

**"ION IONESCU DE LA BRAD" UNIVERSITY OF AGRICULTURAL SCIENCES AND  
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**PhD Attendant,  
RUGINĂ Brăduț Ștefan**

**LENS AND INTRAOCULAR PRESSURE PATHOLOGY IN  
DOMESTIC CARNIVORES**

**PhD MANAGER,  
PhD, Prof. BURTAN Ioan**

**ABSTRACT**

**Key words:** *dog, cat, lens, intraocular pressure, epidemiology, symptoms, diagnosis, treatment*

The thesis entitled „*Lens and ocular pressure pathology in domestic carnivores*” is structured in two parts, according to the Doctoral school. Part I, „*Current state of knowledge regarding the lens and ocular pressure pathology in domestic carnivores*”, contains 86 pages, representing 30% and the second part, „*Personal contributions*”, extended on 203 pages, representing 70% of the content of the thesis.

The first part, divided into two chapters, deals with concise information from the specialized literature, regarding the lens and ocular pressure morphophysiology and data about lens and ocular pressure pathology. This information is considered to be useful for comparing it with the data from the second part. This part is illustrated with 53 pictures and 7 tables, selected as suggestive, in order to detail the synthesized information.

Part II is divided into four chapters (Chapter III-IV) and includes the purpose and the objectives of the research, study material and methods, results and their interpretation. The final conclusions end this part.

The thesis was carried out over a period of four years, from October 2007 until September 2011 and the cases were provided by Centrovet Veterinary Clinic, Bucharest.

The main objectives of the thesis, stated in chapter III, were the following:

- Determination of the relative frequency of lens affections and ocular pressure pathology in carnivores and its correlation with various intrinsic and extrinsic factors;
- Description of the clinical aspects and their correlation with various etiological factors and results of the diagnosis by using paraclinical investigations;
- Elaboration of a diagnosis protocol, through the corroboration of the clinical and imagistic aspects;
- Comparative assessment of some therapeutic, medical and radical methods in lens affections and ocular pressure pathology, in order to establish a certain demeanour in relation to the evolutive form of the affection.

Chapter IV deals with the materials and work methods used for this thesis.

Chapter V details the results obtained during four years of research, the data being detailed in 20 tables and 251 pictures.

An ophthalmologic observation sheet was conceived in order to make a complex epidemiological study for the carnivore pets with ophthalmic affections. The examination of other structures of the eyeball, besides the lens and ocular pressure, was dictated by the fact that the evolution of the endobulbar affections correlates in an etiopathogenetic way. We also mention the fact that in the epidemiological study, we used the term relative frequency, which refers to the cases presented here. When working with a population of domestic carnivores, dispersed over a large enough area, the calculation of the incidence and prevalence of lens pathology and ocular pressure encounters difficulties, as not all the animals with eye problems are brought to a professional consultation.

The epidemiological study allowed to establish the relative frequency of the lens pathology and ocular pressure, correlating it with various intrinsic factors (species, breed, age, sex of the animal) and extrinsic ones (maintenance conditions), where this aspect was relevant to our study.

The results of the epidemiological investigations showed that in all cases with ocular pathology recorded at Centrovet Clinic, lens diseases accounted for 13.7% and 5.72% presented ocular pressure pathology.

The statistical studies allowed the evaluation of some intrinsic factors (species, breed, age) and extrinsic ones (maintenance conditions), involved in the emergence and **development of the lens diseases**. Regarding the species, we notice a higher frequency in dogs (65.45%), compared to the cats (34.55%), the differences being due to the consequence of a greater number of dogs presented at the consultation and their maintenance in paddocks and yards, where they

can injure the eyeball and also in the apartment along with the cats, which may generate conflicts that cause severe ocular trauma.

In terms of how breed influences the relative frequency of lens disorders in carnivores, our studies have shown higher percentages (8.54) in Caniche, Cocker and Teckel dog breeds and 37.5 in Burmese cat breed, respectively. The other breeds scored close rates, without significant differences.

Age was a very important intrinsic factor in the appearance and development of the cataract. In dogs, the cases were diagnosed more frequently in the age group of 7-9 years with 39.68% and in cats, at the age of around 11 years (18.75%). This grouping by age is quite relative, being directly influenced by the owner's interest to take the animal with lens disorder to a professional consultation. The animal is usually brought when the visual acuity tests are negative, or the lens damage is diagnosed at a consultation required by other endophthalmic affections.

In terms of structure, lens disorders were represented in dogs by dystopias (23.18%) and opacifiers (76.82%), including developmental anomalies (microphakia, lenticonus and coloboma), due to their involvement in the development of the cataract.

