	<ul style="list-style-type: none"><li>• Dehydrates vitreous</li><li>• Reduces aqueous production</li></ul>	<ul style="list-style-type: none"><li>• 1 - 2 g/kg i.v. over 20 - 30 min (withhold water for 2 - 4 h)</li><li>• Onset of effect 30 - 60 min</li><li>• Duration of effect 6 - 10 h</li></ul>	<ul style="list-style-type: none"><li>• Dog and cat.</li><li>• Only for emergency treatment.</li><li>• Contraindicated if concurrent renal or cardiovascular disease</li></ul>
<b>Carbonic anhydrase inhibitor [CAI]</b> <ul style="list-style-type: none"><li>• Dorzolamide</li><li>• Brinzolamide</li></ul>	<ul style="list-style-type: none"><li>• Decreases aqueous production</li></ul>	<ul style="list-style-type: none"><li>• 1 drop topically q 8 h (may be used q 4 h temporarily in an acute situation)</li></ul>	<ul style="list-style-type: none"><li>• Dog and cat</li></ul>

# CONTINUING TREATMENT OF GLAUCOMA

Primary glaucoma is a disease that cannot be cured, only managed. The goal of treatment is to maintain control of IOP, to prevent pain and prolong vision.

## Medical treatment

Treatment needs to be tailored to suit the individual patient. Additional medications may be prescribed by a specialist.

**Preventive medication in the fellow eye can significantly postpone the onset of glaucoma in the second eye in many patients (on average from 8 to 30 months).**

## Surgical treatment

### Improving aqueous outflow

- Filtering techniques

### Decreasing aqueous production

- Laser ablation of ciliary body processes
- Cryo ablation of ciliary body processes

### Salvage procedures

- Enucleation
- Evisceration and prosthesis

Depending on the cause of secondary glaucoma, additional treatment (e.g., removal of a luxated lens or medical treatment of uveitis) is likely to be needed. Secondary glaucoma may on rare occasions resolve as the primary problem is controlled. However, it is **STRONGLY** recommended that the opinion of a veterinary ophthalmologist is sought, to assist in the diagnosis and clinical management of these very challenging cases.

# WHEN AND WHY TO REFER TO A SPECIALIST?

- Patients should be referred to a specialist for evaluation of the underlying cause of glaucoma, either on an emergency basis, or soon after emergency treatment has resolved the acute crisis.
- Periodic rechecks by a specialist are needed to ensure adequate response to treatment, and the need for modification of the treatment, and the plan can be assessed.
- Surgical treatment of glaucoma should be left to the specialist.

# UVEITIS

The uvea is the vascular tissue within the eye. Anatomically, it can be divided into iris, ciliary body and choroid. Inflammation of the uvea, i.e. uveitis, can occur due to multiple ocular and systemic causes.

## Ocular reasons for uveitis

### Trauma

- Corneal ulcers (probably the most common)
- Blunt trauma
- Penetrating injuries e.g. cat scratch
- Chemical burn

### Lens induced

- Phacolytic uveitis - caused by resorbing, hypermature cataract
- Phacoclastic uveitis - caused by sudden rupture of the lens capsule (trauma, diabetic or other rapidly progressive cataract)

### Immunological

- Uveodermatologic Syndrome (UDS; Arctic breeds, Akita predisposed)

### Neoplastic

- Primary intraocular tumor (e.g., melanoma, adenocarcinoma)

### Other

- Pigmentary uveitis (Golden Retriever)
- Scleritis

## Systemic reasons for uveitis

### Toxic/endotoxic

- Any causes of bacteremia or endotoxemia e.g. Pyometra, Abscesses

### Infections\*

- Viral, rickettsial, bacterial, protozoal, fungal, algal, parasitic
- \* prevalence varies with geographic location

### Idiopathic / immune-mediated

- In around 50% of cases, the underlying cause is not definitively identified and uveitis is presumed "immune mediated"

### Neoplasia

- Lymphoma
- Metastatic
- Paraneoplastic e.g. myeloma

Systemic causes should always be suspected, especially if both eyes are affected.

Additional diagnostic procedures, such as blood work, urinalysis and diagnostic imaging are often necessary, with specific tests and procedures selected on a case by case basis.



