EVALUATION AND MANAGEMENT OF GLAUCOMA IN DOGS

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DECLARATION

I hereby declare that the thesis entitled **"EVALUATION AND MANAGEMENT OF GLAUCOMA IN DOGS"** is a bonafide record of research work done by me during the course of research and that this thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

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CERTIFICATE

Certified that this thesis entitled **"EVALUATION AND MANAGEMENT OF GLAUCOMA IN DOGS"** is a record of research work done independently by **Priya.P** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

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EXTERNAL EXAMINER

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Introduction

INTRODUCTION

Glaucoma is one of leading causes of blindness in adult dogs. It is a complex group of diseases with an increased intraocular pressure(IOP) which damages the optic nerve head and retinal ganglion cells leading to irreversible blindness. It is often difficult to diagnose as clinical signs remain subtle in early days and most frequently identified only after loss of vision due to irreversible changes accompanied by an eye that is painful and cosmetically unacceptable. In animals the raised IOP is mainly due to a decrease in drainage of aqueous humor and not due to overproduction. Its incidence among dogs is 0.5% and certain breeds like American Cocker Spaniel and Basset Hound are having a high prevalence of > 5% (Gelatt and Mackay, 2004a and Gelatt, 1991).

Glaucoma is generally divided into primary, secondary and congenital. In primary glaucoma elevation in IOP occurs without concurrent ocular diseases. Primary glaucoma is a bilateral disease while secondary glaucoma may be a unilateral disease (Gelatt, 1991). Secondary glaucoma is characterized by concurrent ocular diseases associated with elevated IOP. Causes for secondary glaucoma are lens luxation and subluxation, uveitis, injury, infection, intraocular neoplasms, postsurgical cataract extraction etc. Congenital glaucoma is associated with anterior chamber anomalies. Based on the state of iridocorneal angle glaucoma can be divided into open angle and narrow angle glaucoma.

Clinical signs vary according to speed of onset of disease, severity of rise in IOP, the duration, the cause and age. Clinical signs are episcleral congestion, corneal edema, corneal vascularization, mydriasis, pain, buphthalmos, cupping of optic disc, atrophy of optic disc and loss of vision (Magrane, 1977).

The diagnosis is based on clinical signs and detection of elevated IOP by indentation tonometry or applanation tonometry. Gonioscopy provides information

of iridocorneal anomalies and hence permits the selection of best treatment for patient. Ophthalmoscopic examination reveals the fundic lesions associated with glaucoma.

Primary goal of treatment is to decrease the IOP to a safe level to protect optic nerve so that progressive visual impairment is prevented. Treatment consists of medical and surgical methods which decrease production or increase drainage of aqueous humor and sometimes both. Medical therapy consists of use of several categories of antiglaucoma drugs such as carbonic anhydrase enzyme inhibitors, sympathomimetics, adrenergic antagonists, miotics, hyperosmotic agents and prostaglandins.

Surgeries to correct glaucoma in eyes with potential vision are categorized into those which increase aqueous humor outflow and those decrease aqueous production. Surgical methods to improve drainage include iridectomy, iridencleisis, cyclodialysis, trabeculectomy, gonoimplants etc. and those to decrease production are cyclocryothermy, cyclodiathermy, cyclophotocoagulation etc. Medical treatment is useful in early management of glaucoma but the major disadvantages are their profound systemic side effects, tolerance in long term use, cost and difficulty in administration. Medical management often fails to give adequate reduction in IOP. Long term reduction of IOP requires surgical intervention. Unfortunately, glaucoma is often difficult to control even with surgery because a completely reliable surgical technique has not yet been evolved for dogs. A large number of techniques have been successful in man but several of these may have application in dogs.

Hence a comprehensive study was undertaken with the objective to study the clinical signs associated with glaucoma in dogs and to evaluate the effectiveness of both medical and surgical treatment protocols.

Review of Literature

2. REVIEW OF LITERATURE

2.1. AQUEOUS HUMOR DYNAMICS

Heywood and Street (1974) pointed that aqueous humor had low protein content and a lower concentration of glucose compared to serum.

Caprioli (1985) noted that the intraocular pressure was determined by relative rate of inflow of aqueous humor into the eye and its outflow, when these rates were balanced a steady state existed and IOP remained constant.

Gelatt (1991) stated that about 85-90% of exit of aqueous humor from the dog occurred through corneoscleral trabecular meshwork and rest by uveoscleral outflow pathway (about 10-15 %) posteriorly through the ciliary body.

Aqueous humor was produced at a relatively constant rate by the non pigmented epithelium of ciliary body through a combination of passive processes like diffusion, dialysis, ultra filtration and active transport involving the enzyme carbonic anhydrase (Cook, 1997).

Anterior chamber and posterior chamber of eye is filled with aqueous humor which is an ultra filtrate of plasma (Sansom, 2000).

Cunningham (2002) noted that aqueous humor, a transparent fluid fills the anterior ocular segment and its constant flow from ciliary body via anterior and posterior chambers to the trabecular and uveoscleral outflow pathway supplies the avascular cornea and lens with nutrients and removes the waste products, the rate of

aqueous humor formation was equal to the outflow so that IOP was maintained at a relatively constant level.

According to Grans *et al.* (2004) the rate of aqueous humor production was approximately 2.5 µl / min and outflow equaled its production in normal eye.

2.2. IRIDOCORNEAL ANGLE

The iridocorneal angle is that part of anterior chamber of the eye formed by the junction of iris with corneoscleral tunic at the anterior face of the ciliary body and it extends posterioly as a recess into ciliary body (Bedford, 1977b).

The trabecular meshwork which filled the ciliary cleft of iridocorneal angle posteriorly consisted of two parts an outer densely packed element which was closely applied to the inner scleral face and inner loosely arranged element arising specifically from the ciliary body. As fibers arose from both inner surface of sclera and outer surface of uveal tissue, this part is referred as uveoscleral meshwork (Bedford and Grierson 1986).

Accordine to Helper (1989) the filtration angle is a circular recess where cornea, sclera the ciliary border of iris and the ciliary body would meet, in which located the peculiar framework of trabeculae.

The iridocorneal angle of dogs was limited by the base of iris , the anterior part of the ciliary body, the anterior inner surface of sclera and the anterior of peripheral cornea and the pectinate ligaments spaned the anterior opening of the iridocorneal angle (Ekesten and Narfstrom,1991).

Cook (1997) reported that congenital malformation of iridocorneal angle characterized by continuous sheets of tissue bridging the area which was normally occupied by individual pectinate ligaments and this type was found in Basset hound dogs.

2.3. GLAUCOMA

Bedford (1977a) stated that collapse of ciliary cleft and trabecular meshwork within iridocorneal angle, together with subsequent formation of peripheral anterior syncheia resulted in the maintenance of glaucomatous state.

Gelatt (1991) defined glaucoma as a group of diseases with the common feature of progressive death of retinal ganglion cells and their axons.

Glaucoma is an elevation of intraocular pressure sufficient to damage the optic nerve and produce temporary or permanent blindness (Gionfriddo, 1995).

According to Bath and Dua (2006) in dogs with glaucoma an increase of 20-100% increase in IOP was observed resulting in decreased visual acuity.

2.3.1. Incidence

According to Gelatt and Mackay (2004a) the prevalence of glaucoma in North America was 0.89 % of which highest prevalence was shown by American cocker spaniel 5.52%.The females were more affected compared to males.

According to Gelatt and Mackay (2004b) the prevalence of secondary glaucoma in North America as on 2003 was 0.89%. Secondary glaucomas associated with cataract formation were more than half of total secondary glaucoma.

Kallberg *et al.* (2007) reported that dogs had the highest frequency of primary glaucoma of all animals.

2.3.2. Age

In majority of the breeds of dogs presented with glaucoma were at an average age of six years (Gelatt *et al.* 2003).

In a study conducted in human beings Krupin (2005) observed the occurrence of low pressure glaucoma in older patients.

Crispin *et al.* (2008) observed that age at which glaucoma develops varied with breeds of dogs but the disease was mostly of middle age and the presentation was often acute and painful.

According to Palmer (2008) dogs from ages 4-9 years were most susceptible to primary glaucoma.

2.3.3. Sex

Slater and Erb (1986) reported that the female dogs were at twice the risk of male dogs in development of glaucoma .

Cottrell and Barnett (1988) observed in a study of twenty eight cases of primary glaucoma that female dogs were more affected with glaucoma than male dogs i.e., in the ratio of 2.4:1.

2.3.4. Breeds

According to Slater and Erb (1986) the breeds predisposed to glaucoma were Basset Hounds, Beagle, Boston Terrier, Cocker Spaniel, Dalmatian, Miniature Poodle, Norwegian Elkhound and Siberian Husky.

Dog breeds such as American and English Cocker Spaniels, English and Welsh Springer Spaniels, Basset Hounds, Beagles, Chow Chow, Dalmatians etc were susceptible to primary glaucoma and breeds such as Terriers, Cocker Spaniels etc. were susceptible to secondary glaucoma (Palmer, 2008).

2.3.5. Classification

According to Smedes and Dubielzig (1994) glaucoma could be classified as primary or secondary, acute or chronic and open angle or closed angle.

According to Cook (1997) glaucoma might be classified as either primary or secondary to other ocular diseases. Sub classification of primary glaucoma generally referred to the anatomic configuration of the iridocorneal angel as viewed by gonioscopy: open, narrow or congenital goniodysgenesis.

Deehr and Dubielzig (1998) classified glaucoma by etiology as primary which was a heritable and breed related disease with bilateral potential and secondary glaucoma which was due to a pre existing or concomitant ocular or

systemic disease that appeared to be responsible for an alteration in aqueous humor dynamics.

Spiess *et al.* (1998) reported that congenital glaucoma was associated with variable degrees of goniodysgenesis or could be result of an intrauterine inflammatory disease.

2.3.6. Etiology

As per Magrane (1977) causes of secondary glaucoma were subluxation and luxaton of lens, uveitis, iris atrophy, injury and infection, postsurgical, lenticular intumescence, hypermature cataract and spontaneous lens capsule rupture, intraocular neoplasm etc.

In inflammatory condition of eyes the inflammatory cells migrated into anterior chamber and their presence in iridocorneal angle physically obstructed the outflow pathways leading to an elevated intraocular pressure (Peiffer and Gelatt 1980).

Gelatt (1981) opined that intumescent cataracts produced glaucoma with enlargement of lens capsule which displaced the iris or ciliary body forward causing narrowing of iridocorneal angle.

Johnson and Miller (1990) reported that fungal diseases could cause uveitis via haematogenous route and secondary glaucoma was a frequent complication noticed in dogs.

Ekesten and Narfstrom (1991) observed that the intraocular pressure was significantly higher in eyes with closed iridocorneal angles than in eyes with any other width of the angle.

Sansom *et al.* (1994) during a study in cats found that vitreal hemorrhage and hyphema due to systemic hypertension could cause secondary glaucoma.

Cook (1997) opined that secondary lens luxation associated with glaucoma was usually posterior and incomplete resulting in an aphakic crescent within a fixed and dilated pupil.

According to Deehr and Dubielzig (1998) iridociliary cysts could cause glaucoma by mechanical displacement of iris anteriorly by the iris cyst which narrow or close the iridocorneal angle via a posterior pushing mechanism or the cysts or membranes and syncheia caused by the cysts prevented the aqueous humor from the posterior chamber into the anterior chamber creating pupillary block glaucoma.

According to Spiess *et al.* (1998) ciliary body cyst could cause glaucoma by forward displacement of iris by the cyst and also by formation of preiridal fibrovascular membrane obstructing normal aqueous outflow.

Gionfriddo and Powel (2001) pointed that most common cause of elevated IOP was a primary or secondary iridocorneal abnormality and the primary risk factor of optic nerve damage was elevated IOP.

According to Woerdt (2001) progressive narrowing of iridocorneal angle with consolidation of pectinate ligaments into solid sheets of tissue eventually led to inadequate outflow of aqueous humor and subsequent rise in intraocular pressure.

Primary glaucoma could result in secondary lens luxation and also primary lens luxation could cause secondary glaucoma.

Bjerkas *et al.* (2002) opined that the pectinate ligament dysplasia and narrowing of the iridocorneal angle considered as predictors of glaucoma in certain breeds of dogs. Narrowing of width of opening of ciliary cleft was noted with increasing age could be due to an age related increase in size of lens or due to increase in thickness of Descemet's membrane with age.

Gelatt and Mackay (2004b) pointed that secondary glaucomas could also occur with drugs, diseases, corneal and scleral inflammation, uveitis, trauma and following ocular surgeries.

According to Kallberg *et al.* (2007) etiology of primary glaucoma could be of multifactorial of which mechanical, vascular and other factors may influence individual susceptibility to optic nerve damage.

Primary intraocular diseases or disorders such as anterior lens luxation anterior uveitis, trauma, hyphema, retinal detachment, intraocular neoplasia, periridial fibrovascular membrane formation, or pupillary block resulted in secondary glaucoma and might be unilateral or bilateral based on the primary disease (Palmer, 2008).

2.3.7. Pathogenesis

Peiffer and Gelatt (1980) found the iridocorneal angle open and devoid of congenital abnormalities at the onset of increased intraocular pressure. The iridocorneal angle gradually closed in affected Beagles about 2- 4 hrs after elevation

of intraocular pressure, optic nerve head cupping and atrophy and loss of vision occurred as disease progressed.

Dice (1981) concluded that corneal ooedema was brought about by a breach in the continuity of epithelium or endothelium often by increased intraocular pressure and endothelial decompensation.

MC Laughlin *et al.* (1987) observed neovascularisation of cornea in a glaucomatous Basset hound dog and also observed retinal degeneration characterized by hyper reflectivity of tapetum and attenuation of retinal vessels in the fundus of a cat with glaucoma.

Smedes and Dubielzig (1994) observed on histopathology of glaucomatous canine globe the outflow apparatus including the trabecular meshwork and scleral venous plexus were all distorted and in later stages of disease there was severe atrophy of filtration apparatus and these changes could result in decreased aqueous outflow regardless of whether the changes were primary or secondary.

Smith *et al.* (1996) pointed out that sustained increase in the intraocular pressure altered the neural, glial, supportive and vascular elements of retina and optic nerve head.

Brooks *et al.* (1997) opined that glutamate concentration was potentially toxic to retinal ganglion cells also and attributed to the pathogenesis of primary glaucoma in dogs.

The ischemia produced by increased pressure could lead to ganglion cell and optic nerve death secondary to glutamate mediated excitotoxicity, neurotrophin

deprivation, accumulation of intraneuronal calcium and oxygen free radical formation (Dreyer, 1998).

Abrams (2001) pointed out that increased pressure exerted its effect on optic nerve head resulting in mechanical destruction of neurons of which smaller nerve fibers are damaged first in glaucoma.

Chronic elevation of intra ocular pressure resulted in slow deterioration of all layers of retina, loss of myelin around the optic nerve and enlargement of globe with deterioration of lens zonules which represented as buphthalmos with lens luxation clinically (Woerdt, 2001).

Haneselman (2002) observed the pathological changes attributable to chronically elevated IOP in melanocytic glaucoma in a cairn terrier were observed in retina, optic disc and optic nerve.

Gelatt *et al.* (2003) found in a study conducted in Beagles with primary open angle glaucoma as the IOP increased the blood flow velocities of vortex and ophthalmic veins were decreased.

According to the Grans *et al.* (2004) breed of the dog, gonioscopy and intraocular examination could help the clinician to diagnose whether glaucoma occurred secondary to lens luxation or luxation occurred secondary to glaucoma. Also with sustained glaucoma the iris sphincter muscle failed to contract and resulted in pupillary dilation and also interfered with function of corneal endothelium which led to diffuse corneal oedema.

Mcllnay *et al.* (2004) reported that in glaucoma elevated intraocular pressure inhibited the transport of neurotrophic factors by axons of optic nerve and contributed to loss of ganglion cells by apoptosis. Ischemia found in glaucoma led to release of neurotoxic glutamate causing progressive damage in neighboring cells of retina.

