Scientific Works. Series C. Veterinary Medicine. Vol. LXVIII (1), 2022
ISSN 2065-1295; ISSN 2343-9394 (CD-ROM); ISSN 2067-3663 (Online); ISSN-L 2065-1295

EFFICIENCY AND THERAPEUTIC CONDUCT OF SURGICAL PROCEDURES FOR MATURE CATARACTS IN A DOG, CASE REPORT

Elena BONEA, Cornel IGNA

Banat's University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from Timisoara, Faculty of Veterinary Medicine, 119 Calea Aradului, Timisoara, Romania

Corresponding author email: drboneaelena@yahoo.ro

Abstract

Cataracts are not typically brought to the attention of a veterinarian until owners report their dogs bumping into different kind of things, because when a cataract is fully developed, mature, it leaves the eye functionally blind. The patient of this study is a male old dog, 15 years old, completely blind, with mature bilateral cataract. The quality of his life had a very low score, the dog injured himself with the objects around, his behaviour changed and became retired, sleeping most of the time and became aggressive with owner and dogs around. Because the only effective and recommended treatment is surgery, for economical owner's reason, for the right eye of the dog we chose the manual extracapsular cataract extraction surgical procedure. Short follow-up surgery, dog became visual animal, but irreversible complications occurred, so, after 3 months' time, for the left eye of the dog we proceed with the phacoemulsification method of cataract extraction with the implantation of an intraocular artificial lens. Both eyes surgical methods had good post operatory results, but long-term for the second method results were superior.

Key words*: dog cataract, cataract surgery, phacoemulsification, intraocular lens*

INTRODUCTION

A cataract is a permanent change in the thin, clear, highly organized protein fibers that make up the lens of the eye of the dogs.
This change transforms the clear protein into a milky, white, opaque one. Once the proteins change throughout the entire lens, it is like a frosted pane of glass, and as the lens thickens it becomes more difficult for the pet to see around. When the opacity covers about 60% of the total lens area, visual impairment often becomes apparent.
If the opacity progresses to 100% of the lens, in which case the cataract is fully developed (mature), the dog will be functionally blind in the affected eye (Grogan, 2020). Degree of maturation of cataract are: incipient - earliest lens changes, focal opacity of the lens and radiations or "spoke" shaped opacities; immature - the cataract affects the entire lens, but does not completely abolish the tapetal reflection; mature - lens totally opaque, fundic reflex absent, vision lost with the lens usually normal size; hyper mature - resorption causing decrease in total lens volume and wrinkling of anterior capsule and may have areas of fibrosis and dystrophic calcification (Kecová et al., 2004).
Usually, cataracts are not typically brought to the attention of a veterinarian until owners report their dogs bumping into different kind of things or furniture.
Diagnosis of cataracts is set up on the ophthalmic examination findings and they are seen as an opacification of the lens. A full physical examination, clinical history and, when warranted, a comprehensive hematologic and blood chemistry, should be pursued for patients presenting with cataracts.
Clinically the mature and hyper mature cataracts can be easily seen like a white disk behind the iris. The incipient and immature cataracts may be observed easily with retro illumination of the eye after pharmacologic pupil dilation (i.e., tropicamide or atropine administration topically). Small opacifications of the lens may be observed as dark or light areas within the lens.). Retro illumination will also allow the observer to evaluate the tapetal reflection, thereby allowing differentiation between immature and mature cataracts, if the entire lens is affected. Ophthalmic evaluation with retro illumination and direct focal illumination will help differentiate cataracts from nuclear sclerosis, a normal aging change of the lens caused by increased density of nuclear lens

