

## Canine cataracts and its management: An overview

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### ABSTRACT

A *Cataract*, is an opacity within a lens. Out of various eye disorders CATARACT “*Clouding of eye lens*” is a major problem encountered in canines, and ophthalmic surgery offers great potential for relief of distress and improvement of quality of life. Like a camera eyes have a clear lens inside them that is used for focusing the light. Surgical removal of cataract is a treatment of choice, if restoration of vision is desired. These surgeries are most frequently performed by veterinary ophthalmologists worldwide. Because of required training, operating microscope and microsurgical ophthalmic instruments, cataracts and lens removal is not performed by most veterinarians in clinical patients.

**Keywords:** cataract, phacofragmentation, phaeoemulsion, diopeters

Vision is a precious gift of God to each living being without which whole beautiful world is dark. Vision plays a vital role to move life of human and animal equally. Some ill effects can hindered this sense partially or completely, Veterinary Ophthalmology, a branch of Veterinary science by which a Veterinarian play a key role to restore the ocular health of an animal. Out of various eye disorders CATARACT “*Clouding of eye lens*” is a major problem encountered in canines, and ophthalmic surgery offers great potential for relief of distress and improvement of quality of life. (Gilger, 2002). “Cataract” is a Greek word, which means “*white water falling*”. Early Greeks thought the blurred vision from the cataract was like looking through a waterfall.

A *Cataract*, is an opacity within a lens. The opacity can be focal (incipient) and not interfere the vision much, it can involve more of the lens (immature) and cause blurred vision, eventually entire lens diffusely can become cloudy, and all functional vision lost. This is called mature Cataract. There are numerous theories advocated as the cause of Cataract but mostly canine cataracts are inherited. The Cataracts may develop within weeks or slowly over years, in one or both the eyes (McCalla, 2005).

*Normal physiology and cataracts*

Like a camera eyes have a clear lens inside them that is used for focusing the light. The normal canine lens is a soft, avascular, transparent and highly structured tissue that refracts incoming light rays to a point source on the retina. The canine lens is an ectodermal structure and, is surrounded by vascular envelope, has a volume of approximately 0.5 mL, an anteroposterior thickness of 7 mm. and an equatorial diameter of 10 mm., its dioptric power is 40 to 41 D. The lens include zonular fiber support system, an external capsule comprised of basement membrane, epithelia and differentiated lens fibers. Loss of transparency is almost invariably a common denominator in all lens diseases and because of prevalence of heritable canine lens disorders, Cataracts are among the most common intraocular lesion and leading cause of vision loss in the dogs (Samuelson, 1999).

Like human, dogs also develop cataracts with age (often 8 years of age) and it may be congenital. Cataracts may be associated with some diseases like Diabetes mellitus or in Orphan puppies on an artificial milk replacer diet. But in spite of above factors, some other causes of cataracts are:-

- oxidative damage caused by oxygen free radicals, hydroxides, hydrogen peroxide and ultra violet rays.
- deficiency of antioxidants like glutathione, super oxide dismutase, catalase and ascorbate.
- increase in high molecular weight insoluble proteins (albuminoids) and decrease in soluble proteins (crystallines).
- electrolyte disturbances like increased Na<sup>+</sup>, Ca<sup>++</sup> levels and decrease in K<sup>+</sup> contents within lens (due to decreased activity of epithelial Na<sup>+</sup>/K<sup>+</sup> ATP (adenosine tri-phosphate) pump.
- increased activity of hydrolytic and proteolytic enzymes., and
- traumatic damage to the lens (Sharma, 2002).

*Classification of canine cataracts*

**Table 1:** Classification of canine cataracts based on maturity (Gelatt, 2000).

Type	Area involved	Tapetal reflection	Vision
Incipient	10-15% Involved; Cortices and/or sutures	Present	Present
Immature	Normal and opaque areas and becomes intumescent (swollen)	Present	Present
Mature	Entire lens involved and intumescent (swollen)	Obscured	Absent
Hypermaturation	Reduced overall size Very advanced	Usually obscured Often present	Usually absent Variable

*Changes associated with cataracts*

*Pathophysiologic changes associated with cataracts*

Cataract formation is associated with series of events, that relate to change in the:-

- lens protein contents.
- metabolic pumps.
- ionic concentration.
- antioxidant activity.
- increased level of high molecular weight insoluble proteins (albuminoids) which normally comprises 15% of lens protein, and
- decreased relative amount of soluble proteins (crystalline).

