Glaucoma incidence. Morphofunctional changes in glaucoma in dogs and cats

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Abstract. The article analyzes the data of case histories of dogs and cats for the period from September 2018 to the end of December 2020 with increased intraocular pressure in the Rostov region. Changes in eye structures, causes of glaucoma, research methods, problems of diagnosis and treatment of diseases are described. Particular attention is paid to the consideration of the complications of pathology, as well as the methods of their prevention.

1 Introduction

Glaucoma – group of heavy progressive neurodegenerative diseases, characterized by increased intraocular pressure, damage to the retina and optic nerve [1,2,3]. Is one of the leading causes of loss of visual function in dogs and cats [2]. The disease can be both primary and secondary, developing because of other pathologies. In addition, the scientific literature describes cases of retinal detachment and the development of glaucoma after phacoemulsification in dogs [4,5]. These postoperative complications are most often recorded in the Cocker Spaniel (11.7%), Boston Terrier (10.5%), Labrador Retriever (6.5%), Bichon Frise (6.5%), Shih Tzu (5.8%) and Jack Russell Terrier (5.8%) [5].

In humane medicine, changes in the structures of the eye, detected at increased intraocular pressure, have been studied in sufficient detail, descriptions of the fundus and early markers of the disease are given [6,7,8]. However, literary sources lack data on the manifestations of pathology in small domestic animals. According to these data, the clinical diagnosis in cats is made much less frequently than in dogs. A rare occurrence - 0.3% of the total number of diseases in cats, is most likely associated with a small number of examined by an ophthalmologist. In more than half of cases, neoplasia and about a quarter of anterior uveitis are described as the cause of glaucoma in cats [9].

The aim of the current study was to study the prevalence of ophthalmic pathologies among the total number of patients, as well as to determine the proportion of glaucoma among diseases of the organ of vision and the auxiliary apparatus of the eye in the Rostov region. In addition, we analyzed the complaints that the owners of such animals applied to

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the clinic, morphofunctional changes detected by a specialist during examination, etiology, breed predisposition. Since this pathology is not an endemic disease, the analysis of incident statistics using the example of one clinic can characterize the state of the problem as a whole.

2 Materials and methods

The study was carried out at the Vita veterinary clinic in Rostov-on-Don. In addition to the owners' self-referral to the clinic, patients for ophthalmological examination were sent from third-party clinics and other branches of the Rostov region. The Viasna database was used to analyze the case histories. Clinical cases were selected by the keywords "glaucoma" and "glaucomatous uveitis" among the total mass of patients for the period from September 2018 to the end of December 2020. To make a diagnosis, all animals underwent a clinical and ophthalmological examination, a series of sequential measurements of intraocular pressure (IOP) with a TonoVet tonometer. In the process of tonometry, the position of the patient with a straight head, the absence of pressure on the neck and head area by the assistant, and the correct application of six touches with the probe to the middle of the cornea are important (the angle between them should be 90°). There were 5 such measurements on each eye, the results were recorded and the arithmetic mean value was chosen. The study of the anterior segment of the eye and the auxiliary apparatus was performed using a binocular loupe and a ShinNipponXL1 slit lamp. The assessment of visual function was based on the threat test and the maze test. Comorbidities were detected by assessing tear production with test strips Tearstrips (Contacare), fluorescein (Fluostrips test strips (Contacare)) and LissamineGreen (Contacare) lissamine tests. During the initial examination and the entire observation period, chromatic pupillomotor reactions, ultrasound examination of the eye were also assessed (MindrayDC-n6). Ophthalmoscopy was performed using an OptomedSmartscope m-5 fundus camera and a PanOpticWelchAllyn direct ophthalmoscope.

3 Results

During the study period, 164,973 patients with various diseases applied to the clinic, as well as for preventive care, including medical examination and vaccination, sent animals for research from third-party clinics. Of these, 413 were at the veterinary ophthalmologist with complaints of pathology of the organ of vision or on a routine examination. Increased IOP was noted in 35 subjects. Thus, the incidence of increased IOP was 8.47% of the total number of visits (only primary appointments were taken into account). 60% with ophthalmic hypertension were cats (21 cases) and 40% dogs (14 cases).

