SCLERAL APPROACH FOR EXTRACAPSULAR CATARACT EXTRACTION IN DOGS

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DECLARATION

I hereby declare that the thesis entitled **"SCLERAL APPROACH FOR EXTRACAPSULAR CATARACT EXTRACTION IN DOGS"** is a bonefide record of research work done by me during the course of research and this thesis has not previously formed the basis for the award to me of any degree, diploma, fellowship or associateship or other similar title, of any other University or Society.

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Certified that the thesis entitled **"SCLERAL APPROACH FOR EXTRACAPSULAR CATARACT EXTRACTION IN DOGS"** is a record of research work done independently by **TESSY MATHEW** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, fellowship or associateship to her.

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CONTENTS

LIST OF TABLES

LIST OF PLATES

Introduction

1. INTRODUCTION

The visual system in dog is evolved for an arrhythmic photic existence rather than a strict diurnal or nocturnal vision. Any impairment to the components of this visual system will result in blindness. Cataract is a major cause of visual handicap in animals, especially in old age. Cataract literally means 'to break down' which refers to the disruption of the normal arrangement of the lens fibres or its capsule resulting in loss of transparency of the crystalline lens.

Cataract is medically defined as any opacity of the lens or of its capsule (Helper, 1989 and Glover and Constantinescu, 1997). Cataracts are usually classified on the basis of age of onset, location, cause and degree of maturation. Cataracts can occur due to a number of reasons like indiscriminate administration of drugs, trauma, hereditary predisposition, diabetes mellitus, nutritional deficiencies or toxic substances. Biochemically, fundamental mechanisms in the formation of any form of cataract include some form of osmotic stress, protein aggregation and oxidative stress. The most common type of cataract in dogs occurs as a result of some inherited alterations in lens protein metabolism. Cataract can occur in any age, but its increased incidence is reported in old dogs (Gelatt and Mackay 2005). Although no prevalence studies have been carried out to determine the occurrence of cataract in native dogs, the condition has been reported in many exotic breeds like German Shepherd Dog, Labrador Retrievers and Golden Retrievers, which have been widely introduced in our country.

A major draw back in the treatment of cataract in dogs is that only a few pharmacological agents are capable of retarding the development of cataract or causing its regression (MacMillan *et al.*, 1989). Medical treatment is of little value in the treatment of cataract. Currently surgical extraction of the lens is therefore the most promising treatment for cataract (Bath and Dua, 2006). Extracapsular extraction of cataractous lens performed manually is the most common surgical option for animals. The limiting factor in canine cataract surgery is the difficulty in postoperative care. A surgical technique with minimum postoperative complications and short postoperative period is desirable. The usual surgical method is extracapsular cataract extraction through a clear corneal incision. The disadvantage of this technique is the increased damage to the cornea and increased incidence of postoperative corneal oedema. The occurrence of postoperative scar is also high in case of corneal incisions (Nelms *et al.* 1994). In dogs, cornea accounts for most of the refracting power and the lens provides only the fine focus. Hence, a clear cornea is essential for the successful outcome of cataract surgery. The use of a scleral incision for the approach of anterior chamber will be helpful in minimizing the corneal trauma during cataract surgery (Hickman *et al.* 1995).

Hence the present study was conducted with the objective of evaluating the effectiveness of scleral approach for extracapsular cataract extraction in dogs.

Review of literature

2. REVIEW OF LITERATURE

2.1. VISION IN DOGS

Miller and Murphy (1995) suggested that the dog's visual system was evolved for an arrhythmic photic existence rather than a strict diurnal or nocturnal vision. The dogs have increased sensitivity to moving objects and flickering lights. The visual perception, visual field, and depth perception may vary depending on breed. Regarding colour vision, the dogs have a dichromatic vision with a spectral neutral point.

2.2. ANATOMY AND PHYSIOLOGY OF CANINE LENS

Krawitz (1963) described lens as a transparent biconvex body, supported by suspensory ligament behind the iris and in front of the vitreous humour. The lens is made up of a capsule, which has a single layer of cells only on the anterior surface. Inside the capsule is the lens substance, which is made up of complex combinations of proteins and water. Any changes within the lens capsule or lens substance that reduce its ability to transmit light are called cataractous changes.

Martin and Anderson (1991) described lens as a biconvex, transparent structure suspended by the zonular fibres. The lens is unique in its transparency, lack of nerve supply and high concentration of carbonic anhydrase. The lens capsule has elastic properties but no elastic fibres. The lens fibres elongate and meet fibres from the opposite side to form the lens sutures.

2.3. NORMAL CANINE HAEMATOLOGY

According to Schalm *et al.* (2000), normal values of various haematological parameters were as total leucocyte count 6 to $18x10^3$ cells/cmm (average 11 x 10^3), differential count may be as 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 will be between 12 and 18 g/dl (av. 14.9 g/dl) and packed cell volume 37-55 v% (av. 45.54%).

2.4. INCIDENCE OF CATARACT

Koch (1972) reported bilateral cataracts in a group of related old English Sheep Dogs. Besides cataracts, retinal detachments were detected in some animals. It was opined that the cataracts in this breed were inherited as a recessive trait.

Roberts and Helper (1972) described hereditary form of cataract in a group of two hundred and ninety one Afghan Hounds. The incidence was reported in animals of varying age groups from three months to eight years. Pedigree studies indicated a recessive type of inheritance

Rubin and Flowers (1972) reported the development of bilateral equatorial cataract, prior to two years of age in a family of Standard Poodles. The most common sites of origin of cataracts that progress to completion were the posterior subcapsular area. These cataracts appeared to be transmitted as a simple autosomal recessive gene.

Barnett (1978) described several forms of primary hereditary cataracts and various modes of inheritance in Boston terrier, Staffordshire Bull Terrier, Miniature Schnauzer, Golden Retriever, Labrador Retriever, American

Cocker Spaniel, Afghan Hound and Old English Sheepdog. The bilaterally symmetrical, progressive cataract in Boston Terrier, Staffordshire Bull Terrier and Miniature Schnauzer were due to a simple autosomal recessive gene. The cataract in Afghan Hound and Old English Sheepdog also showed a recessive inheritance. Cataract in the Labrador Retriever and Golden Retriever was due to a dominant gene with a variable expression. The cataract in the American Cocker Spaniel was also due to a dominant gene without a simple type of inheritance.

Yakely (1978) conducted breeding studies and suggested a recessive mode of inheritance for the occurrence of cataract in the American Cocker Spaniel.

According to Barnett (1980) bilateral progressive cataracts were noticed in Welsh Springer Spaniel, between four and six months of age. Pedigree research of first two litters indicated a simple Mendelian pattern of autosomal recessive inheritance.

Narfstorm (1981) reported the occurrence of cataracts in 49 of 97 west highland white terriers, which was attributed to an autosomal recessive inheritance of the trait.

Vainisi *et al.* (1981) reported the occurrence of cataract in timber wolf puppies fed on a commercial formula. The deficiency of arginine in the diet had been attributed as the cause of cataract.

Barnett and Startup (1985) reported two cases of primary and progressive cataract in full siblings from different litters of dogs. The cataracts had been nuclear and capsular in position as well as in the posterior suture lines and the two eyes were symmetrically affected. The sire and dam

in both cases were examined and found to be clinically clear indicating a recessive mode of inheritance.

Barnett (1986) reported the occurrence of bilateral progressive cataract in German Shepherd Dog, due to an autosomal recessive gene.

Barnett (1988) reported that hereditary cataracts occur in a number of dog breeds and most of them follow a recessive mode of inheritance, except in Golden and Labrador Retrievers, where it was via a dominant gene.

Strande *et al.* (1988) reported the occurrence of congenital cataract in four, three week old English Cocker Spaniel pups from a litter of seven pups.

Curtis and Barnett (1989) conducted ophthalmic examination in 3650 Golden and Labrador Retrievers over a period of three years. Cataract was diagnosed in 7.4 per cent of Golden Retrievers and 6.6 per cent of Labrador Retrievers. Of the diagnosed cases, 4.7 per cent were of the posterior polar subcapsular (PPS) type and 5.5 per cent showed hereditary relationship. The prevalence of cataracts of the acknowledged hereditary type was slightly higher in the Labrador Retrievers than in the Golden Retrievers.

Collins *et al.* (1992) reported the occurrence of cataracts in 16 dogs from an inbred line of Chow chows.

Bjerkas and Haaland (1995) reported pulverulent cataracts in 52 of one hundred and two Norwegian buhunds. The age of these dogs ranged from three and a half weeks to 12 years. Both the sexes were equally affected. Except in two cases, the changes were bilateral. The majority of the examined dogs were related and an autosomal dominant mode of inheritance with a high degree of penetrance was suggested.

Gelatt *et al.* (2003) studied the incidence of cataracts in a total of 8222 Bichon Frise dogs. It was observed that both the sexes were equally affected and dogs of two to eight years of age were most frequently affected. In this breed, initial cataract involvement affected the anterior and posterior cortices.

Williams *et al.* (2004) examined 2000 dogs to determine the presence of cataract. They found that animals over 13.5 years were affected by some degree of lens opacity. From the study the age at which prevalence of cataract was 50% in a population which could be correlated with longevity.

Gelatt and Mackay (2005) in a retrospective study on cataract in dogs over a period of 40 years found that in about 60 breeds the prevalence of cataract exceeded the baseline prevalence of 1.61% seen in mixed breed/ hybrid dogs. The prevalence of cataract was found age related, affecting mostly the aged group.

Wallace *et al.* (2005) studied the inheritance of cataract in 61 Bichon Frise dogs and concluded that cataracts appeared as an autosomal recessive trait.

Bath and Dua (2006) described cataract as a leading cause of vision loss in old aged dogs. They studied cataracts in thirteen clinical cases of dogs with record of their breed, age and sex. Cataract was recorded in old dogs without any age, breed or sex specificity. Mean age of senile cataract was recorded as 9.7 ± 0.9 years in eleven cases out of a total of thirteen cases. One case each of juvenile developmental cataract and diabetic degenerative cataract were recorded.

2.5. CAUSES OF CATARACT

Martin *et al.* (1972) recorded that transient cataract was induced with the administration of disophenol in dogs during the treatment of ancylostomosis. Weanling puppies were most susceptible to cataract formation. But in the recommended dose and route of administration (10mg/kg SC) the drug produced either minimal lenticular opacities or none at all.

Glaze and Blanchard (1983) observed that six out of a litter of eight Samoyed puppies developed lenticular opacities when reared upto weaning on a commercial replacement diet for canine milk. Similar opacities were not present in littermates reared on dam's milk.

Shafiuzama *et al.* (1998) reported experimental induction of cataract in canines. They used a 23-gauge needle bent on its tip for scarification of the anterior lens capsule. Cataracts developed in all cases in 8 ± 2 days.

Pillai (2000) induced cataract in dogs by injecting 25 per cent calcium borogluconate into the anterior chamber. Cataracts developed in all cases in 22.58 ± 0.66 days.

Nelson (2000) described cataract formation as a common long-term complication associated with diabetes mellitus in dog. Diabetic cataract formation is related to the altered osmotic relationship in the lens, which result from glucose metabolism through the sorbitol pathway to sorbitol and fructose. Cataract formation is an irreversible process once began.

Keil and Davidson (2001) described diabetes mellitus as a leading metabolic abnormality that causes cataract. In diabetes mellitus, as the glucose

concentration in the aqueous increased, the lenticular anaerobic glycolitic pathway gets saturated and glucose gets shunted down an alternate sorbitol pathway. Accumulation of sorbitol in the lens results in osmotic forces that lead to imbibition of water from the aqueous humour. This excess fluid results in swelling and opacification of the fibre.

Campos *et al.* (2005) reported the occurrence of transient bilateral diabetic cataract in a four month old Brazilian terrier puppy, which showed resorption with prompt insulin therapy.

2.6. EXFOLIATIVE OCULAR CYTOLOGY

Lavach *et al* (1977) obtained conjunctival scrapings from both normal and infected eyes. Keratinised epithelial cells and leucocytes were uncommon in normal eyes. In inflamed conjunctiva the initial inflammatory cell response was seen specific according to the cause. Leucocytes were the predominant cell type in all the cases of acute and chronic bacterial conjunctivitis.

Gelatt (1991) recommended corneo-conjunctival cytology to demonstrate the intensity of inflammation and the presence of infection by the type of inflammatory cells. The smears or scrapings obtained from cornea, conjunctiva, nictitating membrane and eyelid also helped in diagnosis.

Felchle and Urbanz (2001) described methods to obtain samples for conjunctival and corneal cytology using cotton or Dacron swabs, a cryobrush, a malleable platinum spatula or the blunt end of a scalpel blade. The procedures for preparing, staining and examining the smears were also explained. It was also suggested that an ophthalmic examination might be preceded by obtaining a thorough medical and ophthalmic history. Menace reflex acts as an aid to

assess peripheral and central vision roughly. Pupillary light reflex was used for the evaluation of II and III cranial nerves.

2.7. OCULAR THERAPEUTICS

Roberts *et al.* (1986) collected specimens for bacterial cultures 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.

Nasisse *et al.* (1986) studied the response of canine corneal endothelium to intraocular irrigation with saline solution, balanced salt solution and balanced salt solution with glutathione. Corneal oedema was not seen with any of the solutions. Mild to moderate degree of iritis was present in all groups. Endothelial cell gapping observed might have developed due to the fluid turbulence caused by continuous irrigation. It was concluded that irrigating fluid composition had little deleterious effect on corneal endothelium, if fluid volume and time of irrigation are not excessive.

Krohne and Vestre (1987) studied the effects of flunixin meglumine and dexamethasone on the aqueous protein values during and after intraocular surgery in dogs. A combination of both these drugs had a synergestic or additive effect in decreasing the postoperative inflammation than when they were used alone.

According to Sansom (1988) topical use of ocular drugs was found to be beneficial. Even then systemic administration of drugs was essential in case of severe infections. Chloramphenicol was found to have better ocular

concentration than other antibiotics. Aminoglycosides, pencillins, polypeptide antibiotics, tetracyclines, sulphonamides, cephalosporins etc, were also effective against different group of microorganisms.

Gerding *et al.* (1989) studied the effect of intracameral injection of visco-elastic solution on the intraocular pressure in dogs. It was found that increase in intraocular pressure after the visco-elastic solution was aspirated was mild and less prolonged than when the solution was left in the anterior chamber.

Helper (1989) explained the use of mydriatic and cycloplegic agents, which were useful to dilate the pupil, prevent adhesions and to relieve pain by paralyzing the ciliary body. Topical and systemic use of antibiotics and non-steroidal anti-inflammatory agents were also recommended.

Millichamp *et al.* (1991) studied the effect of flurbiprofen on out flow of aqueous humour in 39 dogs. It was reported that though cyclo oxygenase inhibitors like flurbiprofen had potential for controlling ocular inflammation in dogs and they should be used with caution as they cause an increase in intraocular pressure.

Millichamp and Dziezyc (1991) compared the effectiveness of administration of flunixin meglumine intravenously and flurbiprofen topically in controlling ocular irritative response in dogs that had undergone laser anterior capsulotomy. Both the drugs produced similar effects and maintained mydriasis but increased intraocular pressure. The advantage of flurbiprofen over flunixin meglumine lies in its route of administration. Systemic administration of flunixin meglumine had increased risk of side effects like acute renal failure.

Whitely *et al.* (1993b) recommended the topical and systemic administration of mydriatics, antibiotics and anti-inflammatory drugs before and after cataract surgery.

Peterson-Jones and Clutton (1994) studied the effects of intraocular adrenaline to achieve haemostasis and maintain mydriasis in 40 dogs undergoing extracapsular cataract extractions. It was found that the intraocular administration of 100µg of adrenaline did not cause an increase in heart rate or any arrhythmias.

