ESCOLA UNIVERSITÁRIA VASCO DA GAMA

MESTRADO INTEGRADO EM MEDICINA VETERINÁRIA

Cataracts in Labrador Retriever and Jack Russell Terrier: a two-year retrospective study

Rafael Guerra Campos Marques dos Santos

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RESUMO

As cataratas estão entre as doenças oculares mais comuns e são uma das principais causas de perda de visão em cães e humanos. Os Jack Russell Terriers (JRT) e os Labrador Retrievers (LR) estão entre as raças caninas mais afetadas por cataratas. Este estudo teve como objetivo analisar as características clínicas e o desfecho cirúrgico das cataratas em JRT e LR num Hospital oftalmológico Veterinário de referência no Reino Unido.

Foram avaliados retrospetivamente os registos médicos de JRT e LR diagnosticados com cataratas entre janeiro de 2015 e dezembro de 2016, analisando os dados relacionados com a identificação, história clínica, características pré-operatórias e desfecho cirúrgico.

Quarenta e quatro cães (81 olhos), incluindo 26 JRT e 18 LR foram englobados neste estudo. As idades médias foram 10,2 ± 3,2 anos no caso dos JRT e 8,5 ± 3,7 anos em LR. Vinte e oito (63,6%) eram do género feminino e 16 (36,4%) eram do género masculino. Aproximadamente 84% apresentaram cataratas bilaterais. A posição da catarata, na lente, mais prevalente foi do tipo nuclear e cortical nos JRT (42,9%) e subcapsular (31,3%) nos LR com diferenças significativas detetadas entre as duas raças (P=0,013).

As etiologias mais comuns foram as Senis nos JRT (n=7) e de origem genética nos LR (n=7). Foram associadas, às cataratas, outras lesões oculares como alterações da lente (n=18; JRT: n=15; LR: n=3), alterações da retina (n=8; JRT: n=2; LR: n=6) assim como glaucoma (N=6; JRT: n=5; LR: n=1). Trinta e três animais (75,0%, 51 olhos) foram submetidos à cirurgia de facoemulsificação com colocação de lente intraocular. Vinte e oito olhos (54,9%; JRT: n=21; LR: n=7) revelaram estar visuais, 17 olhos (33,3%; JRT: n=11; LR: n=6) apresentaram visão parcial e seis olhos (11,8%; JRT: n=0; LR: n=6) estavam cegos no último registo clínico disponível. Complicações pós-operatórias foram detetadas em 11 olhos (21,6%), tendo sido mais frequentes em cães com cataratas em fases avançadas.

Os resultados obtidos e a natureza multifatorial das cataratas sugerem a realização de estudos adicionais para identificar e caracterizar as variáveis através de uma avaliação mais ampla, incluindo outras raças e fatores determinantes.

Palavras-chave: *Canino, Catarata, Facoemulsificação, Jack Russell Terrier, Labrador Retriever*

I will always feel your hand above my shoulder…

Hope you are proud B.

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É por ti, tudo isto é por ti!

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IOL- Intraocular Lens
IOP- Intraocular Pressure
JRT- Jack Russell Terrier
LR- Labrador Retriever
PLL- Primary Lens luxation
POH- Postoperative Hypertension
PRA- Progressive Retinal Atrophy
SARDS- Sudden Acquired Retinal Degeneration Syndrome
UK- United Kingdom

Cataracts in Labrador Retriever and Jack Russell Terrier: a two-year retrospective study

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ABSTRACT

Cataracts are among the most common ocular diseases and are a leading cause of vision loss in dogs and humans. Jack Russell Terriers (JRT) and Labrador Retrievers (LR) are among the canine breeds most affected by cataracts.

This study aimed to analyse the clinical features and the surgical outcome of cataracts in JRT and LR in an ophthalmological reference Veterinary Hospital in the United Kingdom.

Medical records from JRT and LR diagnosed with cataracts between January of 2015 and December of 2016 were retrospectively evaluated. Data related with identification, clinical history, pre-operative features and surgical outcome were analysed.