Increased level of alpha and

Decreased beta-heavy beta

-light crystallines.

gamma - crystallines

Both hydrolytic and proteolytic enzymes activity is increased, cell membrane rupture is associated with irreversible damage.

*Histopathologic changes associated with cataracts*

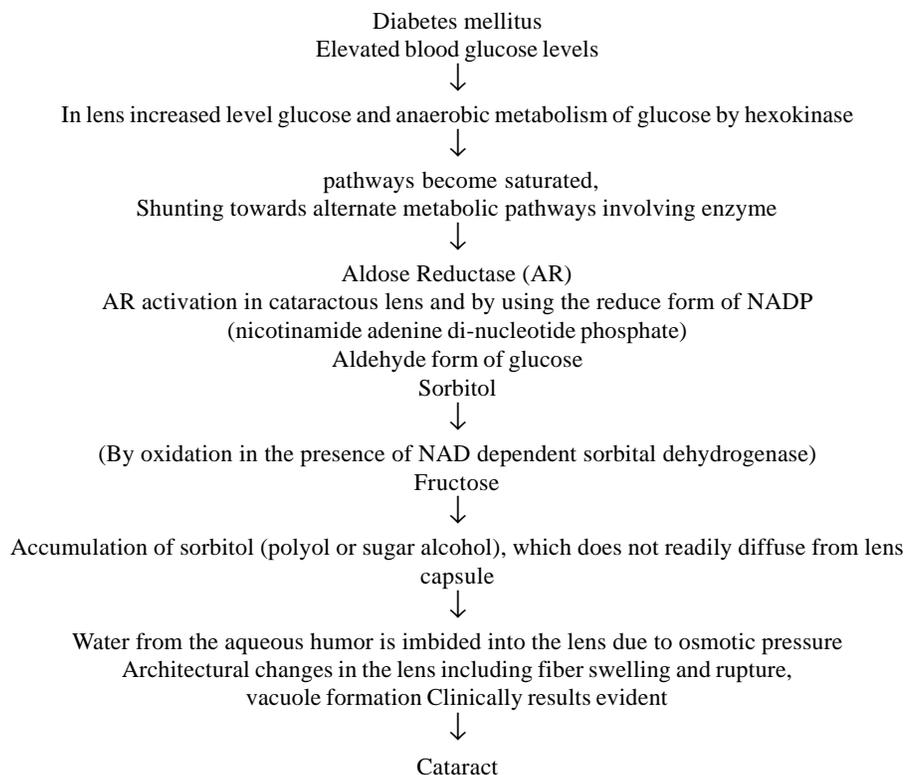
The specific capsular, epithelial, cortical and lens nuclear morphological abnormalities are commonly seen at light microscopy in many types of cataract. Both the anterior and posterior capsules may become thinned with swollen (intumescent) lens and lens capsule may become wrinkled with an advanced hypermature cataract (Davidson, 1999; Gum, 1999).

*Cataracts associated with systemic diseases*

*Diabetes mellitus*

Diabetes mellitus is commonly associated with rapidly developing, bilaterally symmetric cataract formation in the dogs that result from well described alteration

in metabolic pathways.



### *Hypocalcaemia*

Hypocalcaemia, which most commonly results from renal failure or either primary or secondary hypoparathyroidism, may be associated with characteristic cataracts in dog. These cataracts are manifested by multifocal, punctate opacities or coalescing lamellar cortical opacities that are bilaterally symmetric.

### *Hypercupremia*

The characteristic, sun flower shaped, anterior subcapsular cataracts associated with elevated serum and aqueous copper levels in human with *Wilson's disease*, which is genetic disorder of copper metabolism, as well as in those with disorders producing the derangement of copper metabolism. A condition similar to *Wilson's disease* that is characterized by the excessive accumulation of copper in hepatocytes in the Bedlington Terrier.