Miller (1995) described the use of immunosuppressants like cyclosporine and azathioprine as anti-inflammatory drugs in ophthalmology. Azathioprine effectively controlled immune mediated uveitis. Chronic and refractory cases respond to azathioprine at an initial dose of 2mg/ kg body weight per orally.

According to Nasisse (1995) the use of viscoelastic material in intra ocular surgery helped to keep the anterior chamber inflated and also it minimized the corneal endothelial damage.

Taylor *et al.* (1995) found out that prevalence of intraocular bacterial contamination was six times greater in eyes in which extracapsular extraction or intracapsular extraction was performed, compared to those in which phacoemulsification and aspiration was carried out. Surgical approach and intraocular contamination were found to be associated with postoperative development of glaucoma.

Williams *et al.* (1996) recommended the instillation of adrenalin for mydriasis, air or viscoelastic materials to reduce injury to corneal endothelium and iris.

The non steroidal anti-inflammatory drugs were indicated for the treatment of uveitis, blepheritis, conjunctivitis or keratitis. Among them flurbiprofen 0.03% was reported to prevent intraoperative miosis and effective in stabilizing blood aqueous barrier in canines. Systemic therapy was indicated for deep intraocular or orbital infections (Moore 2001).

Munro (2001) opined that topical therapy was the route of choice for majority of ocular surface conditions, with the eyelids, conjunctiva, and cornea and in few instances iris being the target tissue. Topical non-steroidal anti-inflammatory drugs with good corneal penetrating ability like flurbiprofen and diclofenac sodium were recommended over topical steroids especially in cases with penetrating injuries. Cytology and bacterial cultures were reported to be necessary in case of refractory ulcers.

Lannek and Miller (2001) suggested the treatment of a postsurgical increase in the intraocular pressure with topical application of dipivefrin or timolol alone or in combination. If this was not sufficient to keep the intraocular pressure (IOP) below 20 mm of Hg topical and oral administration of carbonic anhydrase inhibitors might be added to the therapy.

Kilic and Unsaldi (2005) investigated the effects of thiopental and ketamine on ocular parameters like intraocular pressure and pupillary size. Xylazine-thiopental combination was found to be better than xylazine-ketamine combination for intraocular surgery as the former combination decreases intraocular pressure.

Yu-Speight *et al.* (2005) studied the aqueous humour concentrations of ciprofloxacin and ofloxacin in 12 dogs after topical administration. Comparison of the aqueous humour concentrations for the two drugs showed that ofloxacin concentrations were significantly higher than ciprofloxacin.

Ofloxacin has shown higher corneal penetration and ability to achieve the MIC_{90} of common ocular contaminants than ciprofloxacin.

2.8. MEDICAL MANAGEMENT OF CATARACT

Rubin and Gelatt (1968) described spontaneous resorption of cataractous lens material especially in dogs of younger age groups. Significant differences were not observed between males and females in cataract resorption. In dogs with resorbing lens, the hazards of iritis could be avoided using mydriatics and topical corticosteroids in severe cases.

Gelatt (1975) reported spontaneous resorption of cataracts in 64 cases in nineteen different breeds of dogs, aged between five months and 14 years of either sex. He opined that if the resorption process was extensive, vision will be restored but medical control of iridocyclitis using mydriatics and corticosteroids was necessary.

MacMillan *et al.* (1989) evaluated the efficacy of zinc citrate ascorbate in 146 dogs (256 eyes) that had varying lens opacities. Of the 138 eyes treated with zinc citrate ascorbate, only four eyes (2.9 per cent) showed decreased lens opacity.

Whitely *et al.* (1993a) reported that aldose reductase inhibitors might be effective in preventing or delaying diabetic cataracts. It was also stated that daily non-steroidal anti inflammatory drug therapy might decrease the progression of cataracts.

Keil and Davidson (2001) reported that dogs unsuitable for cataract surgery could be treated with topical ophthalmic corticosteroids to control lens-induced uveitis. The medications need to be administered for weeks or months depending on the individual animal.

Bath and Dua (2006) opined that treatment of cataract using vitamin E or multivitamin preparations did not have any prognostic value and concluded that medicinal treatment is of little value in cases of cataract.

2.9. SURGICAL TREATMENT OF CATARACT

Magrane (1961) on evaluation of cataract extraction in 104 dogs, it was concluded that extracapsular cataract was the safest procedure for cataract surgery. Iridectomy was found to be unnecessary and presented the danger of haemorrhage.

Magrane (1968) attempted intracapsular lens extraction using cryoprobe in fifteen dogs. The dogs were categorized as having normal clear lens, cataractous and misplaced lenses. In dogs with normal, intact lenses or with uncomplicated juvenile or senile cataract, intracapsular cryoextraction resulted in rupture of the anterior capsule at or near the vertical equator. This necessitated an extracapsular extraction for the removal of the lens content.

According to Gelatt *et al* (1975), though intracapsular cataract extraction technique was preferred to reduce the chances of lens induced uveitis, that procedure was risky in dogs because of the posterior lens capsule was strongly attached to the anterior hyaloid membrane. Rupture of anterior capsule and luxation of the resorbing cataract should be treated by lens extraction to avoid uveitis and glaucoma.

Spreull *et al.* (1980) described the various procedures for lens extraction in dogs. To access the anterior chamber various surgical approaches like corneal, limbal and scleral incisions were used. It was opined that the easiest approach for good access into the anterior chamber was the temporal incision in clear cornea, from 1 o'clock to 5 o'clock angle in left eye

and 11 o'clock to 7 o'clock angle in right eye. Intracapsular lens extraction was suggested as it avoided common risk of secondary cataract in posterior capsule and uveitis due to release of lens substance into the anterior chamber. But the difficulty in breaking of zonular attachments, escape of vitreous and bleeding were the disadvantages. Authors preferred absorbing suture applied in simple interrupted pattern placed 1mm apart and penetrating the cornea through the two third of its thickness to suture the corneal wound. Reconstitution of anterior chamber by injecting saline or air was also suggested.

Rooks *et al.* (1985) analyzed 240 extracapsular cataract extractions in dogs. Three surgical approaches were used: a clear corneal section, limbus-based conjunctival flap and discission/ aspiration. Significant difference in success rates among the three procedures could not be found out. Overall success rate was 79%. The success rate of surgery on juvenile/ congenital cataract was 15% higher than that on diabetic and senile cataract. The success rate was 18% less for lentectomy with concurrent iridectomy than for lentectomy without iridectomy.

Dadke *et al.* (1991) described the surgical management of cataract in buffalo calves. The cataractous lenses were extracted through an incision on the limbus.

Dzeizyc *et al.* (1991) narrated the technique of extracapsular phacofragmentation and aspiration of cataracts in 12 horses. A two millimeter stab incision made into the cornea near limbus at 4 o'clock position was used to access the anterior chamber. Accidental opening of posterior capsule and vitreous prolapse was reported in a few cases as intraoperative complication.

Gelatt (1991) described that the anterior segment of the eye in dogs can be approached through three basic anatomic incisions *viz.*, limbal, clear corneal and scleral. The diffuse haemorrhage associated with scleral incision was considered as its disadvantage.

In a study of phacofragmentation and ocular lens implantation in 296 eyes Nasisse *et al.* (1991) reported that the posterior capsular tears as the common intraoperative complication.

Whitely *et al.* (1993a) in a review of reports on cataracts and management suggested that extracapsular cataract extraction was a more successful (90 percent) procedure than intracapsular extraction in dogs. Clear corneal or limbal based conjunctival flap approach made no difference in success rates. Cataract extraction was suggested only in healthy and tractable candidates free from any systemic or ophthalmic diseases.

Whitely *et al.* (1993b) described the various surgical techniques used for cataract removal in dogs. For extracapsular cataract extraction clear corneal or limbal based conjunctival flap method were equally suggested to approach anterior chamber. Intraoperative complications in extracapsular cataract extraction included large incision, collapse of anterior chamber, posterior capsular tears, vitreous prolapse, lens subluxation, hyphaema, retension of remnants of lens material and subsequent uveitis.

Nelms *et al.* (1994) compared the effects of corneal and scleral approaches for cataract extraction. They found that scleral approach had several advantages over corneal approach like, avoidance of corneal astigmatism, decreased corneal scarring and edema and greater wound stability. The complications encountered with the scleral approach were

excessive bleeding at the incision site, iris prolapse into the surgical wound and difficulty in aspirating cortical material from ventral capsular bag.

Hickman *et al.* (1995) described the technique of entering the anterior capsule through a limbal based conjunctival flap and scleral incision. In spite of its complications like conjunctival bleeding and iris prolapse, scleral method offered satisfactory healing of incision and no postoperative scar persisted.

Spiess *et al.* (1996) evaluated the use of radiofrequency anterior capsulotomy in cataract extraction by phacoemulsification followed by intraocular lens implantation in 21 canine eyes during routine cataract extraction. It was found as an easy and reliable method for excision of the anterior lens capsule. The procedure could be completed in 25 to 30 seconds, thus reducing the overall time of intraocular manipulation.

Williams *et al.* (1996) reviewed the current practices in surgery of cataract in dogs in Great Britain, Europe and the United States of America. Large 190° peripheral corneal incisions were preferred by most surgeons than the limbal incisions beneath the conjunctival flap. Capsulotomy was performed using blade or needle. Intraoperative complications with extracapsular cataract extraction observed were endothelial trauma and subsequent corneal oedema, and inadvertent tearing of posterior lens capsule.

Glover and Constantinescu (1997) recommended a clear corneal incision and a continuous curvilinear capsulorhexis for extracapsular cataract extraction. Use of visco-elastic material during surgery was strongly recommended as it protected the intraocular tissues, maintaining working space, tamponade vitreous, especially when there was posterior capsular tear and reduces instrument contact to the delicate tissues. Intraoperative

complications like miosis, despite the use of mydriatics; iris prolapse owing to incomplete mydriasis, too large corneal incision and excessive vitreous expansion; posterior capsular tear and vitreous prolapse.

Renwick (1997) suggested that phacoemulsification was best done before the cataract becomes mature. When the cataracts were mature or hypermature, the preoperative complications increased and phacoemulsification became technically more difficult to perform.

Devareddy *et al.* (1998) reported implantation of intraocular lens in ten dogs after the removal of cataractous lens through a corneal incision. Iris prolapse was observed as an intraoperative complication.

Hazra and Samanta (1998) described extracapsular extraction in twelve dogs. The incision was made over the limbus at the 11O'clock to 1O'clock position and capsulotomy was done with 26G needle cutting round the clock. Anterior chamber was irrigated with Ringer's lactate solution.

Shafiuzama *et al.* (1998) reported satisfactory extracapsular cryoextraction of the cataractous lens using carbon dioxide as cryogen in dogs. The corneal incision made from 9 O'clock to 3 O'clock position on the superior border was sutured with 8-0 silk. All the operated animals regained ambulatory vision.

Biros *et al.* (2000) narrated extracapsular cataract extraction in 220 dogs (346 eyes) through a 160° two step clear corneal or corneo-scleral incision and a continuous curvilinear capsulorhexis. A one percent solution of hyaluronic acid was used as viscoelastic material to inflate anterior chamber. Severe radial tears, posterior capsular tears with or without vitreous herniation

were reported as intraoperative complications. Corneal incisions were closed with 7/0 or 8/0 polyglactin 910 in simple interrupted pattern.

Pillai (2000) compared the efficacy of cryo-coagulation and intracapsular cryoextraction of the lens for the treatment of cataract in dogs and concluded that intracapsular cryoextraction was better method for treating cataracts in dogs.

Slatter (2001) described the lateral canthotomy technique to improve the exposure of the eyeball for surgical manipulations.

Tyagi *et al.* (2003) reported extracapsular extraction of cataractous lens in a bullock. The lens was extracted through a limbal-based corneal incision from 10 O'clock to 2 O'clock position.

Ramani *et al.* (2005) described the instrumentation and techniques for cataract extraction and intraocular lens implantation in a total of 32 dogs. Extracapsular cataract extraction and cryoextraction of the lens were done through corneal incisions. Anterior capsulorhexis was performed by a can opener method using a bent 26 G hypodermic needle. Miosis was the most commonly encountered intraoperative complication. It occurred during the escape of aqueous humour after corneal stab wound and also during the lens extraction. This problem was overcome by reforming the chamber with viscoelastic material.

Komaramy *et al.* (2006) ensured proper positioning of the globe by retrobulbar injection of normal saline and a scleral stay suture for evaluating a new subretinal injection device in 33 young normal adult mongrel dog models.

2.10. POSTOPERATIVE RECOVERY AND COMPLICATION

Startup (1967) described the various complications encountered in cataract surgery in dogs like failure of corneal healing, iris prolapse, hyphaema, iridocyclitis, keratitis, corneal opacity, or excessive corneal scarring, epithelialisation of anterior chamber, pupillary adhesions, infection, glaucoma and detachment of retina.

Peiffer Jr., (1981) suggested that a low grade uveitis may result from the mechanical presence of *Dirofilaria immitis* in the anterior chamber or due to the toxic effects of its metabolic products. A severe inflammatory response in the eye may be elicited if the worm is broken or killed by a filaricidal therapy.

Paulsen *et al.* (1985) from a retrospective study on 65 cases of lens removal, reported that patients with lens induced uveitis in the eye suffered a greater incidence of surgical complication and an increased rate of failure following surgery. The surgical complications included vitreous presentation, hyphaema, fibrin clot in aqueous and uncontrollable miosis. The causes of postoperative complications were glaucoma, cyclitic membrane formation, miotic pupil, panuveitis and retinal detachment.

Miller *et al.* (1987) reviewed 56 dogs that had undergone cataract extraction by phacofragmentation and aspiration over a period of four years. About 94.6 per cent (53/56dogs) showed improved vision in the immediate postoperative period. Vision was present in 85.2 percent (25/29) of dogs at two years after surgery and was 71.4 percent (5/7) at four years after surgery. Age of the operated dogs was found unrelated to restoration of vision. The commonly detected complications were immediate increase in intraocular pressure, transient corneal oedema and formation of fibro pupillary

membranes. Severe anterior uveitis and secondary glaucoma were suggested as major causes of failure.

According to Nasisse *et al.* (1990) posterior capsular opacification and postoperative pupillary opacification – adherence of fibrin to uveal tissue and residual lens material, and its subsequent organization which resulted in permanent pupillary immobility or formation of iridal and cyclitic membrane- were the two complications of extracapsular cataract extraction in dogs. Authors described successful use of Q switched ophthalmic Neodymium: Yittrium aluminium Garnett (Nd: YAG) laser for the treatment of the same.

In a review of 12 horses that had undergone phacofragmentation for cataract removal, Dziezyc *et al.* (1991) observed that visual results were found to be improved in 10 of the horses. The postoperative complications were corneal ulcer, diffuse corneal oedema and uncontrollable uveitis.

A successful surgical outcome of cataract surgery was defined as a clear visual axis and improvement in or restoration of functional vision, assessed by response to a menacing gesture, ability to follow thrown cotton balls and ability to navigate an obstacle course. Of the 50 eyes, 39(78%) were visual two months after surgery. Causes for poor post operative vision were posterior capsular opacification, retinal detachment and glaucoma (van der Woerdt *et al.*, 1992).

The complications encountered in the cataract surgery included iridocyclitis, glaucoma, iris bombe, hyphaema, fibrin formation, corneal oedema due to endothelial cell dysfunction or loss, capsular opacities and retinal detachment. The use of visco-elastic material, intraocular lens implants, postoperative topical beta-blockers or carbonic anhydrase inhibitors were useful in reducing these complications (Whitely *et al.*, 1993b).

Bagely and Lavach (1994) compared post operative outcome in 123 non-diabetic dogs (182eyes) and 30 diabetic dogs (57 eyes) in which cataract lens extraction was done by phacofragmentation, extracapsular or intracapsular extraction based on the cases. The postoperative complications like diffuse corneal oedema, uveitis and posterior capsular opacifications were found in both groups. When diabetic and non-diabetic dogs were given proper preoperative and postoperative medical regimens, clinical differences in postoperative findings were inapparent.