Mitchell *et al.* (2005) in a study of retinal vessel diameter and open angle glaucoma observed generalized retinal arteriolar narrowing in open angle glaucoma which might be associated with optic nerve damage.

Endothelin and nitricoxide increased significantly in aqueous humor and vitreous humor in naturally occurring glaucoma (Kallberg *et al.* 2007).

Mangan *et al.* (2007) found disruptions of retinal pigment epithelium, increased permeability of vascular endothelium, accumulation of inflammatory cells and retinal swelling or thinning in canine primary glaucoma. The displacement of pigment and accumulation of inflammatory cells in neuroretina suggested inflammation might be an important contributor to retinal damage.

According to Palmer (2008) detrimental elevation of intraocular pressure disrupted the axoplasmic flow and altered the blood flow to optic nerve and retina leading to irreversible damage in 24 to 48 hrs and resulted in permanent loss of vision.

Axonal injury caused by increased IOP resulted in ganglion cell apoptosis and in generation of reactive oxygen species it contributed to the death of previously undamaged ganglion cells (Williams, 2008).

2.3.8. Clinical signs

According to Magrane (1977) the normal canine cornea should be clear, transparent and with no visible blood vessels. Once the cornea had become vasularized, the vessels remained through out the life . When conjunctival vessels become injected , a mild degree of chemosis might accompany the change in vessels and when pressure is restored to normal, the vessels would return to their normal size..

Bedford (1980b) noted that the angle closure glaucoma was common compared to the open angle glaucoma in dogs. Also observed that most of lens luxations were anterior and produced glaucoma, in which blepharospasm, photophobia, lacrimation, dense corneal oedema, defective vision, episcleral and bulbar conjunctival congestion were present.

Gelatt (1981) said that the effects of elevated IOP in dogs varied with age of animal, duration and levels of IOP. The young dogs rapidly developed buphthalmia, which was reversible and tend to protect the vital retina and optic disc from the elevated IOP for a short period of time. He also noticed that corneal changes associated with glaucoma were influenced by the rapidity, duration and extent of elevated IOP. The corneal changes included pigmentation and ruptures in descemet's membrane which produced focal irregular areas of oedema. Corneal oedema associated with glaucoma would disappear with in hours after IOP normalization.

Primary glaucoma in advanced stages was often accompanied by opacities of lens considered as secondary forms of glaucoma (Barnett, 1985).

Moller *et al.* (1985) observed aqueous flare, corneal vascularization oedema and epiphora on ophthalmic examination and on ophthalmoscopic examination revealed profound retinal degeneration characterized by tapetal hyperreflectivity, vascular attenuation and atrophy of optic disc.

Bedford (1988) observed clinical signs such as blepharospasm, excessive lacrimation, episcleral congestion and moderate corneal oedema in a dog with glaucoma.

According to Cottrell and Barnett (1988) the ultimate results of sustained high pressure were stretching of scleral units, enlargement of eye, cupping of optic disc, pressure atrophy of retina and eventual blindness. Finally hypotony due to atrophy of ciliary apparatus and phthisis bulbi might be the final outcome.

Sansom (1988) opined that purulent ocular discharge indicated a bacterial infection. Serous discharge might be due to viral or non pyogenic bacterial infection.

According to Helper (1989) clinical signs observed were pain, cloudy cornea, insensitive cornea, shallow anterior chamber, dilatation of pupil, episcleral vascularization, loss of vision, buphthalmos, cupping of optic disc, atrophy of optic disc and iris atrophy. Full dilatation of pupil in early stage of glaucoma could give the eye an appearance of enlargement. A persistent dilatation might be a symptom of glaucoma in dog especially when it is unilateral. Cupping of optic disc was not an early finding but could be readily seen in blind clear glaucomatous eye. Pain in the eye was demonstrated by squinting the affected eye, especially in bright light, lacrimation and by an altered eating habits and also by general lethargy.

According to Gionfriddo (1995) clinical signs such as corneal oedema, mydriasis, lens luxation, optic disc cupping, retinal changes, blindness etc and generalized corneal oedema were noticed in both acute and chronic cases glaucoma in dogs.

According to Gelatt (1997) a dilated pupil could indicate glaucoma or optic neuritis. Buphthalmos developed in dogs with intraocular pressure of 40 mm of Hg or higher or over a few years when IOP about 30mm of Hg.

According to Spiess *et al.* (1998) clinical signs of glaucoma were corneal opacity, enlarged globe, dilated pupil, red and painful eyes. The histopathology of enucleated glaucomatous globe showed atrophy of ciliary body, degeneration of inner retinal layers and cupping of optic papillae.

The classical presentation of glaucoma and uveitis was the red painful eye. Low grade uveitis in the form of anterior chamber flare frequently accompanied acute glaucoma due to break down in the blood occular barrier that occured with an increase in intraocular pressure. Secondary glaucoma showed the presence of syncheia, iris bombe and a subluxated or luxated lens with cataract formation (Sansom, 2000).

Hasegawa *et al.* (2001) found retinal vessel attenuation, hyper reflective tapetum and pale optic disc in a bilateral glaucoma. The presence of fibrin and flare in anterior chamber in glaucoma could be associated with uveitis.

According to Woerdt (2001) signs of general discomfort, lethargy and anorexia accompanied acute glaucoma and other clinical signs included decreased menace response, conjunctival and episcleral hyperemia, corneal ooedema and a

mydriatic and non responsive pupil. In chronic cases buphthalmos was present and corneal ooedema was less pronounced.

Miller (2003) observed mild degrees of aqueous flare in the anterior chamber of dogs with glaucoma.

Sandt *et al.* (2003) reported that the optic nerve and the retina had the capacity to temporarily adapt to an initially gradual rise in intraocular pressure by changes in their perfusion, thus preventing severe ischemia and vision loss.

Clinical signs varied from vision loss, corneal oedema, mydriasis and episcleral congestion in glaucoma and the mild elevations in IOP caused no observable clinical signs. (Mughannam *et al.* 2004).

Bath and Dua (2006) observed no visible changes in palpebral and bulbar conjunctiva of dogs with glaucoma.

Grozdanic (2007) observed in a study of canine retina and optic nerve function in elevated IOP that canine retina had the capacity to recover at least some visual function even at 14 days after acute elevation of IOP.

Observations noted by the owner in glaucomatous dogs were enlarged globe, red or cloudy eye, serous to seromucoid ocular discharge, subtle signs such as sleeping more etc. Palmer (2008).

2.3.9. Reflexes

According to Magrane (1977) the pupillary light reflex was helpful in determining optic nerve and retinal function. The direct and indirect reflexes were recorded as normal, sluggish, incomplete, sluggish and incomplete or absent.

Gelatt (1997) reported that in glaucoma with high pressure the pupillary light reflex remained absent or slow and positive menace reflex was demonstrated by blinking of eyes which required an intact visual cortex.

Felchle and Urbanz (2001) while examining the anterior segment of the eye in small animals concluded that pupillary light reflex test evaluate the function of retina, optic nerve and the iris sphincter muscle.

Bath and Dua (2006) graded the corneal, palpebral and pupillary reflexes as strong (++), weak (+) and absent (0) in a study conducted in nine clinical cases of glaucoma in dogs.

According to Grozdanic (2007) the glaucomatous dogs with complete absence of menace, dazzle and pupillary light reflex responses could recover some visual function days or weeks after occurrence of glaucomatous attack .

2.3.10. Haematology

According to Schalm *et al.*(2000) normal values of various haematological parameters such as total leukocyte count might be, neutrophils 60-77% (av 70%), band cells 0-3% (av 0.8%), lymphocytes 12-30% (av 20%), monocytes 3-10% (av 5.2%), eosinophils 2- 10% (av 4.0%) and basophils rare. Haemoglobin concentration

between 12 and 18 g/dl (av 14.9g/dl) and packed cell volume 37 -55 v% (av 45.54%).

Hanselman (2002) observed that thrombocytosis was the only significant abnormality in complete blood count in case of melanocytic glaucoma.

The normal blood pressure readings in dogs range from 110-90 in systolic and 55-110 mm of Hg in diastolic blood pressure (Turner, 2005).

Bath and Dua (2006) observed in a study of glaucoma in dogs the mean haemtological values were within normal physiological range.

Palmer (2008) noticed that complete blood count values were in normal range in most of the cases with glaucoma in dogs.

2.3.11. Diagnosis

According to Bedford (1977) Gonioscopy is the examination of iridocorneal angle of eye using a corneal contact lens and gonioscopic examination of the eye had paramount importance in the differential diagnosis of glaucoma and the institution of indicated therapy.

Magrane (1977) found tonometry useful in the early detection of glaucoma, following surgical procedures or medicinal treatment for correction of glaucoma and also for a check on the unaffected eye in glaucoma patients. The normal intraocular pressure in dogs varied between 15 and 30 mm of Hg.

Bedford (1988) found superficial retinal blood vessel attenuation on ophthlamoscopic examination of fundus in a glaucomatous canine eye.

Diagnosis of glaucoma should be based on clinical signs and detection of elevated IOP by tonometry. Schioetz tonometer measured the IOP by determining how far the cornea could be intended by a sliding probe in shaft of instrument. Tonopen tonometer measured IOP by determining the amount of force needed to flatten a specific area of cornea and was accurate compared to schioetz tonometer (Gionfriddo, 1995).

Gelatt (1997) opined that posterior vitreous and ocular fundi could be observed by indirect and direct ophthalmoscopy in dogs.

Ultrasound biomicroscopy provides cross-sectional information of iridocorneal angle and yield information regarding pathogenesis and prognosis of and preferred management approaches to glaucoma, thus useful as a predictor of glaucoma or to diagnose the early stages of glaucoma. (Gibson *et al.* 1998).

Abrams (2001) reported that iridocorneal angle could be evaluated by gonioscopy which involved the placement of a specific goniolens to change the apparent curvature of light rays entering eye to facilitate viewing of iridocorneal angle.

Felchle and Urbanz (2001) pointed out that distant ophthalmic examination helped in assessing patient's ability to navigate in an unfamiliar environment and evaluate patient's mentation, eye and head symmetry, and degree of ocular discomfort. Focal illumination, head loup for magnification, direct ophthalmoscopy, fluorescein staining, Schirmer tear test and tonometry were the suggested modalities

for ophthalmic examination. Ocular involvement might indicate systemic diseases, so a general physical examination should precede the ophthalmic examination.

The diagnosis of glaucoma in dogs and cats could be confirmed by measuring the IOP (Woerdt, 2001).

According to Mughannam *et al.* (2004) the range of normal IOP in puppies and the adult dogs were the same and not found any sustained elevation of IOP during maturation.

Broadwater *et al.* (2008) performed measurement of IOP in routine ophthalmic examinations because its values were important indicators of ocular health and diseased states

Crispin *et al.* (2008) opined that gonioscopy could be used as a method of screening to identify animals predisposed to glaucoma before disease made appearance. Routine Gonioscopy could be performed at five to six months of age in most breeds.

2.4. MANAGEMENT

According to Cook (1997) medical treatment might be of value in early management of glaucoma, long term reduction of IOP nearly always required surgical intervention.

Miller (2003) stated that the primary goal in treatment for all forms of glaucoma was to reduce the IOP to a safer level so that progressive visual impairement could no longer occur.

2.4.1. Medical

Carbonic anhydrase inhibition reduced the aqueous production dramatically but in insufficiency of iridocorneal angle drainage the effect lasted for a short time (Bedford, 1977a).

According to Bedford (1980a) medical therapy could be used as a preoperative requisite in surgery and also in attempted long term control of glaucoma. The medical suppression of elevated IOP could be obtained by three types of drugs the aqueous formation suppressors , the miotics and the hyperosmotic agents. The carbonic anhydrase inhibition could result in 40- 60% suppression of production process and occured within two hours of the oral administration of carbonic anhydrase enzyme inhibitors.

Gelatt (1981) reported the use of carbonic anhydrase inhibitors for both short term and long term management of canine glaucoma and administered two or three times daily.

Medical therapy to restore ocular normotension was based on attempts to reopen the iridocorneal angle by miosis and suppression of aqueous humor, proved ineffective in long term therapy in dogs as studied by Bedford (1988).

Sansom (1998) reported that in severe ocular infections both systemic and topical treatments were essential. An established intraocular infection was difficult to treat due to the blood ocular barrier and absence of lymphatics.

Wilkie and Latimer (1991) noticed that topical administration of timolol maleate resulted in reduction of IOP and pupil diameter in treated and contra lateral

eyes. Also bilateral miosis and relative bradycardia resulted from the systemic uptake because of inhibitory effects of drug on beta adrenergic fibers in canine iris sphincter muscle and those within cardiovascular system.

According to Gionfriddo (1995) oral carbonic anhydrase enzyme inhibitors decreased the production of aqueous humor by up to 50 % and substantially lowered intraocular pressure.

Hasegawa *et al.* (2001) reported that lower IOP could be maintained with medical therapy alone for a long period in dogs with open angle glaucoma.

The common side effects of orally administered carbonic anhydrase inhibitors were metabolic acidosis, excessive panting, gastrointestinal upset, lethargy etc and would disappear 12-24 hrs after discontinuation of drug (Woerdt, 2001).

Willis *et al.* (2002) reported that topical carbonic anhydrase inhibitors reduced IOP without significant systemic side effects compared to the orally administered one in glaucoma.

Maehara *et al.* (2004) observed that topical application of Timolol maleate decreased pulse rate and blood pressure significantly until the end of study period in glaucomatous patients. These systemic side effects were low when nipradilol a α, β antagonist was used. It reduced the IOP by decreasing production and also increasing the uveoscleral outflow.

According to Willis (2004) the medications used in management of glaucoma were categorized by their basic mechanism of action into drugs that reduced production of aqueous humor, those increased outflow without affecting production

and those induce alteration of both pathways of ocular fluid dynamics. He also reported that dosing of 0.5% timolol was typically every 8 -12 hrs in dogs and suggested that it would be appropriate to consider using 0.25% timolol in dogs and cats with weight less than 25 lb and the 0.5% concentrations in dogs weighing greater than 25 lb. The common side effects of timolol maleate were cardiac arrhythmias, heart block, bradycardia, bronchospasm etc.

Mandell and Holt (2005) pointed that gastro intestinal signs, panting and disorientation were frequently noted following the oral administration of carbonic anhydrase enzyme inhibitors because of presence of carbonic anhydrase enzyme in the nephrons of the kidney and erythrocytes.

Turner (2005) reported that carbonic anhydrase enzyme inhibitors reduced the production of aqueous humor by preventing the formation of bicarbonate ions from water and carbondioxide in epithelium of ciliary processes. By reducing the production of bicarbonate ions, less water passed into posterior chamber thus lowering the IOP.

Bath and Dua (2006) opined that treatment with carbonic anhydrase enzyme inhibitors in canine glaucoma was effective as maintenance therapy and not as permanent cure.

Topical betablockers administered in every 8-12 hrs in glaucoma decreased production of aqueous humor and thereby IOP (Townsend, 2007).

Palmer (2008) found that topical sympatholytics such as timolol maleate acted via decreasing the active production of aqueous humor and by increasing the

outflow via miosis and the common side effects noticed were bradycardia and bronchoconstriction.

2.4.2. Surgical

According to Magrane (1977) good signs of successful glaucoma surgery included clearing of a cloudy cornea, less congestion in blood vessels of conjunctiva and episclera, pupil normal or near normal and buphthalmia checked or reduction in globe size.

Bedford (1977) said that the basic operative principle was either to reopen the normal physiological drainage pathway or to create an egress to the subconjunctival tissues or to the suprachoroidal lymph spaces.

Bedford (1980a) had divided the surgical therapy into three such as techniques which reduced the aqueous production, which opened the closed ciliary cleft and those techniques which produced alternative outflow pathway.

Cunningham (1986) observed that ketamine when combined with a benzodiazepine, decreased the intraocular pressure when used for intraocular surgery.

Roberts *et al.*, (1986) collected specimens for bacterial culture from the conjunctival, corneal and eyelid margins of 38 dogs after disinfecting the eye with povidone-iodine or 0.9% sodium chloride solution. Povidone-iodine concentrations of 1:2, 1:10, 1:50 and 1:100 were used. It was concluded that 1:50 povidone-iodine solution was effective in eliminating bacterial contamination of the external ocular tissue without tissue reaction.