Forty-four dogs (81 eyes), including 26 JRT and 18 LR were enrolled in the study. Mean ages were 10.2 ± 3.2 years in JRT and 8.5 ± 3.7 years in LR. Twenty-eight (63.6%) were females and 16 (36.4%) were males. Most dogs (84.1%) presented bilateral cataracts. The most prevalent type of cataracts was nuclear and cortical in JRT (42.9%), and subcapsular in LR (31.3%). Significant differences in cataract location within the lens were detected between the two breeds (P=0.013).

Senile in JRT (n=7) and genetic in LR (n=7) were the most common aetiologies. Concomitant ocular lesions were more frequent in dogs presented with cataracts in advanced stages, and included lens position (n=18; JRT: n=15; LR: n=3) and retinal alterations (n=8; JRT: n=2; LR: n=6), and glaucoma (n=6; JRT: n=5; LR: n=1). Thirty-three animals (75.0%, 51 eyes) were submitted to phacoemulsification with intraocular lens placement. Of these, 28 eyes (54.9%; JRT: n=21; LR: n=7) were visual, 17 eyes (33.3%; JRT: n=11; LR: n=6) presented impaired vision and six eyes (11.8%; JRT: n=0; LR: n=6) were blind at last clinical record. Post-operative complications were detected in 11 eyes (21.6%), being more frequent in dogs presented with cataracts in advanced stages.

The obtained results and the multifactorial nature of cataracts call for further studies to identify and characterize the variables in a broader assessment, including other breeds and influencing factors.

KEYWORDS: Canine, Cataract, Jack Russel Terrier, Labrador Retriever, Phacoemulsification

1. INTRODUCTION

Cataract, defined as any opacity in the lens, is among the most common intraocular lesions and a leading cause of vision loss in dogs (Gelatt, Gilger, & Kern, 2013). However, cataracts are treatable in most cases (Glover & Constantinescu, 1997). Cataracts can be classified according with the age of onset, location within the lens, degree of opacification and aetiology. A combination of all these categories allows a better clinical description of the cataract (Gelatt & Gelatt, 2011). In dogs, cataract formation can be caused by genetic (or presumed genetic) basis, systemic diseases, medications or other toxic substances, dietary deficiencies, injury, age and inflammation (Gelatt *et al.*, 2013). A genetic basis is the most commonly reported aetiology in different breeds (Gelatt & Mackay, 2005), followed by diabetes mellitus (Basher & Roberts, 1995). In the past, extra- and intracapsular lens extraction was the recommended surgical treatment for cataracts (Williams, Boydell, & Long, 1996). However, over the last years, phacoemulsification became the first-choice and the most frequently performed surgical procedure for cataracts treatment in veterinary ophthalmology (Lannek & Miller, 2001; Kang, Park, & Noh, 2015). The phacoemulsification technique is associated with a high percentage of success, however, several post-operative complications are described, including glaucoma, anterior uveitis, wound dehiscence, lens fiber regrowth, lens capsule opacification, Intraocular lens (IOL) descentration/dislocation, hyphema, corneal ulceration, corneal endothelial cell loss, retinal detachment, postoperative ocular hypertension and endophthalmitis (Moore, McLellan, & Dubielzig, 2003, Sigle & Nasisse, 2006; Moeller, Blocker, & Esson, 2011, Klein, Krohne, & Moore, 2011; Braus *et al.*, 2017).

In the United Kingdom (UK), according to the records of the Kennel Club (2017), the Labrador Retriever (LR) was the most registered breed during 2015 and 2016. Moreover, LR and Jack Russel Terriers (JRT) are reported to be the two most popular breeds in the UK (Boyl, 2015). Similarly, LR and JRT are among the most popular breeds in Portugal (Clube Português de Canicultura, 2017).

