MANAGEMENT OF CATARACT IN DOGS :CLINICAL STUDY OF 22 CASES

ABSTRACT: *Total 22 dogs (18 males and 4 female) with mature/immature/juvenile/senile cataracts presented to Department of Veterinary Surgery and Radiology, COVS, Ludhiana were selected and operated with phaco-procedure and afterwards evaluatedfor efficacy of this technique for cataract management using foldable lens implant. Standard protocol of general anaesthesia was adopted for surgery of these cases; drug involved, premedication with Butorphanol (@ 0.2mg/kg) +Acepromazine (@0.001mg/kg) + Glycopyrrolate (@0.01mg/kg) followed by induction using propofol (@4mg/kg). Isoflurane (1-2%) was given for maintenance of anaesthesia. Square edge foldable acrylic lens were installed within capsular bag of 19 dogs whereas in 3 dogs it was not possible. Affected lenses or lens material wasretrievedusing phacoemulsification procedureunder coaxial operating microscope. All the intra-operative complications were recorded in present study. Follow up of all animals were noted and evaluated for visual outcomes and postoperative complications (if, any). In order to calculate the success rate, the total number of eyes operated on for cataract surgery and lens implantation was divided by the number of cases in which successful vision restoration was observed. The results showed that restoration of functional vision was noted 15/22 (68.18%) at the 3-months follow-up period. Follow up in fewcases (n=4) was recorded telephonically. Miosis, iatrogenic lens adherence with endothelium during surgery, failure of hydrodisection and hyphemawere observed as intraoperative problems in this study. Corneal oedema in early postoperative period (within 7-days) was recorded as most common complication of this study. However, uveitis is also reported in many cases but resolved within 7-days of procedure.*

KEY WORDS: Phaco-machine, Cataract, Dogs, Vision, cataract surgery complications

INTRODUCTION

Cataract means opacity of eye lens. Opacity of eye lenses is common cause of vision impairment or blindness in dogs. Complete blindness is observed when cataract is mature involving both eyes with invisibleocular fundusduring ophthalmic examinations (Wilkie and Wolf 1990; Gelatt, *et al.,* 2001; Rajasekaran*et al.,* 2007; Ramani *et al.,* 2013). Patients with sudden development of bilateral cataracts are usually associated with Type-I diabetes (IDDM).Sorbitol pathway plays an important role in cataract formation in dogs. High concentrations of sorbitol, fructose and dulcitol because of hyperglycaemia in diabetic dogs develop lens hyperosmolarity which ultimately leads to opacity (Davidson *et al.,* 1993; Azar *et al.,* 2000). Cataract can be presented at any age but senile cataracts usually presented along with diabetes, are very common in dogs. Maintenance of normal blood glucose level prior to surgery is essential and therefore routine insulin therapy and measurement are necessary especially in cases of diabetic dogs. Classification of cataract basically depends on fundus visibility during fundoscopy. If fundus is clearly visible with opacity of lens then it comes under immature form of cataract. If lens is completely opaque with no fundus visibility then it shouldbe considered as mature form. Dogs with immature cataracts are usually treated with good visual outcomes compare to patients having mature form of cataract. In *Siberian husky* breed, juvenile form of cataract is very commonly reported (might be due to genetic association). However fundus is also visible in hypermature cataracts but such dogs must be avoided for surgery. Usually in such late stage retinal issues are commonly observed in dogs. Cataract can be operated through various techniques. Manual (ECCE,ICCE and MSIC) and Phaco-removal (modern day cataract surgery in dogs in India) are common in practice since 20-yeras in canine/feline practice.Phacoemulsification of juvenile cataract especially in *Siberian husky* breed of dog, possess comparatively better outcomes. IOL (intraocular lens) implantation during phacoemulsification greatly supports the purpose of treatment and improves the quality of life with focused visual outcomes (Glover and Constantinescu,

1997; Davidson, 2001; Dziezyc, 1990; Gaiddon*et al*., 1997; Hollick*et al*., 1997). In this study (*conducted from May 2021 to December 2022*), 22-dogs were selected, operated and evaluated using standard protocols of phacoemulsification procedure along with IOL-implantation (*+41D, Foldable Square Edge Lens*). Intra-operative and post-operative complications were also noted and evaluated.