According to Bedford (1989) the surgical alternative to attempted control through the reduced aqueous production was the improvement of out flow either by reducing the resistance to aqueous drainage through defective ciliary cleft or by completely bypassing the iridocorneal angle.

Collins *et al.*, (1995) described the effect of anaesthetic drugs in ocular patients. The potential benefit of anticholinergic treatment was prevention or reversal of oculocardiac reflex. In ketamine administration the palpebrae remained open, globe was centrally positioned and the palpebral and corneal reflex persisted. Diazepam reduced the ketamine induced increase in IOP. Topically administered anaesthetic may be irritating and can cause transient conjunctival hyperemia.

According to Herring (2003) maintenance of physical integrity, clarity, shape and curvature of cornea were the desirable goals of corneal surgery**.**

Fine *et al.* (2004) used bipolar diathermy to control hemorrhages within anterior chamber during intraocular surgery. He also found that moderate hyphema resolved without permanent sequelae.

Morgan (2004) described the steps for preparation of eyelid surgeries

2.4.2.1. Iridectomy

The principle of iridectomy in treatment of glaucoma was to reopen the filtration angle (Stallard, 1973).

Bedford (1977a) observed that in corneoscleral trephination with peripheral iridectomy the intraocular pressure remained normal in absence of an obvious bleb formation.

Magrane (1977) said that in primary glaucoma the basal (iris root) iridectomy could re-establish circulation to the trabeculum.

Bedford (1980a) reported that a peripheral iridectomy was necessary to prevent the occlusion of the drainage channel in the event of a forward displacement of the iris.

Gelatt (1991) observed the complications such as hyphema, iridocyclitis and presence of fibrin in anterior chamber following complete or peripheral iridectomy.

Wikie (2002) minimized the haemorrhage during iridectomy by the use of epinephrine (1:10,000) and electrocautery.

Hollingsworth (2003) suggested that while suturing the corneal wounds corneal sutures should not pass through the entire thickness of cornea.

2.4.2.2. Trabeculectomy

Ridgway *et al.* (1972) observed the post operative complications in trabeculectomy such as hyphema with average duration of 6.2 days, choroidal effusions, peripheral anterior synechiae and hypotony. Most of the eyes developed external drainage blebs.

Shuster *et al.* (1984) reported that the fornix based conjunctival flap was easier to perform, provided better surgical exposure and was easier to close than the limbus based flap. Also the fornix based conjunctival flap eliminated posterior conjunctival scarring that could delimit the future bleb.

Migdal *et al.* (1994)reported that when trabeculectomy performed as the primary treatment of glaucoma, a successful lowering of IOP was reported to occur in 98% of cases.

Das *et al.* (2001) done a small incision trabeculectomy in which, incision was made in between the insertion of conjunctiva and Tenon's capsule and minimized fibrosis at the level of episclera and subconjunctival space. He also coined that the electrocautery usage could act as a stimuli for post operative scarring.

Ehrnrooth *et al.* (2002) concluded that IOP reducing effect of trabeculectomy decreased gradually over years.

Das *et al.* (2004) pointed that wound healing following trabeculectomy limited its success because of scarring of conjunctiva, Tenon's capsule and episcleral interface. Small incision trabeculectomy had advantage over trabeculectomy with adjunctive metabolites included use of small incision avoiding Tenon's capsule dissection and minimal use of cauterization which would induce scarring and subsequent fistula failure. The complications noted in trabeculectomy were subconjunctival haemorrhage, intraoperative conjunctival button holing, hyphaema and cataract progression.

According to Sihota *et al.* (2004) trabeculectomy without pharmacological modulation had a good success rate for adult primary glaucomas. A progression of lens opacification was seen in older patients.

Stalmans *et al.* (2006) observed that fornix based conjunctival flap resulted in good visualization of the surgical field and allowed the aqueous humor to drain posteriorly promoting the formation of a diffuse bleb.

Crowston (2008) reported that in trabeculectomy post operative scar formation in the subconjunctival tissues could lead to an inadequate IOP lowering and surgical failure.

2.5. POSTOPERATIVE COMPLICATIONS

According to Stallard (1973) the complications of glaucoma surgery were hemorrhage, uveitis, iris prolapse, delayed reformation of anterior chamber, infection, hypotension, cataract lens dislocation etc.

Magrane (1977) observed that the clot following hyphema during intraocular surgery usually resolved in 14 - 21 days.

Shuster *et al.* (1984) observed a small percentage of hyphema had occurred in a few eyes following trabeculectomy and cleared spontaneously in all eyes. The aqueous leak from the conjunctival suture site can occur with fornix based flap these leakages are transient and would resolve spontaneously.

The post operative complications noted after the placement of anterior chamber implants were oedematous swelling and bruising of conjunctiva and eyelids

which lasted for less than five days and within 24 hrs varying amounts of exudates was found in the anterior chamber (Bedford, 1989).

Gionfriddo and Powell (2001) reported that the fibrin clots formed in the anterior chamber during intraocular surgery could produce synechiae and subsequent glaucoma.

2.6. PROGNOSIS

According to Cook (1997) prognosis of vision after medical treatment could be assessed by evaluating the pupillary light responses and return of menace responses after treatment.

The prognosis of vision in acute glaucoma depends on factors such as duration of clinical signs prior to presentation, the breed of dog affected and response to initial treatment (Woerdt, 2001).

Mandell and Holt (2005) reported that despite aggressive therapy long term prognosis for a dog with primary glaucoma was poor.

According to Palmer (2008) secondary degeneration of axons and retinal ganglional cells which continued for several hours or days even if IOP was controlled had an important part in glaucomatous neuropathy in dogs.

Materials and Methods

3. MATERIALS AND METHODS

The study was conducted in eight dogs of different age, breed and sex presented to Veterinary College Hospitals at Mannuthy and Kokkalai. All the dogs presented with ophthalmological complaints were thoroughly examined and IOP was taken in suspected cases and eight dogs with elevated IOP were selected for the study.

3.1. SELECTION OF CASES

Bilateral cases in medical management were considered as a single case and those in surgical management was considered as two cases. Thus nine cases were selected for the study and were serially numbered from I – IX. Case Nos. I, II, III, VIII and IX were subjected to medical treatment. Chronic cases refractory to medical treatment were subjected to surgical treatment and were numbered as IV, V, VI, VII. The observations were made on third, seventh, twenty first, thirty fifth and sixtieth day to study the effectiveness of treatment.

3.2. MEDICAL MANAGEMENT

The medical management consisted of oral administration of carbonic anhydrase enzyme inhibitors at dose rate of 10-30mg/kg bodyweight twice daily (acetazolamide[1]) and ocular instillation of beta blockers (timolol maleate[2]) twice daily. Topical antibiotic eyedrops (ciprofloxacin[3]) and antiinflammatory agents (flurbiprofen[4]) were also given in the cases where an infection and pain suspected.

1. Diamox, (250 mg tablets), Wyeth Ltd, Worli, Mumbai
2. Appatim (0.5%), Appasamy Ocular Devices Pvt. Ltd, Pondichery
3. Ciplox eye drops (0.3%), Cipla Ltd, Verna, Goa
4. Flur (0.03%), Nicholas Piramal, Dhar, Madhya Pradesh

3.3. SURGICAL TREATMENT

All the surgical treatments were performed under general anaesthesia with standard operative preparation.

3.3.1. Preoperative Preparation

Solid food was withheld for 12 hours and liquid food for four hours before surgery in all the cases. The antibiotic eyedrops (polymyxin-chloramphenicol[5]) was instilled for three days prior to surgery.

On the day of surgery affected eye was thoroughly irrigated with normal saline solution and the periocular area was cleaned with sterile cotton to remove accumulated ocular discharge, dirt and tissue debris. The eyelashes were clipped close to palpebral border. The area around the eye was thoroughly scrubbed with povidone iodine solution. The eye was again irrigated with sterile normal saline and then instilled a few drops of povidone iodine[6] (5% w/v) ophthalmic solution.

3.3.2. Anaesthesia

All the dogs were premedicated before the induction of general anaesthesia. Atropine sulphate[7] at the dose rate of 0.045 mg/kg body weight was administered intramuscularly followed by xylazine hydrochloride[8] at the rate of 1.5 mg/kg bodyweight. Anaesthesia was induced with ketamine hydrochloride[9] at the rate of 5 mg/kg given intramuscularly after fifteen minutes of xylazine administration.

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6. Apidine-5 (5% w/v), Appasamy Ocular Devices Pvt. Ltd, Pondichery
7. Atropine sulphate injection, (0.6 mg/ml), Mount Mettur Pharmaceuticals Ltd, India
8. Xylaxin, Indian Immunologicals Ltd (20mg/ml), Andrapradesh
9. Ketmin 50, Themis Medicare Ltd, Mumbai

Anaesthesia was maintained using a combination of equal volumes of xylazine and ketamine along with diazepam[10] at the rate of 0.5mg/kg bodyweight administered to effect.

General anaesthesia was induced in a similar manner on the day of suture removal. On all other occasions cornea was anaesthetized with instillation of lignocaine hydrochloride (4%)[11] solution.

3.3.3. Surgical Technique

All the surgical procedures were conducted with help of an operating microscope[12] with magnification of 1.5 x.

3.3.3.1. Iridectomy

The dog was positioned in lateral recumbency with affected eye above and was draped surgically. Using 4/0 silk stay sutures were taken through the bulbar conjunctiva to fix the eyeball. The eyelids were kept retracted with help of an eye speculum. A clear corneal incision was put on the cornea using number 11 B P blade close to the limbus at 12 o clock position. The corneal incision was extended using Castroviejo corneal scissors. A Collibri forceps was introduced in to the anterior chamber and grasped iris beyond its base and pulled just far enough into the wound. Using iris scissors, excised a portion of iris base avoiding cutting of iris sphincter. Collapsed anterior chamber after corneal incision, due to aqueous leakage was reinflated with visco- elastic material (hydroxyl propyl methyl cellulose[13]).

10. Calmpose injection, Ranbaxy, New Delhi.
11. Xylocaine (4%) Topical, Astra Zeneca Pharma India Ltd, Banglore
12.Ophthalmic operating microscope, AA OM 10, Appasamy Associates, Chennai
13. Appavisc, Appasamy Ocular Devices Pvt. Ltd, Pondichery

Anterior chamber was irrigated with normal saline using irrigating canula. Adrenaline tartarate was instilled into the anterior chamber to control the bleeding vessels. The corneal wound was apposed with partial thickness corneal suture using braided silk 6/0 in simple interrupted pattern.

3.3.3.2. Trabeculectomy

The dog was positioned and the eye was prepared as above. A fornix based conjunctival flap was taken 1 mm away from limbus on the dorsal aspect. The conjunctival flap was undermined using scissors. Then the flap was reflected posteriorly to expose the sclera. A limbal based triangular flap was marked out at 12 O'clock position using No 11 B.P blade. Tip of triangular scleral flap was lifted with a fine forceps. Through the window the greyish trabecular meshwork was exposed. A small portion of the exposed trabeculae was excised using bipolar diathermy, which was followed by aqueous leakage. The eye was irrigated with normal saline solution. The scleral flap was repositioned with interrupted sutures using vicryl 6/0. The conjunctival flap was sutured back in position by simple interrupted pattern using braided silk 4/0 and the stay sutures were removed.

3.3.4. Postoperative Care

The operated eye was bandaged after the instillation of eye drops with gauze padding for the first postoperative day. Topically antibiotic eyedrops (polymyxin- choramphenicol) and anti inflammatory agents (flurbiprofen) were instilled thrice daily for seven days. Postoperatively amoxicillin cloxacillin[14] injection was administered at dose rate of 20mg/kg bodyweight for five days in Case No. V and VII.

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14. Intamox, (500 mg), Intas Pharmaceuticals Ltd, Ahmedabad, India

Ceftriaxone injection[15] at dose rate of 20mg/kg bodyweight for first five post operative days in Case Nos. IV and VI. The sutures were removed after five days.

3.4. MAIN ITEMS OF OBSERVATION

3.4.1. Incidence

The incidence of glaucoma among the dogs presented with ophthalmological complaints was recorded.

3.4.2. Signalment and History

The age, breed, sex, signs noticed by the owner, duration of illness and details of previous medications, if any were recorded.

3.4.3. Physiological Parameters

The rate of respiration (per minute), pulse rate (per minute) and rectal temperature(^{o} C), colour of visible mucous membrane, systolic and diastolic blood pressure were recorded in all cases.

3.4.4. Clinical Examination

3.4.4. 1. General condition of patient

The general condition of animal was visually assessed and categorized as excellent, good, fair and poor.

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15. Intacef, (500 mg), Intas Pharmaceuticals Ltd, Ahmedabad, India

3.4.4. 2. Wet film Examination

One drop of blood was placed on a glass slide, covered with coverslip without air bubbles and observed under low power objective of microscope to identify the presence of any moving blood parasites and observations was recorded on the day of presentation.

3.4.4. 3. Condition of Eye

The eye was observed for gross appearance of cornea, presence and nature of ocular discharge, episcleral congestion, corneal clarity, vascularization of cornea, conjunctival changes, if any and other relevant observations.

3.4.4. 3. 1. Appearance of Eye and Cornea

Gross appearance of eye and cornea was observed for blepharitis, blepharospasm, photophobia, exophthalmos, enophthalmos, periorbital dermatitis, signs of trauma, anisocoria etc were recorded.

3.4.4. 3. 2. Epiphora

Eyes were observed for the presence of lacrimation and nature of discharge. If present the nature of discharge was recorded as serous, mucoid or purulent.

3.4.4. 3. 3. Episcleral Congestion

Episcleral congestion and its changes during the observation period were recorded.

3.4.4. 3. 4. Corneal Oedema

The presence of corneal edema/ corneal opacity in selected cases was recorded.

3.4.4. 3. 5. Corneal Clarity

The clarity of cornea was assessed based on visual examination. The clarity was recorded as clear, hazy, moderate opacity and complete opacity.

3.4.4. 3. 6. Vascularization of Cornea

All the affected eyes were examined for the presence of vascularization of cornea and its changes till the end of the observation period and recorded.

3.4.4. 3. 7. Fluorescein Dye Test

The presence of corneal ulcers was assessed by the use of fluorescein dye in the form of sterile impregnated strips. The strip was moistened with sterile normal saline and touched on conjunctival fornix. The dog was allowed to blink a few times to disperse the stain over the cornea. Afterwards the excess stain was flushed out with sterile normal saline. The cornea was stained fluorescent green wherever there was loss of epithelium.

3.4.4. 3. 8. Mydriasis

Number of animals showing mydriasis were recorded.

3.4.4. 3. 9. Conjunctival Changes

All the affected eyes were examined for conjunctival changes which included generalized congestion, injection of vessels, oedema etc.

3.4.4. 3. 10. Buphthalmos

The eyes were examined for buphthalmos and results were recorded.

3.4.4. 3. 11. Other Relevant Observations

Observations like aqueous flare, anterior synechiae, hyphema, corneal pigmentation, lens luxation and other specific lesions, if any were recorded.

3.4.4. 4. Intraocular Pressure

The Schioetz indentation tonometer was used to measure the intraocular pressure. One drop of lignocaine hydrochloride 4% solution was instilled to desensitize the cornea at five minutes interval for half an hour. The dog was restrained in a sitting position and the eye were directed upward, the lids are separated, the tonometer is allowed to rest by its own weight upon the near centre of the up–turned cornea and the plunger released with 5.5 gm weight in place. The 7.5 gm and 10 gm weights were used if necessary. The scale reading was noted and three consecutive readings were taken. The average value was then converted into mm of Hg using the caliberation table provided by Peiffer (1977).

3.4.4. 5. Reflexes

Menace, palpebral, corneal and pupillary reflexes were monitored in all the animals to evaluate visual disturbances.

3.4.4. 6. Direct Ophthalmoscopy

After attaining mydriasis by instilling Homatropin hydrobromide eyedrops 2 %[16] topically at five minutes interval for half an hour direct ophthalmoscopy was done to evaluate anterior chamber and the fundus. A lens setting of 15 D was used for anterior chamber and -3D for fundus study.

