Glaucoma in animals

Introduction:

- Clinically, glaucoma is generally defined as the rise in intraocular pressure (IOP) beyond that compatible with vision and it is the most difficult management problem encountered in ophthalmology practice.

- Inherited and seen in many breeds of dog: Cocker spaniel, Basset hound, Poodle, Beagle, Samoyed, Chow chow, Boston terrier, Wirehair fox terrier, Saint Bernard, Chihuahua, Dalmatian, Dachshund, Springer spaniel, Brittany spaniel, Malamute, Shar Pei, Siberian husky.
- Normal IOP: In most animal 15-25 mmHg.
- Preferred IOP: 15-20 mmHg.
- 30-30 Rule: According to it 30mmHg IOP for more than 30 hrs result in loss of vision.
  - Pressure more than it can cause loss of vision in just 4 hrs.
  - By the time cornea is edematous, episcleral vessels are injected, the lens is subluxated and eye is buphthalmic, vision is irreversibly lost.

Clinical signs:

- Red eye
- Very squinty and painful eye
- Tearing
- Dilated pupil that doesn't react to light
- Cloudy (whitish/blue) cornea (front surface of the eye)
- Enlarged size of the eye (known as buphthalmos)
- Vision loss

Types of glaucoma:

1. **Primary Glaucoma**: Seen in the absence of signs of concurrent ocular disease.

Ø **Narrow Angle Glaucoma**: Most common.
Ø **Open Angle Glaucoma**: In Beagle breed.
Ø Primary Glaucoma (Either Narrow Angle or Open Angle) is a bilateral disease.

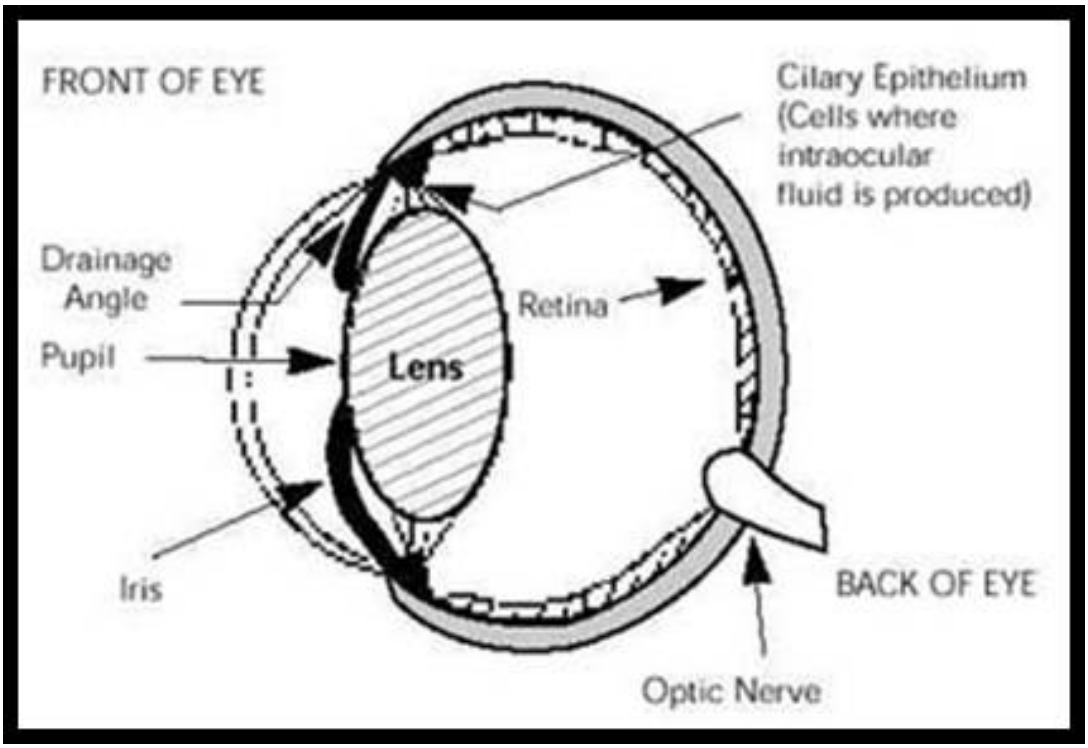
Primary Conditions:

- ***Congenital malformation of angle.***

Common in Basset hounds, Samoyeds, Siberian huskies and Australian Shepherds

- ***Genetically Preprogrammed Narrowing of the Angle***
  Common in Cocker spaniels, Chow, Shar pet, Poodles, Norwegian elkhounds

Determination of type of angle abnormality is important and requires examination by gonioscopy.