METHODOLOGY

All the cases were selected after complete ophthalmic examination along with preoperative ocular ultrasonographic examinations. Blood glucose level was also examined prior to surgery and if that level is found above *300 mg/dL* then case has not been taken for surgery. Blood glucose of all the diabetic cases have maintained below 300 mg/dL(or in reference range with insulin administration) prior to surgery. Surgeries are not done in cases where any abnormalities especially in posterior of eye (vitreous and retina) were reported either during ophthalmic examination (in cases of immature and juvenile cataracts) or in ocular ultrasonography of affected eye hence all such cases were not included in this study. Age of dogs in this study ranged from 7-months to 12-yeras.Total81.81% males and 18.12% female dogs of different breeds were operated. Mature (59.09%, n=13), Immature (27.27%, n=6) and juvenile (13.63%, n=3) cases were selected and taken for surgery (Fig.1 to 6). Diabetic cataracts (27.27%, n=6) were reported mostly in this study followed by other causes. Phacoemulsification technique have been used in 86.36% (n=19) cataract cases in present study. 22.27% (n=5) cases have been associated with intra-operative problems during cataract surgery. In 13.63% (n=3) cases, intraocular lens was not installed due to some specific regions mentioned in table 1 In present study 81.81% cases have been recorded as bilateral cataracts in various dog breeds. Detailed case presentation findings were mentioned in Table.1

TABLE.1 FINDINGS NOTED DURING STUDY PERIOD IN ALL 22-CLINICAL CASES OF DOGS

Case No.	Breed, Sex and Age	Type of Cataract	Cause of cataract	Method used	Intra-operative Hurdles	Operative Time (in minutes)
C1	Labrador, (M), (4Y)	Mature	Diabetes (Bilateral)	Phacoemulsification	Incomplete mydriasis	33
C2	Pug, (F), (8Y)	Mature	Senile (Bilateral)	Phacoemulsification	None	18
C3	Schih Tzu, (F), (1Y)	Mature	Prolonged uveitis, corneal ulcer (unilateral)	Phacoemulsification	None	23
C4	Beagle, (M), (3Y)	Mature	Diabetes (bilateral)	Phacoemulsification	None	17
C5	Pomeranian, (M), (9Y)	Immature	Senile (bilateral)	Phacoemulsification	None	19
C6	Chow-Chow, (M), (2Y)	Immature	Unknown (bilateral)	Phacoemulsification	None	30
C7	Pug, (M), (11Y)	Mature	Diabetes (bilateral)	Phacoemulsification	None	25
C8	Culture Pom, (M), (2Y)	Immature	Unknown (bilateral)	Phacoemulsification	None	15
C9	Siberian Husky, (M), (8-Months)	Juvenile	Breed specific/genetic (bilateral)	Phacoemulsification	None	15
C10	Siberian Husky,	Juvenile	Breed	Phacoemul	None	17

	(M), (7-Months)		specific (bilateral)	sification		
C11	Siberian Husky, (M), (9-Months)	Juvenile	Breed specific (bilateral)	Phacoemul sification	None	31
C12	Pug, (F), (3Y)	Mature	Trauma (unilateral)	Phacoemul sification	None	18
C13	Labrador, (M), (12Y)	Mature	Senile (bilateral)	ECCE due to failure of hydrodissct ion of hard lens	Failure of lens resection and retrieval through phaco-machine followed by phaco burn. Corneal incision was extended to remove intact lens.	40
C14	Beagle, (M), (5Y)	Mature	Diabetes (bilateral)	Phacoemul sification	Lens misplaced and adhered with corneal endothelium during IOL-installation	32
C15	Non-descript, (M), (12Y)	Mature	Trauma (Unilateral)	ICCE due to anterior lens luxation	Anterior capsule already disrupted, IOL was not installed. Corneal incision was extended for removal of entire intact lens.	13
C16	Chow-Chow, (M), (3Y)	Immature	Unknown (bilateral)	Phacoemul sification	None	32
C17	Rottweiler, (M), (8Y)	Mature	Trauma (Unilateral)	Phacoemul sification	None	16
C18	Germen Shepherd, (M), (1Y)	Immature	Unknown (bilateral)	Phacoemul sification	None	21
C19	Boxer, (M), (3Y)	Mature	Diabetes (bilateral)	Phacoemul sification	None	19
C20	Golden retriever, (M), (5Y)	Immature	Unknown (bilateral)	Phacoemul sification	Hyphema	29
C21	Miniature bull terrier, (M), (3Y)	Mature	Trauma (unilateral)	Phacoemul sification	None	17
C22	Pug, (F), (6Y)	Mature	Diabetes (bilateral)	Phacoemul sification	None	23
Total case =22	**Male=18 Female=4**	**Mature= 13 Immature = 6 Juvenile= 3**	**Diabetes= 6 Trauma= 4 Unknown = 5 Others= 7**	**Phaco= 20 ECCE=1 ICCE=1**	**No hurdles= 17 Hurdles= 5**	**Mean±S.E 22.86 ±1.59**