3.4.4. 7. Electrocardiogram (ECG)

Electrocardiogram was taken in animals under medical treatment before and after administration of Timolol maleate.

16. Homide eyedrops, Inoco Remedies Ltd, Verna, Goa

3.4.5. Haematological Parameters

Blood samples were collected in EDTA and were used for haematological evaluation i.e, haemoglobin concentration (Hb) (Sahli's acid haematin method), Volume of packed red cells (VPRC), Erythrocyte sedimentation rate (ESR) (Wintrobe haematocrit method), Total Leucocyte count (TLC). Blood smears were prepared for differential leucocyte count (DLC) and the results were recorded.

Serum blood glucose level was estimated in all the cases on the day of presentation.

3.4.6. Complications

Post operative complications encountered in animals underwent surgery were recorded.

Plate 1: Ocular Therapeutics and Diagnostics

A . timolol maleate, povidone-iodine 5% solution, lignocaine hydrochloride 4%, adrenaline tartarate

homatropine eyedrops, flurbiprofen eyedrops, ploymyxin-chloramphenicol eyedrops, fluorescein strips

Plate 2: Surgical Instruments

A. Operating microscope

B. Surgical set

Plate 3: Diagnostic Instruments

A. Ophthalmoscope

B. Schioetz tonometer

Results

4. RESULTS

4.1. SELECTION OF CASES

All the dogs presented to Veterinary College Hospitals at Mannuthy and Kokkalai with ophthalmological complaints were thoroughly examined, IOP was taken in suspected cases and nine cases (eight dogs) with elevated IOP were selected for the study. All the cases were subjected to detailed clinical and ophthalmological examination.

Among the cases considered for the study three had unilateral glaucoma while others had bilateral. Case Nos. I, II, III, VIII and IX were subjected to medical treatment. Four cases of Case Nos. IV, V, VI and VII were subjected to surgical treatment for egress of aqueous humor such as iridectomy and trabeculectomy.

4.2. MEDICAL MANAGEMENT

The medical treatment was done in five animals which consisted of oral administration of the carbonic anhydrase enzyme inhibitors (acetazolamide) at dose rate of 10- 30 mg/kg bodyweight twice daily and topical betablockers (timolol maleate) were instilled two times daily. Topical anti inflammatory agents (flurbiprofen) instilled thrice daily in Case Nos. I and II. Medical management reduced the IOP in all the animals. The mean percentage of reduction in IOP on the third day was 26.31% and mean percentage reduction in IOP during the observation period was 40%. The greatest reduction was observed in animals with higher IOP. Case Nos. II and IX had reduced appetite following the administration of medicines. Panting was noticed in Case No. VIII after administration of medicines. All the other

animals under medical treatment tolerated the medication and were found effective in resolving the clinical signs and condition.

4.3. SURGICAL TREATMENT

Case Nos. IV, V, VI, VII were subjected to surgical treatment. Of which iridectomy was done in Case No. VI and trabeculectomy for others.

4.3.1. Preoperative Preparation

All the cases were put under medical therapy (oral acetazolamide) prior to surgery to reduce the IOP to satisfactory level. Solid food was withheld for 12 hrs before surgery and liquid food for four hours before surgery in all the cases. Scrubbing the adnexal areas with povidone iodine solution (1:50) and irrigation of eye with normal saline and instillation of povidone iodine solution (5% w/v) were found to be a satisfactory method of preparation of the site for surgery.

4.3.2. Anaesthesia

All the animals were subjected to general anaesthesia. Anaesthetic regimen included intramuscular injection of atropine sulphate (0.045mg/kg body weight) and xylazine hydrochloride (2mg/kg body weight) for premedication and ketamine hydrochloride (5mg/kg body weight) for induction. A mixture of equal volumes of xylazine and ketamine (average 1.5ml) along with diazepam (0.5mg/kg body weight) were given intravenously to effect for the maintenance of general anaesthesia. The anaesthetic regimen adopted was found satisfactory for the surgical manipulation in all cases. Induction and recovery were smooth and uneventful.

General aneasthesia following the same regimen was given only for suture removal. In all other occasions cornea was anaesthetized with instillation of lignocaine hydrochloride (4%) solution. Both of these were found satisfactory for the purpose.

4.3.3. Surgical Technique

All the surgical procedures were conducted with the help of an operating microscope. It provided better visualization of operating field and facilitated gentle manipulation of the delicate tissues.

4.3.3.1. Iridectomy

Iridectomy was done in Case No. VI through corneal approach close to the limbus. Temporary bulbar conjunctival stay sutures applied at temporal and nasal region fixed the eyeball sufficiently during the surgery. Corneal approach to the iris through an incision on dorsal aspect close to the limbus was found satisfactory. Topical instillation of adrenalin tartarate (1: 10, 000) was found effective in controlling the bleeding to a lesser extend. All the surgical manipulations were stopped for a while in order to control the bleeding. The corneal integrity was maintained with visco-elastic material. Irrigation of anterior chamber with normal saline was found effective in removing the remnants of blood clots and visco-elastic material. Corneal incision was sutured using 6/0 silk with interrupted suture pattern. The suture material and pattern were found effective in apposing corneal wound.

The intraoperative complications encountered were severe haemorrhage from the iris and bleeding into the anterior chamber.

The percentage reduction of IOP obtained was 40% during the study period.

4.3.3.2. Trabeculectomy

Trabeculectomy was done in Case Nos. IV, V and VII. Temporary bulbar conjunctival stay sutures were applied to fix the eyeball. Limbal based triangular scleral flap provided better access to the trabecular meshwork. Use of bipolar diathermy and topical instillation of adrenalin tartarate (1: 10,000) effectively controlled the haemorrhage in the entire procedure. The trabecular meshwork was exicised using bipolar diathermy and was followed by aqueous leakage. Irrigation of anterior chamber with normal saline was effective in removing the remnants of blood clots and debris. Absorbable interrupted sutures (vicryl 6/0) apposed the scleral flap. The conjunctival flap was sutured with two or three interrupted sutures using silk 4/0. The suture material and pattern were found effective in apposing the wound.

The intraoperative complication encountered was bleeding into the anterior chamber. Partial disruption of conjunctival sutures was noted in Case Nos. VII and V.

The percentage of reduction in IOP obtained was 45% without significant post operative complications during the study period and 40% reduction in IOP was obtained on third post operative day.

4.3.4. Post Operative Care

The operated eye was bandaged with sterile gauze padding for the first post operative day after instilling the medicines. In order to counteract infection and

inflammation topically polymyxin-choramphenicol eye drops and flurbiprofen eye drops were instilled thrice daily for seven days. Amoxicillin Cloxacillin injection was administered at dose rate of 20mg/kg bodyweight for first five post operative days in Case Nos. V and VII. Ceftriaxone injection at dose rate of 20mg/kg bodyweight for first five post operative days in Case Nos. IV and VI. All the animals tolerated the medication and it was successful in controlling the postoperative infection and pain. There was no self mutilation. The sutures were removed after five days.

4.4. MAIN ITEMS OF OBSERVATION

4.4.1. Incidence

Among the ophthalmic cases presented to the Veterinary College Hospital Mannuthy, the incidence of Glaucoma was 11.32% in the year 2008.

4.4.2. Signalment and History (Table 1)

The age of dogs under this study ranged from 3 years to 14 years with a mean value of 8.61 $\pm$ 1.49. Out of the nine cases, four were Spitz, two Mongrel dogs one Dachshund, one Labrador Retriever and one Cocker Spaniel and. Of the nine cases five were females and rest were males. According to history revealed by the owners symptoms were noticed on an average of five months before presenting to the hospitals. Case No. VII had previous medical treatment for the same condition since one year in the left eye and phthisis bulbi in the right eye with no vision as a result of glaucoma. Case No.III had fungal infection on the body at the time of presentation. Case Nos. VII and VIII had treated for fungal infection on the body previously.

4.4.3. Physiological parameters (Table 2)

4.4.3.1. *Rate of Respiration*

The mean rate of respiration (per minute) was 28.44 ± 2.05 on the day of presentation. It was 30.89 ± 1.79, 29.11 ± 1.46, 30 ± 2.26, 29.33 ± 1.63 and 28.67 ± 1.20 on third, seventh, 21st , 35th and 60th day of observations, respectively. All the values were within normal range.

4.4.3.2. *Pulse Rate*

The mean pulse rate (per minute) recorded on the day of presentation was 98.11 ± 4.30 and on third, seventh, 21st , 35th and 60th day the average pulse rate was 92 ± 3.12, 82 ± 4.00, 85.33 ± 5.21, 86.88 ± 3.12 and 89.33 ± 4.00. All the values were within normal range.

4.4.3.3. *Rectal Temperature*

The mean rectal temperature(^{0}C) in the treated cases was 38.64 ± 0.32, 38.51 ± 0.16, 38.47 ± 0.30, 38.51 ± 0.22, 38.58 ± 0.23 and 38.53 ± 0.26 on the day of presentation, seventh, 21st , 35th and 60th day respectively. All the values were within normal range.

4.4.3.4. *Colour of Conjunctival Visible Mucous Membrane(palpebral / bulbar)*

The colour of visible conjunctival mucous membrane was congested on the day of presentation in Case No. III, which became pale roseate on subsequent observation days. All the surgically treated cases had congested mucous membrane

on third post operative day which became normal by seventh day except in Case No. VI. All other animals had a normal visible mucous membrane on the day of presentation and on subsequent days of observation.

4.4.3.5. *Systolic and Diastolic Blood Pressure*

The mean values of systolic and diastolic bood pressure in mm of Hg were 115.55 $\pm$ 3.43 and 81.11 $\pm$ 4.20, 117.33 $\pm$ 4.21 and 83.11 $\pm$ 4.56, 113. 78 $\pm$ 3.97 and 84.67 $\pm$ 4.26, 118.22 $\pm$ 2.48 and 87 $\pm$ 2.01, 118.78 $\pm$ 2.86 and 82.67 $\pm$ 3.95 and 120.67 $\pm$ 3.17 and 84.89 $\pm$ 1.67 on the day of presentation, seventh, 21^{st} , 35^{th} and 60^{th} day respectively. All the values were within normal range.

4.4.4. Clinical Examination

4.4.4.1. General Condition of Patient

All the animals in the study were found to have a general condition which scored good except Case No. III which had poor body condition.

4.4.4.2. Wet Film Examination

Moving blood parasites were not detected preoperatively in any of the cases.

4.4.4.3. Condition of Eye

4.4.4.3.1. Appearance of Eye and Cornea (Table 3)

In medically managed cases periorbital dermatitis and alopecia were exhibited by Case Nos. I and IX on the day of presentation which resolved completely by seventh day. Case Nos. II and IX had lenticular intumescence. None of the animals had exophthalmos, enophthalmos, trauma etc.

Blepharopasm was exhibited by all animals underwent surgical treatment on the post operative day which resolved by seventh day. Photophobia was exhibited by Case Nos. IV, V, VI and VII on the post operative days which got reduced by seventh day. Case Nos. VI and VII had lenticular intumescence.

4.4.4.3.2. Epiphora

Among the medically treated animals epiphora was present in Case Nos. I, III and VIII on the day of presentation which reduced by third day and became normal by seventh day. Nature of discharge was clear in all the cases on the day of presentation.

Among the surgically treated animals Case No. VI had purulent discharge on post operative days which became clear by twenty first day. In all other cases the discharge was clear through out the observation period.

4.4.4.3.3. Episcleral Congestion (Table 4)

All the animals had episcleral congestion on the day of presentation. In most of the cases had moderate congestion of episcleral vessels which reduced by third day and was absent on seventh day.

In surgically treated cases Case No. III had heavy congestion of episcleral vessels which reduced in size by seventh day and mild amount of congestion persisted through out the study.

4.4.4.3.4. Corneal Oedema (Table 5)

In medically treated cases Case No. II had corneal oedema on the day of presentation which resolved by seventh day.

In surgically treated cases Case No. VI had slight corneal oedema before surgery which became severe after surgery and persisted through out the study. Case No. VII had mild corneal oedema on third post operative day which resolved completely by 21st day.

4.4.4.3.5. Corneal Clarity (Table 5)

Among medically treated cases Case No. I had a hazy cornea on the day of presentation which reduced by third day and was clear on seventh day and Case No. II had moderate corneal opacity on the day of presentation and showed gradual improvement in clarity by seventh day, which cleared by twenty first day. Focal areas of slight cornel opacity were present in Case No. VIII which reduced in

size by third day and resolved completely by seventh day. In all other animals cornea was clear.

Among surgically treated cases Case No. VI had complete opacity of cornea on third postoperative day which persisted through out the study period. All the other animals had a clear cornea on all observation days.

4.4.4.3.6. Vascularization of Cornea (Table 5)

In medically treated cases vascularization of cornea was noticed Case Nos. I and II on the day of presentation. In Case No. I there was regression of blood vessels by seventh day and the vessels remained through out the study period. Case No. II had a fringe of vessels close to the limbus in circumferential manner which gradually disappeared and was clear by twenty first day. Except these two all the other cases were devoid of corneal vascularization.

None of the animals in surgical group showed vascularization of cornea.

4.4.4.3.7. Fluorescein Dye Test

Retention of fluorescein dye in superficial corneal ulcer was noticed in Case No. III and was absent on seventh observation day. All other animals were negative for dye retention.

4.4.4.3.8. Mydriasis

Among the medically treated group Case Nos. I, II , III, VI , VII and IX had mydriasis on the day of presentation. In Case Nos. I, II and IX mydriasis were absent on twenty first day. Case Nos. III had mydriasis throughout the study period.

Among surgically treated group Case Nos. VI, VII had mydriasis on the day of presentation. In Case No. VI mydriasis was not evaluated due to persistent corneal edema on the post operative days.

4.4.4.3. 9. Conjunctival Changes

In medically treated animals generalized congestion of conjunctival blood vessels was noticed in Case No. III and Case No. IX on the day of presentation which reduced by third day and cleared by seventh day.

In surgically treated animals conjunctival oedema and hyperemia were noticed in Case No.VII on the first post operative day which was found reduced on seventh day and was absent on twenty first day. Conjunctival hyperemia noticed in Case Nos. IV, V and VI on the first post operative days which cleared by seventh day in all the cases except Case No. VI.

4.4.4.3.10. Buphthalmos

Among the medically treated cases buphthalmos was present on the day of presentation in Case Nos. I, III and VIII. Condition gradually reduced by seventh day and was almost absent on twenty first day.

Among the surgically treated animals on buphthalmos was found.

4.4.4.3.11. Other Relevant Observation.

Lens luxation and anterior synechiae were present on the day of presentation in Case No. IX left eye and persisted through out the study.

Among the medicaly treated cases aqueous flare was present in Case No. I and in surgically treated cases Case No. VII post operatively, both gradually reduced by seventh day and cleared by twenty first day.

4.4.4.4. Intraocular Pressure

The mean IOP on the day of presentation was 47 $\pm$ 2.32 and on third, seventh, 21st, 35th and 60th day the mean IOP was 32.56 $\pm$ 2.68, 31.33 $\pm$ 1.22, 30.44 $\pm$ 0.92, 29.33 $\pm$ 0.76, and 27.67 $\pm$ 0.60. The mean values showed a gradual decrease throughout the study period. The mean percentage of decrease during the study period was 41% among both the groups.

4.4.4.5. Reflexes (Table 6)

4.4.4.5.1 Menace Reflex

Menace reflex was sluggish in Case No. II on the day of presentation and improved by seventh day. In Case No. VII also the reflex was sluggish and showed an improvement by twenty first day. All the other animals had a normal menace reflex.

4.4.4.5.2. Palpebral reflex

Palpebral reflex was normal in all the animals under study.

4.4.4.5.3. Corneal Reflex

Corneal reflex was normal in all the animals through out the study.

