

# **Primary Anterior Lens Luxation in the Dog**

Samantha Storey

Class of 2018

Clinicopathologic Conference

Presented on February 23, 2018

CPC Advisor

Caroline Betbeze, DVM, MS, Diplomate ACVO

---



---

COLLEGE OF  
VETERINARY MEDICINE

## **Introduction**

Anterior lens luxation is the displacement of the lens into the anterior chamber of the eye due to tearing of zonules, the support ligaments of the lens. Lens luxation may be classified as primary or secondary. Primary lens luxation occurs due to weakened lens zonules that rupture early in life. This condition is inherited in many terrier breeds, as well as the Schnauzer, Shar-pei, Chinese crested, Australian cattle dog, and poodle. The typical age of onset ranges between 3 and 9 years, and presentation is commonly asymmetric.<sup>1</sup> Secondary causes of anterior lens luxation consists of blunt trauma, glaucoma, uveitis, anterior uveal tumors, and cataracts.<sup>8</sup> Clinical signs include changes in anterior chamber depth, blepharospasm, corneal edema, and potentially hyphema.<sup>1</sup> Surgical treatment of anterior lens luxation is recommended, however a non-surgical option is possible when surgery is not feasible.<sup>1</sup>

## **History and Presentation**

Chico is a 7-year-old neutered male Treeing Feist who presented to the MSU-CVM Ophthalmology Department on September 26, 2017 for blepharospasm and epiphora of the right eye for approximately one-month duration. Chico initially presented to his primary care veterinarian and was prescribed neomycin-polymyxin b-dexamethasone ophthalmic suspension, tobramycin ophthalmic solution, oral doxycycline, prednisone, and tramadol. The clinical signs of ocular pain improved with medications, but once the prednisone was tapered, Chico's clinical signs returned. Chico's past ophthalmic history included an anterior lens luxation and intracapsular lens removal of the left eye. This had not had complications that were noted by the owner.

Upon presentation, Chico's vital parameters and physical examination was within normal limits. An ophthalmic exam revealed blepharospasm with enophthalmos, as well as a hyperemic conjunctiva of the right eye. Menace responses and dazzle reflexes were positive in both eyes. Tracking response was negative. Mild corneal edema was noted, as well as a mydriatic pupil. Right to left direct and consensual pupillary light reflexes were absent. The lens was seen in the anterior chamber and the depth of Chico's anterior chamber was decreased on slit-beam examination indicating an anterior lens luxation.

Examination of Chico's left eye revealed positive menace and dazzle responses, and a negative tracking response. Left to right direct and consensual pupillary light reflexes were normal. Aphakia was noted, as his lens was surgically removed due to a previous anterior lens luxation.

### **Pathophysiology**

Primary lens luxation is a hereditary condition that is due to weakened lens zonules. A ring of zonules extend from the ciliary processes and surround the lens suspending it in the patellar fossa, which is a depression in the anterior vitreous. Lens luxation in Jack Russell terriers has a genetic component characterized by a simple autosomal recessive mode of inheritance.<sup>7,9</sup> A mutation in the gene *ADAM-TS17* is the cause of primary lens luxation in 17 identified breeds, many of which are terriers.<sup>12</sup>

Normal zonules are composed of microfibrils, whose primary components are glycoproteins fibrillin-1 and fibrillin-2.<sup>5</sup> In a study evaluating the morphology of zonule fibers, two abnormalities were described. Zonular fiber dysplasia (ZFD) is characterized by a thick, lamellar protein layer tightly adherent to the non-pigmented ciliary body

epithelium. Histopathology of affected zonules reveals solid sheets of acellular, eosinophilic protein tightly adherent to the non-pigmented epithelium over segments of the ciliary body indicating dysplasia of the zonular ligament.<sup>5</sup> The second abnormality described is zonular fiber collagenization (ZFC), in which the zonules have a less pronounced non-lamellar protein that is filamentous in nature and not tightly adhered to the ciliary body epithelium.<sup>5</sup> This study suggests that ZFD is associated with a heritable, breed-related, defect within the zonular fibers due to an earlier age of onset of clinical signs. ZFC had a later age of onset and is likely a condition secondary to disease or aging.<sup>5</sup>