C:case;M:male;F:female,Y:Year

SELECTION OF DOG FOR CATARACT SURGERY

All the animals were selected after conducting complete essential clinical, hemato-biochemical and ophthalmic examinations. Detailed history about occurrence of lesion within eye and other concurrent diseases of dog was taken and considered prior to surgery. Affected eye was evaluated for vision in all the cases. History of complete blindness was recorded in all the bilateral cataract cases. Most important parameter, blood glucose level (in present study cases below 300mg/dL have been selected) was evaluated properly prior to surgery. To rule out retinal detachment and vitreous pathology, ocular ultrasonogrpahy is done in all cases. However few parameters in complete blood count were reported elevated/decreased but cases have been selected due to last stage of mature cataracts. No mortality was reported in present study due anaesthesia and surgical intervention.

PRE-OPERATIVE COMPULSORY PLANNING

a. **Installation of eye drops for pupil dilation:** One protocol is prepared (combination of mydriatics) to achieve adequate mydriasis prior to surgery to facilitate phacoemulsification. However in one case (as mentioned in Table.1 adequate mydriasis has not achieved(might be due to owner ignorance about prescribed protocol). In this case to achieve mydriasis, intraoperative diluted adrenaline solution was injected directly into the anterior chamber. Details of mydriaicagnets and other eye drops of preoperative compulsory protocol were mentioned in Table. 2

TABLE.2 PREOPERATIVE COMPULSORY TOPICAL EYE DROPS PROTOCOL

Name of agent (eye drops)	Purpose	Dose and manner of administration
Tropicamide (1%)	Mydriasis(pupil dilation)	One drop
Cyclopentolate (1%)	Mydriasis (pupil dilation)	One drop after 5 minutes of tropicamindeadministration
Flurbiprofen (0.03%)	NSAID to reduce inflammatory activities prior to surgery	One drop after 5 minutes of cyclopentolate administration
Gatifloxacin(0.3%)	Antibiotic to combat infections of cornea and uvea	One drop after flurbiprofen administration
		The manner of eye dropsfollowed above was repeated for four times (4-cycles) 2-3 hours prior to surgery. Take 10-minutes gap between each cycle starting form tropicamide to gatifloxacin

b. **Immediate pre-operative:** Check blood glucose level and ask about fasting and insulin status of dog. If everything is fine then use medication like meloxicam (0.3mg/kg) as intravenous injection prior to surgery to reduce intra-operative and post-operative inflammation. Inflammation due intra-operative manipulations in lens is most likely occurring in this procedure (because of lens proteins).

ANAESTHESIA FOLLOWED IN PRESENT STUDY

Balance anaesthetic protocol was prepared and used for cataract surgeries in dogs. Drugs which are having issues of increased intraocular pressure were avoided in anaesthetic protocol. Any form of local anaesthesia was not used in this study. Globe was centrally positioned using small sized

(2-0) surgical threads. Premedication done with administration of butorphanol (*@ 0.2mg/kg*), acepromazine (*@0.001mg/kg*) and glycopyrrolate *(@0.01mg/kg)*followed by induction with propofol(*@4mg/kg*) through intravenous route 7 to 10 minutes after premedication.Use of acepromazine was avoided in dogs having age more than 8-years. Endotracheal tubes (range of size used in this study was 5.5 to 10 mm as innder diameter) were placed immediate after induction. All the dogs were maintained on 1-2% of isoflurane in 100% oxygen. After surgery pure oxygen (thorugh ET attached with anaesthesia machine) was given for better recovery atleast for 5-minutes in all the dogs.