Smith *et al.* (1996) studied the incidence of postoperative ocular hypertension after cataract surgery in dogs. They found that increase in intraocular pressure (IOP) was more rapid in eyes that had undergone phacoemulsification compared with those that had extracapsular lens extraction. The various contributing factors for elevated IOP were blockage of iridocorneal angle with cellular and lens debris, increased inflammatory response to free lens proteins, breakdown of the blood-aqueous barrier, and trauma of surgical procedure and release of prostaglandins.

According to Williams *et al.* (1996) the postoperative complications of extracapsular cataract extraction were corneal oedema, uveitis, development of after-cataract due to regeneration of remnants of lens epithelia and retinal detachment.

Devareddy *et al.* (1998) reported corneal opacity, ocular discharge and congestion of sclera and conjunctiva were the major postoperative complication encountered after cataract extraction through corneal incision and implantation of introcular lens in dogs.

Hazra and Samanta (1998) described corneal opacity as the main complication following extracapsular cataract extraction in 12 dogs, which

might be probably due to excessive instrumentation and damage to the cornea by handling and manipulation during the operation. Complete restoration of vision was apparently not possible in all cases.

Shafiuzama *et al.* (1998) reported that all the operated dogs regained functional vision following extracapsular cryoextraction of cataractous lens in dogs. Corneal opacity, increased intraocular pressure, lacrimation, hyphaema, and slight prolapse of iris were the complications encountered

Biros *et al.* (2000) conducted a retrospective study in 220 dogs (346 eyes) that had undergone extracapsular cataract extraction or phacoemulsification for cataracts. Of 346 eyes 58 (16.8 percent) developed postoperative introcular hypertension. Six months after surgery glaucoma was observed in 15.5 percent and at 12 months after surgery it was 28.8 percent. Eyes with hypermature cataracts were at a significantly higher risk for glaucoma since hypermaturity was associated with chronic lens induced uveitis. Eyes with lens induced uveitis showed a heightened inflammatory response after surgery.

Lannek and Miller (2001) observed that dogs with preoperative lens induced uveitis and those with intra operative intraocular haemorrhage were at an increased risk for glaucoma.

Collinson and Peiffer (2002) compared the pathological complications arising from manual extracapsular cataract extraction and phacoemulsification and aspiration. The major complications encountered were keratitis, glaucoma, endophthalmitis, posterior capsular tears, lens remnants and retinal damages. It was suggested that manual extracapsular cataract extraction should be accompanied with rigorous efforts to reduce surgically induced inflammation.

The need for total removal of cortical material in both the surgical techniques without causing damage to posterior capsule was emphasized.

Tyagi *et al.* (2003) observed that corneal opacity developed in the immediate postoperative period, but subsided by about seven days in a bullock undergone extracapsular cataract extraction. A second surgery was done to remove hyphaema and pupillary membranes. Restoration of functional vision was achieved within one and a half month postoperatively.

Johnstone and Ward (2005) studied the incidence of posterior capsule disruption during phacoemulsification in 143 dogs (244 eyes) and it was concluded that there were no significant differences in postoperative complications or visual outcome between eyes with or without posterior capsule disruption. The most significant complication of posterior capsule disruption was the inability to implant an intraocular lens.

Ramani *et al.* (2005) reported mild corneal opacity in few dogs, following cataract extraction and intraocular lens implantation, even though endothelium was avoided in corneal suturing. Posterior capsular tear and prolapse of vitreous were also encountered in few dogs.

Materials and methods

3. MATERIALS AND METHODS

3.1. SELECTION OF CASES

The study was conducted in six dogs (seven cases) of different age, breed, and sex presented to the Veterinary College Hospitals at Mannuthy and Kokkalai. All the animals presented with a history of impaired vision were thoroughly examined and six dogs diagnosed to have cataract were selected for the study. In one case both left and right eyes were subjected to cataract extraction at an interval of seven months and were considered as two separate cases (Plate no:1). The cases were numbered as I, II, III, IV, V, VI and VII. Detailed clinical examinations were carried out in all cases. The dogs were subjected to extracapsular cataract extraction through scleral incision, under general anaesthesia.

3.2. EXTRACAPSULAR CATARACT EXTRACTION

3.2.1. Signalment and Anamnesis

The age, sex, breed, symptoms noticed by the owner, duration of illness and details of former treatments, if any, were recorded.

3.2.2. Preparation of the Patient

Eyes were thoroughly irrigated with sterile normal saline and cleaned with sterile cotton to remove the accumulated ocular discharge and dirt. The dog was placed on azathioprine[1] at the rate of 2 mg/kg body weight, three

[1] Tab.Azoran, 50mg, RPG Life Sciences Ltd., Mumbai

days prior to the day of surgery. Ocular instillation of ciprofloxacin[2], flurbiprofen[3] and tropicamide[4] was started at the rate of one drop into the eye at six hours interval. On the day of surgery tropicamide was instilled at hourly interval.

The area around the eye was thoroughly scrubbed with povidone-iodine solution and prepared for aseptic surgery. The eye was irrigated with sterile normal saline solution.

3.2.3. Anaesthesia

All the dogs were maintained under general anaesthesia during surgery. Atropine sulphate[5] at the rate of 0.045mg/kg body weight was administered intramuscularly as premedicant and after fifteen minutes xylazine hydrochloride[6] at the rate of 2mg/kg body weight, followed by ketamine hydrochloride[7] at the rate of 10mg/kg body weight were given intramuscularly at fifteen minutes interval, to induce general anaesthesia. Anaesthesia was maintained using a combination of equal volumes of xylazine and ketamine along with diazepam[8] at the rate of 0.5mg/kg body weight administered intravenously to effect.

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[2] Ciplox eye drops, Cipla Ltd., Mumbai.
[3] Flur eye drops, Allergan India Ltd., Bangalore.
[4] Tropicamet 1% eye drops, Milmet Laboratories Pvt. Ltd., Baroda.
[5] Avatropine, Avacia Pharmaceuticals, Mumbai.
[6] Inj. Xylaxin, Indian Immunologicals Ltd., Hyderabad.
[7] Inj. Ketmin 50, Themis Chemicals Ltd., Mumbai.
[8] Inj. Calmpose, Ranbaxy, New Delhi.

On review of cases for subsequent observations, general anaesthesia was induced in similar manner only for suture removal. In all the other occasions cornea was anaesthetized by the topical application of lignocaine hydrochloride (4%)[9] solution.

3.2.4. Surgical Technique

About six to ten milliliters of sterile normal saline was injected into the retrobulbar region by inserting a hypodermic needle to a depth of four centimeters approximately. The needle was inserted just above the dorsal margin of the orbital ligament which connects the supraorbital process of the frontal bone and the frontal process of zygomatic bone. The needle is directed posterior to the globe and infront of the orbit to deposit the solution. The head and body of the dog was covered with a drape with its fenestration positioned over the eye (Plate No.5). The eyelids were kept retracted using a wire speculum. The eyeball was fixed using temporary conjunctival stay sutures placed superiorly, inferiorly, temporally and nasally, away from the limbus using silk 2/0 and fixed to drapes using mosquito forceps (Plate No.6). Lateral canthotomy was performed to provide better exposure of eyeball. The surgery was performed with the help of an operating microscope,[10] with a magnification of 0.4x (Plate No. 4).

Conjunctiva was incised on the dorsolateral aspect of the limbus, using a number 11 Bard Parker blade, broken and fixed on the Swiss blade breaker cum handle (Plate No. 7). The conjunctiva was then reflected cranially to expose the sclera. A nick incision was made on the sclera two millimeter away from the limbal margin at 1 O'clock position in the left eye (Plate No.8)

[9] Inj. Xylocaine (4%) Topical, Astra Zencea Pharma India Ltd., Bangalore
[10] Ophthalmic operating microscope, AA OM 10, Appasamy Associates, Chennai

and was extented to 5 O'clock position using Castroveijo corneal scissors (Plate No.9). In the right eye the incision on the sclera was made from 11 O'clock position to 8 O'clock position. The collapsed anterior chamber due to the escape of aqueous humour was inflated by infusion of the visco-elastic material, hydroxy propyl methyl cellulose[11]. The protruding iris was pushed down using an iris retractor. The anterior capsule of the lens was incised using the curved tip of a 24 G hypodermic needle in a can opening fashion. Digital pressure was applied on the ventral aspect of cornea to dislodge the lens material. The dislodged cataractous lens material was extracted out using a Wilder lens loupe (Plate No.10). The lens debris, clots and visco-elastic material were removed by thoroughly irrigating the anterior chamber with sterile isotonic balanced salt solution[12] using an irrigation cannula (Plate No.11). The scleral incision was then apposed with three to five simple interrupted sutures using braided silk 8/0[13](Plate No.12). The anterior chamber was reinflated by injecting sterile balanced salt solution before placing the final suture. The conjunctival incision was left unsutured (Plate Nos.13&14). The canthotomy incision was apposed in simple interrupted pattern using braided silk 2/0. Intraoperative difficulties or complications encountered, if any were recorded.

3.2.5. Post-operative Care

An Elizabethan collar was applied in all the cases to prevent self-mutilation (Plate No.15). Instillations of ciprofloxacin, flurbiprofen and tropicamide were continued upto one-month postoperatively at six hours

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[11] Appavisc, Appasamy Associates, Chennai.
[12] Irrigan, Klar Sehan Pvt. Ltd., Kolkata.
[13]Mersilk, Ethicon, Johnson & Johnson Ltd., Aurangabad
[14] Tab. Sporidex, 250mg, Ranbaxy Laboratories Ltd., New Delhi

interval. Azathioprine at the rate of 2mg/kg and cephalexin[14] at the rate of 22mg/kg body weight, were administered for one week postoperatively. Scleral and canthotomy sutures were removed on the 10th postoperative day. Cases, which had shown a postoperative increase in intraocular pressure, were treated with oral administration of acetazolamide[15] at the rate of 25mg/kg body weight orally.

3.3. ITEMS OF OBSERVATION

All the dogs were subjected to detailed clinical and physiological, haematological and serum biochemical investigations preoperatively and postoperatively until the cornea became clear or for a maximum period of 60 days.

3.3.1. Physiological Parameters

The respiratory rate (per minute), pulse rate (per minute) and rectal temperature (°C) were recorded on the day of surgery and on third, seventh and 10th postoperative day and thereafter at fortnightly interval for a maximum period of 60 days.

3.3.2. Clinical Observations

Following clinical observations were made preoperatively and postoperatively on the third, seventh, 10th day and thereafter at two weeks interval for a maximum period of 60 days.

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[15] Tab. Diamox, 250mg, Cyanamid India Ltd., Mumbai

3.3.2.*1. General condition of the animal*

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

3.3.2.*2. Visual function*

The visual function of the animals under the study was assessed based on the menace reflex and photomotor pupillary reflex. Menace reflex was evaluated by moving an object towards the eye and observing the blinking of the eyelids. Photomotor pupillary reflex was assessed by flashing a bright and narrow beam of light into the eye and noting the change in the pupillary size.

3.3.2.*3. Photophobia*

Discomfort for the eye on exposure to light was assessed by alternate exposure of eye to bright and dim lights.

3.3.2.*4. Lacrimation/ discharge from eye*

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

3.3.2.5. *Stage of cataract*

The stage of cataract was assessed and recorded as premature, mature and hypermature based on the visual assessment of fundic light reflection. Presence of fundic light reflection was considered as an indication for premature cataract and absence of fundic refection for mature or hypermature cataract.

3.3.2.6. *Moving parasites in wet film of blood*

One drop of blood was collected on a clean glass slide and observed immediately under the low power objective of the microscope to identify the presence of any moving blood parasites and the observation was recorded.

3.3.2.7. *Intraocular pressure*

Intraocular pressure (IOP) was monitored preoperatively and subsequently from the 10^{th} postoperative day onwards at two weeks interval using Shiotz indentation tonometer and the values were recorded.

3.3.2.8. *Exfoliative cytology of lacrimal smear*

The lacrimal fluid was absorbed on to cotton swab and rolled over a microscopic slide to prepare the smear. It was then air dried and stained with Wright's stain to demonstrate the exfoliated cells (Gelatt, 1991).

3.3.2.9. *Condition of conjunctiva*

The conjunctiva was observed for changes like oedema and active hyperemia and was recorded, before and after surgery.

3.3.2.*10. Condition of the cornea*

3.3.2.10.1. General appearance of cornea

The shape, luster and curvature of the cornea were visually assessed preoperatively and postoperatively and observations were recorded

3.3.2.10.2. Keratitis

The eye was observed preoperatively and postoperatively for objective signs of keratitis like loss of transparency, ciliary injection, vascularization, ulcerations and cellular deposits in the anterior chamber and results were recorded.

3.3.2.10.3. Corneal oedema

The presence of corneal oedema before and after surgery were observed and recorded.

3.3.2.10.4. Corneal clarity

Preoperatively and postoperatively the clarity of the cornea was assessed based on visual examination and was scored as ++++ (clear), +++ (hazy), ++ (moderate clarity) and + (completely opaque) and observations were recorded.

3.3.2.*11. Healing of scleral wound*

The healing of the scleral wound was evaluated by observation of the site of surgery on third, seventh, 10^{th} postoperative days and observations were recorded.

3.3.3. Haematological parameters

Blood samples collected with EDTA pre-operatively and postoperatively at third, seventh and 10^{th} day were used for haematological evaluation *viz.*, haemoglobin concentration (Sahli's acid haematin method), volume of packed red cells (VPRC) (Wintrobe haematocritmethod), total leucocyte count (TLC), differential leucocyte count (DLC) and the results were recorded.

3.3.4. Biochemical parameters

Serum separated from the blood samples collected without anticoagulant was analysed to determine the preoperative blood glucose level by Folin - Wu method.

3.3.5. Postoperative complications

The cases were observed for postoperative complications like infection, mutilation, bleeding into anterior chamber, corneal oedema and opacity and others if any, and were recorded.