fibers. Identification of the location of the cataract within the lens and further characterization of the cataracts typically require advanced training and slit-lamp bio microscopy performed by a veterinary ophthalmologist.
According to Hlinomazová and Vlková, 2003, after clinical examination of the patient, the preoperative examination should include also a complete ophthalmologic exam. Also, intraocular pressures (IOP) for both eyes need to be checked to see for underlying glaucoma or uveitis.
There are many studies for dog lenticular disorders or with lens changes, for all degrees of cataract and cataract treatment options and their follow-up (Davidson et al., 1991; Nassise et al., 1990, 1991; Gaidon et al., 1991; Lim et al., 2011; Fischer and Meyer-Lindenberg, 2014; Ionascu, 2013). When the dog's quality of life is being significantly affected by the loss of vision resulting from cataracts, the only efficient and recommended treatment is surgery with the lens extraction (Lim et al., 2011). There are two methods for lens extraction in dogs: extra-capsular surgical technique when the lens is extracted through a corneal or scleral incision line (Patil et al., 2014) and intra-capsular lens phacoemulsification, or removal of lens material through small incision with fragmentation, emulsification and aspiration (Davidson et al., 1991; Gaiddon et al., 1991, 2000; Gilger, 1997; Nasisse et al., 1990, 1991).
In patients for which cataract surgery is not an option (e.g., severe cardiac disease precluding anesthesia, clients have declined surgery, etc.), supportive topical therapy should be instituted long-term to help prevent complication such as lens-induced uveitis and glaucoma secondary to cataracts (Park et al., 2009).

CASE PRESENTATION

This case report describes the treatment of a bilateral cataract in a dog by two different surgical method, one for each eye and the use of an intraocular lens in one eye.
The patient of this case study has the name Unic, it is a male dog, 15 years old, cross-breed, medium size, 18 kg, overweight, non-neutered, completely blind. His owner reported that his dog was injuring himself with the objects around, his behavior changed and became retired or sleeping and sometimes even got aggressive with him or with the other dogs from the house.
At clinical examination we noticed that the dog was blind, and thorough slit lamp examination, we noticed white disks behind both iris' eyes because of the lens opacification. After pharmacologic pupil dilation (i.e., tropicamide topically) mature cataracts were observed easily with retro illumination of the eye. We set up the diagnostic of mature bilateral cataract for our patient. Tonometry show that both Unic's eyes had normal intraocular pressure (IOP) with value of 13 mm Hg on the right eye and 15 mm Hg on the left eye, this investigation shown that no underlying glaucoma occur as a cataract complication.
Thorough slit lamp examination we checked the possible visual interference in cornea (opacity, edema, pigmentation) or anterior lens capsule and the state of suspensory apparatus of the lens (signs of lens subluxation). No fundoscopy exams were done in order to check retinal detachment or progressive retinal atrophy and no electroretinography was done in order to check the retinal function, at the dog's owner request.
Blood work is a very important diagnostic tool that provides a significant amount of information about a pet's health. We tested blood glucose level; dog value was 102 mg/dl (normal dog values 80-120 mg/dl), which could have revealed diabetes, which is a systemic disease that can accompany cataract (Falca et al., 2011).
We did also a biochemical blood profile in order to assess the function of internal organs. Biochemical analyses of dog's blood had the next results: alkaline phosphatase (ALP) U/I 33 (<68), amylase U/I 1005 (<1289), bilirubin mg/dl 0.1 (0.5), glutamine transferase GGT U/I 15 (<20), alaninaminotransferase ALT U/I 50 (<89), cholesterol mg/dl 220 (110-300), creatinine mg/dl 0.8 (<1.8), urea mg/dl 30 (<54), all the parameters we tested were in range of dog normal values.
We also did a Complete Blood Count of the dog, including red and white cell count and the measure of hemoglobin. Values we count were as follows, all of the dog were normal values (we represented in parentheses the normal dog's values): white blood cell count (WBC) 10.6 x 10^3/mcl (4-12 x 10^3/mcl), red blood cell count

(RBC) was 6.2 x 10-6/mcl (5.7-10.5 x 10^6/mcl), hemoglobin (HGB)- 14 g/dl (9-16 g/dl), hematocrit (HCT) 48% (38-52%), corpuscular volume (MCV) 55.9 fl (40-60 fl), corpuscular hemoglobin (MCH) 18.2 pg (15-20 pg) corpuscular hemoglobin concentration (MCHC) 33.5 g/dl (32-36 g/dl) , platelets (PLT) 210/mcl 160-420/mcl), segmental neutrophils 52% (51-72%), Lymphocytes 30% (8-35%), Monocytes 6% (1-9%), (Eos) 4% (0-9%), Basophils 2% (0-2%), all the parameters were in range.