SURGICAL PROCEDURE FOLLOWED IN PRESENT STUDY

Head of all dogs kept in position laterally (with the selected eye towards the surgeon) and animal positioners were used to make animal recumbent on surgical table. Animal's head was carefully stabilized through surgical drapes kept just beneath head. Cataract surgery was performed using phacoemulsification unit with aid of operating co-axial microscope. Surgical site was prepared aseptically and the surgical area was draped carefully toensure globe exposure during the surgery. A clear corneal incision was made at the cornea with a 2.8 mm angled keratotome. Afterwards, trypan blue dye was used for effectively staining the anterior lens capsule. The anterior chamber volume was restored with hydroxyl propyl methyl cellulose(a viscoelastic material). Tuberculin syringe (1ml) was used to make stab into the anterior lens capsule followed by an anterior continuous curvilinear capsulorhexisusingthoughlens capsule forceps. Part of anteriorlens capsule, approximately 6-8 mm in diameter, was carefully torn in circular manner and removed. Hydrodissection was performed afterwards to release any attachment between the remaining lens capsule and lens cortex using 5 ml syringe filled normal saline solution.Phaco tip was introduced through the corneal incision through the anterior lens capsule opening to chop and sculpt the opaque lens. Irrigation and aspiration were used towards the end of the surgery to remove the remaining lens materials from the equatorial and posterior lens capsules. Flexible, injectable and acryl polymer optic and polypropylene haptics (41D), square edge foldable acrylic lens were installed in required cases. The acrylic IOL had a square edge. The IOL optic was folded using IOL-holding forceps and inserted into the IOL cartridge. After filling the capsular bag and anterior chamber with normal saline, the IOL in the cartridge was inserted into the capsular bag with the IOL inserter without enlarging the corneal incision. See Fig.7 for surgical procedure of cataract removal though phaco-machine used in present study. Postoperatively, Cefotaxime (*@ 25 mg/kg*) and Meloxicam (@ 0.2 mg/kg body weight) were administered intramuscularly for 7 and 3 days respectively. Gatifloxicin – Prednisolone eye-drops were instilled topically after every 2 hours for first week .This dose was tapered 4 hourly for 2ndweek, four times a day for 3rd week and two times a day for 4th week. Details are mentioned in Table.3 The dogs underwent phacoemulsification were examined for any postoperative complications.

TABLE.3POST-OPERATIVE COMPULSORY MEDICATIONS

Name of agent (eye drops)	Purpose	Dose and manner of administration
Tropicamide (1%)	As cycloplegic drug to relieve iris spasms and thereby controlling ocular pain	One drop in day for 7-days
Gatifloxacin (0.3%) + 1% Prednisolone	To control uveitis and corneal oedema which may occur as a results of surgery (application of one-month)	2 drops every 2-hours for first week followed by every 4-hours second week then every 8-hours third week and finally every 12-hoours for fourth week
Injection meloxicam	NSAID to reduce inflammatory activities	0.2 mg/kg, IM, 3-days
Cefotaxim	Antibiotic to combat infections of cornea and uvea	25mg/kg, IM, 7-days
Note: owner must be advised to report after 10-days of surgery for further follow-up and ocular ultrasound.		