Plate 1: Bilateral cataract-Case II

Plate 2: Viscoelastic material, suture material and balanced salt solution used in the study

Plate 3: Ophthalmic instruments used for cataract surgery

Plate 4: Operating microscope in use for cataract surgery

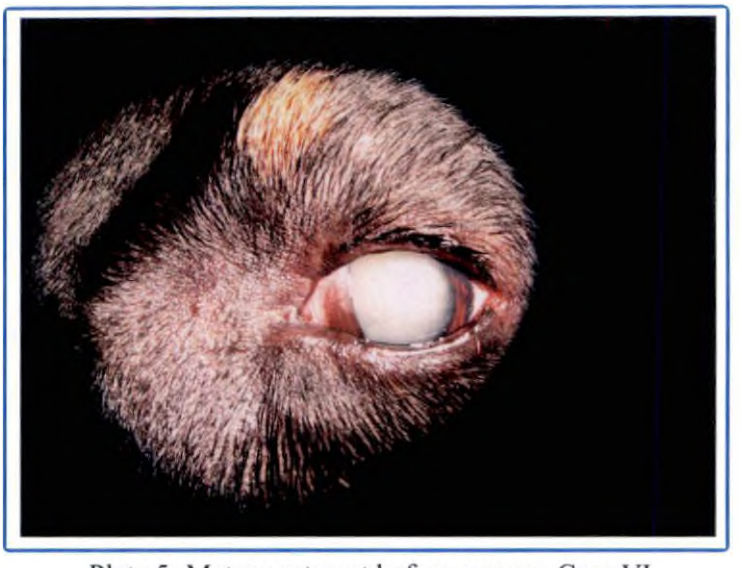

Plate 5: Mature cataract before surgery-Case VI

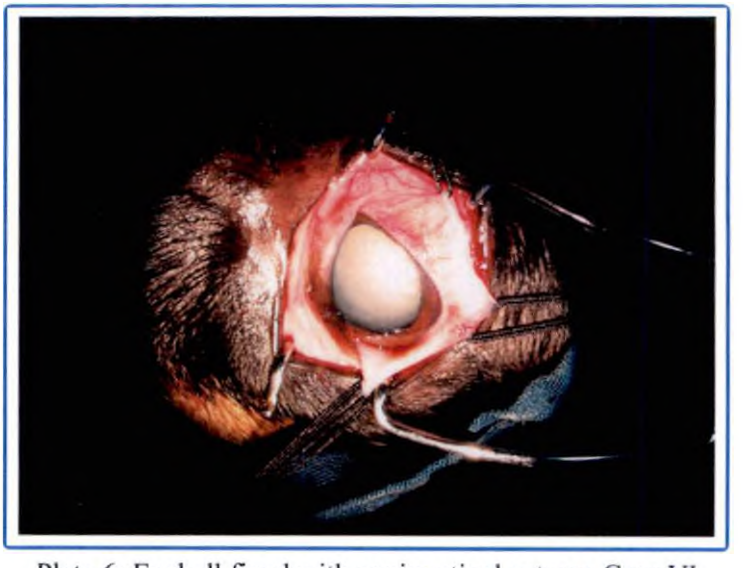

Plate 6: Eyeball fixed with conjunctival sutures-Case VI

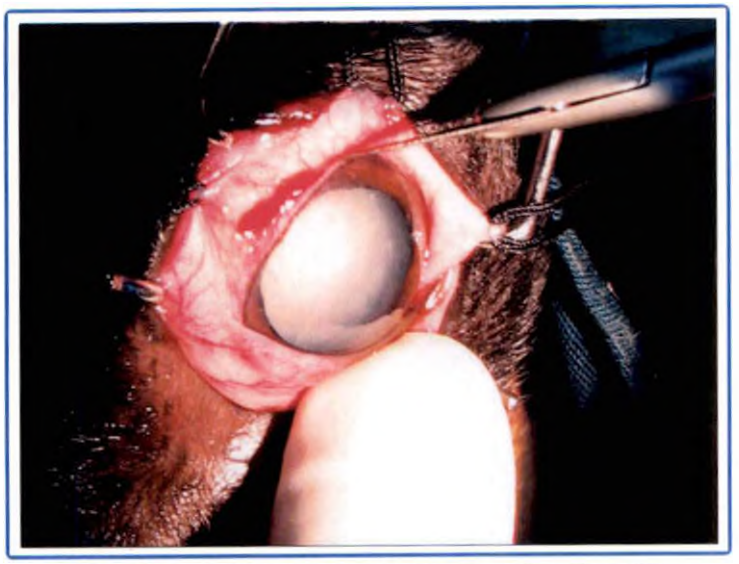

Plate 7: Incision made on the conjunctiva-Case VI

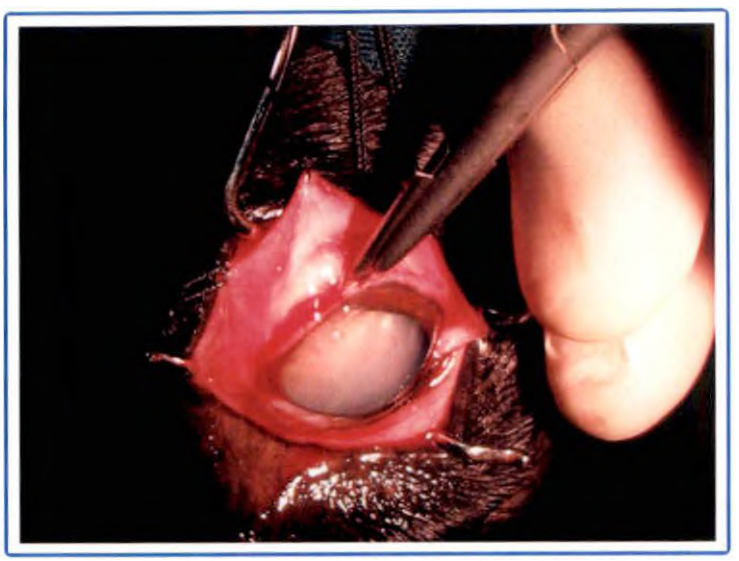

Plate 8: Incision made on the sclera-Case VI

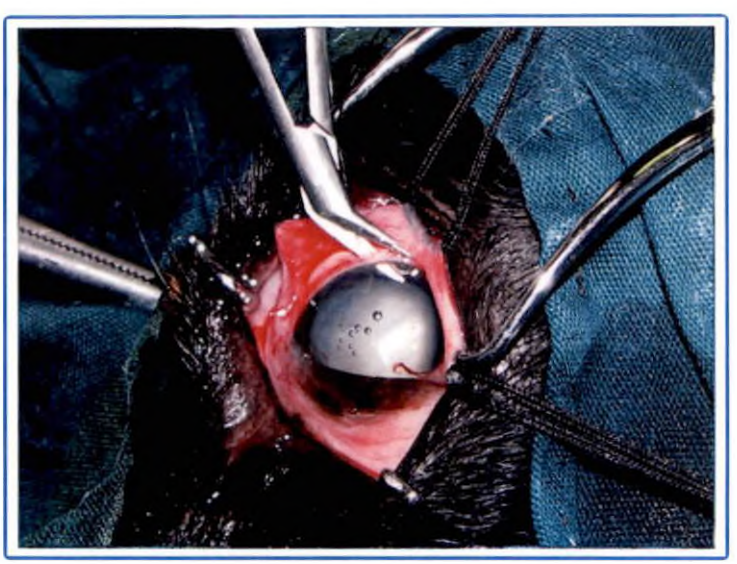

Plate 9: Enlarging the scleral incision using Castroveijo corneal scissors-Case VI

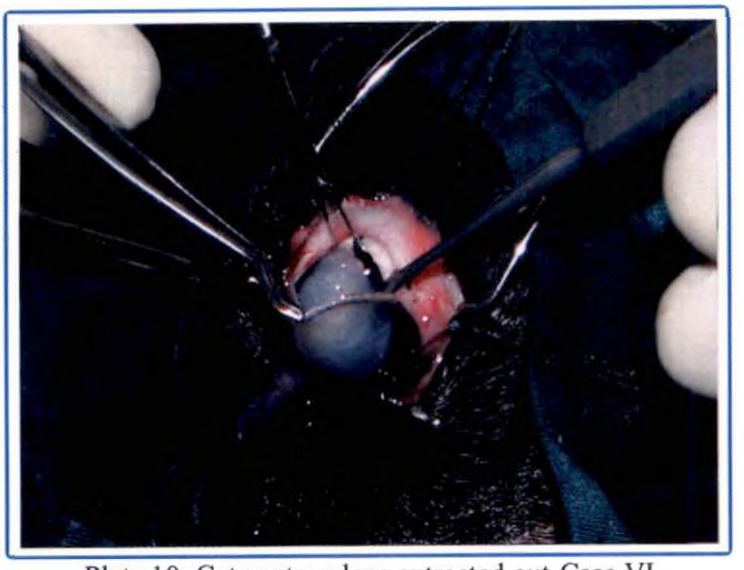

Plate 10: Cataractous lens extracted out-Case VI

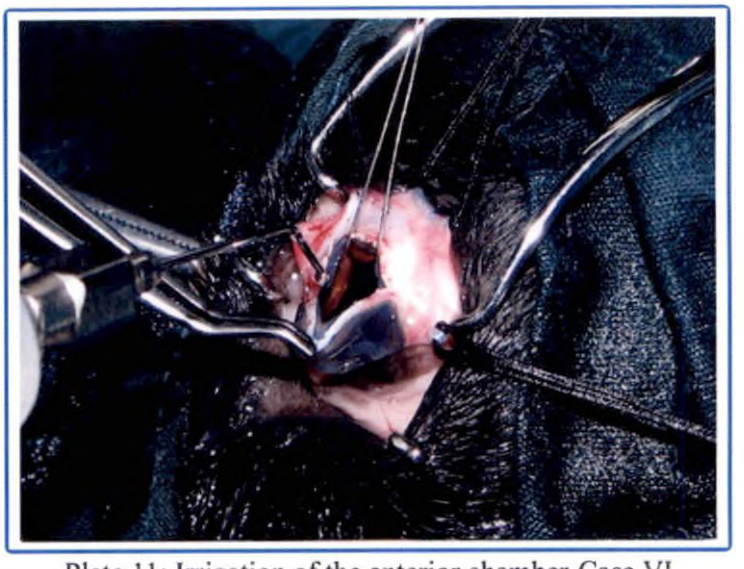

Plate 11: Irrigation of the anterior chamber-Case VI

Plate 12: Suturing of scleral incision-Case VI

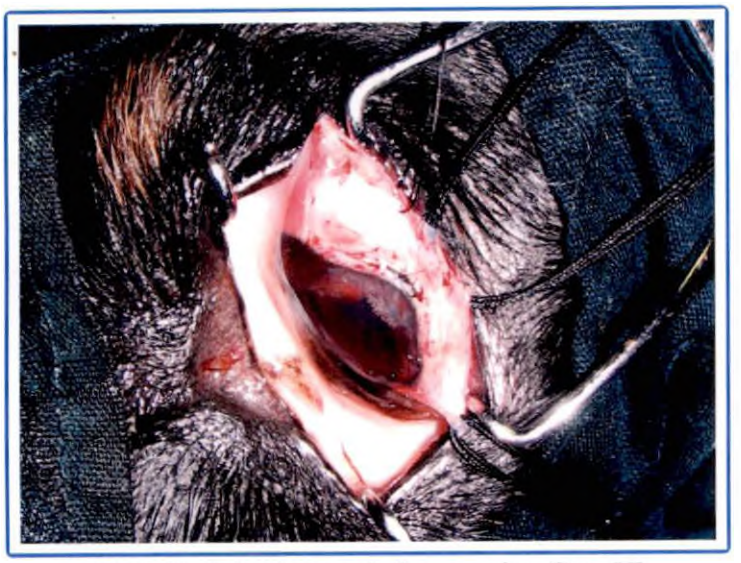

Plate 13: Scleral wound after suturing-Case VI

Plate 14: Eye - immediately after suturing-Case VI

Plate 15: Animal with Elizabethan collar-Case III

Results

4. RESULTS

4.1. SELECTION OF CASES

All the animals presented to the hospital with impaired vision were subjected to detailed clinical examination and seven cases (six dogs) with cataract were selected for the study. The cases were serially numbered from I to VII. In all animals extracapsular extraction of the lens was carried out through a scleral incision.

4.2. EXTRACAPSULAR CATARACT EXTRACTION

4.2.1. Anamnesis (Table 1)

Among the six dogs selected for the study, four were males and two were females. The age of the dogs ranged from one year to 13 years with an average of seven years. The dogs belonged to different breeds *viz.*, Dachshund (3), German Shepherd Dog (1), Labrador Retriever (1) and Spitz (1). Of the six cases, five had bilateral cataracts. Bilateral cataract surgery was done in only one animal, which was considered as two cases (Cases III and VII).

4.2.2. Preparation of the Patient

Preoperative medications like azathioprine orally and ciprofolxacin, flurbiprofen and tropicamide as ocular instillations, were started three days prior to surgery.

Scrubbing the region around the eye with povidone-iodine solution and irrigation of eye with normal saline was found as a satisfactory method for site preparation.

4.2.3. Anaesthetic Regimen

All the animals were subjected to general anaesthesia before surgical treatment. Anaesthetic regimen included atropine sulphate (0.045mg/kg body weight) and xylazine hydrochloride (2mg/kg body weight) for premedication, ketamine hydrochloride (10mg/kg body weight) for induction of general anaesthesia. A mixture of equal volumes of xylazine and ketamine and diazepam at the rate of 0.5mg/kg body weight was given intravenously to effect for the maintenance of anaesthesia. The anaesthetic regimen adopted was found satisfactory for intraocular manipulation in all the cases. Induction of and recovery from anaesthesia was smooth and uneventful. Same anaesthetic regimen was used satisfactorily in all the cases for suture removal. On all other observations tonometry was done after instilling lignocaine hydrochloride (4%).

4.2.4. Surgical technique

4.2.4.*1. Procedure*

Extracapsular extraction of the cataractous lens was done in all the cases through an incision made on the sclera.

Moderate degree of temporary exophthalmos was induced by the retrobulbar injection of normal saline and lateral cathotomy helped to achieve sufficient exposure of the globe and sufficient room for the scleral incision and intraocular manipulations.

The temporary conjunctival stay sutures applied at the superior, inferior, temporal and nasal regions fixed the eyeball efficiently during the surgery.

Scleral approach to access the anterior chamber, through an incision on the dorsolateral aspect and two millimeters away from the limbal margin, was found satisfactory, except for the iris prolapse and conjunctival haemorrhage. The prolapse of iris could be effectively controlled by retracting it with an iris retractor. Topical instillation of adrenalin tartarate (1: 10,000) was found effective in controlling the conjunctival bleeding.

The collapsed anterior chamber after its entry, was reinflated with the visco-elastic material, hydroxy propyl methyl cellulose and it was found effective in reducing the corneal endothelial damage and creating space for the extraction of cataract.

The anterior capsule of the lens was incised in a can opening fashion using the bent tip of a 24 G hypodermic needle and the technique was found satisfactory.

The lens material after capsulotomy could be removed easily by applying digital pressure and the Wilder lens loupe, except in Case I in which the cataract was hypermature and in Case IV in which lens material was adhered to the iris.

Irrigation of the anterior chamber with sterile isotonic balanced salt solution was found effective in removing the remnants of lens material, clots and visco-elastic material.

After the extraction of the lens the anterior chamber was re-inflated with balanced salt solution, which was satisfactory in reforming the anterior chamber.

The scleral incision was sutured using 8/0 silk in simple interrupted suture pattern. The suture material and the pattern were found effective in apposing the scleral wound.

In general, the surgical procedure for extracapsular extraction of the cataract through the scleral incision was uneventful in all the cases except for the intraoperative complications mentioned below.

4.2.4.*2. Intraoperative complications*

4.2.4.2.1. Prolapse of iris

Iris was prolapsed through the scleral incision in Case I and Case II along with the outflow of aqueous humour. In other cases retracting the iris with an iris retractor could effectively control the prolapse.

4.2.4.2.2. Bleeding into the anterior chamber

In Case I and Case III bleeding from iris during the extraction of lens was observed. In Cases I, II and III haemorrhage from the conjunctival vessels infiltrated into the anterior chamber (Plate 16). Topical instillation of adrenaline tartarate (1:10,000) following the conjunctival incision effectively controlled the haemorrhage throughout the procedure in all other cases.

4.2.4.2.3. Miosis

Miosis following the access into the anterior chamber was seen in Case III and V which posed disturbance for the extraction of the lens. This, to some extent, could be overcome by inflation of the anterior chamber with the visco-elastic material.

4.2.4.2.4. Posterior capsular tear and vitreous prolapse

Posterior capsular tear and prolapse of vitreous was noticed during surgery in Cases IV, VI and VII. Vitrectomy was performed in these cases before closing the scleral wound.

4.2.4.2.5. Remnants of lens material

Remnants of lens material was found adhering to the capsule and it is in Cases I and IV, part of which could be removed by irrigation with sterile isotonic balanced salt solution.

4.2.5. Postoperative Care

All the animals were provided with Elizabethan collar until proper healing was achieved, in order to prevent self-mutilation. All of the animals tolerated the use of the collar and was found to be very effective. The use of cephalexin orally was advised for first five to seven postoperative days and ciprofloxacin topically continued for one month postoperatively was found to be effective in counteracting infection. Flurbiprofen was prescribed for topical use until the inflammatory changes subsided. Tropicamide was applied topically postoperatively and was effective in preventing synechia formation. In Cases III and IV intraocular pressure was found mildly elevated postsurgically and could be managed successfully with oral administration of acetazolamide at the rate of 25mg/kg body weight. Oral administration of azathioprine continued for one week postoperatively was found effective in controlling lens-induced uveitis in Cases I and IV, in which intracameral remnants of lens material was seen.