We discuss the cataract surgical treatment options with the owner. Together, we decided to start with one of the eyes, the right one, with the surgical extra-capsular lens extraction method.

Surgery was performed under general anesthesia, which consisted of premedication with diazepam (intravenous, dose 0.5-1 mg/kg, Diazepam Terapia SA, Romania) and ketamine (8 mg/kg, Ketamidor, Richter Pharma AG, Austria), and narcotic induction with Propofol 1% (3-6 mg/kg - self-dosing, Fresenius SE&C, Germany), after which the subject was intubated and connected to the closed-loop, assisted-breathing inhalation anesthesia apparatus, the anesthesia being maintained throughout and maintenance with isoflurane (at concentrations ranging from 5% to 0.5%, Anesteran, Rompharm Company, Romania) vaporized in oxygen using intermittent positive pressure ventilation.

From 2 h before surgery, atropine, tropicamide with phenylephrine, dexamethasone, flurbiprofen sodium and gentamycin eyedrops were administered every 30 min.

For a good visualization of the anatomical components of the eye we used a magnifying glass with lamp. The surgical instruments we used were the ophthalmological ones: curved Castroviejo corneal scissors, corneal forceps, conjunctival forceps, Castroviejo straight corneal forceps, Mackool Barraquer 0.5 mm spatula, dog eye speculum, single-use eye cannula.

The eyeball was fixed with an eye speculum that allows easy access to operative area with less injury (Figure 1). A stab incision was made through the sclera above the cornea using a surgical blade that was extended with corneal scissor (Figure 2). After the entry in anterior chamber, anterior chamber collapsed which was partially filled with saline water to prevent injury to corneal epithelium. Then, capsule was tear with double bended 23 G needle, which was passed horizontally and then twisted to 90º to perform capsulotomy. We used a colorant blue to marked the anterior capsule.

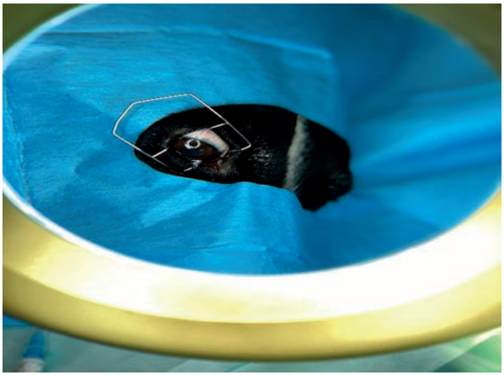

Figure 1. The aspect of the eyeball with the eye speculum through the magnifying glass

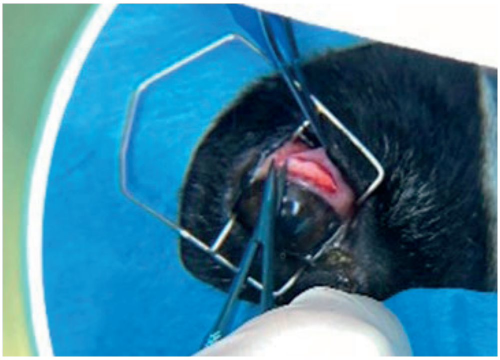

Figure 2. The incision on the sclera

Then, slowly proceed to capsulorhexis, when the capsule was tear at weaker equatorial region of lens. After removal of anterior capsule, the cortical and nuclear material of lens luxated in the anterior chamber (Figure 3) from where we removed them, without disturbing posterior lens capsule, with the use of a small lens loupe (Figure 4). We perform a gentle irrigation of anterior chamber using saline water, and after, we closed the sclera and the conjunctiva suturing with 8-0 mononylon in three separate stitches, after filing the anterior chamber with saline water, with a good aspect of the eye, with no hemorrhagically residues. Dog received an intraconjuctival injection with gentamycin and dexamethasone, and his owner was recommended to follow a schedule of dosage and prescribed with dexamethasone and enrofloxacin for initial one-week general treatment after surgery and topical eye drops with gentamycin and dexamethasone.