### **Diagnostic Approach/Considerations**

Initial approach for anterior lens luxation begins with the same diagnostic testing as any other ophthalmic issue – vision assessment, thorough exam of both eyes with a direct ophthalmoscope, Schirmer tear test, fluorescein stain, and tonometry. Vision is assessed by testing the menace response, dazzle reflex, and ability to track. Direct ophthalmoscopy may reveal the lens in the anterior chamber. However, if corneal edema or hyphema is present, visualization of the lens may be impaired. If the anterior chamber cannot be visualized, ultrasound of the chamber may be used to verify a luxated lens. The slit beam transilluminator is useful to determine if the depth of the anterior chamber is decreased indicating an anterior luxation. Schirmer tear test and staining of the cornea are useful tests to rule out other causes of blepharospasm and epiphora such as ulcerative and non-ulcerative keratitis. Tonometry is useful to determine if glaucoma is present due to the displaced lens obstructing aqueous humor outflow via pupillary block. Although

many weeks and months may persist between luxation of the contralateral eye, primary lens luxation is invariably bilateral.<sup>12</sup> A thorough examination of the contralateral eye should be always be performed and focused on detecting subtle signs of subluxation. An aphakic crescent at the area of subluxation is a classic sign that may be visible when the pupil is dilated and the lens is retroilluminated, however it is not always present. More subtle signs include an asymmetrically shallow anterior chamber, phacodonesis, iridonesis, or liquefied vitreous in the anterior chamber.<sup>1,13</sup>

Anterior lens luxation is considered an emergency for a variety of reasons. Complete luxation of the lens into the anterior chamber brings the lens into contact with the cornea, thus impairing endothelial function resulting in edema.<sup>1</sup> As the animal moves, the lens may move freely within the anterior chamber striking the cornea resulting in pain and potentially causing irreversible damage.<sup>1</sup> A very serious complication of anterior lens luxation is secondary glaucoma. As the lens moves anteriorly it may pull the still attached vitreous with it, thus impeding the flow of aqueous humor causing an increase in intraocular pressure.<sup>1</sup> For these reasons, terrier breeds as well as the Schnauzer, Shar-pei, Chinese crested, Australian cattle dog, and poodle should have both eyes thoroughly examined for a lens luxation when presenting with non-specific signs of a painful eye.

In Chico's case, primary anterior lens luxation was evident based on the combination of his clinical signs of epiphora and blepharospasm, visualization of the lens and decreased depth of the anterior chamber, history of previous anterior lens luxation, and genetic predisposition. Schirmer tear test revealed adequate tear production of 17 millimeters per minute. Tonometry revealed a normal intraocular pressure of 19 mmHg, and fluorescein stain was negative. Schirmer tear test of the left eye revealed no tear

production (0 mm/minute) likely secondary to user error since his corneal appeared to be appropriately hydrated and glossy. His subsequent examinations revealed consistently normal tear production. It also had a normal intraocular pressure of 20 mmHg.

### **Treatment and Management**

Treatment of anterior lens luxation may be addressed with a few different options depending on the situation. The lens may be surgically removed or replaced, or non-surgically reduced into the posterior chamber. If the eye is non-visual and painful, a salvage procedure such as an enucleation may be elected.