4.2.5.1. *Removal of sutures*

Sutures were found intact in all cases keeping the wound edges apposed, till they were removed. The sutures were removed on the 10^{th} postoperative day, except in Cases IV and V where the sutures were removed on the seventh postoperative day. In these cases scleral wound was healed and the suture material was causing corneal irritation.

4.3. ITEMS OF OBSERVATION

4.3.1. Physiological Parameters (Table 2)

4.3.1.1. Respiration rate

The average respiration rate (per minute) of the selected cases was 29.71 ± 1.69 preoperatively on the day of surgery. It was 28.57 ± 1.91, 29.86 ± 2.02, 29.43 ± 3.11, 27.71 ± 1.87, 29.33 ± 1.87, 29.0 1.65 and 30.33 ± 1.54 on third, seventh, 10^{th}, 24^{th}, 38^{th}, 52^{nd} and 60^{th} postoperative days respectively. All values were within the normal range.

4.3.1.2. Pulse rate

The mean pulse rate (per minute) recorded preoperatively on the day of surgery was 105.86 ± 4.71. It was 106.86 ± 3.91, 101.14 ± 4.3, 101.43 ± 3.39, 101.0 ± 3.46, 102.67 ± 3.74, 97.83 ± 1.72 and 97.17 ± 1.65 on third, seventh, 10^{th}, 24^{th}, 38^{th}, 52^{nd} and 60^{th} postoperative days respectively. The values obtained were within the normal range.

4.3.1.3. Rectal temperature

The mean rectal temperature (°C) recorded was 38.74 ± 0.15 preoperatively on the day of surgery and 38.63 ± 0.18, 38.85 ± 0.14, 38.50 ± 0.15, 38.68 ± 0.10, 38.52 ± 0.14, 38.76 ± 0.18 and 38.77 ± 0.08 on third, seventh, 10^{th}, 24^{th}, 38^{th}, 52^{nd} and 60^{th} postoperative days respectively and the values were within the normal range.

4.3.2. Clinical Observations

4.3.2.*1. General clinical condition*

All the cases except IV and VI were apparently in good body condition at the time of presentation of cases. The dog in Case IV was a working dog and its body condition was poor. It improved in condition when sufficient rest was given. The dog in Case VI was found suffering from diabetes mellitus on subsequent investigations.

4.3.2.*2. Visual function*

The visual function was assessed based on the menace reflex and photomotor pupillary reflex. Menace reflex was absent in all the cases preoperatively. Photomotor pupillary reflex was present in all cases preoperatively and postoperatively. Postoperatively all cases except Cases II, III and V showed menace reflex from 38^{th} day onwards. In the mentioned cases menace reflex was not observed till the end of observation period.

4.3.2.*3. Photophobia*

Photophobia was absent in all cases preoperatively and post operatively.

4.3.2.*4. Lacrimation/ discharge from the eye (Table 3)*

Purulent discharge was present in Case I and serous discharge was noticed in Case III preoperatively. Mucoid discharge was present in all cases postoperatively on third, seventh and 10^{th} postoperative days. It was found subsided in the subsequent observations.

4.3.2.*5. Stage of cataract (Table 1)*

In all the eyes operated, tapetal reflection was absent preoperatively and hence was considered to have mature cataract except in Case I. In Case I, apart from the absence of tapetal reflection, the lens appeared milky white and hence it was considered as hypermature cataract.

4.3.2.*6. Moving parasites in wet film*

Moving blood parasites, microfilaria, were detected only in Case II. The dog was treated with subcutaneous injection of ivermectin at the rate of 200µg/kg body weight and diethyl carbamazine citrate orally at the rate of 6.6mg/ kg body weight preoperatively. But the condition had shown recurrence in the 38^{th} postoperative observation day.

4.3.2.*7. Intraocular pressure (Table 4)*

The mean intraocular pressure (IOP) (mm of Hg) was 20.57 ± 0.97 preoperatively. Mean postoperative values were 22.71 ± 1.31, 23.29 ± 1.58, 24.0 ± 1.18, 23.0 ± 0.76 and 23.0 ± 0.89 on third, seventh, 10^{th}, 24^{th}, 38^{th}, 52^{nd} and 60^{th} postoperative observation days. Mild increase in IOP was recorded in Cases III and V postoperatively. In Case II intraocular pressure was not measured from 52^{nd} day due to severe keratitis.

4.3.2.*8. Exfoliative cytology of lacrimal smear*

Exfoliative cytology of lacrimal smear was conducted preoperatively on the day of surgery. The major cell type found was epithelial cells.

4.3.2.*9. Condition of conjunctiva (Table 3)*

4.3.2.9.1. Conjunctival oedema

Noticeable conjunctival oedema was not present in any of the cases preoperatively. Mild degree of conjunctival oedema was noticed in all cases postoperatively on third day but it subsided by 10^{th} postoperative day.

4.3.2.9.2. Conjunctival hyperaemia

Conjunctival hyperaemia was absent in all the eyes preoperatively. Hyperaemia was noticed postoperatively in all the eyes, towards the dorsolateral aspect of limbus upto 10^{th} day and thereafter it subsided.

4.3.2.*10. Condition of the cornea.(Table 3)*

4.3.2.10.1. General appearance of the cornea

Preoperatively in all the cases the cornea appeared normal with regard to its shape, luster and curvature.The shape of the cornea remained normal in all the cases postoperatively. Luster of the cornea was found altered depending upon the corneal oedema. The cornea retained its normal curvature postoperatively in all cases except in Cases III and V (Plate 17 &18). In Case III, bulging of the cornea was noticed on the third postoperative day and which was resolved by 24^{th} postoperative day. The same dog had an increase in intraocular pressure and it resolved in two weeks subsequent to treatment with acetazolamide. In Case V, in which vitreous was found prolapsed, the corneal

bulging appeared from third postoperative day onwards and remained without change till the end of observation period.

4.3.2.10.2. Keratitis

None of the cases had shown signs of keratitis in the preoperative observation period. Signs of pain, severe corneal oedema and ulceration were noticed in Case II from 10th postoperative day onwards (Plate 29). All the other cases did not show any sign of keratitis postoperatively.

4.3.2.10.3. Corneal oedema

Preoperatively none of the cases had shown any corneal oedema. But corneal oedema was noticed in all the eyes on postoperative observation on third day. In Case I the oedema involving the entire cornea was noticed which resolved in about one month time. In Cases II and III oedema involving the cornea was persisting throughout the observation period. In Cases IV, V, VI and VII oedema was present only on the dorsolateral aspect of cornea parallel to suture, which remained till the end of observation period.

4.3.3.10.4. Corneal clarity (Table 5)

Preoperatively all the cases had clear cornea (+ + + +). On postoperative observation on third day Cases I, II and III had moderate corneal clarity (+ +) on third day, which decreased to completely opaque by the 10th day (+). In Case I it gradually improved and became hazy (+ + +) by the last observation on 60th day. In Cases II and III corneal clarity did not improve and remained opaque (+) throughout the observation period. In Cases IV, V, VI and VII cornea remained clear (+ + + +) throughout the observation period except for the dorsolateral aspect near the suture line (Plate Nos. 19, 20, 21, 22, 23, 24, 25 & 26).

4.3.2.11. Healing of scleral wound

The healing of scleral wound was assessed visually. In all the cases both the scleral and canthotomy wounds showed apparently good healing by seven days.

4.3.3. Haematological Parameters (Table 6)

4.3.3.1. Haemoglobin concentration

The mean haemoglobin concentration (g/dl) was 13.21 ± 0.26 preoperatively and 13.39 ± 0.26, 13.0 ± 0.15 and 13.19 ± 0.17 on the subsequent postoperative observations on third, seventh and 10^{th} day respectively. All the values were within the normal range.

4.3.3.2. Volume of packed red cells

The mean Volume of packed red cells VPRC (%) was 50.43 ± 2.0 preoperatively and 44.71 ± 1.91, 42.29 ± 1.70 and 43.14 ± 0.77 on the third, seventh and 10^{th} postoperative days. The VPRC values obtained were within the normal range.

4.3.3.3. Total leucocyte count

The mean total leucocyte count ($x10^3$ cells/cmm) was 11.67 ± 0.64 preoperatively on the day of surgery and was 12.69 ± 0.42, 12.09 ± 0.35 and 11.64 ± 0.23 on the postoperative observation on third, seventh and 10^{th} days. The findings were within the normal range.

4.3.3.4. Differential leucocyte count

The mean differential count for neutrophils (%) was 74.29 ± 1.89 percent on the day of surgery. On the third, seventh and 10th postoperative days the values were 76.14 ± 0.86, 75.0 ± 0.49 and 75.0 ± 0.72 respectively. The mean percentage for lymphocytes was 24.71 ± 1.64 preoperatively and 21.29 ± 0.84, 24.14 ± 0.80 and 24.43 ± 0.81 on postoperative observations. The differential count for eosinophils (%) was 0.57 ± 0.30 preoperatively and 1.71 ± 0.18, 0.43 ± 0.30 and 0.29 ± 0.18 on the postoperative observations. The mean monocyte count (%) was 0.43 ± 0.20 on the day of surgery and 0.43 ± 0.20, 0.29 ± 0.18 and 0.29 ± 0.18 on subsequent observations.

4.3.4. Biochemical Parameters (Table 7)

Blood glucose level (mg %) was estimated in all cases preoperatively. The mean blood glucose level was 110.57 ± 35.83 on the day of surgery. All the dogs had blood glucose values within the normal range except for Case VI, which showed abnormally high value of 325 mg%, which influenced the mean value. That case was proved diabetic on subsequent investigations and responded to insulin therapy.

4.3.5. Postoperative Complications

4.3.5.*1. Infection*

There was no sign of infection was noticed in any of the operated eyes.

4.3.5.*2. Mutilation*

All the animals tolerated the use of an Elizabethan collar and none of them mutilated the surgical site throughout the period of observation.

4.3.5.*3. Others*

Other complications encountered in the study included vitreous prolapse, increase in intraocular pressure and corneal opacity.

4.3.5.3.1. Increase in intraocular pressure

Increased intraocular pressure was recorded in Cases III, IV and V by 10^{th} day onwards. Intraocular pressure responded to treatment with acetazolamide and reduced in two weeks time.

4.3.5.3.2. Persistent corneal oedema

Persistent corneal oedema was seen in Cases II and III throughout the observation period, which did not respond to any of the treatments adopted (Plate nos: 27&28).

4.3.5.3.3. Vitreous prolapse

Vitreous prolapse was encountered in Case V on postoperative observation on third day and was left as such.

Table 1: Anamnesis of the animals subjected for cataract surgery

Case No.	Breed	Sex	Age (Years)	Duration of illness	Involvement of eye	Eye operated	Stage of cataract
I	Dachshund	Male	13	> 1 year	Bilateral	Left eye	Hyper-mature
II	Dachshund	Male	8	6 months	Bilateral	Left eye	Mature
III	Labrador	Male	1	6 months	Bilateral	Right eye	Mature
IV	German Shepherd Dog	Female	10	5 months	Unilateral	Left eye	Mature
V	Spitz	Male	10	> 1 year	Bilateral	Right eye	Mature
VI	Dachshund	Female	9	3 months	Bilateral	Left eye	Mature
VII	Labrador	Male	2	1 year	Bilateral	Left eye	Mature

Table 2: Table showing mean values of physiological parameters before and after cataract surgery in dogs

Parameters	Preoperative	Postoperative						
		Day 3	Day 7	Day 10	Day 24	Day 38	Day 52	Day 60
Respiration rate (per minute)	29.71 ± 1.69	28.57± 1.91	29.86± 2.02	29.43± 3.11	27.71± 1.87	29.33± 1.87	29.00± 1.65	30.33± 1.54
Rectal temperature (° C)	38.74± 0.15	38.63± 0.18	38.85± 0.14	38.50± 0.15	38.68± 0.10	38.52± 0.14	38.76± 0.18	38.77± 0.08
Pulse rate (per minute)	105.86± 4.71	106.86± 3.91	101.14± 4.30	101.43± 3.39	101.0± 3.46	102.67± 3.74	97.83± 1.72	97.17± 1.65

Table 3: Table showing observations on the appearance of eye during postoperative period

Case No.	Days of observation						
	3rd Day	7th Day	10th Day	24th Day	38th Day	52nd Day	60th Day
I	Mucoid discharge, moderate oedema and hyperemia of conjunctiva, corneal oedema	Mucoid discharge, moderate oedema and hyperemia of conjunctiva, corneal oedema healing of scleral wound	Mucoid discharge, mild conjunctival oedema and hyperaemia,corneal oedema, healing of scleral wound	Corneal oedema decreased	Cornea hazy	Haziness of cornea	Cornea still hazy in appearance
II	Mucoid discharge, moderate oedema and hyperemia of conjunctiva, corneal oedema	Mucoid discharge, moderate oedema and hyperemia of conjunctiva, corneal oedema healing of scleral wound	Mucoid discharge, mild conjunctival oedema and hyperaemia,corneal oedema, healing of scleral wound	Corneal oedema present	Severe keratitis and Corneal oedema	Cornea opaque	Opaque cornea
III	Mucoid discharge, moderate oedema and hyperemia of conjunctiva, corneal oedema	Mucoid discharge, moderate oedema and hyperemia of conjunctiva, corneal oedema healing of scleral wound	Mucoid discharge, mild conjunctival oedema and hyperaemia,corneal oedema, healing of scleral wound	Corneal oedema present	Corneal oedema present	Opaque cornea	Opaque cornea

Table 3: continued

Case No.	Days of observation						
	3rd Day	7th Day	10th Day	24th Day	38th Day	52nd Day	60th Day
IV	Mucoid discharge, moderate oedema and hyperemia of conjunctiva, corneal oedema	Mucoid discharge, moderate oedema and hyperemia of conjunctiva, corneal oedema towards suture line healing of scleral wound	Mucoid discharge, mild conjunctival oedema and hyperaemia,corneal oedema, healing of scleral wound, sutures removed	Corneal oedema towards the suture line	Corneal oedema towards the suture line	Corneal oedema towards the suture line	Corneal oedema towards the suture line
V	Mucoid discharge, moderate oedema and hyperemia of conjunctiva, corneal oedema	Mucoid discharge, moderate oedema and hyperemia of conjunctiva, corneal oedema towards suture line, Vitreous prolapse, healing of scleral wound sutures removed	Mucoid discharge, mild conjunctival oedema and hyperaemia,corneal oedema towards suture line, vitreous found prolapsed	Corneal oedema towards the suture line	Corneal oedema towards the suture line	Corneal oedema towards the suture line	Corneal oedema towards the suture line

Table 3: continued

Case No.	Days of observation						
	3rd Day	7th Day	10th Day	24th Day	38th Day	52nd Day	60th Day
VI	Mucoid discharge, moderate oedema and hyperemia of conjunctiva, corneal oedema	Mucoid discharge, moderate oedema and hyperemia of conjunctiva, corneal oedema towards suture line healing of scleral wound sutures removed	Mucoid discharge, mild conjunctival oedema and hyperaemia,corneal oedema towards suture line	Corneal oedema towards the suture line	Corneal oedema towards the suture line	Corneal oedema towards the suture line	Corneal oedema towards the suture line
VII	Mucoid discharge, moderate oedema and hyperemia of conjunctiva, corneal oedema	Mucoid discharge, moderate oedema and hyperemia of conjunctiva, corneal oedema healing of scleral wound	Mucoid discharge, mild conjunctival oedema and hyperaemia,corneal oedema towards suture line, healing of scleral wound, sutures removed	Corneal oedema towards the suture line	Corneal oedema towards the suture line	Corneal oedema towards the suture line	Corneal oedema towards the suture line

Table 4: Table showing intra ocular pressure (mm of Hg) in dogs subjected for cataract surgery