RESULTS AND DISCUSSION

Follow-up of cases have taken either in clinic or thorugh telephonic contact with owner atleast up to 3-months of surgery. A successful surgical outcome was defined as restoration of functional vision, assessed by response to a menacing gesture and the ability to navigate an obstacle course. Success rate was determined by dividing the number of eyes that successfully restored the vision with the total number of the eyes operated for cataract surgery and lens implantation. The results showed that restoration of functional vision was noted 68.18% (15/22) uptothe 3-months follow-up period. Menace response had become positive. These dogs passed all patterns of maze test in light room conditions. The value of mean preoperative intraocular pressure (IOP) ± S.E. and Schirmer's tear test (STT) were 19.32 ± 1.56 mmHg and 23.30±2.41mm/min respectively noticed. Their vision remained until the last day of evaluation. To conclude, phacoemulsification with square edge acrylic foldable +41D intraocular lens implantation was foundan effective technique with success rate of 78.94% (n=15/19, in 3-cases IOL installation was not successful) for management of mature cataract in dogs. However the sample size is not enough to conclude the outcomes therefore larger samples with experienced surgeon is essentially required to reach on conclusions of phaco-technique for the management of cataracts in dogs.Seefigure 8-12 for complications during and after cataract surgery in present study. Majority of dogs had bilateral cataract (81.81%) in present study and similar findings were reported with study of Tuntivanich and Tuntivanich (2003). The potential complications of canine phacoemulsification surgery are numerous and include corneal edema, nebula, corneal ulcer, uveitis, glaucoma, posterior and anterior lens capsule opacification and lens drop, retinal detachment, endophthalmitis, and wound dehiscence (Gaiddon*et al*., 1997). In present study corneal oedema/opacity (72.72%, n=16/22) was reported as most common complication especially in early follow up period followed by anterior lens capsule opacificaion (4.54%, n=1/22), iris bombe (4.54%, n=1), glaucoma (18.18%, n=4/22), posterior lens capsule opacification (13.63%, n=3/22) and retinal detachments (9.09%, n=2/22). Problem of corneal oedema got resolved after frequent administration of 1% prednisolone eye drops upto disappearance. Moore *et al* (2003), also reported that the most frequently observed complication within 48 hours postoperative was uveitis, recorded in 72% of eyes. Uveitis is reported as concurrent complication in all the dogs but resolved within one week when topical steroid was used as prescribed. But in 2-cases where lens materials supposed to be remained even after proper surgery, uveitis persisted more than 7-days. out of these 2-cases, one case suffered with retinal detachment also in later stage.Jhala*et al*.,(2009) also observed corneal oedema in eyes underwentECCE,however, the corneal opacity resolved within 3 weeks of time in their study.

CONCLUSIONS

Never suggest topical eye-drops as only form for cataract treatment in any species. Surgery is the only option for management of opaque lenses. There is no other option exists for cataract management in dogs. Medical management can prevent development of cataracts in special circumstances (like in trauma; if uveitis is prevented in early stage then cataract will rarely develop). Dogs with immature cataracts are the choice of patients for surgery. Unilateral cataracts are usually associated with non-diabetic causes (like trauma, cat-scratch and uveitis and infectious agents. Rarely, helminths swirling within anterior chamber of eye in dogs cause unilateral cataracts in dogs. Siberian husky breed of dog is commonly affected with juvenile cataracts as mentioned in this article therefore common reported in early age usually with immature form. Hence Siberian husky breed with this type of cataract can be best treated with visual outcomes if diagnosed earliest.Phaco-burn is common practice by beginners in the canine ophthalmology. Excess heat with inadequate use of ringers lactate during surgery can cause endothelium damage. Once endothelium get damaged then definitely corneal oedema exists. If NSAIDs are not used properly (both topical and parental), uveitis may persists in postoperative days leads to failure of surgery. Retinal issues are common when eye has manipulated excessively during surgery. Expert hands, complete knowledge of phaco-machine, use of pre-

operative topical protocol for mydriasis, surgeons patience and duration of phacoemulsification, post-operative management with both topical and parental medicines and application of E.collar greatly affects final visual outcomes.