The most frequent complaints during treatment were lacrimation, blepharospasm, changes in the transparency of the cornea, periodically "reddening" eyes, depression of the animal. In the terminal stage, the owners treated with an enlargement of the animal's eyeball in size (Fig. 1), blindness in bilateral lesions. In 11.4%, increased IOP values were revealed during a routine examination, allowing to identify pathology at an early stage and intervene in time. At the same time, the owners did not notice any signs of pathology. When the animals were examined by an ophthalmologist, in addition to the above signs, symptoms of anterior uveitis were detected - opacification of the intraocular fluid (IHF), precipitates on the corneal endothelium, eversion of the pigment layer of the iris and chorioretinitis, rupture of descemet's membrane and penetration of the intraocular membrane and in the corneal stroma - Gaab's stripes (Fig. 2), congestive episcleral vessels (Fig. 3). Clinical signs in terms of frequency of occurrence are presented in Table 1.

Fig. 1. Buphthalmus (right eye).

Fig. 2. Gaab stripes.

Fig. 3. Congestive episcleral vessels.

Table 1. Frequency of occurrence of clinical signs.

clinical signs	dogs		cats	
	Number of cases	% of all clinical cases in dogs	Number of cases	% of all clinical cases in cats
fundus vascular attenuation	1	2,8	4	11,4
optic disc atrophy (ODA)	1	2,8	3	8,5
retinal detachment	3	8,5	5	14,3
blindness	4	11,4	5	14,3
lens subluxation	1	2,8	3	8,5
lens luxation	1	2,8	-	
buphthalmus	4	11,4	5	14,3
hemophthalmos	3	8,5	3	8,5
chorioretinitis	-	-	3	8,5
Gaab stripes	3	8,5	1	2,8
synechiae	2	5,7	2	5,7
cataract	4	11,4	4	11,4
congestive episcleral vessels	3	8,5	1	2,8
endothelial corneal edema	2	5,7	2	5,7
corneal vascularization	1	2,8	-	-
Total	14		21	

It was possible to establish the cause of the increased intraocular pressure only in 14 patients. In other cases, it was not possible to objectively determine the root cause due to various factors. Some of the animals (8.5%) were picked up by volunteers on the street and taken to the clinic for examination. Other reasons for the unknown anamnesis were: free-range keeping of animals and lack of information from the owners, initial referral to an ophthalmologist already in the terminal stage of the disease, unwillingness of the owners to examine and treat their animal for various reasons.

The most numerous group in dogs and cats was post-traumatic glaucoma in 42% of cases. Injuries to the head and, in particular, the eyeball and periocular tissues are one of the most common reasons for contacting a veterinary ophthalmologist. These include penetrating wounds of the cornea, bitten wounds for the periorbital region, closed injuries of the eyeball as a result of autoinjuries, falls from a height or blows with blunt objects. Penetrating wounds with a cat's claw, branches and other sharp objects often cause damage to intraocular structures with rupture of the lens capsule, damage to the iris and, as a result, the formation of anterior and posterior synechia. In blunt trauma, the causes of increased intraocular pressure may be hemorrhages in the anterior chamber with a block of the iridocorneal angle, hemophthalmus, partial or complete separation of the lens from the zinn ligaments.

The second most common group was postuveal glaucoma as an emerging complication of anterior uveitis. In some cases, such a problem arose against the background of the development of acute or exacerbation of chronic iridocyclitis, and in others it was a distant result of post-inflammation of the choroid. In 3 cases in cats with glaucoma, in addition to anterior uveitis, we observed signs of chorioretinitis. All were subsequently confirmed to

have diseases such as leukemia, immunodeficiency, coronavirus infection or toxoplasmosis in various combinations.

In 8.5% of the subjects, acute ophthalmic hypertension was recorded, which was stopped by medication, after which it was possible to gradually discontinue the drugs under the control of tonometry. Subsequently, no clinical manifestations were identified. Further observation of the animals from 3 to 18 months did not lead to the detection of a relapse.