2.**Secondary Glaucoma :** Elevated IOP associated with concurrent ocular disease.
These concurrent ocular diseases include:

- Uveitis: associated with luxation or swelling of lens (pupillary block), miosis of any cause, posterior synechiae or chronic immune mediated uveitis (most common in cats).
- Intraocular hemorrhage
- Neoplasia
- lens displacement

Diagnosis:

- Complete medical history
- Physical examination
- Determine if the glaucoma is primary or secondary
- Extent of damage to optic nerve & retina.
- Utrasonography: If eye is too cloudy. Helps to identify tumors, and damage to the optic nerve.

- **Ocular Tonometry**: Measurement of pressure within the eye ball. The tonometer is the device used to measure IOP. Most commonly used instruments for Ocular Tonometry in veterinary practice are
    - Schiotz tonometer
    - Mentor Tonopen
    - Applanation Tonometry : Mackay Marg Pneumotograph is used

Factor Affecting IOP: Struggling, Excitement, Blepharospasm, Corneal Scarring, Sedation of anaesthesia

- **Gonioscopy:**
    - The examination of the irido-corneal angle by means of a specially designed lens placed on the cornea.
    - It evaluates how close a tumor is to invading the drainage angle.
    - Gonioscopy is essential for classification of glaucoma and for best selection of therapy.
- **Tonography:**
    - The determination of degree of resistance associated with movement of aqueous humor from the eye.
    - Changes in IOP are measured.
    - Average facility of outflow in dog is 0.24
    - In glaucoma this value will be below 0.13
- **Water provocative testing:**
    - Application of topical corticosteroids or drinking of a specified amount of water to stimulate an increase in IOP in patients with open drainage angle.
    - The mean increase in IOP in normal dogs ranges from 3.1-8.6 mmHg
    - The mean increase in IOP in glaucomatous dogs ranges from 7.3-19.9 mm Hg
- **Mydriatic provocative testing**
    - Patient is placed in a dark room.
    - A topical short acting mydriatic applied in eye.
    - IOP measured at intervals over several hours.
    - If narrow angle glaucoma, a significant increase in IOP noted.

Treatment:

- Medical therapy
- Surgical therapy for visual eyes
- Surgical therapy for blind eyes

Medical therapy:

Aims:

- To decrease the production of fluid within the eye,
- To improve the flow of fluid out of the eye,

- To control any inflammation.

Medications:

- Parasympathomimetic agents
- Sympathomimetic agents
- Beta-adrenergic blocking agents
- Hyperosmotic agents
- Carbonic anhydrase inhibitors
- Alpha$_2$-adrenoreceptor agonists

Parasympathomimetic agents

- Used topically
- Effect parasympathetic receptors
- **Two classes:** Direct Acting (Cholinergic) Agents; Indirect Acting Cholinesterase Inhibitors
- **Side Effects:**
  - They sting on application
  - Cause brow aches
  - Blurred vision
- **Action is by**:
  - Increasing outflow from eye
  - Decreasing the production within eye.
  - **Drugs:**
    - **Cholinergic Agents:**
      Carbachol - 0.75%-3%
      Pilocarpine - 20, 40 inserts
      Pilocarpine HCl Gel - 4%;
      Pilocarpine HCl - 0.25%-10%
    - **CholinesteraseInhibitors:**
      Physostigmine - 0.25 & 0.5%;
      Demarcarium bromide - 0.25% & 0.5%;
      Echothiophate iodide - 0.03%, 0.06%, 0.125%, 0.25%.

- **Disadvantage**: Diarrhoea; Salivation; Bradycardia.
- **Management**: Atropine; Pyridine-2 aldorime methyl iodide.

Sympathomimetic agents: Used topically.

- Act on sympathetic receptors
- Improve uveoscleral flow
- Cause a reddish discoloration of the tears
- **Drugs:**

Dipivephrine HCl - 0.1%;
Epinephrine borate - 0.5%, 1% ,
2%; Epinephrine HCl 0.5%, 1%, 2%

Beta-adrenergic blocking agents:

- Reduce IOP by blocking beta-adrenergic receptors (Decreasing aqueous production).
- **Side Effects:** Bradycardia and lower blood pressure; Aggravate some respiratory conditions.
- **Drugs:**

Betaxolol HCl 0.25%, 0.5%
Carteolol HCl 1%
Levobunolol HCl 0.25%, 0.5%
Metipranolol 0.3%
Timolol hemihydrate 0.25%, 0.5%
Timolol maleate .25%, 0.5%
Timolol maleate (long-acting)0.25%, 0.5% (once daily app.)