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FIGURES

Fig.1: Immature cataract in a Labrador

Fig.2: Mature cataract (traumatic) in a Pug

Fig.3: cataract and lens luxation in a ND dog; was removed thorugh ICCE

Fig.4: Bilateral cataract in Culture Pom

Fig.5: Pre-surgical ocular USG (note cataract)

Fig. 6: Juvenile cataract in a Siberian Husky

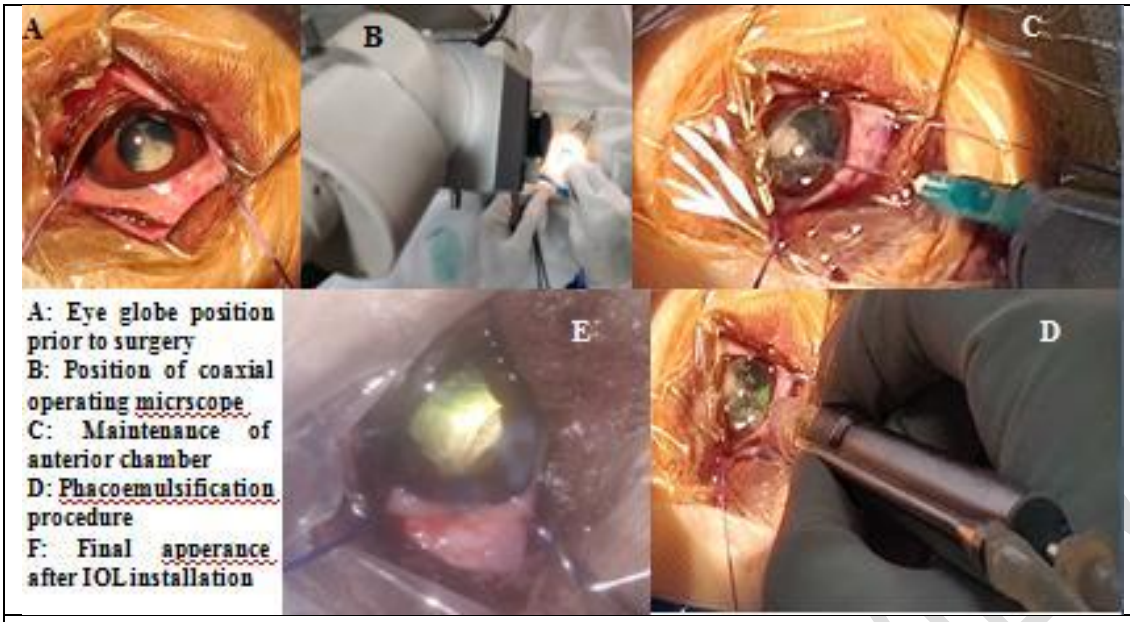

Fig: 7: Pictorial presentation of technique of cataract removal (intraoperative procedures)

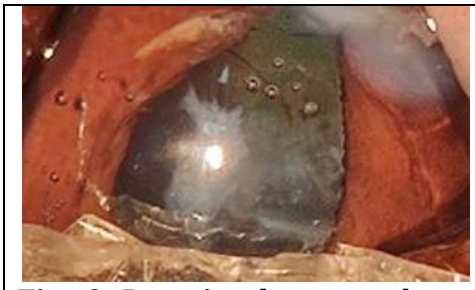

Fig. 8 Posterior lens capsule opacification (PCO) after surgery in a Labrador

Fig.9: Anterior lens capsule opacification (ACO) after surgery in a Begale

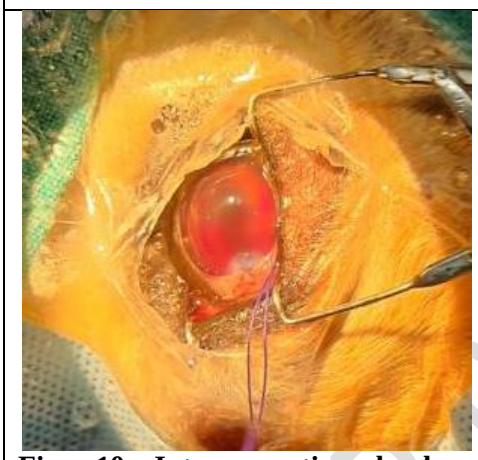

Fig. 10 Intra-operative hyphema during cataract surgery in a Labrador. However it was resolved within a week of surgery.

Fig. 11 Iris bombe reported in a beagle associated with glaucoma secondary to cataract surgery.

Fig. 12 Corneal oedema in a pom reported as an early post-operative complication (might be due to phaco-heat).