Cases	Preoperative	Postoperative				
		Day 10	Day 24	Day 38	Day 52	Day 60
I	16	18	18	22	22	
II	24	22	24	26		
III	22	28	30	28	26	25
IV	20	24	26	25	24	24
V	19	22	25	26		25
VI	21	22	20	19	21	20
VII	22	23	20	22	22	21
Mean	20.57±0.97	22.71±1.13	23.29±1.58	24±1.18	23±0.76	23±0.89

Table 5: Table showing the observation on postoperative corneal clarity in dogs subjected for cataract surgery

Cases	Postoperative						
	Day 3	Day 7	Day 10	Day 24	Day 38	Day 52	Day 60
I	++	+	++	+++	+++	+++	+++
II	++	++	++	+	+	+	+
III	++	+	+	+	+	+	+
IV	++	++	++	++	+++	+++	++++
V	++	+	+++	+++	+++	+++	++++
VI	++	++	+++	+++	+++	+++	++++
VII	++	++	+++	+++	+++	+++	++++

* In Cases IV, V, VI and VII corneal oedema was seen towards the dorsolateral aspect of cornea towards the suture line

Table 6: Table showing mean values of haematological parameters before and after cataract surgery in dogs

Parameters		Preoperative	Postoperative		
			Day 3	Day 7	Day 10
Haemoglobin (g/dl)		13.21±0.26	13.39±0.26	13.0±0.15	13.19±0.17
VPRC (%)		50.43±2.0	44.71±1.91	42.29±1.70	43.14±0.77
Total Leucocyte Count($x10^3/cmm^3$)		11.67±0.64	12.69±0.42	12.09±0.35	11.64±0.23
Differential Leucocyte Count (%)	N	74.29± 1.89	76.14±0.86	75.0±0.49	75.0±0.72
	L	24.71± 1.64	21.29±0.84	24.14±0.80	24.43±0.81
	E	0.57± 0.30	1.71±0.18	0.43±0.30	0.29±0.18
	M	0.43± 0.20	0.43±0.20	0.29±0.18	0.29±0.18
	B	0	0	0	0

Table 7: Table showing values of blood glucose level before cataract surgery in dogs

Case No.	Blood glucose level (mg/dl)
I	65.0
II	72.0
III	75.0
IV	70.0
V	85.0
VI	325.0
VII	82.0
Mean	**110.57 ± 35.83**

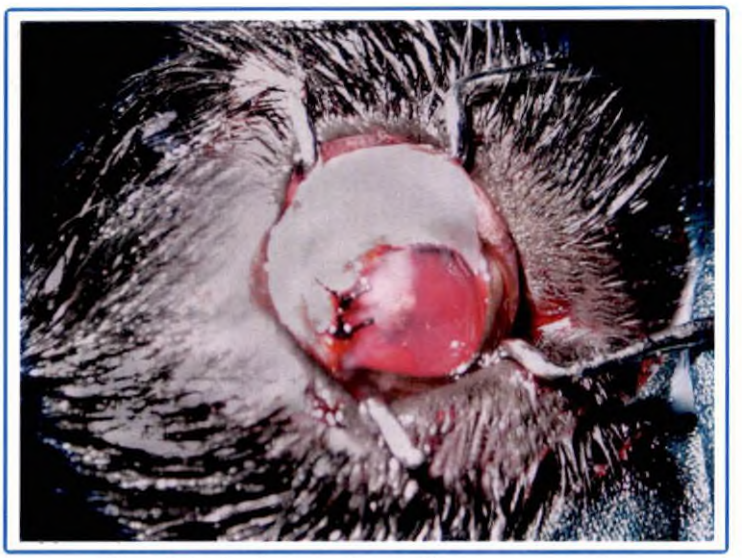

Plate 16: Hyphaema-immediate postoperative period -Case III

Plate 17: Postoperative oedema causing bulging of cornea-Case III

Plate 18: Postoperative bulging of cornea -Case V

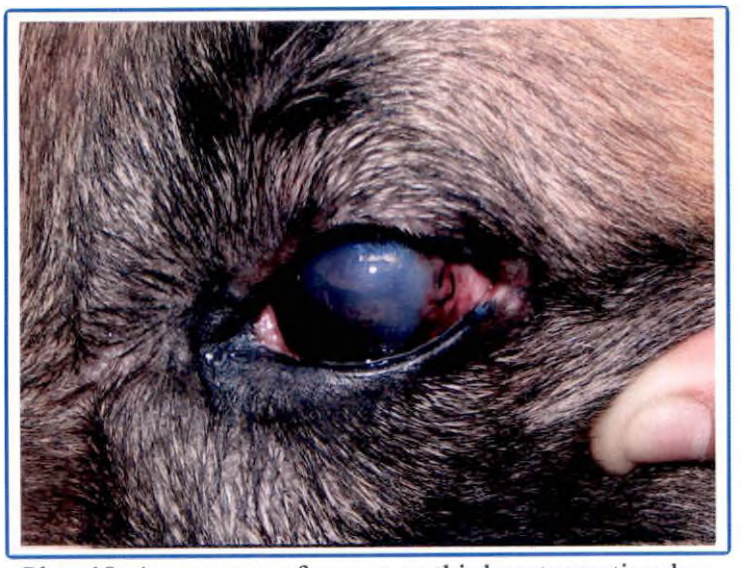

Plate 19: Appearance of cornea on third postoperative day-Case IV

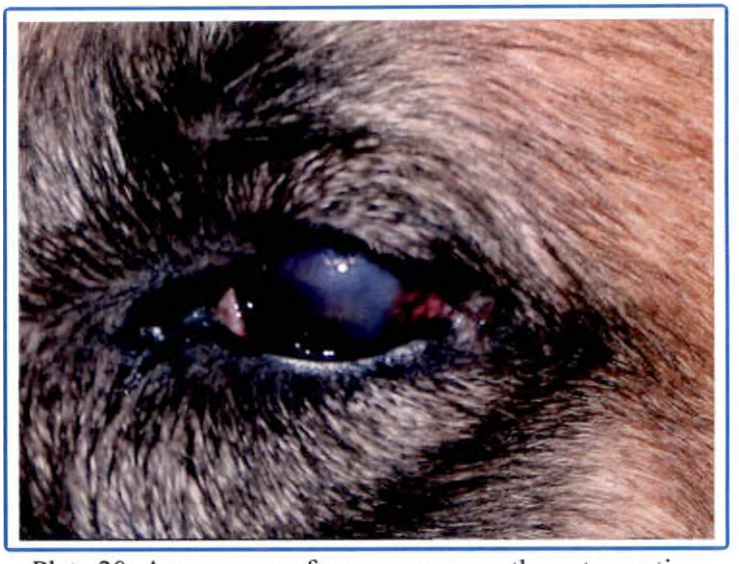

Plate 20: Appearance of cornea on seventh postoperative day-Case IV

Plate 21: Appearance of cornea on 10th postoperative day-Case IV (before suture removal)

Plate 22: Appearance of cornea on 24th postoperative day-Case IV

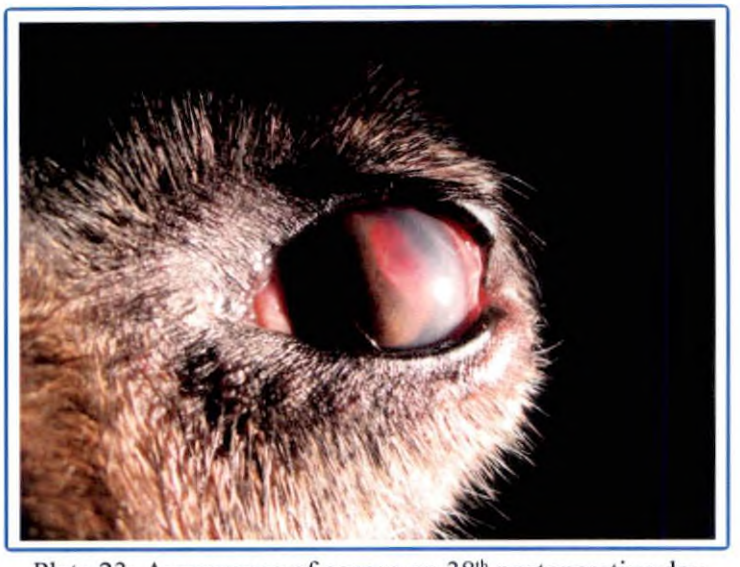

Plate 23: Appearance of cornea on 38th postoperative day-oedema towards dorsolateral aspect of cornea- Case IV

Plate 24: Appearance of cornea on seventh postoperative day-Case VI

Plate 25: Appearance of cornea on 10th postoperative day showing oedema on the dorsolateral aspect-Case VI

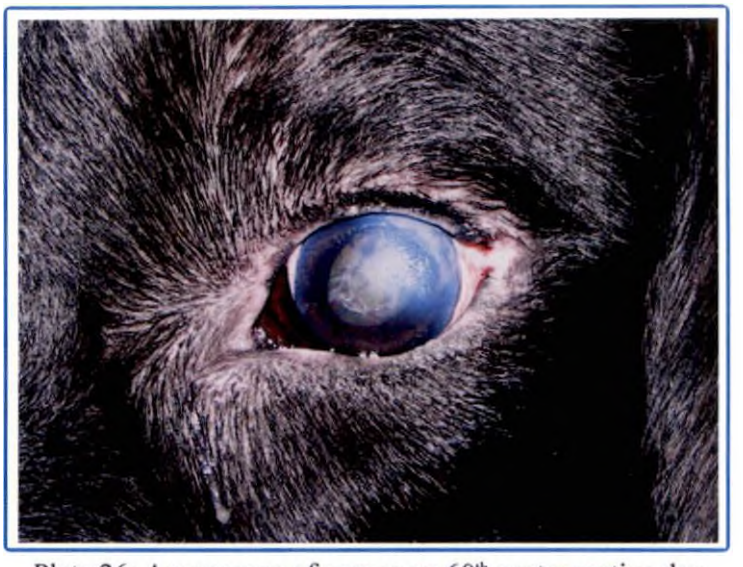

Plate 26: Appearance of cornea on 60th postoperative day showing oedema on the dorsolateral aspect-Case VII

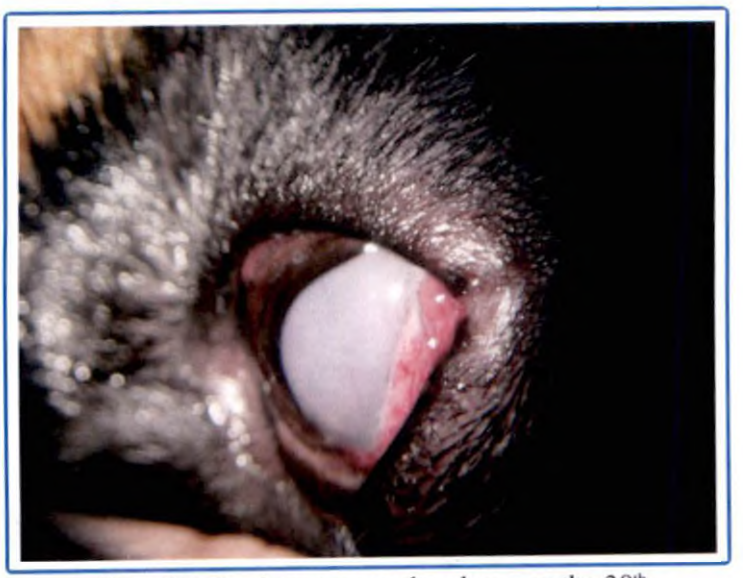

Plate 27: Persistent corneal oedema on the 38th postoperative day-Case II

Plate 28: Persistent corneal oedema on the 60th postoperative day-Case III

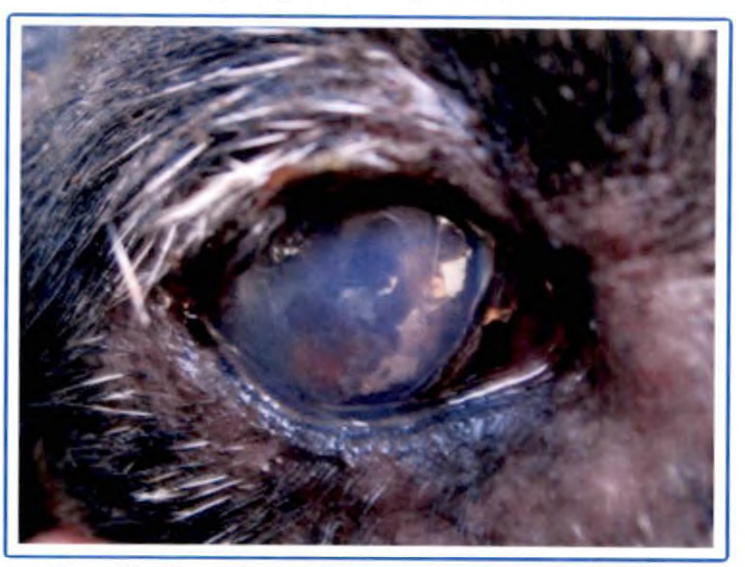

Plate 29: Keratitis on 52nd postoperative day- Case II

Discussion

5. DISCUSSION

5.1. SELECTION OF CASES

The study was carried out in six dogs (seven eyes) presented to Veterinary Hospital, Kokkalai and Mannuthy and diagnosed to have cataract. The selected cases were serially numbered as I, II, III, IV, V, VI and VII after detailed clinical examination. All the cases were subjected to extracapsular cataract extraction through scleral incision and the effect of surgery was studied.

5.2. EXTRACAPSULAR CATARACT EXTRACTION

5.2.1. **Anamnesis** (Table 1)

Among the selected dogs four were males and two were females. Sex difference in the incidence of cataract was not generally seen. (Bjerkas and Haaland, 1995; Gelatt *et al.* 2003, and Bath and Dua, 2006).

The average age of the selected dog was seven years with a range of one to 13 years (Table 1). According to Roberts and Helper (1972), the age of Afghan hounds affected with cataract ranged from three months to eight years. It was three and half weeks to 12 years in Norwegian buhunds (Bjerkas and Haaland, 1995), two to eight years in Bichon Frise dogs (Gelatt *et al.* 2003). William *et al.* (2004) reported some kind of reduced opacity among the examined dogs above the age of 13.6 years. Prevalence of cataract was found age related and mostly

affecting the aged group (Gelatt and Mackay, 2005). Cataract was reported in old dogs with a mean age of 9.7 ± 0.9 (Bath and Dua, 2006).

The selected dogs included various breeds like Dachshund (3), German Shepherd Dog (1), Labrador Retriever (1) and Spitz (1) (Table 1). Breed wise incidence of cataract cannot be studied with such a small population. In about 60 breeds of dogs, the prevalence of cataract was found to exceed the base line prevalence of 1.61% in mixed/ hybrid dog (Gelatt and Mackay, 2005). Any breed specificity was not found in the occurrence of cataract (Bath and Dua, 2006).

Of the six dogs selected five had bilateral cataract (Table1). Bilateral cataracts were commonly encountered in dogs as reported by Barnet (1978), Barnet (1980) in Welsh Springer Spaniels, Barnet (1986) in German Shepherd Dog and Bjerkas and Haaland (1995) in Norwegian Buhunds.

5.2.2. Preparation of the Patient

All the cases were administered with azathioprine at the rates of 2 mg/kg body weight orally and ciprofloxacin, flurbiprofen and tropicamide topically, three days prior to surgery. Use of immunosuppressants like azathioprine was reported as effective in immune mediated uveitis (Miller, 1995). Topical use of anti-inflammatory agents was found effective in reducing the inflammation after intraocular surgeries (Krohne and Vestre, 1987 and Helper, 1989). Among the NSAIDs flurbiprofen specifically was found beneficial in ocular surgeries as it reduced the inflammation and maintained mydriasis. But the use of flurbiprofen

increased intraocular pressure (Millichamp *et al.*, 1991; Millichamp and Dziezyc, 1991; Moore, 2001 and Munro, 2001). Collinson and Peiffer (2002) also emphasized the need for rigorous efforts to reduce inflammation following manual extracapsular extraction of cataract. Topical instillation of different antibiotics was found effective against different groups of microorganisms (Sansom, 1988; Helper, 1989 and Yu-Speight *et al.*, 2005). Mydriatics and cycloplegic agents were found useful in dilating the pupil during surgery and to prevent adhesions postoperatively (Helper, 1989). These agents were also found effective in controlling lens induced iridocyclitis (Rubin and Gelatt, 1968; Gelatt, 1975 and Keil and Davidson, 2001).