The main causes of lens dystopia were represented by accidental ocular trauma, or the evolution of some endophthalmic diseases (glaucoma, uveitis, cataract), which favoured zonulolysis. The ophthalmoscopic examination revealed the moving of the lens forward, by pupillary opening (anterior dislocation) or towards the vitreous body, producing posterior dislocation.

From the etiopathogenetic point of view, cataract was diagnosed shortly after birth or several years, which allowed us to describe the congenital (7.6%) or acquired cataract (92.4%).

The following forms were included in the structure of the acquired cataract: traumatic (24.7%), deriving from endophthalmic affections (20.5%), metabolic-nutritional (11%), iatrogenic (6.8%), toxic (4.1%) and senile in 32.9% of cases.

As for the eyeball where the acquired cataract developed, we noticed that the affection occurred unilaterally (38.4%) and bilaterally (61.6%). The congenital cataract was diagnosed only bilaterally, genetic disorders affecting both eyes.

In terms of evolution, the ophthalmologic investigations led to the description of the following clinical forms of cataract: incipient (16.5%), immature (29.1%), mature (35.4%) and hypermature (19%), the frequency being in relation to the owners' interest to bring the animal to a professional consultation.

The beginning and development of the lens disorders manifest through the affection of the visual acuity, requiring the use of ophthalmological investigations on the position and

morphology of the lens. In case of dystopia, the clinical signs appear in short time but in cataract, the clinical expression is related to the degree of opacification.

Thus, in cataract, the visual acuity tests show the alteration of the response since early form, but they are hardly noticeable and interpretable, excepting Sanson-Purkinje image which is visibly impaired. In case of immature form of cataract, opacification is weakly visible, so the visual tests are positive, but delayed, especially the orientation test in space with low light. In ophthalmologic examination, the eye fundus can hardly be distinguished.

The mature cataract stage is expressed clinically by total opacification of the lens, the visual acuity tests give negative answers and the eye fundus cannot be explored ophthalmoscopically.

On ultrasound, marked hyper-ecogenity areas are highlighted. In hypermature cataract, we notice the absence of the responses to the visual acuity test, the animal doesn't move in unknown spaces and the completely opacified lens have porcelain colour. Clinically and ophthalmoscopically, we notice the affection of other eye structures too. Ultrasound shows hyper-ecogenic structures.

Lens disorder treatment was correlated with etiopathogenesis, clinical form and lens relationship with other ocular structures. In relation to these criteria, the treatment was medical and surgical.

The medication used in lens dystopia was in relation to its movement. Thus, in posterior dislocation, the use of miotics, steroidal or nonsteroidal anti-inflammatory drugs, by reducing the production of aqueous humor and increasing the drainage, the possibilities of developing complications are reduced. In case of anterior dislocation of the lens, corneal complications and IOP have a quick evolution and thus, it is recommend to perform surgery by intracapsular extraction of the lens.

In cataract, medical therapy aimed at stimulating the lens metabolism in order to slow the opacification evolution. To achieve the objective, we applied the alternative therapy with ozone and the use of kinoidic inhibitors , by administration of Quinax, collyrium 0.15 mg/ml.

Ozone therapy was applied by major autohaemotherapy, perfusion with sodium chloride solution 0.9%, initially ozonated and by continuous ozonation or rectal insufflations of O<sub>3</sub>/O<sub>2</sub>, according to the protocol. The assessment of visual acuity tests, parallel to the ophthalmoscopic and ultrasound exams, revealed the role of additional oxygenation of the aqueous humor by administration of O<sub>3</sub>/O<sub>2</sub> , having the ophthalmic circulation as a target. In incipient and immature cataract, clinical forms in which the visual acuity tests are less influenced, we noticed the maintenance of these tests at the initial parameters. The ophthalmoscopic examination didn't reveal the opacification progress.

Quinax eye drops, as kinoidic inhibitor agent, determined the surcease of cataract evolution and the facilitation of reabsorption. The conclusions were highlighted by the responses to the visual acuity tests and the images offered by ophthalmoscopic and ultrasound examinations.

The surgical treatment in the lens diseases stands for a major medical responsibility, considering the intra- and postoperative risks. In order to perform a successful intervention, special attention was given to the case selection, by pre-surgical evaluation, both of the patient and the owner.

The ethological assessment of the animal required the withdrawal of the aggressive, unapproachable, agitated animals, which make difficult the performance of the routine examinations and the application of the medical treatment, especially the topical ones. We also excluded from surgery the patients whose owners didn't show understanding towards the animal's health, inherent risks and complications, postoperative length of treatment, involvement in the administration of the prescribed medication and the surveillance of the operated area.

The surgical techniques aimed at intracapsular or extracapsular lens extraction, this option being in relation to the type of affection and induced complications.

The intracapsular extraction was performed in the lens dystopia through its anterior dislocation, in order to prevent complications and in total cataract cases with lens and cracked crystalloid opacification.