Hyperosmotic agents:

- Used in acute glaucoma & prior to intraocular surgery.
- Lower Intraocular Pressure by Dehydrating and shrinking the Vitreous.
- **Drugs:**

Mannitol	5-20%	0.5-2g/kg	IV	30-60 min/6 h
Glycerin	100%	.33 cc/lb.	p.o.•	1-2 h/8 h

- •Give with equal volume of water, milk, or melted ice cream. Withhold water for 1.5 h after dose.

Carbonic anhydrase inhibitors

- Most effective medications for Glaucoma in small animals
- Decrease the secretion.
- **Side Effects:**

1. Can Result in Acidosis
2. Hyperventilation
3. lethargy and weakness
4. Anorexia

5. Gastrointestinal Disturbances
6. Altered Taste & Smell
7. Ureteral Colic
8. Bone Marrow Suppression.

- **Drugs:**

Dichlorphenamide –	5mg/kg orally	twice daily
Acetazolamide -	10mg/kg orally	twice daily
Ethoxzolamide -	4mg/kg orally	twice daily
Methoxzolamide -	10mg/kg orally	twice daily
Brinzolamide•	1% ophthalmic suspension	2 h/8-12 h*
Dorzolamide HCl•	2% ophthalmic solution	2 h/8 hr *

- Not to be given concurrently with systemic carbonic anhydrase inhibitor

The alpha$_2$-adrenoreceptor agonists:

1. Apraclonidine -reduces aqueous secretion

Side Effects :

- Ø Mydriasis In Dogs
- Ø Miosis In Cats
- Ø Conjunctival Blanching
- Ø Ciliary Vasoconstriction
- Ø Eyelid Retraction

2. Brimonidine Tartrate 0.2% Ophthalmic Solution
   - Ø Decreases Aqueous Humor Production
   - Ø Increasing the Uveoscleral Outflow.
   - Ø Neuroprotective

Prostaglandinf$_2$-alph analogue: Latanoprost

- Ø Lowers IOP by increasing: outflow of aqueous humor.
- Ø Recently introduced to the market
- Ø shows good results

- Ø Requires only once daily application

1. Can be irritating

2. Chronic use has been reported to increase irideal pigmentation.

Neuroprotective agents

Damage to the Retina May Precede the Actual Pressure Rise

- Ø Protect the neural retina

- Ø Brimonidine : Neuroprotective

SURGICAL THERAPY FOR VISUAL EYES

1. Glaucoma shunt or Gonioimplant: Preferred surgical procedure is Ahmed valve sutured to the sclera under the conjunctiva and Tenon's capsule (usually in the superotemporal quadrant)

- v Antifibroproliferative agent (5-flourouracil or mitomycin C applied to exposed sclera via a surgical sponge)

- v Subconjunctival injections: 0.05 cc (2.5 mg) of mitomycinC 0.1-0.2 mg/ml weekly for 8-12 weeks.

- v Drawback :
  - v Corneal and conjunctival irritation
  - v Scleral malacia
  - v Migration of the implants
  - v Scarring over the shunt

Laser cyclophotocoagulation:

Partial destruction of the ciliary body

Drawbacks: Inflammation; Immediate pressure spikes

Iridencleisis: In this procedure the iris is positioned at the limbus which facilitates the aqueous humor outflow.

Cyclodialysis: It is the creation of artificial fistula between anterior chamber through sclera into the conjunctival sac.

Iridectomy: It is surgical removal of the iris.

SURGICAL THERAPY FOR BLIND EYES

1. Medical therapy on such eyes is expensive

2. Pain

1. Enucleation:
   - v Most obvious and least complicated solution
   - v Permanent Tarsorrhaphy
   - v Orbital space (silicone spheres)
   - v Prosthetic eyes.

2. Evisceration and intraocular prosthesis:
   - v A black silicone sphere(globe)
   - v Intraocular contents (removed)

   Procedure:
   Dorsal scleral incision
   Maintaining the shape of the globe

3. Intravitreal injection of gentamicin
   Globe preservation

   Procedure :
   - v 15 mg of gentamicin mixed with 0.2-0.4 mg of dexamethasone
   - v Injected into vitreous through super temporal sclera, 5 mm posterior to the limbus
   - v A 20-22 gauge needle is used to aspirate 0.5-1.5 cc of vitreous prior to injection
   - v Needle must be carefully angled to avoid the lens
   - v Severe endophthalmitis will result when the lens capsule is perforated
   - v Gentamicin is toxic to the retina and ciliary processes, therefore causes chemical ablation of the secretory capacity of the ciliary body is accomplished.

IMPORTANT POINTS

- Medical therapy is not a permanent solution for most glaucoma cases.
- The fellow eye must be examined and the owner taught to recognize early signs.
- At best, winning is difficult and therapy must be early and aggressive if vision is to be preserved.