Phakotopic glaucoma was observed in two cases in Chinese Crested and Chihuahua dogs. In the first case, a primary dislocation of the lens of the eye is likely, since there is a breed predisposition to this pathology. Secondary glaucoma developed due to block of the iridocorneal angle, and as a result of late seeking help in this dog, we observed endothelial corneal edema and subtotal retinal detachment detected by ultrasound. However, the luxation of the lens into the anterior chamber is possible in this animal as a consequence of the development of cataracts, since examination with a slit lamp in the second eye revealed initial cataract changes. The intraocular pressure was within the normal range. The dog's owner was advised to enucleate the eye with buphthalmus and carry out phacoemulsification on the other side, without waiting for complications. In the case of the Chihuahua, the initial examination revealed signs of anterior uveitis-unilateral (deep scleral hyperemia according to the results of the test with irifrin, slight eversion of the pigment layer of the iris). At the same time, IOP values were borderline - 10 mm Hg. A therapeutic treatment was prescribed and re-admission after 3 days. Despite the recommendations, the owner only asked for help after 2 weeks. On examination, we observed subluxation of the lens in the PT (Fig. 4), increased IOP - 54 mm Hg. It was recommended to remove the lens, but the further fate of the patient is unknown to us.

Fig. 4. Lens subluxation in CT in Chihuahua.

Two dogs developed glaucoma as a consequence of overripe cataracts. One 24-year-old cat had neoplastic glaucoma that underwent exenteration.

The distribution of the frequency of occurrence of increased IOP among breeds is presented in Table 2.

Table 2. Frequency of occurrence by breed.

breed	dogs		breed	cats	
	Number of cases	%		Number of cases	%
Shih tzu	1	7	Scottish lop-eared	1	4,8
Chinese Crested	2	14	Angora	2	9,5
Yorkshire Terrier	1	7	Oriental	1	4,8
American staffordshire terrier	1	7	Siamese	1	4,8
Chihuahua	3	21	British	1	4,8
Dachshund	1	7	Mestizo	15	71
French Bulldog	1	7			
Tibetan terrier	1	7			
Jack Russell Terrier	1	14			
Mestizo	2	7			
Total	14	100	21		100

3.1 Ophthalmoscopy

Examination of the fundus (FD) is an integral part of an ophthalmological examination, including for a patient with increased intraocular pressure, whenever possible. Preserved transparency of the media and contraindications to drug mydriasis allowed ophthalmoscopy to be performed in all patients only with the help of a fundus camera. In the case of intact transparency and patients who came with mydriasis, it was additionally possible to examine the fundus of the eye with a direct ophthalmoscope. Characteristic changes at an early stage were attenuation of the fundus vessels of varying severity, expansion of the excavation of the optic nerve head. At more advanced stages, in most animals, we noted atrophy of the optic nerve disc with a characteristic pale gray color, the absence of peripheral retinal vessels and thinning of the central ones, and in some animals, the complete disappearance of retinal vessels (Fig. 5). The study revealed signs of chorioretinitis in 3 cats, retinal detachment (local or subtotal, total) in two cats and two dogs. In other cases, the diagnosis of retinal detachment was made after an ultrasound scan of the eye, since ophthalmoscopy was impossible due to the opacity of the eye media for various reasons.

Fig. 5. The fundus of a blind cat with glaucoma. Complete absence of retinal vessels, optic disc atrophy.

3.2 Ultrasound examination of the eye

This study is a minimally invasive and safe method for diagnosing ophthalmic pathologies. And although ultrasound of the eye was performed in all patients who consulted an

ophthalmologist, it played a special role in violation of the transparency of the eye media (edema and opacity of the cornea, mature cataract, hemophthalmus, etc.), making it possible to assess the thickness of the cornea, the size and contents of the anterior chamber of the eye (ACE), position, size and transparency of the lens, the contents of the vitreous body (VB), the state of the retina, the anterior-posterior size of the eyeball. In patients with end-stage glaucoma, we observed an increase in the size of the eye, an increase in the anterior chamber. A frequent finding was partial, subtotal (with attachment at the optic nerve head and dentate line), and total retinal detachment. In traumatic damage to the eyeball, changes in echogenicity were visualized in hemophthalmos (hyphema, hemorrhages in the ST), and ruptures of the anterior lens capsule. Lens dislocation, in addition to examination, was also confirmed using the ultrasound method (Fig. 6).