*High IOP (>40 mmHg)  
is typically painful*



# CLINICAL SIGNS OF UVEITIS

## Acute uveitis

- Pain
  - squinting, tearing
- Congested episcleral vessels
- \*Lowered IOP (often <10mmHg)
- Miotic (constricted) pupil
- "Cloudy eye"
  - Corneal edema
  - Aqueous flare
- Swollen iris
- Cloudy vitreous
- Variably reduced vision
- Chorioretinitis / retinal detachment

## Chronic uveitis

- Iris hyperpigmentation
- Iris neovascularization and fibrotic membranes
- Synechiae (adhesions between iris and lens and / or cornea)
- Intraocular hemorrhage
- Cataract formation
- Retinal degeneration – diffuse, or focal chorioretinal scars
- Phthisis bulbi
- Retinal degeneration

\*Note that both acute and chronic uveitis can lead to secondary glaucoma. Thus an IOP >15mmHg in an eye with other significant signs of uveitis is a particular cause for concern, since IOP is expected to be low in inflamed eyes.

# TREATMENT OF UVEITIS

*Symptomatic treatment should be initiated with the goal of reducing inflammation and pain and minimizing the risk of intraocular complications, such as synechiae. Symptomatic anti-inflammatory treatment should always be started, regardless of the underlying cause. Additional treatment should be initiated according to the underlying etiology, e.g. to treat underlying systemic or local disease.*

## Systemic anti- inflammatory medication

NSAIDs are highly effective and they are generally safe to use, even if the uveitis is caused by infection.

Meloxicam and carprofen are the most frequently used NSAIDs in dogs and cats. Normal doses and precautions should be followed, with dose or dose frequency reduced as severity of clinical signs diminish

Systemic corticosteroids, or other immunosuppressive drugs, are usually used only in cases of severe immune-mediated uveitis (such as UDS) in which systemic infectious or neoplastic disease has been excluded by careful clinical evaluation and diagnostic testing. Systemic corticosteroid doses should be tapered very gradually as control of clinical signs is achieved.

## Topical anti-inflammatory medication

Topical NSAIDs can be used (with caution) in cases of corneal trauma but are typically not used more than twice a day.

Topical corticosteroids (1% prednisolone acetate or 0.1% dexamethasone) are more often used, due to their superior anti-inflammatory effect.

**CAUTION!** Topical corticosteroids should not be used in cases with corneal ulcers (though systemic administration of CCS is not specifically contraindicated in subjects with corneal ulcers and injuries.)

Depending on the severity of the inflammation, topical corticosteroids may be given as frequently as hourly, though 4-6 times a day application is more typical. Frequency of administration is then slowly and cautiously reduced to once a day or once every other day, as the severity of clinical signs reduce.

## Other

Topical atropine is used to

- Dilate the pupil to prevent synechiae formation
- Relax ciliary body muscle spasms to reduce pain
- Stabilize uveal blood vessels

Atropine is given as needed (preferably "to effect") to dilate the pupil and maintain moderate mydriasis. This generally means dosing once to four times a day.

Additional therapies should target the underlying cause of uveitis if known

## When and why to refer to specialist?

Trauma patients (especially if corneal penetrating injury and /or lenticular trauma is known or suspected) should be promptly referred to a specialist.

Cases with severe uveitis and uncertain etiology should also be evaluated by a specialist, as well cases that do not respond to symptomatic therapy within 1-2 days.



*Aqueous flare, iridal swelling and miosis in a dog with uveitis.*

## *Suggested reading*

- Gould, McLellan (editors): Manual of Canine and Feline Ophthalmology, 3rd Edition. BSAVA 2014
- Mitchell, Oliver: Feline Ophthalmology, The Manual. Servet Publishing 2015
- Pizzirani (editor): Glaucoma in Veterinary Clinics of North America: Small Animal Practice. Vol 45, Issue 6, 2015
- Maggs, Miller, Ofri (editors): Slatter's Fundamentals of Veterinary Ophthalmology. Saunders Publishing 2017
- Gilger (editor): Equine Ophthalmology, 3rd Edition. Wiley Blackwell Publishing 2017 

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