4.4.4.5.4. Pupillary Light Reflex

Pupillary Light Reflex (PLR) was sluggish in Case Nos. VI and VII and the Case No. VII showed gradual improvement during the study period. PLR was absent in Case No. III and Case No. IX on the day of presentation. In Case No. IX PLR was present from seventh day onwards and Case No. III showed a little improvement from twenty first day onwards. Except Case No. II and VII visual status was normal in other animals.

4.4.4.6. Direct Ophthalmoscopy

Direct ophthalmoscopy found to be a very useful diagnostic tool to evaluate fundus. Case No. VII on ophthalmoscopic examination revealed attenuated retinal blood vessels and a normal optic disc. Case No. VIII had hyper reflective tapetum and normal optic disc. Ophthalmoscopy was not done in Case Nos. II, VI and IX due to cataractous changes in the lens. All the other cases had a normal fundus without characteristic lesions.

4.4.4.7. Electrocardiogram

Electrocardiogram was taken in animals under medical treatment before and after administration of timolol maleate. Case No. VIII had sinus arrhythmia following the topical application of timolol maleate. In Case Nos. I, III, and IX didn't show any variations in ECG on the observation periods. Case No. II also had sinus arrhythmia and age related changes in the ECG such as ventricular dilatation.

4.4.5. Haematological Parameters (Table 7)

4.4.5.1. Haemoglobin Concentration

-

The values of haemoglobin concentration (g/dl) were 13.18 $\pm$ 0.78, 12.72 $\pm$ 0.51, 13.47 $\pm$ 0.46, 13.24 $\pm$ 0.32, 13.37 $\pm$ 0.38 and 13.34 $\pm$ 0.36 on the day of presentation, seventh, 21^{st} , 35^{th} and 60^{th} day respectively. All the values were within normal range.

4.4.5.2. Volume of Packed Red Cells

The mean values of Volume of Packed Red Cells (%) were 41.33 $\pm$ 2.60, 40.44 $\pm$ 1.32, 41.11 $\pm$ 1.42, 41.44 $\pm$ 1.25, 40.44 $\pm$ 1.18 and 41.22 $\pm$ 1.10 on the day of presentation, seventh, 21^{st} , 35^{th} and 60^{th} day respectively. The values were within normal range.

4.4.5.3. Erythrocyte Sedimentation Rate

The mean values (mm/hour) were 4.89 ± 1.12, 3.78 ± 0.83, 4.33 ± 0.47, 3.22 ± 0.52, 3.67 ± 0.65 and 2.78 ± 0.55 on the day of presentation, seventh, 21st , 35th and 60th day respectively. All the values were within normal range.

4.4.5.4. Total Leukocyte Count

The mean values of total leukocyte count (x 10^3 cells/ cmm) were 11.09 ± 0.70, 11.16 ± 0.68, 10.2 ± 0.64, 9.50 ± 0.36, 9.98 ± 0.36 and 9.44 ± 0.25 on the day of presentation, seventh, 21st , 35th and 60th day respectively. All the values were within normal range.

4.4.5.5. Differential Leukocyte Count

The mean differential count of neutrophils (%) was 71.56 ± 1.51, 71 ± 1.87, 70.44 ± 1.74, 69.11 ± 1.19, 68.33 ± 0.96 and 68 ± 0.53 on the day of presentation, seventh, 21st, 35th and 60th day respectively. The mean percentage for lymphocytes was 23.22 ± 1.51, 24.11 ± 2.21, 25.78 ± 1.19, 24.56 ± 0.87, 26.44 ± 1.04 and 25 ± 1.18 on the day of presentation, seventh, 21^{st,} 35th and 60th day respectively. The average differential count for eosinophils (%) was 2.55 ± 0.56, 1.89 ± 0.20, 1.67 ± 0.53, 1.22 ± 0.62, 1.67 ± 0.44 and 2.11 ± 0.54 on the day of presentation, seventh, 21st, 35th and 60th day respectively. The mean percentage of monocytes was 2.67 ± 0.67, 3 ± 0.80, 2.67 ± 0.80, 4 ± 0.65, 3.55 ± 0.73 and 5.33 ± 0.72 on the day of presentation, seventh, 21st, 35th and 60th day respectively.

All the values for differential leukocyte count remained within normal range.

4.4.5.6. Serum Blood Glucose Level (Table 8)

The serum blood glucose levels (mg/dl) on the day of presentation were 90.67 $\pm$ 5.12.

All the values were within normal range.

4.4.6. Complications (Table 9)

The post operative complications were corneal scarring, hyphema, anterior synechiae. Corneal scarring was noticed in Case No. VI on the post operative days and was present through out the study. Mild hyphema was noticed on immediate post operative days in all animals underwent surgery and it resolved spontaneously in subsequent days. Anterior synechiae was present in Case No. VI on third post operative day and was present through out the study. Conjunctival hyperemia and oedema was noticed in Case No. VII on immediate post operative days and cleared by seventh day.

Table 1: Anamnesis of animals subjected for the study

Case No	Breed	Age (years)	Sex	IOP (mm of Hg)	Treatment adopted
I	Spitz	3.5	Female	46	Medical
II	Spitz	14	Male	48	Medical
III	Dachshund	3	Female	63	Medical
IV	Mongrel	10	Female	43	Surgical
V	Mongrel	10	Female	43	Surgical
VI	Spitz	13	Male	42	Surgical
VII	Labrador Retriever	9	Male	40	Surgical
VIII	Cocker Spaniel	5	Female	52	Medical
IX	Spitz	10	Male	46	Medical
Mean ±SE		8.61±1.49		47±2.32	

Table 2: Mean values of physiological parameters of dogs under study

Sl No	Parameters	0 day	3 day	7 day	21 day	35 day	60 day
1	Rate of respiration	28.44±2.05	30.89±1.79	29.11±1.46	30±2.26	29.33±1.63	28.67±1.20
2	Pulse rate	98.11±4.30	92±3.12	82±4.00	85.33±5.21	86.88±3.12	89.33±4.00
3	Rectal temperature	38.64±0.32	38.51±0.16	38.47±0.30	38.51±0.22	38.58±0.23	38.53±0.26
4	Systolic & diastolic blood pressure	115.55±3.43 and 81.11±4.20	117.33±4.21 and 83.11±4.56	113.78±3.97 and 84.67±4.26	118.22±2.48 and 87±2.01	118.78±2.86 and 82.67±3.95	120.67±3.17 and 84.89±1.67

Table 3: General clinical signs of animals studied on day of presentation

Case No	Eye affected right/left	Episcleral congestion	Conjunctival hyperemia	Mydriasis	Buphthalmos	Epiphora
I	Both	P	A	P	P	P
II	Both	P	A	P	A	A
III	One	P	P	P	P	P
IV	One	P	A	A	A	A
V	Both	P	A	A	A	A
VI	Both	P	A	P	A	A
VII	One	P	A	A	A	A
VIII	Both	P	A	A	P	P
IX	One	P	P	P	A	P

Present – P Absent - A

Table 4: Observation of episcleral congestion

Case No	Days of observation					
	0	3	7	21	35	60
I	Moderate	Mild	Absent	Absent	Absent	Absent
II	Moderate	Mild	Absent	Absent	Absent	Absent
III	Heavy	Moderate	Mild	Mild	Mild	Mild
IV	Moderate	Mild	Absent	Absent	Absent	Absent
V	Moderate	Mild	Absent	Absent	Absent	Absent
VI	Moderate	Mild	Absent	Absent	Absent	Absent
VII	Moderate	Mild	Absent	Absent	Absent	Absent
VIII	Moderate	Mild	Absent	Absent	Absent	Absent
IX	Moderate	Mild	Absent	Absent	Absent	Absent

Table 5: Condition of cornea on the day of presentation

Sl No	Case No	Corneal clarity	Corneal edema	Vascularization
1	I	Hazy	Absent	Present
2	II	Moderate	Moderate	Present
3	III	Normal	Absent	Absent
4	IV	Normal	Absent	Absent
5	V	Normal	Absent	Absent
6	VI	Normal	Mild	Absent
7	VII	Normal	Absent	Absent
8	VIII	Normal	Absent	Absent
9	IX	Normal	Absent	Absent

Table 6: Observation of reflexes on the day of presentation

Case No	Menace reflex	Palpebral reflex	Corneal reflex	Pupillary light reflex
I	Normal	Normal	Normal	Normal
II	Sluggish	Normal	Normal	Normal
III	Normal	Normal	Normal	Absent
IV	Normal	Normal	Normal	Normal
V	Normal	Normal	Normal	Normal
VI	Normal	Normal	Normal	Sluggish
VII	Sluggish	Normal	Normal	Sluggish
VIII	Normal	Normal	Normal	Normal
IX	Normal	Normal	Normal	Absent

Table 7: Mean values of haematological parameters

Parameters		Observation days					
		First	Third	Seventh	21st	35th	60th
Hb(g/dl)		13.18±0.78	12.72±0.51	13.47±0.46	13.24±0.32	13.37±0.38	13.34±0.36
VPRC(%)		41.33±2.60	40.44±1.32	41.11±1.42	41.44±1.25	40.44±1.18	41.22±1.10
ESR(mm/hr)		4.89±1.12	3.78±0.83	4.33±0.47	3.22±0.52	3.67±0.65	2.78±0.55
TLC ($x10^{3/}$cmm)		11.09±0.70	11.16±0.68	10.2±0.64	9.50±0.36	9.98±0.36	9.44±0.25
DLC (%)	N	71.56±1.51	71±1.87	70.44±1.74	69.11±1.19	68.33±0.96	68±0.53
	L	23.22±1.51	24.11±2.21	25.78±1.19	24.56±0.87	26.44±1.04	25±1.18
	E	2.55±0.56	1.89±0.20	1.67±0.53	1.22±0.62	1.67±0.44	2.11±0.54
	M	2.67±0.67	3±0.80	2.67±0.80	4±0.65	3.55±0.73	5.33±0.72
	B	0	0	0	0	0	0

Table 8: Serum blood glucose values on the day of presentation (day zero)

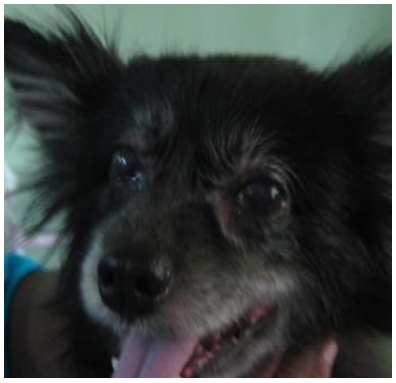
Sl No	Case No	Serum blood glucose value(mg/dl)
1	I	120
2	II	110
3	III	78
4	IV	79
5	V	79
6	VI	82
7	VII	98
8	VIII	81
9	IX	89

Table 9: Post operative complications

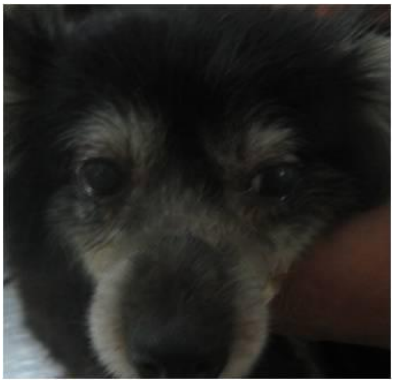
Complications	Cases studied			
	IV	V	VI	VII
Hyphema	Present	Present	Present	Present
Corneal scarring	-	-	Present	-
Anterior syenichiae	-	-	Present	-
Conjunctival oedema	-	-	-	Present

Plate 4: Medical Management

A. Day of presentation



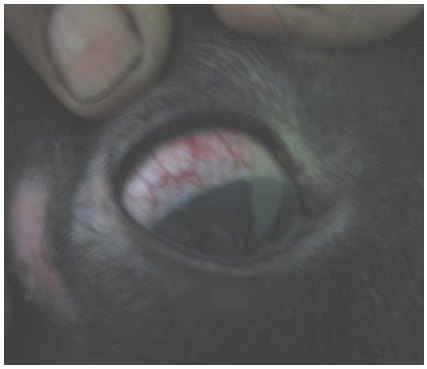
B. On day twenty one



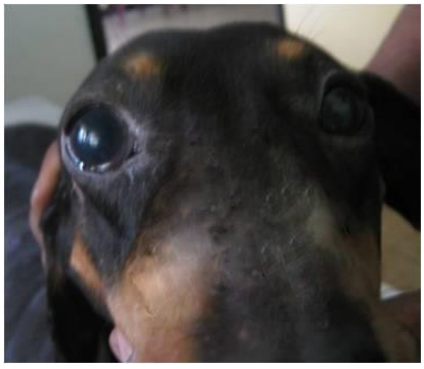
C. On day sixty

Plate 5: Clinical signs

A. corneal oedema



B. episcleral congestion



C. buphthalmos and mydriasis

Plate 6a: Iridectomy

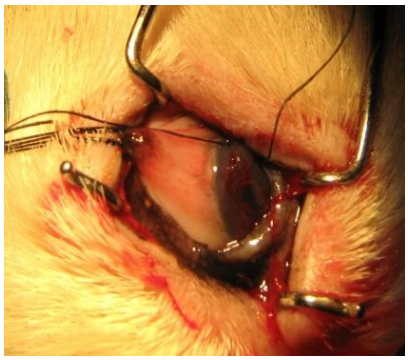
A. pre operative appearance

B. positioning of eyeball

B. corneal incision

C. grasping of iris

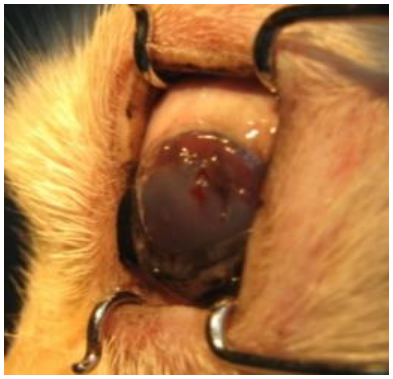
Plate 6 b: Iridectomy



A. suturing of cornea

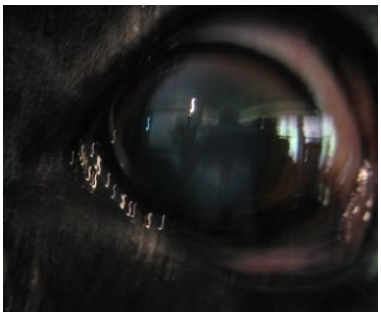
B. post operative appearance

C. on third post operative day



D. after suture removal

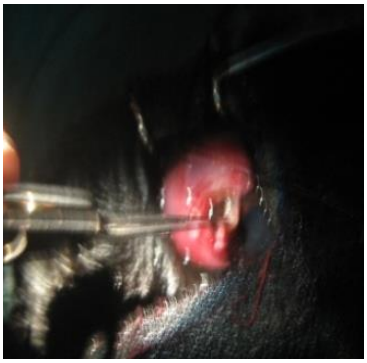
Plate 7a: Trabeculectomy



A. pre operative appearance

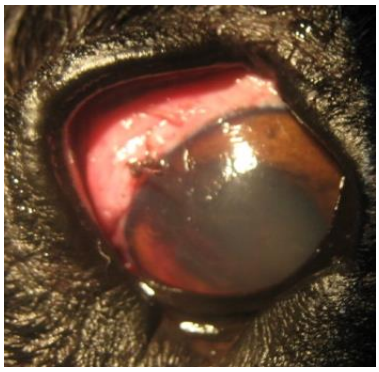
B.conjunctival flap

C. scleral flap

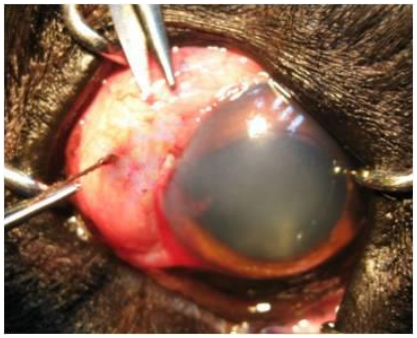


D.trabeculae

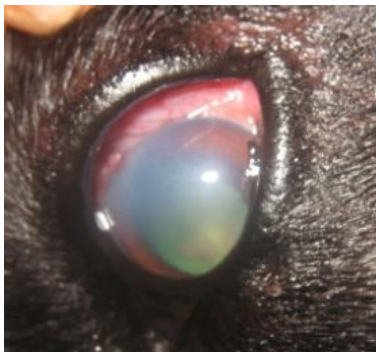
Plate 7b: Trabeculectomy



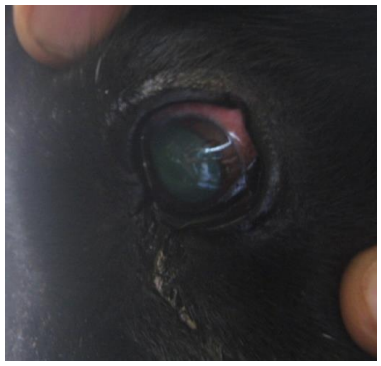
A. Post operative appearance



B. Suture removal

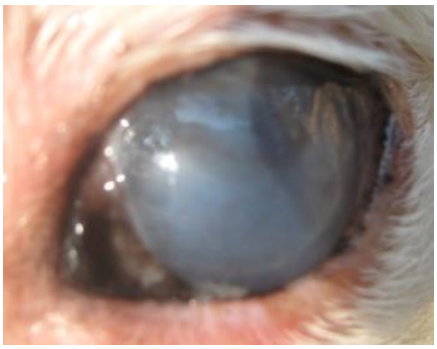


C. on day seven



D. on day sixty

Plate 8: Post Operative Complications



A. corneal oedema & anterior synechiae

B. conjunctival hyperemia and oedema

C. blood clot in the anterior chamber

Discussion

5. DISCUSSION

5.1. SELECTION OF CASES

The study was carried out in nine cases presented to the veterinary hospitals at Kokkalai and Mannuthy and diagnosed to have glaucoma. Among these cases three had unilateral glaucoma in which only one eye was affected while others had bilateral glaucoma.