Pure-breed dogs are more predisposed to develop cataracts than mixed-breed dogs (Bellumori, Famula, & Bannasch, 2013), and LR and JRT are among the canine breeds most affected by cataracts (Adkins & Hendrix, 2005; Oberbauer, Hollingsworth, & Belanger, 2008; Moeller *et al.*, 2011; Donzel, Arti, & Chahory, 2017). Hereditary cataracts are described in both breeds, namely anterior and posterior cortical cataracts in JRT (Maggs, Miller, & Ofri, 2008) and posterior subcapsular (triangular) cataracts in LR (Gelatt *et al.*, 2013). Moreover, in JRT, genetic primary lens luxation is considered a cause of cataract development, and represent a potential risk for complications associated with cataract treatment (Kecová & Necas, 2004).

The purpose of this study was to analyse the clinical features and the surgical outcome of cataracts in two different breeds, namely LR and JRT in an ophthalmological reference Veterinary Hospital in the United Kingdom.

2. MATERIALS AND METHODS

2.1. Study design and data collection

This descriptive retrospective study was conducted in the canine population attended at a reference veterinary ophthalmological center – The Eye Clinic-ROWE Veterinary Referrals (Bristol, UK) during 2015 and 2016. The medical record system (Vet Space Voyager 2.5.1.) was searched for dogs that met the established inclusion criteria: purebred Labrador Retriever or Jack Russell Terrier diagnosed with uni- or bilateral cataracts by a Member of the Royal College of Veterinary Surgeons.

Data of the variables evaluated was obtained at different stages of the clinical cases in all the dogs selected, namely identification and clinical history, complete ophthalmic examination, preoperative features and postoperative outcome. Complete ophthalmic examination included visual testing (menace response, dazzle reflex, obstacles test), pupillary light reflex, Schirmer tear test, Slit-lamp biomicroscopy (SL-17; Kowa, Japan), indirect ophthalmoscopy (Keeler®; Keeler, UK), tonometry (Tonovet Icare®; Icare, Finland), and gonioscopy (Barkan-lovac® lens; Barkan, USA) performed after pupil dilation (topical 0.5% tropicamide solution). Each surgical candidate underwent a combined electroretinography (ERG) (Eickemeyer® ERG System; Eickemeyer, UK) and a B-scan ocular ultrasonography (Mylab ™ one vet; Esaote, Genoa). If no contraindications were identified on clinical and ophthalmologic examinations and on ultrasonography, and if appropriate photoreceptors function was confirmed by ERG, surgery was planned.

Data related with identification included breed, age, weight, gender and neuter status. Preoperative variables analysed included evaluation of affected eye(s) (unilateral vs bilateral), type of cataract (location within the lens, stage of progression) aetiology of cataract, intraocular pressure (IOP), presence of other concomitant ocular diseases and recommendation (yes or no) to phacoemulsification surgery. Cataracts were classified according to the location of the opacity within the lens in capsular, subcapsular, zonular, cortical, nuclear, sutorial, axial, equatorial, nuclear and cortical as described by Gelatt & Gelatt (2011), and according with stage in incipient, immature, mature, intumescent and hypermature as described by Gelatt *et al.* (2013). Concomitant ocular lesions detected in the dogs enrolled in the study were grouped in lens changes (namely lens luxation, lens subluxation and lens rupture), retinal alterations (including sudden acquired retinal degeneration syndrome (SARDS), poor retinal function and retinal detachment) and glaucoma.

Postoperative variables evaluated comprised the measurement of IOP, evaluation of complications and assessment of the visual outcome (visual, impaired vision, no vision). Postoperative IOP was classified as normal if lower than 20 mmHg, as ocular hypertension if ranging from 20 to 25 mmHg, as high intraocular pressure if ranging from 25-35 mmHg, and as acute secondary glaucoma if above 35 mmHg. Assessment of visual outcome was determined based on history and ophthalmological examination on the last clinical record available.

2.2. Statistical analysis

Statistical analysis was performed with software R®, version 3.3.3. The Chi-square test for independence was used for categorical variables. The t-student test for independent samples was used for continuous variables. P <0.05 was considered to indicate statistical significance.