In intracapsular lens removal, the entire lens and its capsule are removed.<sup>3</sup> The primary objective for intracapsular lens removal is to prevent the most common complication of secondary glaucoma and to preserve vision.<sup>3</sup> Patients are under general anesthesia and placed in dorsal recumbency. Neuromuscular blocking agents are administered to maintain the globe in a neutral position.<sup>4</sup> The peripheral corneal or limbal approach may be used to access the anterior chamber.<sup>3</sup> Once the anterior chamber has been accessed, the lens may be removed with a lens loop, viscoelevation, cryothermy, or intracapsular forceps. Each mechanism has advantages and limitations. The lens loop is placed on the posterior surface of the lens to lift it from the anterior chamber. If the vitreous is still attached to the posterior lens surface, the loop may also be used to separate the adhesions. Viscoelevation is another lens removal technique, which involves the placement of viscoelastic material posterior to the lens to float it out of the corneal incision. Cryothermy is the use of either nitrous oxide or carbon dioxide cryoprobe to attach to the lens equator and lift the lens from the anterior chamber. The lens may also

be removed by grasping it firmly with intracapsular forceps, however this may be difficult if the lens is unstable and is not usually recommended.<sup>3</sup> After removal of the lens, any remaining formed vitreous should be excised and removed. An air bubble may then be injected into the anterior chamber to detect any remaining vitreous. The corneal or limbal incision is apposed with 8-0 or 9-0 simple interrupted absorbable sutures placed 1-1.5 mm apart and approximately two-thirds of the thickness of the cornea to ensure adequate apposition. A 22-25g needle is then placed between two of the sutures and lactated ringers or a balanced salt solution is injected until intraocular pressure of 10-15 mmHg is achieved. If leaks are detected, additional sutures are placed in the disrupted area.<sup>3</sup>

Another surgical option is implantation of a synthetic lens. This procedure may be performed at the same time as the luxated lens is removed, or after a previous lensectomy to restore vision. Anchoring sutures are placed to secure the synthetic lens in the posterior chamber with lens haptics placed between the vitreous and iris leaflets. Postoperative complications include decentration of the lens, usually as a result of inaccurate suture replacement, however in most cases it does not significantly affect vision. Tilting of the lens is a less common complication that may noticeably affect vision quality. Suture fixation of intraocular lenses has been widely accepted as safe and effective, and may improve vision for suitable patients.<sup>13</sup>

Transcorneal reduction of the lens into the posterior chamber may be successful with the use of pharmacological agents, however complications such as corneal ulceration and anterior uveitis are common.<sup>2,6</sup> This approach should be performed by an ophthalmologist and may be a reasonable alternative when surgical intervention is not

feasible.<sup>6</sup> The lens is non-surgically displaced from the anterior chamber back to the posterior chamber, and permanent miotic therapy is initiated to ensure the lens remains in the posterior segment<sup>1</sup>.

If access to an ophthalmologist is not feasible, or if there is a period of time before referral, acute management of clinical signs should be initiated. If intraocular pressures are high normal or elevated, the use of carbonic anhydrase inhibitors and a beta-blocker should be initiated. Topical steroids should be administered for inflammation. Intravenous mannitol may be administered to dehydrate the vitreous and decrease intraocular pressure. Pain should be managed appropriately with NSAIDs.<sup>10</sup>

### **Case Outcome**

On September 27, 2017, Chico underwent an intracapsular lens extraction without complication. The anterior chamber was accessed via a 170 degree corneal incision. The lens was separated from the posterior vitreous with a lens loop and floated out of the anterior chamber with sodium hyaluronic acid viscoelastic material. An automated vitrectomy was performed on the vitreous that remained in the anterior chamber after lens extraction in order to decrease the chance of a pupillary block post-operatively. Over the next 48 hours, Chico's intraocular pressure returned to normal at 18 mmHg. A fibrin clot was noted in the anterior chamber, likely due to post-operative uveitis and mild intraocular hemorrhage during the surgery. Mild mucoid discharge was present around his right eye and blepharospasm was noted which was attributed to the large corneal incision. He was discharged with instructions to give one prednisolone acetate 1% drop in the right eye every 6 hours, one timolol 0.5% drop in the right eye every 12 hours, 2.5 mg



of tramadol every 12 hours, and a tapering course of prednisolone tablets (2.5 mg orally every 12 hours for 2 additional days, then 2.5 mg orally every 24 hours for 5 days, then 2.5 mg orally every other day for 5 doses) to manage pain, inflammation, and intraocular pressures.