### *Cataracts associated with medications and other toxic substances*

Several environmental toxins and systemically administered pharmacological agents

produce cataracts in the dogs. This type of cataracts occur presumably on the equatorial region (in the area of lens fiber elongation).

#### *Cataracts associated with dietary deficiencies*

A specific neonatal cataract is sporadically seen in puppies fed on oral milk replacement products. Experimental studies suggest that some puppies may show the signs of cataracts as earlier as 3<sup>rd</sup> week of milk replacer diet. These opacities are often mild, do not threaten vision, and can become less prominent or even resolve with age. The pathogenesis of these opacities, however, may be more complex than single amino acid deficiency (e.g, tryptophane, phenylalanine, histidine) (Gelatt, 2000)

#### *Cataracts associated with injuries to the lens*

Mild blunt injuries to the globe rarely causes damage to the lens, moderate blunt injuries, may result into displacement of iris, thus causing pigment deposition from the posterior iris epithelia. Contusion to the lens from blunt injury may produce cataracts because of the resulting ocular compressive forces in turn damage to the lens epithelia, and also rupture or disruption of the lens fiber membrane. Various degree of subcapsular cataracts formation generally occurs adjacent to site of injury. Penetrating ocular injury that perforate anterior lens capsule invariable causes focal to diffuse cataracts formation. Traumatic anterior lens capsule disruption most commonly occurs in young animals from cat claw wound or dog bites and through other sources. Small rents in the lens capsule may spontaneously a seal through fibrous metaplasia of lens epithelia assisted by exudates from the uveal tract. Rents larger than 1.5 mm often cause progressive opacification of the lens and in the dog, generally associated with phacoelastic uveitis which results in vision threatening sequel. Prophylactic lensectomy has been recommended for lens capsule rents larger than 1.5 mm (Smith *et al.*, 1996). Cataracts are associated with chronic complication from exposure of the eye to the ionizing radiation (Jamieson *et al.*, 1991).

#### *Age related cataracts*

Cataracts are commonly seen in aged dogs, and they are often classified being “senile” or “age-related” if no other antecedent cause is apparent. The age of onset at which a cataract should be considered to be age related more than 6-8 years in dogs (Gelatt, 2000)

#### *Cataracts resulting from inflammation and lens associated inflammation*

The lens responds in non-specific fashion to contiguous inflammation (i.e. *Uveitis*) from any cause by developing a cataract. There is formation of synchiae to the anterior lens capsule, with the proliferation of fibrovascular membranes onto the surface (Gelatt, 2000).

## **DIAGNOSIS OF CANINE CATARACTS**

A complete evaluation of eye by Veterinary ophthalmologist will determine, if cataract surgery can help a pet. Surgery is generally recommended when the cataracts cause diminished vision, or for progressive cataracts where vision loss is anticipated. The surgical success rates for cataracts in the early stage are higher than for advanced cataracts that have been present for months to years (Gelatt, 2000).

#### *Ultrasound-a-scan*

There are numerous structural abnormalities in the posterior segment of eye that may complicate cataract surgery. The A-Scan measurement is most commonly used to measure the eye length to determine the intraocular lens, minute retinal detachment which is common with hypermature cataracts. So, retinopexy can be done with cataract surgery (Gilger, 2002).

#### *Gonioscopy*

Gonioscopy (“gonio—” means “angle”) is the examination of the iridocorneal drainage angle of the eyes. Aqueous humor is constantly secreted into the eye, and is constantly drained from the eyes through a sieve-like meshwork of tissue called the iridocorneal angle, or “drainage angle”. Gonioscopy is usually performed under light sedation, and a special contact lens called a goniolens is placed on the eye. The lens looks like a clear plastic mushroom. Then the ophthalmologist views the angle through the lens. The lens bends the light rays so the angle can be examined.

#### *Electroretinography*

Like other nervous tissue of the body, the retina generates electrical currents. The electroretinogram (ERG) is a measurement of electrical function that helps to determine the functioning of the rods and cones of the retina. ERG testing is essential in determining whether or not animals with cataracts have operable eyes. It is important to know if the retina is healthy prior to performing cataract surgery and ERG testing allows us to determine retinal health (Sims, 1999).