3. RESULTS AND DISCUSSION

Forty-four dogs (81 eyes), including 26 JRT (59.1%) and 18 LR (40.9%), with ages ranging from one to 17 years of age were enrolled in the study (table 1). Mean age of the whole population studied was 9.2±3.5 years. In JRT, the mean age at presentation was 10.2±3.2 years, and in LR was 8.5±3.7 years (table 1). No significant differences in age at presentation were detected between JRT and LR in the present study (P=0.08). Most studies revealed that the majority of dogs presented with cataracts were of geriatric age (Moore *et al.*, 2003; Park *et al.*, 2009; Moeller *et al.*, 2011), as detected in the present study. However, LR were reported to be younger at diagnosis than other breeds in the study of Adkins and Hendrix (2005). Weight ranged between 3.85 and 38.5 Kg, with a mean of 7.8±1.7 kg in JRT and 29.1±5.4 kg in LR.

Twenty-eight dogs (63.6%) were females (JRT: n=15; LR: n=13) and 16 (36.4%) were males (JRT: n=11; LR: n=5) (table 1). Thirty-one (70.5%) were neutered (JRT: n=16; LR: n=15) and 13 (29.5%) were intact (JRT: n=10; LR: n=3) at presentation. Most studies describe a female predisposition for cataract development (Chahory, Clerc, & Guez, 2003; Adkins & Hendrix, 2005; Park *et al.*, 2009). However a recent study performed in France revealed an opposite trend in JRT and LR, with male dogs being more frequently affected than females (Donzel *et al.*, 2017). In our study, females were more frequently affected by cataracts than males in both breeds. However, differences in gender between breeds were not significant (P=0.51). Being neutered was associated with a decreased risk for early onset cataract development in a recent publication (Belanger, Bellumori, & Bannasch, 2017). In the present study, six dogs (JRT: n=2; LR: n=4) were under five years of age, but most (n=4) were neutered at diagnosis.

Thirty-seven animals (84.1%) presented bilateral cataracts, four (9.1%) presented an unilateral cataract in the right eye and three (6.8%) were unilaterally affected in the left eye. Among the JRT group, 23 dogs (82.1%) were affected bilaterally, two dogs presented unilateral cataract in the right eye and one animal presented unilateral cataract in the left eye. Fourteen LR (87.5%) were affected bilaterally, while four dogs presented unilateral cataract, two animals in the right eye and two in the left eye (table 1). In this study, bilateral cataracts were more frequent than unilateral cataracts in both breeds, as reported in most studies (Biros *et al.*, 2000; Moeller *et al.*, 2011; Donzel *et al.* 2017).

Most dogs included in the study (n=29; 35.8%; JRT: n=21; LR: n=8) presented nuclear and cortical cataracts. Nuclear and cortical cataracts were the most common type in JRT, while subcapsular cataracts were the most frequent in LR (LR: n=10) (table 1). Most of subcapsular cataracts were posterior polar (triangular), which are hereditary in LR (Kraijer-Huver *et al.*, 2008). A significant

difference in cataracts location between LR and JRT was detected in the present study (P=0.013), and is probably related with development of genetic cataracts in both breeds.

Most dogs in this study presented unilateral or bilateral mature cataracts (n=18). Mature (n=18 eyes) and immature (n=11 eyes) were the most common type of cataracts in JRT, while intumescent (n=9 eyes), immature (n=8 eyes) and incipient (n=8 eyes) were the most prevalent in LR (table 1). Previously, Lynch & Brinkis (2006) also reported mature cataracts as the most prevalent type of cataract at presentation.

