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# Acute Primary Angle-Closure Glaucoma

## **P** Profile

### Definition

Acute glaucoma is a group of potentially blinding disorders unified by a common theme: high ( $\geq 25$  mm Hg) intraocular pressure (IOP) damages the optic nerve. Acute glaucoma is most frequently seen as primary angle-closure glaucoma (PACG) in dogs with drainage angle abnormalities (goniodysgenesis or narrow drainage angles, **Figure 1**) or secondary to other ophthalmic diseases such as anterior uveitis, hyphema, intraocular neoplasia, or anterior lens luxation (**Figure 2**). This article will focus on PACG.

**Genetic Implications.** Complex inheritance pattern with strong breed predispositions (see **Signalment**)

**Incidence/Prevalence.** One in 119 dogs has some form of glaucoma in its lifetime.

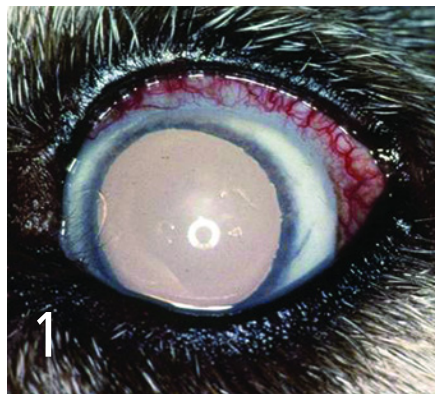
**Geographic Distribution.** Worldwide

### Signalment

#### Breed predilection.

**Goniodysgenesis:** Arctic circle breeds (Akita, Alaskan malamute, Norwegian elkhound, Samoyed, Siberian husky), basset hound, Bouvier des Flandres, flat-coated retriever, poodles (all varieties), shar-pei, Shiba Inu, spaniels (English cocker and English springer)

**Narrow drainage angles:** American cocker spaniel, Boston terrier, chow chow, golden retriever, Leonberger, Welsh springer spaniel



**1** A Siberian husky with acute primary angle-closure glaucoma. Note the mydriasis and conjunctival hyperemia.



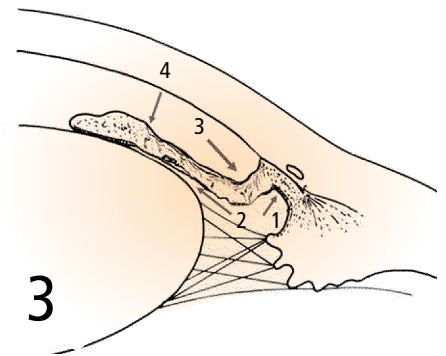
**2** Anterior lens luxation in a terrier dog. Note the position of the lens in front of the iris and the aphakic crescent dorsally.

**Age and range.** Typically 4 to 9 years of age

**Gender.** 2:1 female to male ratio

### Causes & Risk Factors

Breed, age, and sex are significant risk factors. Acute PACG attacks often occur at night or are precipitated by stress, excitement, or other events that create a mid-range to dilated pupil.



**Proposed mechanism of acute PACG in dogs:** In short, increased pulse pressure in the choroid forces aqueous humor in the posterior chamber against the posterior peripheral iris (1) and through the pupil (2) into the anterior chamber. Preexisting drainage angle abnormalities prevent this excess aqueous humor from leaving the eye (3), resulting in increased contact between the iris and the anterior lens capsule (4, "reverse ball valve"). This continues until IOP reaches about 50 to 80 mm Hg. *Modified with permission from Slatyer's Fundamentals of Veterinary Ophthalmology, 4th ed. Maggs DJ, Miller PE, Ofri R (eds)—St. Louis: Elsevier, 2008, pp 230-257.*

### Pathophysiology

Proposed mechanism for acute PACG (**Figure 3**):

- Drainage angle malformations hold the peripheral iris in abnormal proximity to the cornea.
- Stress or excitement causes the pupil to become mid-range, allowing the less taut iris to come into greater contact with the anterior lens surface.

IOP = intraocular pressure; PACG = primary angle-closure glaucoma

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- Increased pulse pressure in the choroidal blood vessels pushes against the vitreous and aqueous humors in the posterior chamber, forcing more aqueous humor through the pupil and into the anterior chamber.
- The compromised drainage angle prevents this additional fluid from escaping the anterior chamber and creates a “reverse ball valve” in which the iris is forced into greater apposition with the lens, which prevents additional aqueous from returning to the posterior chamber.
- This process repeats until IOP reaches a physiologic maximal value of about 50 to 80 mm Hg.