Electroretinography is a painless procedure that is performed under sedation or brief general anesthesia. In a darkened room, special electrodes are attached to the skin, and a special contact lens is placed on the eyes. Bright strobe lights are flashed into the eyes, and a waveform response then shows up on a computer screen. The height of the waveform is measured, and this value correlates to how well the retina is functioning (Sims, 1999).

## **MANAGEMENT OF CATARACTS**

#### *Clinical and medical treatment of cataracts*

Appropriate owner education regarding treatment of the visually impaired or blind dogs is an important role for clinician to undertake. Most blind dogs develop permanent behavioral change and are limited functionally. Common changes,

includes, a stay closer to the owner and a more caution approach to the environment. Sometimes it becomes difficult in recognizing the dog's impairment due to compensatory development of other senses. Obvious, safety precautions include adequate fencing or containment of the blind dogs when outdoors, minimal movement of furniture within the home, and limited access to stairs, decks or pools.

A variety of therapeutic agents that have been claimed to prevent, delay or even reverse cataracts are currently available and have studied in both humans and the dog. Therapies with topical or systemic selenium-vitamin E, superoxide dimutase, carnosine (a dipeptide antioxidant), or zinc citrate have been advocated for canine cataracts, though none has proved to be efficacious in controlled studies (Rajalakshami *et al.*, 2002).

#### *Surgical treatment of cataracts*

Surgical removal of cataract is a treatment of choice, if restoration of vision is desired. These surgeries are most frequently performed by veterinary ophthalmologists worldwide. Because of required training, operating microscope and microsurgical ophthalmic instruments, cataracts and lens removal is not performed by most veterinarians in clinical patients. As a results, careful selection of patients, practical knowledge of surgical procedures, well understanding of expected surgical results and complications are desired prior to *EYE SURGERY*.

#### *Preoperative medication and anaesthesia*

Before any intraocular procedure, medications administered to reduce existing, subclinical inflammation and to dilate the pupil. According to Gilger and Slatter (2002) the routine schedule followed cataract surgery is topical corticosteroids (dexamethasone), a topical non steroidal anti inflammatory drug, one or a combination of mydriatics (phenylephrine 2.5%) and topical antibiotics (dexacidin) are used before or at the day of operation. Atropine (1%) and for sure renal function, flunixin meglumine is administered intravenously @ 0.25 mg/kg immediately after anaesthetic induction. Systemic antibiotics and supportive drugs also used routinely.

General anaesthesia is required for intraocular surgery. The type of anaesthesia, drugs used, and dosages depend on the signalment and health status of the patient. Preanaesthetic medications frequently used are acepromazine, diazepam, and oxymorphone. Anaesthesia is induced by use of barbiturates and propofol. Use of ketamine or xylazine is not recommended because of possibility of raising intraocular pressure. Gas anaesthetic such as isoflurane, and oxygen are used to maintain the anaesthesia. Neuromuscular blockade is also strongly recommended for intraocular surgery. It has advantage of reducing the extraocular muscle tension and excellent globe positioning due to easy manipulation.

#### *Surgical techniques*

The four categories of surgical techniques have used routinely. They have their own advantages and disadvantages. They are:

- Intracapsular cataract extraction
- Extracapsular cataract extraction
- Phacofragmentation or discission and aspiration
- Phacoemulsion and aspiration

#### *Intracapsular cataract extraction*

Intracapsular cataract extraction is a cataract surgery technique that removes the entire lens and lens capsule. This technique is not commonly used for routine cataract extraction but may be used to remove a luxated lens. Increased inflammation and increased chance of glaucoma are common problems after this technique.

#### *Extracapsular cataract extraction*

Extracapsular cataract extraction is removal of the lens cortex and nucleus, leaving the lens capsule intact. In experienced hands, this is the successful surgical procedure in dogs.