The area around eye was scrubbed with povidone-iodine solution before the surgery. Povidone-iodine at a concentration of 1:50 was effective in eliminating the bacterial contamination of the lid margin (Roberts *et al.*, 1986).

5.2.3. Anaesthetic Regimen

An anaesthetic regimen using atropine-xylazine – ketamine-diazepam was found satisfactory for the intraocular manipulations during present study. But Kilic and Unsaldi (2005) found xylazine - thiopental combination better than xylazine - ketamine combination as the former decreased the intra ocular pressure.

5.2.4. Surgical Technique

5.2.4.*1.Procedure*

Extracapsular extraction of cataractous lens was done in all the seven cases. Extracapsular extraction was recommended as the safest technique for cataract in dog (Magrane, 1961) and was reported feasible even in cases failed with intracapsular cryoextraction (Magrane, 1968). According to Gelatt *et al.* (1975) intracapsular extraction of cataract reduced the chance of lens-induced uveitis, but the procedure was risky in dogs because of the strong attachments of posterior capsules to the hyaloid membrane. Spreull *et al.* (1980) also expressed similar opinion on intracapsular lens extraction. Difficulty to break zonular attachment and bleeding into the anterior chamber were other difficulties encountered. Whitely *et al.* (1993a) claimed more success (upto 90%) for extracapsular cataract extraction than intracapsular extraction in dogs. Satisfacotry extracapsular cryoextraction of cataractous lens was reported by Shafiuzamma *et al.* (1998) and intracapsular cryoextraction by Pillai (2000). Tyagi *et al.* (2003) successfully conducted extracapsular cataract extraction in a bullock. Ramani *et al.* (2005) described successful extracapsular extraction of cataract in 32 dogs.

A better exposure of the eyeball and sufficient space for the intraocular manipulations were obtained in all the cases by inducing moderate temporary exophthalmos by retrobulbar infusion of normal saline and lateral canthotomy. The eyeball could be effectively fixed by applying temporary conjunctival stay sutures at the dorsal, inferior, nasal and temporal parts of the eyeball. Komaramy *et al.*, (2006) achieved

proper positioning of the globe by retrobulbar injection of saline and a stay suture. Slatter (2001) opined that lateral canthotomy greatly improved the exposure of the eye and fixation sutures placed partially through sclera, on its superior, inferior, nasal and temporal parts, were invaluable in fixing the eyeball for surgeries.

In the present study the anterior chamber was accessed for the cataract extraction through a scleral incision placed dorsolateral to the cornea and was found satisfactory. Gelatt (1991) opined that anterior chamber in dogs could be approached through three basic anatomic incisions like clear corneal, limbal and scleral, with almost same results. Nelms *et al.* (1994) opined that scleral approach had several advantages over corneal approach like avoidance of corneal astigmatism, decreased corneal scarring and oedema and greater wound stability. Scleral method was found to offer satisfactory healing of incision and no persistent postoperative scars (Hickman *et al.*, 1995).

According to Spreull *et al.* (1980), who tried corneal, limbal and scleral incisions to access anterior chamber, the easiest approach was temporal incision in clear cornea. But Rooks *et al.* (1985) did not find any significant difference in success rate among clear corneal and limbus based conjunctival flap approaches. Any difference between clear corneal and limbal based conjunctival flap incisions was observed by Whitely *et al.* (1993a and 1993b). On a review of current preferences of surgeons for cataract surgery Williams *et al.* (1996) found that most of the surgeons preferred corneal incisions to limbal incisions below conjunctival flap. Endothelial trauma and subsequent corneal oedema was a major complication. Devareddy *et al.* (1998) also did cataract extraction through corneal incisions but encountered iris prolapse as an

intraoperative complication. Incision on the limbus was the preferred approach for ECCE for Hazra and Samanta (1998). Biros *et al.* (2000) used clear corneal or corneo-scleral incision for ECCE in 220 dogs. Ramani *et al.* (2005) reported cataract surgery in 32 dogs through corneal incision.

In the present study conjunctival bleeding and prolapse of iris through the incision was found as two disadvantages of the scleral incision. Nelms *et al.* (1994) narrated complications encountered in scleral approaches like excessive bleeding from the incision site, iris prolapse into the surgical wound and difficulty in aspirating cortical material from ventral capsular bags. Conjunctival bleeding and iris prolapse were also reported in scleral approaches by Hickman *et al.* (1995).

Conjunctival bleeding could be effectively controlled by topical instillation of adrenalin 1:10,000. This was in agreement with the findings of Peterson – Jones and Clutton (1994). Adrenalin was found effective in achieving mydriasis during surgery (Williams *et al.*, 1996).

In the present study, the use of visco-elastic material, hydroxy propyl methyl cellulose was found effective in re-inflating the anterior chamber and thus to reduce injury to the corneal endothelium and availing sufficient space for the lens extraction. This was in accordance with the finding of Williams *et al.*, (1996) and Nasisse (1995). Biros *et al.* (2000) used one percent solution of hyaluronic acid as viscoelastic material to inflate anterior chamber. Gerding *et al.* (1989) pointed out an

increase in intraocular pressure when the visco-elastic material was left in the anterior chamber.

After accessing the anterior chamber the anterior capsule of lens was incised in a can opening fashion using the bent tip of a 24 G hypodermic needle. This technique was found satisfactory in all the cases. This observation was in compliance with that of Williams *et al.* (1996), Hazra and Samanta (1998) and Ramani *et al.* (2005). Spiess *et al.* (1996) successfully used a radiofrequency for anterior capsulotomy. Glover and Constantinescu (1997) and Biros *et al.* (2000) used a continuous curvilinear incision for capsulorhexis.

The lens material after capsulotomy could be removed easily by applying digital pressure and the Wilder lens loupe, except in two cases, of which one was a hypermature cataract.

The anterior chamber irrigation with sterile isotonic balanced salt solution effectively removed the blood clots, lens material and the visco-elastic material in the study. This was in agreement with the observations of Nassie *et al.* (1986) who used saline solution, balanced salt solution and BSS with glutathione with almost equal effects. They opined that irrigating fluid composition had little deleterious effect on corneal endothelium; if the fluid volume and time of irrigation were not excessive. Hazra and Samanta (1998) used Ringer's lactate solution for irrigation of the anterior chamber.

Anterior chamber was re-inflated with balanced salt solution before closing the scleral wound. Spreull *et al.* (1980) used air or saline to reconstitute anterior chamber after cataract surgery.

At the end of the procedure the scleral wound was sutured with 8/0 silk using three to five simple interrupted sutures. None of the reports specifically mention the suturing of the scleral wounds. Spreull *et al.* (1980) preferred absorbable suture material placed in simple interrupted pattern penetrating two third of its thickness to suture corneal wounds. Glover and Constantinescu (1997) and Biros *et al.* (2000) apposed the corneal incision using 7/0 or 8/0 polyglactin 910 in simple interrupted pattern. The suture material and pattern used in the present study was found satisfactory in bringing about apposition of the scleral wound.

5.2.4.2. Intraoperative complications

5.2.4.2.1.Prolapse of iris

Iris was prolapsed in first two cases along with the outflow of aqueous humour through the scleral incision. Similar observations were noticed with scleral incision by Nelms *et al.* (1994) and Hickman *et al.* (1995). Glover and Constantinescu (1997) opined that iris prolapse occur because of incomplete mydriasis, too large incision and excessive vitreous expansion, and its correction was better done with visco-elastic material than instruments. Iris prolapse was noticed with corneal incision also (Devareddy *et al.*, 1998). Difficulties caused by the prolapse of iris could be successfully passed over by retracting the iris away from the incision using an iris retractor.

5.2.4.2.2.Bleeding into the anterior chamber

In the present study bleeding from the iris in two cases and haemorrhage from the conjunctival vessels in three cases had infiltrated into the anterior chamber (Plate no: 16). Gelatt (1991) reported diffused haemorrhage associated with scleral incision. Bleeding into anterior chamber during extracapsular extraction of cataract was reported by Whilely *et al.* (1993b). Nelms *et al.* (1994) and Hickman *et al.* (1995) also reported excessive bleeding with scleral incision. The incidence of bleeding could be reduced by instillation of adrenaline tartarate (1: 10,000) in the rest of the cases. Intraocular infusion of adrenalin was reported to achieve haemostasis and mydriasis by Peterson-Jones and Clutton, (1994) and Williams *et al.* (1996)

5.2.4.2.3. Miosis

Miosis following the entry into the anterior chamber and subsequent hindrance to cataract extraction was noticed in two cases. Inflation of anterior chamber with viscoelastic material reduced the effects of miosis to some extend. Collapse of anterior chamber and subsequent miosis was reported as one of the intraoperative complications of cataract extraction by Whitely *et al.* (1993b), Glover and Constantinescu (1997) and Ramani *et al.* (2005).

5.2.4.2.4. Posterior capsular tear and vitreous prolapse.

Posterior capsular tear and vitreous prolapse was noted in three cases and vitrectomy was performed in these cases before closing the scleral wound. Similar intraoperative complication was reported by

Dzeizye *et al.* (1991) while performing phacofragmentation in horses and in dogs by Nasisse *et al.* (1991), Whitely *et al.* (1993b), Glover and Constantinescu (1997), Williams *et al.* (1996), Biros *et al.* (2000) and Ramani *et al.* (2005). According to Johnstone and Ward (2005) the posterior capsular tears did not affected the outcome of lens extraction.

5.2.4.2.5. Remnants of lens material.

Remnants of lens material adhering to the capsule or iris arised as a complication in two cases. Retention of lens material may cause severe uveitis (Gelatt *et al.*, 1975; Whitely *et al.*, 1993b and Nelms *et al.*, 1994). Nasisse *et al.* (1990) opined that remnants of lens materials and their subsequent organization might result in permanent pupillary immobility or formation of iridal and cyclitic membranes. Collinson and Peiffer (2002) suggested complete removal of the cortical material on manual extracapsular cataract extraction.

5.2.5. Postoperative Care

Self-mutilation and accidental injury to the eye could be effectively prevented by the application of Elizabethan collar and was well tolerated by all the dogs (Keil and Davidson, 2001).

Oral medication with cephalexin and topical medication with ciprofloxacin effectively controlled infection in all the cases of the present study. According to Taylor *et al.* (1995) prevalence of intraocular contamination was six times greater in eyes in which extracapsular or intracapsular extraction was performed than to those in which

phacoemulsification was performed and intraocular contamination was found to be associated with development of postoperative glaucoma. Sansom (1988) and Whitely *et al* (1993b) observed that topical use of antibiotics was beneficial to control ocular infection and systemic administration in case of severe infection. According to Yu-Speight *et al.* (2005) topical application of ofloxacin had higher corneal penetrability than ciprofloxacin.

Topical as well as systemic administration of steroidal and non-steroidal anti-inflammatory agents was generally recommended to reduce postoperative inflammation (Krohne and Vestre, 1987; Helper, 1989; Millichamp *et al* 1991 and Whitely *et al.,* 1993b). In the present study topical application of flurbiprofen satisfactorily controlled the postoperative inflammation. Flurbiprofen was reported to have specific effect in controlling postoperative inflammation and maintaining mydriasis (Millichamp *et al.*, 1991; Millichamp and Dziezyc, 1991; Moore, 2001 and Munro, 2001).

Mydriatic, tropicamide, used topically in the present study avoided the chance of development of postsurgical anterior synechia. Postoperative use of mydriatics was recommended by many authors like Helper (1989) and Whitely *et al.,* (1993b).

Mild elevation of intraocular pressure in two cases postoperatively was managed successfully with administration of acetazolamide at the rate of 25mg/kg bodyweight (Whitely *et al.*, 1993b).

Oral administration of azathioprine, an immunosuppressant was found effective in controlling the lens-induced uveitis in two cases in which intracameral adhesion of remnants of lens material was noticed. Miller (1995) recommended the use of azathioprine for the effective control of immune mediated uveitis.

5.2.5.1. Removal of sutures

Sutures remained intact till they were removed by the 10^{th} postoperative day in all the cases, except in case IV and V in which sutures were removed on the seventh day as the tip of suture material was causing irritation to cornea.

5.3. ITEMS OF OBSERVATION

5.3.1. Physiological Parameters (Table 2)

Any of the cases had not shown any obvious signs of any systemic illness as evidenced by the examination of physiological parameters like respiration, pulse and temperature. Since ocular involvement may indicate systemic disease, a general physical examination should precede the ophthalmic examination (Felchle and Urbanz, 2001).

5.3.2. Clinical Observation

5.3.2.1. General clinical condition

All the animals were having apparently good body condition except in two cases, of which one was a working dog, which improved in condition following rest, and the other was suffering from diabetes mellitus. Inspite of polyphagia and polydypsia the dogs with diabetes mellitus will be presented in a debilitated condition (Nelson, 2000).

5.3.2.2. Visual function

Visual function was assessed using menace test and photomotor pupillary reflex (Felchle and Urbanz, 2001). According to van der Woerdt *et al.* 1992, a successful surgical outcome of cataract surgery was defined as a clear visual axis and improvement in or restoration of functional vision, assessed by response to a menacing gesture, ability to follow thrown cotton balls and ability to navigate through an obstacle course. The major drawback noticed in assessing the visual function was the difficulty in getting the observations when there was persistent corneal oedema.

Menace reflex was absent in all cases preoperatively in the present study. Four cases (57%) developed menace reflex by 38^{th} postoperative day and in the other cases (43%) menace reflex was absent till the end of the observation period. In two cases corneal oedema and complete opacity was present throughout the observation period. Miller *et al.* (1987) reported improvement of vision in 85.2% of the dogs in the

immediate postoperative period after phacofragmentation and aspiration. Dziezyc *et al.* (1991) obtained improved vision in 10 out of 12 horses after phacofragmentation. Visual function was regained in 78% of the operated cases of cataract in dogs according to van der Woerdt *et al.* (1992). Shafiuzama *et al.* (1998) claimed that all the dogs that underwent cryoextraction of cataract regained ambulatory vision. Tyagi *et al.* (2003) obtained restoration of functional vision following extracapsular cataract extraction in one and half month in a bullock. But Hazra and Samanta (1998) with the experience of 12 ECCE in dogs opined that complete restoration of vision was apparently not possible in all cases.

5.3.2.3. Photophobia

Photophobia especially to bright light was described in painful conditions of the eye (Helper, 1989). But photophobia was not appreciated in any of the cases before and after surgery.

5.3.2.4. Lacrimation / discharge from the eye (Table 3)

Preoperatively purulent and serous discharge was noticed in one case each. Mucoid ocular discharge was present in all the cases in the immediate postoperative period, which subsided from the 10^{th} postoperative day. Increased mucus production was suggested as a sign of conjunctivitis by Helper (1991). Shafiuzama *et al.* (1998) and Devareddy *et al.* (1998) encountered lacrimation as a postoperative complication.

5.3.2.5. Stage of cataract (Table 1)

Gelatt (1991) classified cataracts based on the stage of maturity with respect to the amount of tapetal reflection. In the present study all eyes were having mature cataracts except in one case, which was hypermature. In order to avoid preoperative as well as surgical complication Renwick (1997) suggested an early removal of cataract before it is mature or hypermature.