In most cases was possible to determine the cataract aetiology (n= 33, 75.0%). Of these, the most common causes included inherited (n=11; JRT: n=4; LR: n=7), diabetes mellitus (n=8; JRT: n=4; LR: n=4), senile (n=8; JRT: n=7; LR: n=1) and congenital (n=4; JRT: n=3; LR: n=1). In 11 cases (25.0%; JRT: n=8; LR: n=3) the aetiology was not determined. It is documented that both studied breeds have highly heritable-correlated cataracts (Oberbauer *et al.*, 2008; Gelatt *et al.*, 2013). Cataracts secondary to diabetes mellitus are characterized by a rapid bilateral onset, and presented in the mature or intumescent stages (Lynch & Brinkis, 2006). Some studies reported that cataracts caused by diabetes mellitus were significantly more common in the LR than in other breeds (Moeller *et al.*, 2011; Donzel *et al.*, 2017). In the present study, a higher percentage of cataracts secondary to diabetes mellitus were observed in LR (22.2%) than in JRT (15.4%). However, the difference between breeds was not significant (P=0.17). In accordance to what is described in literature, trauma and PRA were infrequent causes of cataracts in our study (Park *et al.*, 2009; Donzel *et al.*, 2017) (table 1).

Concomitant ocular lesions in dogs with cataracts detected in the present study included other lens alterations (n=18; JRT: n=15; LR: n=3), retinal alterations (n=8; JRT: n=2; LR: n=6) and glaucoma (n=6; JRT: n=5; LR: n=1). Lens alterations were the most common concomitant ocular lesions detected in JRT, including lens luxation, lens subluxation and lens rupture, while retinal alterations were the most frequent in LR. The results obtained are similar to those reported by Donzel *et al.* (2017). The JRT have a genetic predisposition to primary lens luxation (PLL), however, lens (sub)luxation can also be secondary to cataract development, mainly to hypermature cataracts (Gelatt *et al.*, 2013). In this study four JRT were diagnosed with PLL (PPL DNA test, Animal Health Trust, UK).

Thirty-three dogs (75.0%; JRT: n=22; LR: n=11) were submitted to phacoemulsification with intraocular lens (IOL) placement, of which 18 dogs (54.5%) underwent bilateral surgery, and 15 (45.5%) underwent unilateral surgery. Eleven dogs (25.0%) were not considered viable candidates for phacoemulsification due to ocular and/or systemic contra-indications. The percentage of dogs presented with cataracts in which phacoemulsification and IOL placement was considered as the adequate treatment was higher than in previous studies (Adkins & Hendrix, 2005), however the number of canine breeds included (n=54) was higher than in our study.

Table 1. Characterization of study dog population by signalment, stage of progression and location of lens opacities

Breed	**Age±SD [range] (years)**	**Male/Female Ratio (n)**	**Eyes affected (n)**	**Stage of progression (number of eyes)**	**Opacities localization (number of eyes)**
Jack Russell Terrier (n=26)	10±3.29 [3-17]	11:15	Bilateral:23 Right:2 Left:1	Incipient:8 Immature:11 Mature:18 Intumescent:6 Hypermature:6	Unknown:18 Subcapsular:3 Cortical:5 Equatorial:2 Nuclear and Cortical:21
Labrador Retriever (n=18)	8.06±3.65 [1-12]	5:13	Bilateral:14 Right:2 Left:2	Incipient.8 Immature:8 Mature:6 Intumescent:9 Hypermature:1	Unknown:7 Capsular:2 Subcapsular:10 Cortical:2 Nuclear:2 Equatorial:1 Nuclear and Cortical:8