Prognosis for uncomplicated intracapsular lens extraction following primary anterior lens luxation is variable depending on the duration of the lens displacement and the pre-surgical complications. Early surgical intervention before the development of glaucoma or retinal detachment improves outcome. After surgical removal of the lens, animals have the human equivalent of 20/400 vision.<sup>11</sup> Intracapsular lens extraction patients have a higher likelihood to develop post-operative glaucoma or retinal detachment than phacoemulsification patients.

At Chico's first postoperative recheck, he had mild anterior uveitis and the incision site was healing appropriately. He had positive menace, dazzle, pupillary light reflexes, and tracking in both eyes. There was mild corneal edema and stain uptake at the incision site. Fibrin strands and 1+ aqueous flare was noted in the anterior chamber. Chico's owner was instructed to continue administering one prednisolone acetate 1% drop every 6 hours in the right eye and one timolol 5% drop every 12 hours in the right eye to control inflammation and intraocular pressures. He was recommended to come for a three-month recheck but currently has not returned to MSU\_CVM.

## References

1. Maggs D, Miller P, Ofri R. Lens Luxation. In: Slatter's Fundamentals of Veterinary Ophthalmology. 4<sup>th</sup> ed. St. Louis: Saunders Elsevier, 2008: 272-275.
2. Colitz C, O'Connell K et al. Lens-related Emergencies: Not Always So Clear. Topics in Companion Animal Medicine 2015; 30:81-85.
3. Gelatt K, Wilkie D. Surgical Procedures of the Lens and Cataract. In: Veterinary Ophthalmology. 1<sup>st</sup> ed. Saunders Elsevier, 2011:335-337
4. Maggs D, Miller P, Ofri R. Ocular Pharmacology and Therapeutics. In: Slatter's Fundamentals of Veterinary Ophthalmology. 4<sup>th</sup> ed. St. Louis: Saunders Elsevier, 2008: 51-52.
5. Morris R, Dubielzig R. Light-microscopy evaluation of zonular fiber morphology in dogs with glaucoma: secondary to lens displacement. Veterinary Ophthalmology 2005; 8: 81-84
6. Montgomery K, Labelle A, Gemensky-Metzler A. Trans-corneal reduction of anterior lens luxation in dogs with lens instability: a retrospective study of 19 dogs. Veterinary Ophthalmology 2014; 17:275-279
7. Oberbauer A, Hollingsworth S, Belanger J, Regan K, Famula T. Inheritance of cataracts and primary lens luxation in Jack Russell Terriers. Journal of Veterinary Research 2008; 69: 222-227.
8. Glover T, Davidson M, Nasisse M, Olivero D. The intracapsular extraction of displaced lenses in dogs: A retrospective study of 57 cases. Journal of the American Animal Hospital Association. 1995 Jan-Feb; 31(1):77-81.
9. Lazarus JA, Pickett JP, Champagne ES. Primary lens luxation in the Chinese Shar Pei: clinical and hereditary characteristics. *Vet Ophthalmol* 1998;1:101-107.
10. Colitz C. The Next Level Ophthalmology: Canine Glaucoma. Clinicians Brief. March 2010: 24-26.
11. Wilkie D. Lens Luxation. In: Clinical Veterinary Advisor. 2<sup>nd</sup> ed. Saunders Elsevier, 2011: 1413-1416
12. Gould D, Pettitt L, McLaughlin B, Homes N, Forman O, Thomas A, Ahonen S, Lohi H, O'Leary C, Sargan D, Mellersh C. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. Veterinary Ophthalmology (2011) 14, 6:378-384
13. Nasisse M, Glover, T. Surgery for lens instability. Veterinary Clinics of North America. 1997 September; 27, (5): 1175-1192.