Extracapsular extraction surgery was performed in cases where phacofragmentation and aspiration of the lens fragments were possible and this can be followed or not by foldable artificial lens implant inserted in the lens capsule.

Regardless of the used technique, the preoperative preparations are important both in the performance of the surgery and the postoperative evolution. Three days before the surgery, anti-inflammatory medication with maximum potential and anti-infective medication with good ocular penetration are administered; the established scheme continues for another 30 days postoperatively.

The approach and lens extraction were considered the most important moments, avoiding trauma to the iris, ciliary bodies and cornea. Therefore, the corneal incision was paralingual, at the limit with the sclerocorneal limbus, reducing the surgery trauma, bleeding and inflammation. The maintenance of the anterior chamber shape and the corneal endothelium protection was achieved by the injection of a viscoelastic substance.

The achieved access allowed intracapsular extraction of the dislocated or opacified lens, which is checked in terms of integrity, as the remainings can trigger uveal reactions.

In lens extracapsular extraction through phacoemulsification, capsulorhexis was performed, allowing the introduction of the hand piece of the phacoemulsificator. The device

adjustment regarding the ultrasound power and aspiration rate was correlated with the cataract type, reducing the working time and inflammatory response. The initiation of the phacoemulsification, beginning from the middle of the lens ray to the hard center, accomplished a phacoemulsification with minimal inflammatory reactions.

In cases where the phacoemulsification surgery was followed by foldable artificial lens implant, this one was introduced through the capsulorhexis window, respecting the cartridge loading technique, injection and positioning. Lens extraction surgery, regardless of the used method, led to the recovery of the anterior chamber volume, the corneal suture catching the bulbar conjunctiva, in order to speed healing, the correct joining of the wound edges, canthorrhaphy and the application of the protective dressing.

As for the **intraocular pressure pathology**, researches have shown that glaucoma development is the result of some endophthalmic disorders, which can be correlated with a number of intrinsic factors, species, breed, sex and age respectively.

When regarding the species, we notice a higher frequency in canines, compared with the cats. Thus, researches have shown that in 41 diagnosed cases, 78% were canines and only 22% were felines. The difference is due to the higher number of dogs presented at the consultation, but also because of the fact that the cats were not diagnosed with primary glaucoma, which is frequent in dogs.

As for the influence of the breed on the glaucoma frequency, we find it more often in Cocker, Husky but most breeds have scored similar percentages, with slight variations. In cats, the higher frequency was found in Burmese breed. Both in canines and felines, the frequency is higher in the pure breeds than the mixed ones.

In terms of sex predisposition, no differences were found in cats, but in canines the ratio M/F was 1/1,3.

The performed researches have shown that glaucoma is an affection that evolves over time and the appearance of the first clinical signs doesn't correspond to the disease onset, especially in primary glaucoma. In secondary glaucoma, the eye examinations imposed by the presence of some ophthalmic affections, reveals the onset of glaucomatous disease.

The IOP measurement in carnivores showed that glaucoma may occur from the age of 0-6 months in dogs, but more frequently at 5-7 years and in cats at 3-5 years.

The onset is marked by transient changes of IOP and visual acuity, that don't attract particular attention but they worsen gradually, leading to blindness due to the damage of the cornea, iris, lens, retina and papilla of the optic nerve. An increased and persistent IOP causes corneoscleral distension, which is reversible in young animals and irreversible in adult ones, leading to buphthalmia.

The animal's changes of behaviour due to ocular pains are represented by anxiety or offence, aggressive reactions to the investigation of the ocular area. These signs are useful for the diagnosis, which is confirmed by tonometry, gonioscopy, ophthalmoscopy. Ocular ultrasound, chromatic pupillary reflex test and electroretinography are very useful and they revealed the state of the retina and optic nerve.

IOP determination showed its variation according to the breed, age, time of the day, animal's behaviour, means of retaining and it highlights the advantages of TonoVet tonometer in its registration. The maximum benefits offered by Koepe gonioscopes allowed the classification of glaucoma in relation to the state of the iridocorneal angle and the pectinate ligament.

The medical treatment of glaucomatous disease is aimed at reducing the production and increasing the drainage of the aqueous humor. The use of specific medication did not stop the evolution of the glaucomatous disease, but delayed the changes of ocular structures and the loss of vision.

The surgical intervention was applied to cases where the functionality of the eyeball is compromised and the pain sensation became unbearable, externalized through behavioral disorders. The technique aimed at emptying the eyeball and applying an intrascleral prosthesis with artificial eyeball, for the animal's aesthetics or the complete removal of the eye, followed by the suture of the palpebral slant. Each technique has advantages and disadvantages related to the patient's aesthetic appearance and postoperative complications.