Among these cases five cases were subjected to medical treatment (Case NoS. I, II, III, VIII and IX). Four cases (Case Nos. IV, V, VI and VII) were subjected to surgical treatment.

5.2. MEDICAL MANAGEMENT

Five dogs (Case No. I, II, III, VIII and IX) were subjected to medical treatment consisted of oral administration of carbonic anhydrase enzyme inhibitors (acetazolamide) and topical betablockers (timolol maleate) instillation twice daily could reduce the IOP to 40% during the study period. According to Hasegawa *et al*. (2001) lower IOP could be maintained with medical therapy alone for a long period in dogs with open angle glaucoma. According to Bedford (1977a) carbonic anhydrase inhibition reduced the aqueous production dramatically. Bedford (1980a) pointed out that the carbonic anhydrase inhibition could result in 40- 60 % suppression of production process and occurs with in two hours of oral administration of carbonic anhydrase enzyme inhibitors. Gelatt (1981) used carbonic

anhydrase enzyme inhibitors for both short term and long term management of canine glaucoma with twice daily administration.

According to Palmer (2008) topical sympatholytics such as timolol maleate acted via decreasing the active production of aqueous humor and by increasing the outflow via miosis. Townsend (2007) pointed out that topical betablockers administered in every 8 -12 hours in glaucoma decreased the production of aqueous humor and there by IOP also. Concentration of Timolol maleate used was in accordance with Willis (2004) who suggested 0.25 % timolol in dogs with weight less than 25 lb and 0.5 % concentrations in dogs weighing greater than 25 lb.

According to Wilkie and Latimer (1991) the topical administration of Timolol maleate resulted in reduction of IOP and pupil diameter in treated and controlateral eyes. No significant decrease in pulse pressure or bradycardia was observed in this study. All the other animals under medical treatment tolerated the medications and were found effective in resolving the condition.

Side effects noticed following oral administration of carbonic anhydrase enzyme inhibitors were gastrointestinal upset and panting which were in compliance with the observations of Mandell and Holt (2005) who observed gastrointestinal signs, panting, disorientation following oral administration of carbonic anhydrase inhibitors because of presence of carbonic anhydrase enzyme in nephrons of kidney and erythrocytes. According to Woerdt (2001) the common side effects of orally administered carbonic anhydrase inhibitors were metabolic acidosis, excessive panting, gastrointestinal upset and lethargy and would disappear 12 -24 hours after discontinuation of drug.

5.3. SURGICAL TREATMENT

Case Nos IV, V, VII were subjected to trabeculectomy. In Case No VI, iridectomy was done. Surgical treatments were carried out under general anaesthesia with proper preoperative preparation. All the surgical procedures were conducted with the help of operating microscope with a magnification of 1.5x.

5.3.1. Preoperative Preparation

All the cases were put under medical therapy with oral administration of acetazolamide prior to surgery to reduce the IOP which was found sufficient to reduce the IOP. Bedford (1980a) suggested that medical therapy could be used as a pre requisite in surgery.

All the animals were fasted for 12 hrs before surgery and withheld liquid food for four hours before the surgery. The adenexal areas were scrubbed with povidone-iodine solution before the surgery. The eye was irrigated with normal saline and a few drops of povidone-iodine (1: 50) were instilled before surgery. Povidone-iodine solution were effective in eliminating the bacterial contamination of the lid margins (Roberts *et al.* 1986 and Morgan (2004).

5.3.2. Anaesthesia

In this study, anaesthetic regimen including atropine sulphate, xylazine hydrochloride, ketamine hydrochloride and diazepam provided sufficient anaesthesia for surgeries and suture removal. Instillation of lignocaine hydrochloride produced topical anaesthesia satisfactory for eye examination and for measuring IOP.

The potential benefit of anticholinergics was prevention or reversal of oculocardiac reflex. In ketamine administration the palpebrae remained open and globe was centrally positioned. Ketamine when combined with a benzodiazepine decreased the IOP (Cunningham, 1986). Diazepam reduced the ketamine induced increased IOP. Analgesia was found to improve animals comfort and minimized tendency to self trauma. Topically administered anaesthetic may be irritating and can cause transient conjunctival hyperemia (Collins *et al*. 1995) as observed in this study following the application of lignocaine hydrochloride(Case No. VII).

5.3.3. Surgical Technique

5.3.3. 1. Iridectomy

Iridectomy was done in Case No VI through a corneal approach close to the limbus. The principle of iridectomy in treatment of glaucoma was to reopen the filtration angle (Stallard, 1973). Basal root iridectomy indicated in glaucoma as reported by Magrane (1977) which could reestablish the circulation to the trabeculum. Topical instillation of adrenaline tartarate (1:10,000) minimized the haemorrhage during iridectomy as observed by Wilkie (2002). Direct corneal suturing was carried out maintaining microsurgical principles. Partial thickness interrupted corneal sutures were used for apposition of wound edges. The sutures were placed equidistant from the wound edges. The technique was found satisfactory. This was in accordance with the opinion of Hollingsworth (2003) that the corneal sutures should reach 80-90% of the stromal depth and it could be placed one millimeter from the wound edges with the distance of one millimeter between the sutures. The advantages of simple interrupted pattern included increased knot security, easy to place without tissue lifting and selective suture removal according to healing during the post operative period (Herring, 2003).

The percentage reduction in case underwent iridectomy was 40% during the study period.

The intraoperative complication encountered were hyphema which was in compliance with the observations of Gelatt (1991) following peripheral iridectomy.

5.3.3. 2. Trabeculectomy

Trabeculectomy was done in Case No IV, V and VII. Temporary conjunctival stay sutures fixed the eyeball for the surgical manipulations. Fornix based conjunctival flap was used in this study. According to Shuster *et al.* (1984), the fornix based conjunctival flap was easier to perform, provided better surgical exposure and was easier to close than limbus based flap. The fornix based conjunctival flap allowed the aqueous humor to drain posteriorly promoting the formation of diffuse bleb. In this study cauterization effectively controlled the intraoperative bleeding of episclera and sclera during the creation of scleral flap. The triangular scleral flap with the base towards limbus was found ideal and apposition was easy with a single suture at the apex. Bipolar diathermy and topical instillation of adrenalin tartarate (1; 10,000) controlled the haemorrhage. Fine *et al.* (2004) used bipolar diathermy to control hemorrhages within the anterior chamber during the intraocular surgery. The intraoperative complication encountered was hyphema which was in compliance with observation of Das *et al. (*2004). Conjunctival flap sutured with silk 4/0 was found effective in apposing the wound. Trabeculectomy produced 45% reduction in IOP during the study period and produced 40% reduction on third post operative day. In a study conducted by Migdal *et al.* (1994) up to 98% reduction in IOP was observed in trabeculectomy in human patients.

5.3.4. Post Operative Care

Parentral administration of antibiotics and topical applications of polymyxin-chloramphenicol eyedrops and flurbiprofen eyedrops effectively controlled infection, inflammation and post operative pain in all animals. According to Sansom (1988) an established intraocular infection was difficult to treat due to presence of blood ocular barrier and absence of lymphatics. So in case of infection both systemic and topical treatments should be considered. Flurbiprofen controlled the post operative inflammation in the present study (Sansom, 2000).

5.4. MAIN ITEMS OF OBSERVATION

5.4.1. Incidence

The incidence of glaucoma in the present study was 11 % among the ophthalmological cases presented to the Veterinary hospitals Mannuthy and Kokkalai. Gelatt *et al.* in 2004 calculated the prevalence of glaucoma in North America as 0.89 %. Kallberg *et al.* (2007) reported that dogs had the highest frequency of primary glaucoma of all animals.

5.4.2. Signalment and History

5.4.2. 1. Age

The average age of animals selected for the study was 8.61 $\pm$ 1.49 (3 years - 14 years). This was in accordance with observations of Palmer (2008). Krupin *et al.*

(2005) and Crispin *et al.* (2008) noted that ages at which glaucoma develop varied with breed but the disease was mostly of middle age.

5.4.2. 2. Breed

In this study as far as breed predisposition is concerned, four were Spitz, two Mongrels, one Dachshund, one Labrador Retriever and one Cocker Spaniel. This may be due to higher population of Spitz in the area.

5.4.2. 3. Sex

Of the eight animals there were four females and four males. But a higher incidence of glaucoma in females was reported by Cottrell and Barnett (1988) and Slatter and Erb (1986).

5.4.2. 4. History

Symptoms were noticed on an average of five months before presenting to the hospitals. This might be due to the fact that the symptoms are often subclinical and go unnoticed by the owner.

Case Nos. III, VII and VIII had fungal infection over the body. According to Johnson and Miller (1990), fungal disease could cause uveitis via haematogenous route and result in secondary glaucoma.

5.4.3. Physiological Parameters

None of the animals showed any obvious sign of systemic illness as evidenced by the examination findings. Because the ocular involvement may indicate systemic diseases a general physical examination should preceed the ophthalmic examination as per Felchle and Urbanz (2001).

5.4.3.1. Systolic and Diastolic Pressure

The mean values of systolic and diastolic blood pressure were 115.55 $\pm$ 3.43 and 81.11 $\pm$ 4.20, i.e. within normal range. The normal blood pressure readings in dogs range from 110- 90 mm of Hg in systolic and 55 -110 mm of Hg in diastolic blood pressure (Turner, 2005).

5.4.4. Clinical Examination

5.4.4.1. General Condition of Patient

All the animals were in good body condition except Case No. III.

5.4.4.2. Wet Film Examination

Moving blood parasites were not observed preoperatively in any of the cases.

5.4.4.3. Condition of Eye

5.4.4.3.1. Appearance of Eye and Cornea

Periorbital dermatitis and alopecia were exhibited by Case Nos. I and IX which disappeared in due course. Blepharospasm and photophobia were shown by animals underwent surgery on immediate post operative days which might be due to the post operative pain. Case Nos. II, VI, VII and IX had lenticular intumescence.

5.4.4.3.2. Nature of Discharge

Nature of discharge was clear in all the cases on the day of presentation. In Case No.VI purulent discharge was present on post operative days which suggest a bacterial infection. According to Sansom (1988), the purulent discharge indicated a bacterial infection. Epiphora was present in Case Nos. I, III, VIII and IX on the day of presentation disappeared in due course, which was in accordance with the observations of Moller *et al*. (1985). In all the other cases the discharge was clear through out the observation period.

5.4.4.3.3. Episcleral Congestion

All the animals showed episcleral congestion on the day of presentation. According of Helper (1989) episcleral congestion was a constant finding in elevated IOP. The vortex veins within sclera were affected by initial increasing pressure and thus anterior ciliary vein would take over their work and become distended in the process. Episcleral congestion was absent by seventh day in all animals except Case No III in which a mild amount of congestion presisted through out the study.

5.4.4.3.4. Corneal Oedema

Corneal oedema was present in Case Nos. II, VI, VII and VIII, which disappeared in the due course except in Case Nos. VI. Corneal oedema is a frequent finding in most of canine glaucoma.(Gelatt, 1981., Moller *et al.* 1985., Bedford, 1988., Gionfriddo, 1995., Woerdt, 2001 and Mughannam *et al.* 2004). According Magrane (1977) cloudy cornea in glaucoma was due to oedema of stroma and collection of fluid under and between epithelial cells. Corneal oedema associated with glaucoma would disappear within hours after IOP normalization (Gelatt, 1981).

According to Woerdt (2001) in chronic cases of glaucoma corneal oedema was less pronounced. In all the other animals cornea was clear without oedema. Corneal oedema was brought about by a breach in continuity of epithelium and endothelium often by increased IOP (Dice, 1981).

5.4.4.3.5. Corneal Clarity

Case Nos. I and II showed some degree of corneal opacity. All the other animals had a clear cornea.

5.4.4.3.6. Vascularization of Cornea

Vascularization of cornea was noticed in Case Nos I and II. In Case No. I the corneal vessels showed regression and remained throughout the study period. This was in accordance with the findings of Magrane (1977). In Case No. II regression of vascularization noticed from seventh day onwards and cornea became devoid of blood vessels from 21st day of observation.

5.4.4.3.7. Fluorescein Dye Test

Fluorescein dye strips were used for assessing the depth, extent and healing of corneal lesions. In Case No. III there was fluorescein dye retention on the day of presentation and was absent on seventh day.

5.4.4.3.8. Mydriasis

Mydriasis was present in six cases (Case No I, II, III, VI, VII and IX) on the day of presentation. Mydriasis is one of clinical signs of glaucoma (Helper, 1989., Gionfriddo, 1995., Gelatt, 1977., Spiess *et al*. 1998., Woerdt, 2001 and Mughannam *et al.* 2004). Mydriasis was absent on twentyfirst day in Case No I, II and IX. In case No III and VII mydriasis persisted through out the study. According to Helper (1989) pupil dilatation was caused by a pressure paresis of ciliary nerves, or paresis of sphincter fibers because of oedematous pressure. If the IOP was reduced by medical or surgical means the pupil might again become normally mobile and contracted. If the attack was prolonged and had produced synechiae or iris atrophy pupil remains dilated for the life even though pressure normalized.

5.4.4.3.9. Conjunctival changes

Generalized congestion of conjunctival blood vessels was found in Case Nos. III and IX which cleared in due course. Bedford (1980) observed bulbar conjunctival congestion in glaucomatous eyes.

According to Magrane(1977) conjunctival vessels become injected and a mild degree of chemosis might accompany the change in vessels. When pressure restored to normal, the vessels would return to their normal size. Conjunctival hyperemia noticed on post operative days might be due to conjunctivitis following surgery. Woerdt (2001) observed conjunctival hyperemia in acute glaucoma.

5.4.4.3.10. Buphthalmos

Buphthalmos was present on the day of presentation in Case Nos. I, III and VIII which disappeared in the due course. The young dogs rapidly developed buphthalmia, which was reversible and tend to protect the vital retina and optic disc from elevated IOP for a short period of time (Gelatt, 1981).

In most of buphthalmic eyes pupil were dilated which is in accordance with observation of Helper (1989) who said that full dilatation of pupil in early stage of glaucoma would give the eye an appearance of enlargement. Buphthalmos developed in dogs with IOP of 40 mm of Hg or higher or over a few years when IOP about 30 mm of Hg (Gelatt, 1997). As per Woerdt (2001) buphthalmos was present in chronic cases of glaucoma.