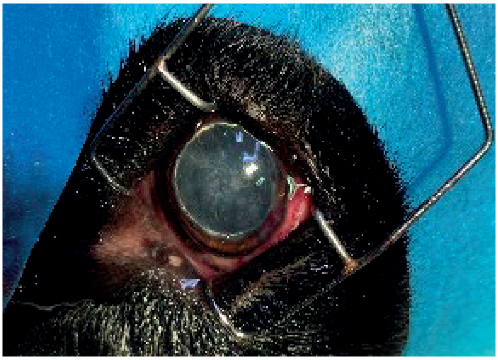

Figure 3. The luxation of the lens after the capsulorhexis

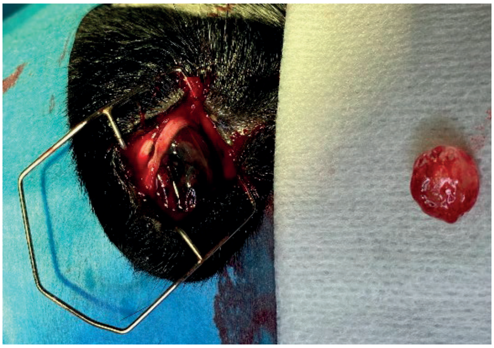

Figure 4. The aspect of the eye after removing the lens and the aspect of the removed lens

The dog was examined at days 7, 14, 21, one and three months after the surgery was performed. At day 7, the dog eye was examined, and uveitis occurred post-surgery, so he was prescribed general treatment with dexamethasone until day 30. At 14-day examination, a cloudiness in the upper half of the eye corneas was noticed. Corneal opacification progressively advanced and when we re-examined the dog at day 30 after the surgery (Figures 5, 6), also posterior capsular opacification (PCO) developed and the dog had partial loss of vision with his right eye. No other post-operatory complication was observed.

Reexamination dog's eyes after 3 months, when owner came back to the Clinique with the same problem, that the dog cannot see, we noticed that the post-operatory corneal opacification made his right-eye blind again.

Figure 5. Aspect of the cornea at day 30 after surgery

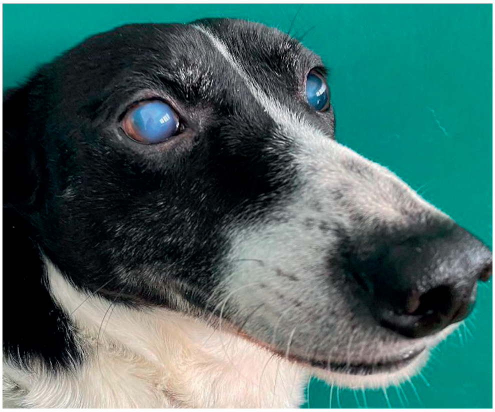

Figure 6. Aspect of the corneal opacity of right eye at day 30 post-surgery and mature cataract of left eye

Discussing surgical treatment options with the owner again, and taking in consideration the many studies that consider phacoemulsification surgical method with intraocular lens implantation, as a highly successful procedure to restore vision in dogs with cataracts, with few post-operatory complications (Nassise et al., 1991; Wilkie and Colitz, 2013), we proceed with this method for dog's left eye surgical treatment. This procedure uses an ultrasonic device to break up and remove the mature lens from the dog's eye, and is the same procedure that it used in cataract surgery on people.

For this surgical method we used a surgical microscope, with magnification in 5 steps, with two 10x tilting binoculars with wide field, 50W LED lighting system, with articulated mobile arm and with the possibility of horizontal and vertical movement. Pre-operatory preparations were the same as first method.

During phacoemulsification technique, we started with a small incision at the edge of the clear cornea to enter in the anterior eye chamber. We injected trypan blue using a canula in the anterior chamber for better visualization of the lens capsule for performing the capsulorhexis (Figure 7), and then with a viscoelastic substance, we filled the entire anterior chamber of the eye.