Fig. 6. Ultrasound examination of a dog's eye with location of the cataract lens in the PCH, increased PCH, corneal edema and buphthalmos.

3.3 Visual function

In 26% of the subjects, visual function was irretrievably lost due to late seeking help and the development of serious complications. At the same time, in about half of the cases, the owners did not suspect decreased vision or blindness in their pet (only cases with bilateral pathology or with a single preserved eye were taken into account). Basically, this fact was recorded among cats, since they were well oriented in their usual home environment, especially if the decrease in visual function progressed gradually. Some owners only noticed dilated pupils, but some did not attach importance to this fact either. In the advanced stages of the disease, we observed no positive effect on the therapy, and in some cases we immediately recommended the owners to enucleate or exenterate.

4 Discussion

Among the studied group of dogs, no breed predisposition was revealed, which may be associated with a small sample. The vast majority of ophthalmic hypertensive cats were mestizo males. This fact, in our opinion, is associated with the fact that among this group there are more often cats with free-range content, not castrated. According to statistics, it is these individuals who are more likely to receive injuries, including the eyeball, and the prevalence of infections among the population is also higher. Such factors can lead to iridocyclitis, damage to intraocular structures, complicate the closure of drainage tracts, pupillary block and cause ophthalmic hypertension. In addition, a specialist is often consulted several days, weeks, or even months after the injury. such animals often

disappear from home for a long time. Another reason for late visits is the inattentive attitude of the owners to their animals, the lack of annual preventive examinations by the veterinarian, the unwillingness of people to examine the pets even with obvious signs of pathology. In such cases, it can be difficult to help the animal preserve its vision, to determine the root cause and prognosis. A high percentage of cases with an unknown history and unknown fate, even after the diagnosis and clarification to the owner about the problem and the methods of treatment, shows their irresponsible attitude.

A serious problem, according to which iridocyclitis is complicated by glaucoma in the long-term period, is the inaccessibility of ophthalmological care in many districts of the Rostov region. Most clinics do not have the availability of specialized equipment and narrow-profile specialists, thus leading to diagnostic errors. An examination with the naked eye is often insufficient to detect initial anterior uveitis. In addition to measuring intraocular pressure, patients require biomicroscopy, ophthalmoscopy, ultrasound, and, if necessary, additional research methods. Due to inflammation of the ciliary body and hypotension, the obtained tonometry results can be interpreted incorrectly. In addition, in such a situation, the IOP values can be borderline and fluctuate during the day, thus, without arousing suspicion from the doctor.

To assess the effectiveness of the prescribed therapy, it is imperative to monitor IOP according to an individual plan. Short intervals between tonometry have to be done at first, while the frequency of use of certain drugs is being determined, the need to add new ones is being considered. The lack of effect on drug treatment is an indication for surgical intervention. In an acute attack of glaucoma, it is often necessary to resort to invasive methods of lowering IOP as an emergency measure, since high ophthalmotonus always leads to the development of complications. An acute attack of ophthalmic hypertension requires immediate medical intervention, careful monitoring of the patient in the future and timely correction of IOP. High IOP values within 24-48 hours lead to irreversible loss of vision.

A high percentage of owners who do not notice the blindness of their pet proves that in a familiar environment, animals may not demonstrate a decrease in visual function, even in its complete absence. To establish this fact, a specialist examination and special tests and studies are required.

5 Output

This study showed that glaucoma is a common disease among animals in the Rostov region, but at the moment it is not possible to identify the breed predisposition. An analysis of the statistics of clinical signs made it possible to understand what manifestations of the disease the owners pay attention to and what the doctor finds during a thorough examination. Thanks to the study, it became clear that the most common secondary ophthalmic hypertension occurs in the Rostov region as a result of traumatic injury and a complication of anterior uveitis. Based on the incidence of complications of glaucoma, it can be concluded that more often the owners of the patients apply already at the later stages of the disease. This fact becomes a serious problem in understanding the etiological factor, makes it difficult, and sometimes does not give the opportunity to help the animal. Preventive examinations help in many cases to suspect a problem, to make a diagnosis at an early stage and thereby increase the chances of successful treatment.

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