5.4.4.3.11. Other Relevant Observation

Lens luxation and anterior synechiae was present a Case No. IX and persisted through out the study. In this case primary glaucoma caused secondary lens luxation which is in accordance with the findings of Woerdt (2001).

Aqueous flare was present in Case No. I which is in accordance with observation of Moller *et al.* (1985). Aqueous flare was present in Case No. VII post-

operatively could be due to inflammation and cleared in the due course. Miller (2003) observed mild degrees of aqueous flare in anterior chamber of dogs with glaucoma.

Lenticular intumescence was noticed in Case Nos. II, VI and IX on the day of presentation. According to Gelatt (1981) intumuscent cataracts produced glaucoma with enlargement of lens capsule which displaced iris or ciliary body forward causing narrowing of iridocorneal angle. Age related changes in lens thickness produced shallow anterior chamber which could result in development of pupillary block and then primary angle closure glaucoma **(**Ekesten and Torrang, 1995 and Bjerkas *et al.* 2002). Lenticular intumescence could cause secondary glaucoma as per Magrane (1977).

5.4.4.4. Intraocular Pressure

All the cases showed a gradual decrease in the IOP during the study period. The mean percentage of decrease during the study period was 41% of which 30% reduction occurred in first three days. Only 5% reduction in IOP was noticed between 35^{th} and 60^{th} day of observation.

5.4.4.5. Reflexes

Palpebral and corneal reflex were present in all the cases throughout the observation days. Menace reflex was normal in all cases except case No.VII which was sluggish. This was due to the cataractous changes in the lens of the animal. Decreased menace reflex was observed in glaucoma by Woerdt (2001). Pupillary light reflex was defective in Case Nos. III, VI, VII and IX which showed a gradual improvement in the study period. According to Brooks and Dziezye (1983) the

pupillary light reflex was dependent upon the functional integrity of iris sphincter muscle, retina and optic nerve. Gelatt (1997) observed that in glaucoma with high pressure, pupillary light reflex(PLR) remained absent or slow. The PLR test evaluate the function of retina, optic nerve and the iris sphincter muscle (Felchle and Urbanz (2001). The negative PLR in most of cases could be due to pressure paresis of iris sphincter muscle due to elevated IOP.

5.4.4.6. Direct Ophthalmoscopy

Direct ophthalmoscopy was done to evaluate the fundic lesions associated with the glaucoma. Case No.VII revealed attenuated retinal blood vessels and a normal optic disc. Mc Laughlin *et al.* (1987) observed attenuated retinal vessels in the fundus of a cat with glaucoma. Generalized retinal narrowing was observed in glaucoma by Mitchell *et al.* (2005). According to Palmer (2008) detrimental elevation of IOP altered the blood flow to optic nerve and retina. Retinal blood vessel attenuation was observed in glaucomatous eyes by Moller *et al.* (1985)., Bedford (1988)., Hasegawa *et al.* (2001) and Sandt *et al.* (2003). Hyper reflective tapetum was found in Case No.VIII might be due to retinal degeneration which was in accordance with the findings of Moller *et al.* (1985) and Hasegawa *et al.* (2001.)

All the other animals had a normal optic disc. According to Helper (1989) cupping of optic disc was not an early finding but seen in blind, frank glaucomatous dogs.

5.4.4.7. Electrocardiogram

Electrocardiograph of Case No. II showed sinus arrhythmia after administration of timolol maleate. This was in accordance with the findings of Willis

(2004). In all the other animals there was no significant variation in electrocardiogram.

5.4.5. Haematological Parameters

All the haematological parameters were within the normal range. This was in accordance with the findings of Schalm *et al*. (2000) ., Bath and Dua, (2006) and Palmer, (2008). Serum blood glucose levels were within the normal range in all the animals. Bonovas *et al.* (2004) suggested that diabetic patients were at significantly increased risk of developing glaucoma.

5.4.6. Complications

The post operative complications were corneal scaring, hyphema and anterior synechiae. Stallard (1973)., Magrane (1977) and Shuster *et al.* (1984) had encountered hyphema as post operative complication in glaucoma surgery. Oedematous swelling and bruising of conjunctiva were present in Case No. VII following trabeculectomy which is in accordance with the findings of Bedford (1989). Clot formation subsequent to hyphema resolved spontaneously in subsequent days (Magrane, 1977). Corneal scaring and corneal oedema were present in Case No. VI through out the study period, might be due to irreversible corneal damage.

Summary

6. Summary

Eight dogs with elevated intraocular pressure (IOP) were studied for the type of lesions, clinical signs, efficacy of diagnostic procedures, efficacy of medical and surgical treatment. Dogs presented with the ophthalmological complaints were thoroughly examined and eight dogs with elevated IOP were selected for the study. Initially medical treatment was given and for those cases which are refractory to medical treatment, surgical treatment was adopted. Surgical treatment consisted of iridectomy and trabeculectomy. The dogs belonged to various breeds like Spitz, Dachshund, Labrador Retriever, Cocker Spaniel and Mongrel dogs of either sex with an average age of 8.61 years(range 3 years to 14 years).

All the animals selected for the study were examined for their general condition, haematological parameters, physiological parameters, appearance of the eye and cornea, nature of discharge, episcleral congestion, corneal clarity, vascularisation of cornea, conjunctival changes, buphthalmos and other relevant observations. Wet film examination for the presence of moving blood parasites was conducted. Intraocular pressure was measured on all days of observation. Reflexes like menace, palpebral, corneal and pupillary reflexes were monitered on the observation days. Direct ophthalmoscopy and fluroscein dye test and measurement of systolic and diastolic blood pressure were also done in animals on all observation days. Electrocardiographic changes were recorded in animals underwent timolol therapy.

The medical treatment consisted of a combination of oral administration of carbonic anhydrase enzyme inhibitors and ocular instillation of beta blockers. Topical antibiotic eyedrops and anti-inflammatory agents were advised in selected cases, were an infection, pain and inflammation were noticed.

The cases selected for surgical treatment were put under medical therapy prior to surgery to reduce the IOP to satisfactory level and fasted for 12 hours before surgery.

All the cases were subjected to general anaesthesia using atropine, xylazine, ketamine given intramuscularly and maintained with intravenous administration of a mixture of equal volumes of xylazine and ketamine along with diazepam at dose rate of 0.5 mg/kg bodyweight. The anaesthetic procedure was found satisfactory for surgical procedures. The eye and adenexa were prepared aseptically for the surgery.

The surgical procedures adopted were iridectomy and trabeculectomy. The operated eye was bandaged with gauze padding for first post operative day. Parenteral administration of antibiotics, topical instillation of polymyxin-choramphenicol eyedrops, flurbiprofen eyedrops were effective in controlling post operative infection, inflammation and pain. Sutures were removed on fifth post operative day.

Physiological parameters like respiration rate, pulse rate and rectal temperature remained within the normal range in all the animals through out the observation days. The systolic and diastolic blood pressure values were within the normal range throughout the observation periods. All the dogs had a good body condition except one and all were free of any moving blood parasites on wet film examination. Blepharospasm was shown by animals underwent surgery and resolved by seventh day. Photophobia was present in one but was absent by the seventh day. Four animals had cataractous changes in the lens.

Nature of discharge was clear in all the cases initially. Epiphora was present in four animals which cleared by seventh day. In one surgical case on post operative days which cleared by 21st day of observation.

All the animals had episcleral congestion initially which was absent on seventh day and one animal showed mild episcleral congestion through out the study period. Three animals had corneal oedema on the day of presentation and one resolved by seventh day and other by 21st day of observation. In one animal underwent surgical treatment corneal edema persisted through out the study period.

Hazy cornea was present in one animal and moderate corneal opacity in another one, both improved by seventh day. Vascularization of cornea was present in two cases, of which one showed regression of blood vessels and remained through out the study. In the second animal vascularization cleared by 21st day.

Retention of fluroscein dye in superficial corneal ulcer was noticed in one case and all the other animals were negative for dye retension. Six animals showed mydriasis on the day of presentation and in three of them mydraisis was absent by 21st day and two cases had mydriasis through out the study period.

Generalized congestion of conjunctival blood vessels was noticed in two animals on the day of presentation which reduced by third day and cleared by seventh day. Conjunctival oedema and hyperemia were noticed in one animal on the first post operative day and it was found reduced on seventh day and was absent on twenty first day. Conjunctival hyperemia noticed in three animals which underwent surgery on the first post operative day which got cleared by seventh day in all the cases except one.

Buphthalmos was present on the day of presentation in three animals and gradually reduced by seventh day and was almost absent on twenty first day.
Lens luxation and anterior synechiae were present on the day of presentation in one case and persisted through out the study. Aqueous flare was present in two cases post operatively which gradually reduced by seventh day and cleared by twenty first day.

All the cases showed a gradual decrease in the IOP during the study period. The mean percentage of decrease during the study period was 41% of which 30% reduction occurred in first three days. The mean percentage of decrease in IOP medically treated cases was 40% , in iridectomy also 40% reduction was obtained and in trabeculectomy 45% reduction was obtained. The percentage reduction of IOP in fourth day was also higher with trabeculectomy.

Menace reflex was sluggish in two cases on the day of presentation and improved during the study period. All the other animals had a normal menace, palpebral and corneal reflex through out the study. Pupillary Light Reflex (PLR) was sluggish in two animals and showed a gradual improvement during the study period. PLR was totally absent in two animals on the day of presentation of which one showed improvement from seventh day onwards while the other showed a little improvement from twenty first day onwards.

On ophthalmoscopic examination revealed attenuated retinal blood vessels and a normal optic disc in one animal and a hyper reflective tapetum with normal optic disc in the other animal. Ophthalmoscopy was not done in three animals due to cataractous changes in the lens. All the other cases had a normal fundus without characteristic lesions.

Electrocardiogram was taken in animals under medical treatment before and after administration of timolol maleate, two animals showed sinus arrhythmia following the topical application of timolol maleate, while others had a normal electrocardiogram. All the haematological parameters were within the normal range through out the observation period.

The post operative complications were corneal scarring, hyphema, anterior synechiae etc. Corneal scarring, persistent corneal edema and anterior synechiae was noticed in one animal on the post operative days and was present through out the study. Mild hyphema was noticed on immediate post operative days in all animals underwent surgery and it resolved spontaneously in subsequent days. Conjunctival hyperemia and oedema were shown by one animal on immediate post operative days and cleared by seventh day.

From the present study following conclusions were made

- The incidence of glaucoma was 11% among the dogs with ophthalmological complaints presented to the Veterinary Hospitals at Mannuthy .
- Incidence was more common in aged dogs.
- Episcleral congestion was the most important clinical sign and other s were buphthalmos, corneal ededma and mydriasis.
- Schioetz tonometer could be used as an effective tool for diagnosing glaucoma.

- Medical management with oral administration of carbonic anhydrase enzyme inhibitors and beta blockers effectively reduced the IOP for short term period but in long term management they were ineffective.

- Medical management could also effectively resolve the clinical signs like episcleral congestion, corneal oedema , mydriasis etc

- Panting and gastrointestinal upsets were the side effects of carbonic anhydrase enzyme inhibitors and cardiac arrhythmias was noticed as side effects of beta blockers.

- Surgical procedure iridectomy effectively reduced the IOP but the post operative complications like anterior synechiae and corneal oedema limited the success of this technique.

- Surgical procedure trabeculectomy effectively reduced the IOP with out any significant post operative complications and lowering of IOP lasted for more than six months.

- The advantages of trabeculectomy over iridectomy were greater reduction in IOP with a clear cornea and absence of post operative complications like corneal scarring and anterior synechiae.

- Post operative complications were hyphema, anterior synechiae and persistent corneal oedema of which hyphema resolved spontaneously in subsequent days.

References

References

Abrams, K.L. 2001. Medical and surgical management of the glaucoma patient. *Clin. Tech. Small Anim. Prac*. 16: 71-76

Barnett, K. C. 1985. The diagnosis and differential diagnosis of cataract in the dog. *J. Small Anim. prac*. 26: 305-316

Bath,G. S. and Dua, K. 2006. Glaucoma in dogs. *Indian J.Vet. Med*. 26:152-153

Bedford, P. G. C. 1977a. The surgical treatment of canine glaucoma. *J. Small Anim. prac*. 18: 713-730

Bedford, P. G. C. 1977b. Gonioscopy in the dog. *J. Small Anim. prac*. 18: 615-629

Bedford, P. G. C. 1980a. The treatment of canine glaucoma. *Vet Rec*. 107:101-104

Bedford, P. G. C. 1980b. The aetiology of canine glaucoma. *Vet Rec*. 107: 76-82

Bedford, P. G. C. 1985. A simple method of gonioscopy for the dog and cat. *J. Small Anim. Prac*. 26: 407-410

Bedford, P. G. C. 1988. The use of a one piece drainage system in the treatment of a closed angle glaucoma in a dog. *J. Small Anim. Prac*. 29: 231-237

Bedford, P. G. C. 1989. A clinical evaluation of a one piece drainage system in the treatment of canine glaucoma. *J. Small Anim. Prac*. 30: 68-75

Bedford, P. G. C., and Grierson, I. 1986. Aqueous drainage in the dog. *Res. Vet. Sci.* 41:172-186

Bjerkas, E., Ekesten, B. and Farstad, W. 2002. Pectinate ligament dysplasia and narrowing of the iridocorneal angle associated with glaucoma in the English Springer Spaniel. *Vet. Ophthalmol*. 5: 49-54

Bonovas, S., Peponis, V. and Filloussi, K. 2004. Diabetes mellitus as a risk factor for primary open angle glaucoma: a meta analysis. *Diabet. Med.* 21: 609-614

Broadwater, J.J., Schorling, J.J., Herring, I.P. and Elvinger, F. 2008. Effect of body position on intraocular pressure in dogs without glaucoma. *Am. J. Vet. Res.*69: 527-530

Brooks, D. E., Gracia, G. A., Dreyer, E. B., Zurakowski, D. and Franco-Bourland, R. E. 1997. Vitreous body glutamate concentration in dogs with glaucoma. *Am. J. Vet. Res.* 58: 864-867

Brooks, D. E., Komaromy, A. M. and Kallberg, M. E. 1999. Comparative optic nerve physiology: implications for glaucoma, neuroprotection, and neuroregeneration. *Vet. Ophthalmol*. 2: 13-25

Brooks, D.E. and Dziezye, J. 1983. The canine glaucomas: pathogenesis, diagnosis and treatment. *Comp. On Cont. Educ.*, 5: 292-298

Caprioli, J. 1985. The pathogenesis and medical management of glaucoma. *Drug Dev Res.* 6: 193-215

Collins, B. K., Gross, M. E. ,Moore, C. P. and Branson, K. R. 1995. Physiologic, pharmacologic and practical considerations for anaesthesia of domestic animals with eye diseases. *J. Am. Vet. Med. Assoc.* 207:220-230

Cook, C. S. 1997. Surgery for glaucoma. *Vet Clin Small Anim*. 27:1109-1129

Cottrell, B. D. and Barnett, K. C., 1988. Primary glaucoma in the Welsh Springer Spaniel. *J. Small Anim. Prac.* 29: 185-199.

Crowston, J.G. 2008. Long-term outcomes of trabeculectomy. *Clin. Exp. Ophthalmol.* 36: 705-706

Crispin, S., Gould, D., Mould, J.E and Renwick, P. 2008. Hereditory eye disease and the BVA/ KC/ ISDS eye scheme: an update. *In. Pract*. 30: 2-14

Cruise, L. J. and McClure, R. 1981. Posterior Pathway for Aqueous Humor Drainage in the Dog. *Am. J. Vet. Res.* 42: 992-995

Cunningham, A.J. 1986. Intraocular pressure- physiology and implications for anaesthetic management. *Can. Anaesth Soc J.* 32: 195*

Cunningham, J.G. 2002. *Textbook of Veterinary Physiology*. Third edition. Saunders company, Philadelphia. pp 575

Das, J., Sharma, P. and Chaudari, Z. 2004. Acomparative study of small incision trabeculectomy avoiding tenons capsule vis- a- vis trabeculectomy with mytomycin- C. *Indian .J. Ophthalmol.* 52: 23-27

Das, J., Sharma, P. and Chaudari, Z., Bhomaj. S. 2001. Small incision trabeculectomy: experiences with this new procedure for glaucoma surgery in Indian eyes. *Acta Ophthalmol.* Scand. 79: 394–398.