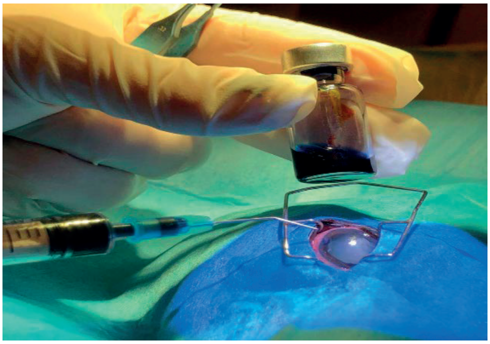

Figure 7. Injection of trypan-blue in the anterior eye chamber

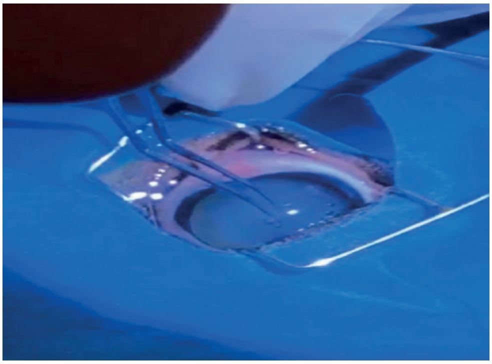

Figure 8. Capsulorhexis procedure

We performed the circular capsulorhexis continuously in the equatorial area (Figure 8), with the aid of a Utrata forceps and a capsulorhexis cystotome, then followed by hydrodisection, rotation and phaco emulsification of the lens core with the phaco device sonde. The fracture technique used was phaco-chop and the phacoemulsification parameters were set in 60% of ultrasonic power, 40 cc/min, 12 pulses/sec.
The aspiration of the cortical waste was performed with the irrigation/aspiration pen of the device (Figure 9). Then, we used a thin haptic intraocular lens (IOL) made of silicon elastomer and acrylate/methacrylate polymers, foldable, for implanting through the small corneal incision (2.5-3.5 mm).

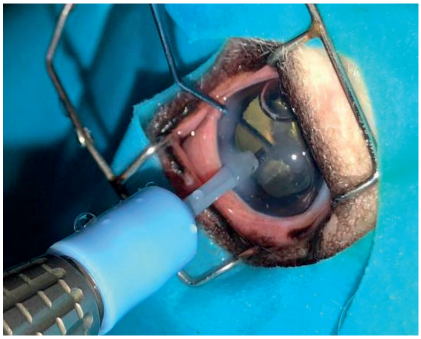

Figure 9. Phaco-chop fragmentation of the lens, with irrigation and aspiration of cortical waste

The IOL came sterile with single-use preloaded injector for easy handling and insertion. We previously folded the IOL using an IOL-holding forceps, then we inserted it into the IOL cartridge and after, through the incision, into the capsular bag from where we removed the mature lens.
Finally, it was performed the aspiration of the viscoelastic substance and the injection of an air bubble on the anterior chamber, and hydration of the surgical borders. A two stitches suture using 8-0 mononylon was made on the main incision.
Dog received an intraconjuctival injection with gentamycin and dexamethasone, and his owner was recommended to follow a schedule of dexamethasone and enrofloxacin for initial one-week general treatment after surgery, and topical eye drops with gentamycin and dexamethasone. The animal's appetite was back to normal immediately post-surgery and all vital parameters remained unchanged.
The dog was examined at days 7, 14, 21 and one month after the surgery was performed.
At day 7, a small corneal inflammation was noticed at the incision area. Topical eye drops like previously, were recommended for two more weeks, two times per day.
No other post-surgical complication was noticed until day 30.
Two months after surgery the dog presented for a recheck examination. The animal was reported to be active, with normal food and water intake and perceived to be visual and comfortable.

DISCUSSIONS

Cataract surgery in companion animals is considered an elective procedure that aims to improve the animals' quality of life.

Because of the considerable progress in cataract surgery in recent decades, lens opacities can now be operated on with very good short-term success (90-95%), taking into account that proper patient selection is essential to maximize the probability of a successful surgical outcome (Fischer and Meyer-Lindenberg, 2014).

According to Patil et al., 2014, manual extra capsular cataract extraction was standard and the most popular method of lens removal in dog for many years in which, the anterior lens capsule, the lens cortex and nuclear material were extracted. Although the approach of extra capsular cataract extraction is primitive, it has been still recommended in cataract cases of dog due to size, density of cataractous lens and thick capsule (Patil et al., 2014), also for being an economical advantageous method that doesn't need a special equipment. For all these reasons, and mostly because of financial reasons, together with the dog owner's we chose and proceed with this method for dog right eye.