SD – standard deviation

Forty-five out of the 51 eyes (87.2%) submitted to phacoemulsification and IOL placement were visual (n=28, 54.9%; JRT: n=21; LR: n=7) or had impaired vision (n=17, 33.3%; JRT: n=11; LR: n=6) at the last clinical available record. Six eyes (11.8%; JRT: n=0; LR: n=6) were blind at final evaluation (table 2). The results obtained in visual outcome after phacoemulsification and IOL placement in the present study are in accordance to what is described in previous investigations (Sigle & Nasisse, 2006; Klein et al., 2011). Post-operative complications were detected in 11 eyes (21.6%), including glaucoma (n=6), high intraocular pressure (n=2), intraocular hypertension (n=2) and suture dehiscence (n=1) (table 2). Most of these complications (n=9) developed in dogs presented with cataracts in advanced stages (mature, intumescent or hypermature). Ocular hypertension represents a severe complication after phacoemulsification. In this study intraocular hypertension, high intraocular pressure and glaucoma developed after surgery in 10 eyes despite the preventive hypotensive treatment implemented in the first few hours following phacoemulsification. In most cases increases in IOP are reported to resolve within 24h after cataract surgery (Smith, Brooks, & Lazarus, 1996; Chahory et al., 2003). However, a serious transient IOP increase may cause severe damage to the retina and optic nerve, leading to severe vision impairment or blindness (Chahory et al., 2003). Table 3 summarizes mean IOP´s measurements before and after surgery in both breeds, with p-values presented for comparison. Before surgery, levels of IOP were not significantly different between JRT and LR. However, in JRT levels of IOP were significantly lower after surgery than before surgery (P=0.04), probably due to the aggressive ocular hypotensive treatment instituted in the post-operative period. In LR, levels of IOP were higher in the postoperative period than before surgery, however the differences were not significant (P=0.11).

Table 2. Visual outcome and complications after phacoemulsification in Jack Russell Terriers (n=22) and Labrador Retrievers (n=11)

	Visual outcome (number of eyes)	**Post-surgery complications (number of eyes)**
Jack Russell Terrier	Visual: 21 Impaired Vision: 11 Blind: 0	Glaucoma: 3 High intraocular pressure: 1
Labrador Retriever	Visual: 7 Impaired Vision: 6 Blind: 6	Glaucoma: 3 High intraocular pressure: 1 Ocular hypertension: 2 Sutures dehiscence: 1

In the present study, incidence of post-operative complications was similar between LR and JRT. However, the six dogs that were blind after surgery in the present study were all LR. A higher risk of increased IOP, glaucoma and blindness after phacoemulsification is reported in LR than in

other breeds, including JRT (Moeller et al., 2011). The presentation of the dogs at the later stages of cataracts development was reported to be associated with a higher prevalence of ocular pre- and post-surgical complications (Adkins & Hendrix, 2005). In the present study, ocular pre- and post-surgical complications were more frequent in dogs presented with cataracts in the later stages (including mature, intumescent or hypermature) than in dogs presented with cataracts in earlier stages (including incipient and immature), however the differences were not significant (P=0,707 and P=0,412, respectively), probably due to the low number of dogs included in the study.

Table 3. Intraocular pressure (mmHg), presented as mean with standard deviation, before and 24 hours after surgery in Jack Russell Terriers and Labrador Retrievers. Significant differences are presented in bold.

	Before Surgery	**24h After Surgery**	*P*
Jack Russell Terrier	14.53 (±8.78)	11.26 (±5.50)	**0.04**
Labrador Retriever	12.90 (±5.80)	19.00 (±15.58)	0.11
P	0.33	**0.04**	

CONCLUSIONS

The obtained results indicate that cataracts in JRT and LR were more frequent in females and in geriatric animals of both genders, however, cataracts were also diagnosed in very young animals of both breeds. Most dogs were bilaterally affected, and usually presented at the later stages of cataracts development. Cataract location within the lens was significantly different between breeds. Nuclear and cortical was the most prevalent type of cataracts in JRT and subcapsular was the most common type in LR, reflecting the (presumed) genetic aetiology of cataracts in both breeds. Most dogs presented with cataracts were considered clinically adequate candidates for phacoemulsification with IOL placement, and most dogs submitted to surgery had a good / acceptable visual outcome. Concomitant ocular disorders and post-operative complications were more frequent in dogs presented with advanced stages of cataracts.

The obtained results and the multifactorial nature of cataracts call for further studies, in order to identify and characterize the variables in a broader assessment including a larger number of animals, dogs of other breeds and other influencing factors.

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