Deehr, A. J. Dubielzig, R. R. 1998. A histopathological study of iridociliary cyst and glaucoma in Golden Retrievers. *Vet. Ophthalmol.* 1: 153-158

Denis, H. M. 2002. Anterior lens capsule disruption and suspected malignant glaucoma in a dog. *Vet. Ophthalmol.* 5: 79-83

Dice, P.F. 1981. The Canine Cornea.*Veterinary Ophthalmology*. (ed. Gelatt, K.N.) Second edition Lea and Fabiger, Philadelphia. pp 343-374

Dreyer, F.B. 1998. A proposed role of exitotoxicity in glaucoma. *J. Glaucoma.* ***7*****:** 62-67*

Ehrnrooth, P., Lehto, I., Puska, P. and Laatikainen, L. 2002. Long-term outcome of trabeculectomy in terms of intraocular pressure. *Acta Ophthalmol. Scand.* 80: 267–271

Ekesten, B. and Narfstrom, K. 1991. Correlation of morphologic features of the iridocorneal angle to intraocular pressure in Samoyeds. *Am. J. Vet. Res.* 52: 1875- 1878

Ekesten, B. and Torrang, I. 1995. Age related changes in ocular distances in normal eyes of Samoyeds. *Am. J. Vet. Res.* 56: 127-133

Esson, D., Fahrer, C. S., Zarfoss, M. K. and Dubielzig, R. R. 2007. Suspected uveal metastasis of a nail bed melanoma in a dog. *Vet.Ophthalmol.* 10: 262-266

Felchle, L. and Urbanz, J. L. 2001. Examining the anterior segment of the eye in small animals. *Vet. Med.* 96: 792 – 780

Fine, I.H., Hoffman, R.S. and Packer, M. 2004. Bimanual bipolar diathermy for recurrent hyphema after anterior segment intraocular surgery. *J. Cataract. Refract. Surg*. 30: 2017–2020*

Gelatt, K.N. 1981. The Canine Glaucomas. *Veterinary Ophthalmology*. Lea and Fabiger, Philadelphia. pp 390-434

Gelatt, K.N. 1991. The Canine Glaucomas. *Veterinary Ophthalmology*. (ed. Gelatt, K.N.) Second edition Lea and Fabiger, Philadelphia. pp 396-428

Gelatt, K. N.1997. Visual disturbance: where do I look?. *J. Small Anim. Prac.* 38: 328-335

Gelatt, K. N., Miyabayashi, T., Nicholson, K. J. G. And Mackay, E. O. 2003. Progressive changes in ophthalmic blood velocities in Beagles with primary open angle glaucoma. *Vet.Ophthalmol.* 6: 77-84

Gelatt, K. N. and Mackay, E. O. 2004a. Prevalence of breed – related glaucomas in pure- bred dogs in North America. *Vet.Ophthalmol.* 7: 97-111

Gelatt, K. N. and Mackay, E. O. 2004b**.** Secondary glaucomas in the dog in North America**.** *Vet.Ophthalmol.* 7: 245-259

Gibson, T. E., Roberts, S.M., Severin, G. A., Steyn, P. F. and Wrigley, R. H.1998. Comparison of gonioscopy and ultrasound biomicroscopy for evaluating the iridocorneal angle in dogs. *J. Am. Vet. Med. Assoc.* 213: 635- 638

Gionfriddo, J. R.1995. Recognizing and managing acute and chronic cases of glaucoma. *Vet Med*. 90: 265- 276

Gionfriddo, J. R. and Powell, C. C., 2001. Traumatic glaucoma in a dog. *Vet Med*. 96: 830-836

Grans, B. H., Cullen, C. L. and Peiffer, R. L. 2004. *Veterinary Ophthalmology Essentials*. Butterworth Heinemann Philadelphia. pp 206

Grozdanic, S. D., Matic, M., Betts, D. M., Sakaguchi, D. S. and Kardon, R. H. 2007. Recovery of canine retina and optic nerve function after acute elevation of intraocular pressure: implications for canine glaucoma treatment. *Vet. Ophthalmol.* 10: 101-107

Hanselman, B. A. 2002. Melanocytic glaucoma in a cairn terrier. *Can Vet J*. 43: 296-298

Hasegawa, T., Doki, k. and Yanase, J. 2001. Long term management of a glaucomatous eye in a dog treated with medical therapy alone. *J. Med. Vet. Sci.* 63: 1323-1325

Helper, L.C. 1989. *Magrane's Canine Ophthalmology*. Fourth edition. Lea and Fabiger, Philadelphia. pp. 297

Herring, I.P. 2003. Corneal surgery: instrumentation, patient considerations and surgical principles. *Clin. Tech. Small Anim. Pract*. 18: 152-160

Heywood, R. and Street, A. E., 1974. Biochemical studies on aqueous humor of Beagle dogs. *Res. Vet. Sc.* 17: 401-403

Hollingsworth, S.R. 2003. Corneal surgical procedures. *Clin. Tech. Small Anim. Pract*. 18: 161-167

Johnson, B. C. and Miller, W.W. 1990. Recognizing ocular signs of systemic diseases in dogs. *Vet Med*. 85:1076-1090

Kallberg, M.E., Brooks, D. E., Gelatt, K. N., Sanchez, C. A. G., Szabo, N. J. and Lambrou, G. N. 2007. Endothelin-1, nitric oxide, and glutamate in the normal and glaucomatous dog eye. *Vet. Ophthalmol.* 10: 46-52

Krupin, T., Leibmann, J.M., Greenfield, D.S., Rosenberg, L.F., Ritch, R. and Yand. J.W. 2005. The low pressure glaucoma treatment study (LoGTS). *Ophthalmol.* 112: 376-385 *

Maehara , S.K., Tsuzuki, O. N. K., Yokoyama, T., Yamashita, K. and Kotani, T. 2004. Effects of topical nilapridol and timolo mlaeate on intraocular pressure, facility of outflow, arterial blood pressure and pulse rate in dogs. *Vet. Ophthalmol.* 7: 147-15

Mandell, D. C and Holt, E. 2005. Ophthalmic Emergencies. *Vet Clin Small Anim*. 35: 455–480

Mangan, B.G., Yahya, K. A., Chen, C. and Gionfriddo, J.R. 2007. Retinal pigment epithelial damage, breakdown of the blood–retinal barrier, and retinal inflammation in dogs with primary glaucoma. *Vet. Ophthalmol.*10: 117-124

Magrane, W.G. 1977. *Canine Ophthalmology*. Third edition. Lea and Febiger, Philadelphia. pp. 304

McLaughlin,S. A., Render, J.A., Brightman, A. H., Whiteley, H. E., Helper, L. C. and Shadduck, J. A. 1987. Intraocular findings in three dogs and one cat with chronic glaucoma. *J. Am. Vet. Med. Assoc.* 191: 1443-1445

Mcllnay, T. R., Gionfriddo, J. R. Dubielzig, R. R., Powell, C. C. and Madl, J. E. 2004. Evaluation of glutamate loss from damaged retinal cells of dogs with primary glaucoma. *Am. J. Vet. Res.* 65: 776-786

Migdal, C., Gregory, W. and Hitchings, R. 1994. Longterm functional outcome after early surgery compared with laser and medicine in open angle glaucoma. *Ophthalmol.* 101: 1651-1657

Miller, P.E., Schmidt, G.M., Vainisi, S.J., Swanson, J.F. and Hermann, M.K. 2000. The efficacy of topical prophylactic antiglaucoma therapy in primary closed agle glaucoma in dogs: A multicenter clinical trial. . *J. Am. Anim. Hosp. Assoc.* 36: 431-438

Miller, P.E. 2003. Glaucoma. In: Slatter, D, ed. *Text Book of Small Animal Surgery Vol. II.* Third edition. W.B. Saunders Co., Philadelphia, pp. 1454- 1477

Mitchell, P., Leung, H., Wang, J.J. and Klein, R. 2005. Retinal vessel diameter and open angle glaucoma: Blue Mountains Eye Study. *Ophthalmol.* 112: 245-250

Moller, I., Cook, C. S., Peiffer, R. L., Nasisse, M. P. and Harling, D. E. 1985. Indications for and Complications of Pharmacological Ablation of the Ciliary

Body for the Treatment of Chronic Glaucoma in the Dog. *J. Am. Anim. Hosp. Assoc.* 22: 319- 326

Morgan, R. V. 2004. Preparations for eyelid surgeries. *Vet. Med.* 40: 346-350

Mughannam, A. J., Cook, C. S. and Fritz, C. L. 2004. Change in intraocular pressure during maturation in Labrador Retriever dogs. *Vet. Ophthalmol.* 2: 87- 89

Palmer, C.L.E. 2008. Acute Glaucoma. *Comp. Cont. Educ. Pract. Vet.* 10: 1-8

Peiffer , R.L., Gelatt, K. N. and Gwin, R.M. 1977. Schiotz caliberation table for canine eye. *J. Canine. Pract.* 4: 49*

Peiffer , R.L. and Gelatt, K. N. 1980. Aqueous humor outflow in beagles with inherited glaucoma: Gross and light microscopic observations f the iridocorneal angle. *Am. J. Vet. Res.* 41:1808-1813

Plummer, C. E., Mackay, E. O. and Kirk, N. G. 2006. Comparison of the effects of topical administration of a fixed combination of dorzolamide–timolol to monotherapy with timolol or dorzolamide on IOP, pupil size, and heart rate in glaucomatous dogs. *Vet. Ophthalmol.* 9: 245-249

Ridgway, A. E. A., Rubinstein, K. R. and Smith, V. H. 1972. Trabeculectomy A study of 86 cases. *Br. J. Ophthamol.* 56: 511- 516

Roberts, S.M., Severin, G. A. and Lavach, J.D. 1986.Antibacterial activity of dilute povidone-iodine solutions used for ocular surface disinfection in dogs. *Am. J. Vet. Res.* 47: 1207-1210

Sandt, R. R. O. M., Boveve, M. H., Stades, F.C. and Kik, M. J. L. 2003. Abnormal ocular pigment deposition and glaucoma in the dog. *Vet. Ophthalmol.* 6: 273-278

Sansom, J. 1988. Antibacterials in the treatment of ocular infections. *J. Small Anim. Prac.* 29: 487-499

Sansom, J., Barnett, K. C., Dunn, K.A., Smith, K. C. and Dennis, R., 1994. Ocular disease associated with hypertension in 16 cats. *J. Small Anim. Prac.* 35: 604-611

Sansom, J. 2000. Diseases involving the anterior chamber of the dog and cat. *In. Pract.* 22: 58-69

Schalm, O. W., Feldman, B.F., Zinkl, J.G. and Jain, N.C. 2000. *Veterinary Haematology*. Fifth edition. Lippincott Williams and wilkins, Philadelphia. pp 1344

Sihota, R., Gupta, V. and Agarwal, H.C. 2004. Long-term evaluation of trabeculectomy in primary open angle glaucoma and chronic primary angle closure glaucoma in an Asian population **.** *Clin. Exp. Ophthalmol.* **32: 23-28**

Shuster, J. N., Krupin, T., Kolker, A. E. and Becker, B. 1984. Limbus- v Fornix-Based Conjunctival Flap in Trabeculectomy. *Arch ophthalmol.* 102: 361-362

Slater, M. R. and Erb, H. N. 1986. Effects of risk factors and prophylactic treatment on primary glaucoma in the dog. *J. Am. Vet. Med. Assoc.* 188: 1028-1030

Slater, D. and Colitz, C. M. H. 2003. Principles of Ophthalmic surgery (Ed. Slater, D.) *Textbook of Small Animal Surgery Vol.II.* Third edition.W.B. Saunders Co., Philadelphia. pp 1287-1303

Smedes, S. L. and Dubielzig, R. R. 1994. Early degenerative changes associated with spontaneous glaucoma in dogs. *J. Vet. Diagn. Invest.* 6: 259-263

Smith, J. P., Brooks, D. E., Lazarus, J. A., Kubilis, P. S. and Gelatt, K. N.1996. Ocular hypertension following cataract surgery in dogs: 139 CASES (1992-1993). *J. Am. Vet. Med. Assoc.* 209: 105-111

Spiess, B. M., Bolliger, J. O., Guscetti, F., Haessig, M., Lackner, P. A. and Ruehli, M. B. 1998. *Vet. Ophthalmol.* 1: 41- 45

Stallard, H.B. 1973. *The Eye Surgery*. Fifth edition. John wright and son Ltd, Britain. pp 930

Stalmans, I., Gillis, A., Lafaut, A. S. and Zeyen, T. 2006. Safe trabeculectomy technique: long term outcome. *Br. J. Ophthamol.* 90: 44- 47

Townsend, W.M. 2007. Ophthalmic drugs : what s new?. *Vet. Med.* 102: 540-545

Turner, S. 2005. Veterinary Ophthalmology. A manual for Nurses and Technicians. Butterworth Heinemann Philadelphia. pp 205

Williams, D. L., Barrie, K. and Evans, T. F. 2002. *Veterinary Ocular Emergencies.* Butterworth Heinemann Philadelphia. pp 106

Williams, D. L. 2008. Oxidative Stress and the Eye. *Vet Clin Small Anim*. 38: 179-192

Wilkie, D. A. and Latimer, C.A. 1991. Effects of topical administration of timolol maleate on intraocular pressure and pupil size in dogs. . *Am. J. Vet. Res.* 52: 432-435

Wilkie, D.A. 2003. Ophthalmic Emergencies. In: Slatter, D, ed. *Text Book of Small Animal Surgery Vol. II.* Third edition. W.B. Saunders Co., Philadelphia, pp. 1477- 1486

Willis, A.M., Diehl, K.A. and Robbin, T. E. 2002. Advances in topical glaucoma therapy. *Vet. Ophthalmol*. 5: 9-17

Willis, A.M. 2004. Ocular hypotensive drugs. *Vet.Ophthalmol*. 34: 755-776

Woerdt, A. V. 2001. The Treatment of Acute Glaucoma in Dogs and Cats. *J Vet Emerg Crit Care*. 11: 199- 204

* Originals not consulted

EVALUATION AND MANAGEMENT OF GLAUCOMA IN DOGS

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ABSTRACT

The efficacy of various treatments for glaucoma were studied in nine cases. Dogs presented with the ophthalmological complaints were thoroughly examined and eight dogs with elevated intraocular pressure (IOP) were selected for the study. Initially medical treatment was given and for those cases which are refractory to medical treatment, surgical treatment was adopted.

The medical treatment consisted of a combination of oral administration of carbonic anhydrase enzyme inhibitors and ocular instillation of beta blockers. The surgical techniques adopted was iridectomy and trabeculectomy. Both performed under general anaesthesia. Parenteral administration of antibiotics, topical instillation of polymyxin-choramphenicol eyedrops, flurbiprofen eyedrops were given on the post operative days.

The incidence of glaucoma was 11% among the cases presented with the ophthalmological complaints. The dogs belonged to various breeds like Spitz, Dachshund, Labrador Retriever, Cocker Spaniel and Mongrel dogs of either sex with an average age of 8.61 years(range 3 years to 14 years). The major clinical signs observed were episcleral congestion, corneal oedema, vascularization of cornea, mydriasis, congestion of conjunctival blood vessels and buphthalmos.

Medical management with oral administration of carbonic anhydrase enzyme inhibitors and beta blockers effectively reduced the IOP for short term period but in long term management they were ineffective. Panting and gastrointestinal upsets, cardiac arrhythmia were the side effects observed in animals underwent medical therapy. Surgical procedure iridectomy effectively reduced the IOP but the post operative complications like anterior synechiae and corneal oedema limited the success of this technique. Surgical procedure trabeculectomy effectively reduced the

IOP without any significant post operative complications and lowering of IOP lasted for more than six months. The advantages of trabeculectomy over iridectomy were greater reduction in IOP with a clear cornea and absence of post operative complication like anterior synechiae.