First days after the surgery, the dog became very active, comfortable and has regained his vision. Most dogs will have enough vision to tackle obstacle, boost confidence and avoid life-threatening accidents and improve overall their quality of life, even they remain with aphakia at eye, like in this right dog eye. After 14 days post-surgery, the dog started to develop a corneal opacification and posterior capsular fibrosis that led to definitive opacification of cornea at the next re-examinations, that made him again blind. If postoperative complication can be prevented (PCO in our case right eye), then the extracapsular cataract manual extraction can be an alternative to owners which can't afford lens cost and would like to resolve vision loss in their pet.

Development of corneal opacity might be due to excessive handling, as this case selected had mature cataract, this is in agreement with Dziezyc, 1990 and Joy et al., 2011.

According to many studies, the phacoemulsification surgical method and intraocular lens implantation is a highly successful procedure to restore vision in dogs with cataracts (Nassise et al., 1991; Wilkie and Colitz, 2013). Nowadays, even in veterinary medicine, the method of choice in most cases is phacoemulsification, or removal of lens material through small incision with fragmentation, emulsification and aspiration (Davidson et al., 1991; Gaiddon et al., 1991, 2000; Gilger, 1997; Nasisse et al., 1990, 1991). The only disadvantages are the costs of equipment and materials of this procedure.

According to Sigle and Nasisse, 2006, surgical success rates have increased over time with refinements of surgical technique, but a surgical success is not guaranteed. Surgery is considered to have failed when dogs develop painful and/or blinding complications such as endophthalmitis, retinal detachment, or glaucoma. Our results with this method for dog's left eye were successful and we didn't have any complications like the studies describes.

In addition to the advantages of improved vision in pseudo phakic eyes, there are several studies suggesting that posterior capsular opacification (PCO), a common complication after cataract surgery in humans and animals, may be mitigated by the IOL. This is supported by several studies that showed that the lens design, material and chemical properties could decrease PCO (Nishi et al., 2004; Buehl and Findl, 2008). According to these, we used a soft acrylic haptic IOL for the dog left eye. Two months post-surgery, the results were good and no PCO was observed in our dog case.

In the recent past there were studies of Davidson et al., 2013, valuating the IOL size and dioptric power in pet dogs, concluded that most dogs will see much better when an artificial lens (IOL - 41D) is implanted inside the lens capsule.

According to Konopińska et al., 2021, phacoemulsification method is considered to significantly reduce endothelial cell damage, which is preventing the posterior capsular opacification, corneal opacification, but despite all the improvements in the techniques used in cataract surgery and lens design, statistically, PCO was reported to occur after surgery in some cases.

Advantages of phaco-chop include also reduction of zonular and capsular stress because forces are directed toward an opposing instrument and the phaco tip is kept in a central 'safe zone' in the middle of the pupil (Kecova and Neaas, 2004). But, because of the mature cataract, the time of this technique was longer, because of the difficulty of ultrasound to chop the cataract of its hardness and complication according to literature may appear (Davidson et al., 1991; Nasisse et al., 1990, 1991).

In conclusion, our case report reveals good long-term results after the phacoemulsification surgical method with intraocular lens implantation.

REFERENCES

Buehl, W. and Findl, O. (2008). Effect of intraocular lens design on posterior capsule opacification. *Journal Cataract Refractive Surgery.* 34:1976-1985.

Davidson, M.G., Murphy, C.J., Nasisse, M.P., Hellkamp, A.S., Olivero, D.K., Brinkmann, M.C., Campbell, L.H. (1993). Refractive state of aphakic and pseudophakic eyes of dogs. *American Journal Veterinary Research.* 54:174-177.

Davidson, M.G., Nasisse, M.P., Jamieson, V.E., English, R.V., Olivero, D.K. (1991). Phacoemulsification and intraocular lens implantation: a study of surgical results in 158 dogs. *Progress in Veterinary and Comparative Ophthalmology 1:* 233-238.

Dziezyc J. (1990). Cataract surgery, current approaches. *Veterinary Clinical North American Small Animal Practice*. 20:737-754.

Fischer, M.C., Meyer-Lindenberg, A. (2014). Cataracts in dogs--overview and guideline for decision making in treatment. *TierarztlIche Praxis Ausgabe. K Kleintiere Heimtiere 42*(6):411-23.