#### *Phacofragmentation or discission and aspiration*

Phacofragmentation and aspiration technique is a type of extracapsular cataract extraction. With this technique a automatic machine is used to fragment and aspirate the lens out of the eye through a small corneal incision. at the same time anterior eye chamber is irrigated to keep it inflated. All these action of machine is controlled by the surgeon with the foot pedal. Advantage of this technique is cataract is removed through small incision, keeping the eye inflated throughout surgery and complete removal of lens fragments.

Selection of appropriate phacofragmentation and aspiration machine is critical in dogs. The machine must have a single port for irrigation, aspiration and fragmentation. The handpiece should have sufficient power to fragment the typically hard canine cataract (Gilger, 1997).

#### *Phacoemulsion and aspiration*

The anterior *Capsulectomy and Capsulorrhexis*, a perfect capsulorrhexis usually leads to a successful cataract procedure and allow easy insertion of intraocular lens. Capsulectomy is excision of a portion of capsule, and capsulorrhexis is rupture of lens capsule. The most commonly employed capsulorrhexis (sometime capsulorrhexis used to designate all procedure of anterior capsule removal) used before phacoemulsification (Seibel, 1993). A modification of this technique is to make a curvilinear incision beginning centrally and moving to the capsule periphery the “J” incision (Fine, 1991).

Phacoemulsification and aspiration technique is done in two fashions, the “*classic one handed*” and “*two handed*” techniques. In classic one handed, only one incision (no side port) into the anterior chamber is made, in which the phaco tip is inserted. However, two hands are used to control the handpiece. Most veterinary surgeons used modified technique in which one hand controls the phacofragmentation and aspiration handpiece and other hold the stabilization forceps.

#### *Intraocular lens implantation*

Synthetic intraocular lenses are used routinely in dogs to replace the cataractous lens. These are well tolerated by canine eye and allow the eye to be emmetropic after cataract extraction.

Numerous styles and materials are used in the construction of various types of lens, but until recently, the one piece polymethylmethacrylate in-the-bag intraocular lens has been used in the dogs most frequently. This intraocular lens has a modified C-loop haptic design with a 6- to 7-mm-diameter optic and a 16- to 18-mm haptic diameter. The standard power of canine lens is 41.5 diopters (Davidson, 1993). Through selection of patients, intraocular lenses help stabilize the internal structure of the eye (i.e., vitreous face, and iris) by filling space left by the removal of large canine lens. The presence of intraocular lens also may decrease the development and severity of capsular fibrosis, the most common complication after surgery.

#### *Postoperative treatment*

Treatment after surgery is aimed at diminishing intraocular inflammation, preventing infection and preventing intraocular adhesion by keeping the pupils mobile and dilated. Therefore, topical corticosteroids, mydriatics (atropine or topicamide) and antibiotics are commonly used after surgery for up to 4 to 6 weeks. In rare cases, when the inflammation is severe, systemic corticosteroids and antibiotics may also be used.

#### *Complications of untreated cataracts*

If cataract surgery is not performed, many canine cataracts will progress, eventually they may result in leakage of the lens protein and subsequent lens induced uveitis. By medical therapy spontaneous reabsorption of cataractous lens material occurs most frequently in younger dogs (Van der Woerd *et al.*, 1992). Uveitis may proceed to glaucoma and *phthisis bulbi* (Biros *et al.*, 2000). Hypermature cataracts may cause vitreous degeneration and retinal detachment, thus leading to complete loss of vision (Davidson, 1991; Van der Woerd *et al.*, 1992). Clinical visible changes in animal behavior are observed only after a loss of sufficient loss of transparency.

## **CONCLUSION**

On the above mentioned facts we can conclude that the ophthalmic infections is a

common diseases in canines. The cataracts is a very serious disorder but, its solution is very simple needs only the proper awareness of dog's owners and timely treatment. So, the extension of clinical services or conduction of informatory camps is necessary for dog's welfare.

Inspite of all development in eye surgery, veterinarians face lot of problems in eye surgery because of postoperative management but if the patient is evaluated timely and given by appropriate treatment, we can save the vision of a Now in our curriculum limitations are customize our exposure for the eye care, so only extracapsular cataract surgery done by limited hands of veterinarians with the great success rate.

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