5.3.2.6. Moving parasites in wet film.

Moving blood parasites, microfilaria were detected in one case. The case was treated for microfilaria and cured preoperatively, but had recurrence of the condition on 38th postoperative day. A low-grade anterior uveitis was found associated with the presence of immature heartworms or its toxins in the anterior chamber (Peiffer Jr., 1981). This particular case had persistent corneal opacity till the end of observation period, which may be attributed to the above said phenomenon.

5.3.2.7. Intraocular pressure (Table 4)

The intraocular pressure (IOP) in the preoperative period was within the normal range in all the cases. A mild increase in IOP was seen in three cases on the third postoperative day. An immediate postoperative increase in intraocular pressure following phacofragmentation was encountered by Miller *et al.* (1987). An increased IOP following cataract surgery was reported by Whitely *et al.* (1993b), Biros *et al.* (2000) and Keil and Davidson (2001). Smith *et al.* (1996) described an increase in

increase in IOP following phacoemulsification due to the blockage of iridocorneal angle with cellular and lens debris, increased inflammatory response to free lens proteins and trauma of surgical procedure and release of prostaglandins. Whitely *et al.* (1993b) and Lannek and Miller (2001) had suggested the treatment with carbonic anhydrase inhibitors to keep the IOP within 20mm of Hg. In the present study, the cases with an increase in IOP responded to treatment with carbonic anhydrase inhibitors.

5.3.2.8. Exfoliative cytology of lacrimal smear

The material for cytology was collected early in the examination, to reduce the chances of altering the cytological features and the examination was carried out according to the suggestions of Gelatt (1991). The major cell type found was epithelial cells, which was in accordance with the findings of Lavach *et al.* (1977).

5.3.2.9. Condition of the conjunctiva (Table 3)

The conjunctiva in the immediate postoperative period showed moderate oedema and hyperemia towards the dorsolateral aspect of the limbus in all the cases. These were suggested as important signs of conjunctivitis (Helper, 1991). These signs were subsided by 10^{th} postoperative day. Signs of conjunctivitis exhibited may be considered as a natural response to the conjunctival wound or due to the irritation from the scleral suture.

5.3.2.10. Condition of the cornea (Table 3)

5.3.2.10.1. General appearance of cornea

With regard to the shape, the cornea remained normal in all the cases postoperatively. A bulging of the cornea was noticed in two cases during the postoperative observation period (Plate Nos.17 & 18). A conical shape to the cornea as a result of severe corneal oedema associated with endothelial dystrophy or inflammatory decomposition has been described by Helper (1989).

5.3.2.10.2. Keratitis

Severe degree of keratitis was encountered in one case where there was a recurrence in the incidence of Dirofilariasis (Plate No. 29). Peiffer, Jr. (1981) has suggested that a severe anterior uveitis may be indicated if the worm is broken down by a filaricidal agent or due to its metabolic toxins.

5.3.2.10.3. Corneal oedema

Corneal oedema was absent in all the cases preoperatively. But postoperatively corneal oedema was observed by third day. In one case the corneal oedema subsided by one month and in other two it persisted throughout the period of observation. In the remaining cases corneal oedema was present on the dorsolateral aspect parallel to the suture line. Transient postoperative corneal oedema was reported as a postsurgical

complication by Dziezyc *et al.* (1991), Whitely *et al.* (1993b), Bagely and Lavach (1994), Williams *et al.* (1996) and Keil and Davidson (2001).

5.3.2.10.4. Corneal clarity (Table 5)

Good corneal clarity could be attained in four cases except at the dorsolateral aspect towards the suture line by the end of the postoperative observation period (Plate Nos. 19,20,21,22,23,24,25&26). In one case it became hazy and in other two cases did not become clear till the end of the observation period. Corneal opacity following cataract surgery was reported by many workers like Shafiuzama *et al.* (1998), Tyagi *et al.* (2003) and Ramani *et al.* (2005). The postoperative corneal opacity may probably be due to excessive instrumentation and damage to the cornea during surgery (Hazra and Samantha, 1998). Scleral approach for cataract extraction had been suggested to minimize corneal scarring (Nelms *et al.*, 1994, Hickman *et al.*, 1995).

5.3.2.11. Healing of scleral wound

All the cases in the present study had shown apparently good healing by the seventh postoperative day. Good healing of the scleral incision in cataract surgery in dogs was reported by Hickman *et al.* (1995).

5.3.3. Hematological Parameters (Table 6)

The haematological parameters *viz.* haemoglobin concentration, volume of packed red cells, total leucocyte count and differential leucocyte count in the all the cases did not vary much from the normal range to indicate any underlying disease process during preoperative as well as postoperative observation period (Schalm *et al., 2000)*.

5.3.4. Biochemical parameters (Table 7)

The blood glucose level was estimated preoperatively, after separation of serum from whole blood. In all the cases except in one the values were within the normal limits. In the mentioned case, the value was very high suggesting diabetes mellitus. Diabetes mellitus was described as a leading cause of cataract in dogs (Nelson, 2000 and Keil and Davidson 2001). The said case had an uneventful recovery and regained functional vision. Bagely and Lavach (1994) observed no apparent clinical differences in postoperative findings when diabetic dogs were given proper preoperative and postoperative treatment.

5.3.5. Postoperative Complications

5.3.5.1. Infection

Postoperative ocular infection was not encountered in any of the cases. Prompt use of systemic and topical use of antibiotics had helped to avoid infection. This was in accordance with the observations of Sansom (1988), Whitely *et al* (1993b) and Yu-Speight *et al.* (2005).

5.3.5.2. Mutilation

Self- mutilation was not encountered in any of the operated eyes. Mutilation was effectively prevented by Elizabethan collar and all the dogs in the study tolerated the use of the collar (Keil and Davidson, 2001).

5.3.5.3. Others

5.3.5.3.1. Increase in intraocular pressure (Table 4)

A mild increase in intraocular pressure in the postoperative period was noticed in three cases. Postoperative ocular hypertension was reported following extracapsular cataract extraction in 16.8 percent dogs by Biros *et al.* (2000). Smith *et al.* (1996) suggested that the increase In IOP during postoperative period was due to the blockage of irido-corneal angle with cellular and lens debris, increased inflammatory response to free lens proteins and trauma of surgical procedure and release of prostaglandin. According to Lannek and Miller (2001) dogs with preoperative lens induced uveitis and those with intraoperative intraocular hemorrhage were at an increased risk of glaucoma.

5.3.5.3.2. Persistent corneal oedema

Corneal oedema persisted even to the end of the observation period in two cases (Plate nos: 27 & 28). Similar observations were made by Startup (1967), Dziezyc *et al.* (1991), Whitely *et al.* (1993b),

Shafiuzama *et al.* (1998), Williams *et al.* (1996) Hazra and Samantha (1998) and Ramani *et al.* (2005).

5.3.5.3.3. Vitreous prolapse

Vitreous prolapse was observed in one case on the third postoperative day observation. Similar complication was reported by Dzeizye *et al.* (1991) while performing phacofragmentation in horses, and in dogs by Paulsen *et al.* (1985), Nasisse *et al.* (1991), Whitely *et al.* (1993b), Glover and Constantinescu (1997), Williams *et al.* (1996), Biros *et al.* (2000) and Remani *et al.* (2005).

Severe anterior uveitis, secondary glaucoma and formation of fibropupillary membrane were observed as postoperative complications by Miller *et al.* (1987). Postoperative capsular opacification, formation of iridal and cyclitic membrane were described as postoperative complication by Nasisse *et al.* (1990). Other postoperative complications reported were corneal ulcer, uncontrollable uveitis (Dziezyc *et al.*, 1991), hyphaema, iridocyclitis, glaucoma, iris bombē, fibrin formation, retinal detachment and pupillary adhesion (Startup, 1967, Paulsen *et al.*, 1985, Woerdt *et al.* 1992, Whitely *et al.* 1993b, Bagely and Lavach, 1994, Williams *et al.* 1996, Keil and Davidson, 2001 and Collinson and Peiffer, 2002).

Summary

6. SUMMARY

The effectiveness of scleral approach for extracapsular cataract extraction was studied in six dogs (seven cases). Dogs presented with the history of impaired vision were clinically examined and cases with cataract were selected for the study. The selected dogs belonged to various breeds like Dachshund (3), German Shepherd Dog (1), Labrador Retriever (1) and Spitz (1) of either sex with an average age of seven years (range one to 13 years). Of the six dogs five had bilateral cataract. Five dogs had mature cataract and one had hypermature cataract. Cataract extraction was done in both the eyes in one case at an interval of seven months.

All the cases were put on preoperative medication consisting of azathioprine at the rate of 2mg/kg body weight orally and ciprofloxacin, flurbiprofen and tropicamide topically three days prior to surgery. The area around the eye was scrubbed with povidone-iodine solution before surgery.

All cases were subjected to general anaesthesia using atropine-xylazine–ketamine given intramusculary and maintained with intravenous administration of equal volumes of xylazine and ketamine and diazepam at the rate of 0.5mg/kg body weight. The anaesthetic regimen was found satisfactory for the intra ocular manipulations.

A better exposure of the eyeball and sufficient space for the intraocular manipulations were obtained in all the cases by inducing

moderate temporary exophthalmos by retrobulbar infusion of normal saline and by lateral canthotomy. The eyeball could be effectively fixed by applying temporary conjunctival stay sutures at the superior, inferior, nasal and temporal parts of the eyeball.

The anterior chamber was accessed through a scleral incision placed two millimeters away from and dorsolateral to the limbus. Visco-elastic material, hydroxy propyl methyl cellulose was infused in re-inflating the anterior chamber during the surgery. After accessing the anterior chamber the anterior capsule of lens was incised in a can opening fashion using the bent tip of a 24 G hypodermic needle and the lens material was removed by applying thumb pressure and the Wilder lens loupe. The anterior chamber was irrigated with sterile isotonic balanced salt solution to remove the blood clots, lens material and the visco-elastic material. The scleral wound was sutured with 8/0 silk using three to five simple interrupted sutures.

Conjunctival bleeding and prolapse of iris through the incision was found as two disadvantages of the scleral incision. Conjunctival bleeding was effectively controlled by topical instillation of adrenalin 1:10,000. An iris retractor was used to prevent prolapse of iris. Miosis, posterior capsular tear, vitreous prolapse and remnants of lens material adhering to the capsule or iris were the other intra operative complications encountered.

Self-mutilation and accidental injury to the eye could be effectively prevented by the application of Elizabethan collar and was well tolerated by all the dogs. Oral medication with cephalexin for five days and topical instillations of ciprofloxacin, flurbiprofen and

tropicamide for one month was effective in controlling postoperative infection, inflammation and formation of anterior synechia.

Mild elevation of intraocular pressure in two cases postoperatively was managed successfully with administration of acetazolamide at the rate of 25mg/kg bodyweight. Oral administration of azathioprine, an immunosuppressant was found effective in controlling the lens-induced uveitis.

Sutures remained intact till they were removed by the 10^{th} postoperative day in all the cases and all the cases had shown apparently good healing.

Physiological parameters like respiration, pulse and temperature remained within normal range in all animals throughout the observation period.

Visual function was assessed using menace test and photomotor pupillary reflex. Menace reflex was absent in all cases preoperatively in the present study. Four cases (57%) developed menace reflex by 38^{th} postoperative day and in the other cases (43%) menace reflex was absent till the end of the observation period. In the latter cases corneal oedema and complete opacity was present throughout the observation period. Photophobia was not appreciated in any of the cases before and after surgery.

Preoperatively purulent and serous discharge was noticed in one case each. Mucoid ocular discharge was present in all the cases in the

immediate postoperative period, which subsided from the 10^{th} postoperative day.

Moving blood parasites, microfilaria was detected in one case. The case was treated for microfilaria and cured preoperatively, but had recurrence of the condition on 38^{th} postoperative day.

The intraocular pressure (IOP) in the preoperative period was within the normal range in all the cases. A mild increase in IOP was seen in three cases on the third postoperative day. The major cell type found in the exfoliative lacrimal cytology, conducted preoperatively, was epithelial cells.

The conjunctiva in the immediate postoperative period showed moderate oedema and hyperaemia towards the dorsolateral aspect of the limbus in all the cases. These signs were subsided by 10^{th} postoperative day.

With regard to the shape, the cornea remained normal in all the cases postoperatively. A bulging of the corneal oedema was noticed in two cases during the postoperative observation period. Severe degree of keratitis was encountered in one case where there was a recurrence in the incidence of microfilaria. Corneal oedema was not noticed in any of the cases preoperatively. But postoperatively corneal oedema was observed by third day. In one case the corneal oedema subsided by one month and in other one it persisted throughout the period of observation. In the remaining cases corneal oedema was present on the dorsolateral aspect parallel to the suture line.

Good corneal clarity could be attained in four cases except at the dorsolateral aspect towards the suture line by the end of the postoperative observation period. In one case it became hazy and in other two cases cornea did not become clear till the end of the observation period.

The haematological parameters *viz.*, haemoglobin concentration, volume of packed red cells, total leucocyte count and differential leucocyte count in all the cases were within normal range.

The blood glucose level was estimated preoperatively, in all the cases except in one, the values were within the normal limits. In the mentioned case, the value was very high suggesting diabetes mellitus.

Postoperatively ocular infection and self mutilation were not encountered in any of the case. Other postoperative complications encountered were mild increase in intraocular pressure in three cases; persistent corneal oedema in one case and vitreous prolapse in one case.

From the present study the following conclusions could be arrived at.

- The scleral incision, 2 mm away on the dorsolateral aspect of limbus was found suitable in accessing anterior chamber for extracapsular extraction of lens.
- Conjuctival bleeding and prolapse of iris were the major complication encountered with scleral incision
- Healing of the scleral wound was found satisfactory
- Cataract can be extracted through the scleral incision with least formation of corneal oedema and opacity

- Moderate and temporary exophthalmos induced by retrobulbar infusion of normal saline was an effective method in exposing and fixing the eyeball during intraocular surgery
- Use of visco-elastic material was found useful in reconstructing the anterior chamber to get sufficient space for intraocular manipulations and to reduce injury to the intraocular structures.
- Sterile isotonic balanced salt solution was a satisfactory medium for irrigating and reconstituting the anterior chamber.
- Uses of synthetic absorbable suture material are suggested for scleral suture to avoid general anaesthesia and trauma associated with the suture removal.

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SCLERAL APPROACH FOR EXTRACAPSULAR CATARACT EXTRACTION IN DOGS

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ABSTRACT

The effectiveness of scleral approach for extracapsular cataract extraction was studied in six dogs (seven cases). Dogs presented with the history of impaired vision were clinically examined and cases with cataract were selected for the study. All dogs were put on to medication with azathioprine orally and ciprofloxacin, flurbiprofen and tropicamide topically three days prior to surgery.

General anaesthesia was induced with atropine - xylazine - ketamine given intramuscularly and maintained with xylazine - ketamine - diazepam combination given intravenously. A scleral incision, two millimeters away and parallel to the limbus on the dorsolateral aspect was used to access the anterior chamber. Anterior capsulotomy was performed and lens was extracted. Collapse of anterior chamber was prevented by infusing the visco-elastic material, hydroxy propyl methyl cellulose. Sterile isotonic balanced salt solution was used to irrigate the anterior chamber. Scleral incision was sutured with 8/0 silk in simple interrupted pattern.

Postoperatively all the dogs were maintained on cephalexin, azathioprine orally and ciprofloxacin, flurbiprofen and tropicamide topically. Scleral wounds were healed uneventfully and sutures were removed on 10^{th} postoperative day. Major intraoperative complications encountered during the study were haemorrhage from the conjunctival incision, prolapse of iris, miosis and remnants of lens material in the anterior chamber.

Out of the seven cases, four achieved functional vision by one month and corneal clarity except at the dorsolateral aspect near the suture line and in the remaining three, cornea remained opaque. Postoperative complications encountered were persistent corneal oedema in three cases, mild increase in intraocular pressure in two and vitreous prolapse in one.