Gaidon, J.A., Lallement, P.E., Peiffer, R.L. (2000). Implantation of a foldable intraocular lens in dogs, *Journal of the American Veterinary Medical Association, 216*(6), 875-7, 864.

Gaidon, J.A., Rosolen, S.G., Steru, L., Cook, C.S., Peiffer, R.Jr. (1991). Use of biometry and keratometry for determining optimal power for intraocular lens implants in dogs, *American Journal Veterinary Research, 52*(5): 781-3.

Gilger, B.C. (1997). Phacoemulsification technology and fundamentals. *Veterinary Clinical North American: Small Animal Practice* 27: 1131-1141.

Grogan Tyler (2020). Cataracts in Dogs: The Importance of Early Detection and Management. *Summer 2020, Today's Veterinary Nurse, Ophthalmology*.

Hlinomazova, Z and Vlkova, E. (2003). Uveitis anterior. In: Rozsíval P: Infections of the Eye. *Grada Publishing s.r.o., pp.* 127-148.

Ionașcu Iuliana. (2013). Atlas de oftalmologie veterinară. *Editura Curtea Veche*, 2013

Joy N., Jhala S.K., Patil., D.B., Parikh, P.K, Sheth, M.J., Mistry, K. (2011). Complications of extracapsular cataract surgery: A report of 54 cases. *Indian Journal of Veterinary Surgery.* 32(1):27-30.

Kecová, H., Neãas, A. (2004). Review Article. Phacoemulsification and Intraocular Lens Implantation: Recent. Trends in Cataract Surgery. *Acta Veterinary Brno*, 73:85-92.

Konopińska, J., Młynarczyk, M., Dmuchowska, D. A., & Obuchowska, I. (2021). Posterior Capsule Opacification: A Review of Experimental Studies. *Journal of clinical medicine,* 10(13), 2847.

Miller, T.R., Whitley, R.D., Meek, L.A., Garcia, G.A., Wilson, M.C., Rawls, B.H. (1987). Phacofragmentation and aspiration for cataract extraction in dogs: 56 cases (1980-1984*). Journal of American Veterinary Medical Association,* 190: 1577-1580.

Nasisse, M.P., Davidson, M.G. (1991). Surgery of the lens. In: Gelatt, K.N. (ed): *Veterinary ophthalmology, 2nd edition*, Lippincott Williams and Wilkins, 827-856.

Nasisse, M.P., Davidson, M.G., Jamieson, V.E., English, R.V., Olivero, D.K. (1990). Phacoemulsification and intraocular lens implantation in dogs: a study of technique in 158 dogs. *Progress in Veterinary and Comparative Ophthalmology 1*:225-232.

Nasisse, M.P., Davidson, M.G., Jamieson, V.E., English, R.V., Olivero, D.K. (1991). Phacoemulsification and intraocular lens implantation: a study of technique in 182 dogs. *Progress in Veterinary and Comparative Ophthalmology*. 1:225-232.

Nishi, O., Nishi, K. and Osakabe, Y. (2004). Effect of intraocular lenses on preventing posterior capsule opacification: Design versus material. *Journal Cataract Refractive Surgery.* 30:2170-2176

Park, S.A, Yi, N.Y., Jeong, M.B., Kim, W.T., Kim, S.E., Chae, J.M., Seo, K.M. (2009). Clinical manifestations of cataracts in small breed dogs. *Veterinary Ophthalmology.* Jul-Aug;12(4):205-10.

Patil, V.N., Pati, P.B., Parikh, P.V., Talekar, S.H., Patil, D.B., Kelawala, N.H., Seth, M. (2014). Extracapsular cataract surgery in canine- A pictorial view. *International Journal of Veterinary Science & Research. 1*(1): 1-6.

Sigle KJ, Nasisse M.P. (2006). Long-term complications after phacoemulsification for cataract removal in dogs: 172 cases (1995-2002) *Journal of American Veterinary Medical Association.* 228:74-79.

Wilkie D.A., Colitz C.M.H. (2013). Surgery of the lens. *In: Gelatt KN, ed. Veterinary Ophthalmology, 5th edn. Ames, IA: Wiley-Blackwell*. 1234-1286.