The attack may spontaneously resolve if increased IOP can force the drainage angle open or cause the peripheral iris to “slide” off the curved anterior lens capsule, thereby disrupting the ball-valve effect. Sustained IOP increases, however, mechanically distort and reduce blood flow to the optic nerve, thereby interfering with the flow of critical growth factors and nutrients to the retinal ganglion cells. Death of these cells can lead to a vicious cycle—dying ganglion cells release glutamate and other neurotoxins that kill adjacent, previously healthy ganglion cells, even if IOP is returned to normal.

**Signs**

**History.** An acutely red, painful eye, often with a cloudy cornea and potentially rapid vision loss. Occasionally the clinical signs are intermittent and spontaneously resolve. Signs of general malaise (eg, lethargy, anorexia) may be present as well.

**Physical Examination.** May present unilaterally, but both eyes are at risk. IOP is typically > 25 mm Hg (usually much greater). Other signs include engorged episcleral vessels, diffuse corneal edema, a fixed and relatively dilated pupil, and pallor/cupping of the optic nerve head (seen with ophthalmoscopy). Vision is usually, but not always, absent.

CAI = carbonic anhydrase inhibitor; IOP = intraocular pressure; PACG = primary angle-closure glaucoma

**Pain Index**

Acute glaucoma creates considerable, but poorly localized, pain involving the head and orbit. Humans compare this pain to a migraine headache, and dogs undoubtedly experience a comparable sensation. In addition, lethargy and anorexia may be signs of pain.

**Dx Diagnosis**

**Definitive Diagnosis**

Increased IOP and presence of the appropriate clinical signs

**Differential Diagnosis**

Improper tonometric technique or an uncooperative patient can provide falsely high IOP readings. In acute PACG there are no other obvious causes of the glaucoma (lens luxation, hyphema, anterior uveitis) other than those involving the drainage angle (not visible without gonioscopy). Ultrasonography may help identify whether abnormalities other than glaucoma (eg, retinal detachment, intraocular tumors, etc) are present.

**Tx Treatment**

**Inpatient or Outpatient**

Usually inpatient until IOP is stabilized

**Medical**

- Apply 1 to 2 drops of 0.005% latanoprost (Xalatan; Pfizer, www.xalatan.com) to affected eye and measure IOP in 1 to 2 hours.
- If IOP is not down in 2 hours administer:
  - *Mannitol*: 1 to 1.5 g/kg slow IV over 20 minutes  
 or 5 to 7.5 mL/kg of a 20% solution
  - *Oral carbonic anhydrase inhibitor (CAI)*: Methazolamide or dichlorphenamide, 2.2 to 4.4 mg/kg PO Q 8 to 12 H  
 or *topical CAI*: 2% dorzolamide (Trusopt, www.merck.com) or 1% brinzolamide

(Azopt, www.alcon.com) Q 8 H  
 - 2% *pilocarpine*. 1 drop every 10 minutes for 30 minutes, then Q 6 H

**Surgical (typically referral procedures)**

- *Eyes with the potential for vision*: Laser cyclophotocoagulation, endocyclophotocoagulation, cyclocryosurgery, and/or gonioimplantation
- *Blind eyes* (ie, no vision for at least 1–2 weeks after onset of vision loss): Consider intrascleral prosthesis or enucleation

**Activity**

Restricted until IOP is stable and any surgery sites have healed

**Client Education**

Glaucoma is often blinding but there is some hope that vision can be preserved depending on the magnitude as well as duration of the IOP increase. Eyes with chronic IOP increases should be regarded as painful even if the animal behaves relatively normally. Surgically lowering IOP in these eyes invariably improves the dog’s quality of life. The client should also be aware that the fellow normotensive eye is at considerable risk of developing acute glaucoma (see **Prevention**).

**Medications**

**Drugs**

See above.

**Contraindications**

Do not use atropine or tropicamide.

**Precautions**

- Heat and/or filter mannitol to prevent IV administration of crystals.
- Systemic CAIs (methazolamide, dichlorphenamide) can induce hypokalemia and metabolic acidosis.
- Dogs that have received mannitol or a

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**Tx** at a glance

**Emergency Treatment**

- 1–2 drops of 0.005% latanoprost to affected eye
- Measure IOP in 1–2 H
- If IOP is not down in 2 H give:
  - Mannitol: 1–1.5 g/kg slow IV over 20 min or 5–7.5 mL/kg of a 20% solution
  - Oral CAI: Methazolamide or dichlorphenamide, 2.2–4.4 mg/kg PO Q 8–12 H or a topical CAI: 2% dorzolamide or 1% brinzolamide Q 8 H
  - Pilocarpine (2%): 1 drop every 10 minutes × 3; then Q 6 H
- Begin prophylactic therapy for fellow eye

systemic CAI can have hydration or electrolyte disturbances that impact general anesthesia.

**Interactions**

Most topical antiglaucoma drugs are synergistic with one other. Demecarium bromide is an organophosphate—be careful with drugs that have a comparable mechanism of action.

**Follow-Up**

**Patient Monitoring**

Measure IOP several times a day initially, then less frequently as it stabilizes. When treating for glaucoma, keep IOP below 20 mm Hg. It is not uncommon for dogs that initially respond to medical management to become nonresponsive within 6 months and require surgery.

**Prevention**

The fellow normotensive eye in dogs with acute PACG has a 50% chance of experiencing an overt attack of glaucoma within 8 months. Topical therapy with 0.5% betaxolol Q 12 H or 0.125% to 0.25% demecarium bromide Q 24 H along with a topical corticosteroid Q 24 H (at night) has been shown to reduce the likelihood of an attack to 50% in 30 months.

CAI = carbonic anhydrase inhibitor

**Course & Future Follow-Up**

Life-long therapy is generally required if the affected eye is to retain vision. In addition, life-long follow-up is required unless an enucleation or globe-salvage procedure has been performed.

**In General**

**Relative Cost**

- Inpatient medical care: \$\$ to \$\$\$/day
- Outpatient medical care: \$ to \$\$/month
- Surgical care: \$\$\$\$\$

**Cost Key**

\$ = < \$100	\$\$\$\$ = \$500–\$1000
\$\$ = \$100–\$250	\$\$\$\$\$ = > \$1000
\$\$\$ = \$250–\$500	

**Prognosis**

Guarded for preservation of vision

**Future Considerations**

Many new antiglaucoma drugs are in the pipeline and surgical procedures continue to be refined. Neuroprotective drugs may become a therapeutic mainstay in the future. ■

See Aids & Resources, back page, for references, contacts, and appendices.

Article archived on [www.cliniciansbrief.com](http://www.cliniciansbrief.com)

Resources & offers available at no cost to veterinary practices

- The Zoological Education Network has developed a new brochure, *Tips to Reduce Feather Picking*, to help the clinician explore possible reasons why pet birds self-mutilate and what to do about it. Download the brochure and see other free titles available at [www.exoticdvm.com](http://www.exoticdvm.com).



- *Quick Guide: Diagnosing Gastrointestinal Disease* is a 32-page compendium that includes tips on history-taking, physical examinations, and diagnostic tests; GI algorithms; and information about Purina Veterinary Diets that support GI health in dogs and cats. To order, call the Nestlé Purina Veterinary Resource Center at 800-222- 8387 or visit [www.purinavets.com](http://www.purinavets.com) (user name: purinavets; password: nutrition).



- The Humane Society of the United States has prepared a “Providing for Your Pet’s Future Without You” kit that includes fact sheets, alert cards, emergency decals, and caregiver information forms for pet owners. For the full kit, write to [petsinwills@hsus.org](mailto:petsinwills@hsus.org) or call 202-452-1100. PDFs of the fact sheet in English and Spanish are available at [www.hsus.org](http://www.hsus.org).

- Free samples of “green nutrition” Pet Green Treats with wheatgrass for dogs and cats are available from Bellrock Growers’ Web site, [www.bellrockgrowers.com](http://www.bellrockgrowers.com). A downloadable e-book, *Why Green Nutrition*, is also available free on the Web site.

- Visit the revamped *Clinician’s Brief* site to download client education handouts that can be customized to your hospital. Topics include obesity risks, food supplements, and achieving a dog’s ideal weight. Go to the “What You Need to Know About” area at [www.cliniciansbrief.com](http://www.cliniciansbrief.com).

Send information on no-cost resources and offers to [meg@cliniciansbrief.com](mailto:meg@cliniciansbrief.com).