

Sudden Blindness: Our Story

by Gail Rein

Luna, my young Entlebucher, went suddenly blind in both eyes February 4, 2021 at 7:30 pm. The next six weeks were a wild roller coaster.

Although it is unusual for both eyes to be suddenly struck at the same time, it happens. Because both of Luna's eyes were affected, it was far more challenging for our vet and the specialists to diagnose and treat her condition.

I'll share some of the wildness and confusion, what we've learned, where we are now, and some thoughts about what Entle owners can do to be proactive so they don't experience what we did.

Key Events

First episode of blindness. January 11th started with vomit a bit past 6 am. By 8:30, both eyes were huge, foggy, round orbs and Luna was disoriented and scared. Dr. Allred, one of our two regular vets, had never seen anything like it and said looked like Luna was in shock as if she had ingested a toxin such as poison or marijuana. Luna's vision started coming back while he examined her. The last thing he said to me was "It could happen again." These words haunted me for days.

Every day that passed without incident, I sighed with relief. Still, I was haunted and after one of many conversations with Luna's breeder Jen Shaul, I decided to take Luna to the ophthalmologist in El Paso we saw in 2019 for her OFA eye exam. Our appointment was Feb. 11.

Two warning signs I missed. At the end of our evening walk on February 2nd, two things happened that I didn't think much about at the time, but I noted them in my diary because they were unusual.

- When Luna jumped up on the bench for her daily brushing, she over-shot and both of her right feet missed the bench.
- Walking the second segment of a retaining wall she slipped off the end as though she didn't see it.

Second episode of blindness, 25 days after the first episode. February 4th at 7:30 pm Luna went suddenly blind in both eyes. I was bewildered by the suddenness because Luna seemed fine all day, until the minute it struck.

She played fetch and walked the long expanses of retaining walls at the university without any problem. She caught her Hol-ee Roller in mid-air several times when I threw it for her

and ate dinner with her usual vigor. But when I put on her harness for our evening walk, she didn't know exactly where I was. Luna was suddenly, profoundly blind, and I had a premonition she would never see again.

We carried on and finished our evening routine. I helped Luna find her way to her bed and then went to bed myself. Neither of us slept very well. Luna did a lot of soft moaning. I got up several times to comfort her. She really wanted to be cuddled, which was very unusual.

The next morning, I took Luna to our local clinic as soon as it opened. Everything checked out normal except her eyes. Dr. Laney felt because it came on so suddenly and in both eyes, the cause was probably genetic. She said Luna needed to see a specialist and gave her a Previcox injection and pills for her pain.

Exam and treatment by an ophthalmologist. February 6th, we checked in at an animal hospital in Albuquerque at 9 am and Luna was there until a bit past 4 pm. Dr. Peterson, an ophthalmologist, said Luna had anterior uveitis with secondary glaucoma. The pressure in Luna's eyes was in the mid-50s, which is very high (normal range is 10-25). Seeing no secondary signs of anterior uveitis, Dr. Peterson said it was an acute, but severe, onset.

Uveitis is an inflammatory process involving the middle (inner) three layers of the eye and it can elevate the pressure in the eye. There are many possible causes including tick-borne diseases, bacterial diseases, fungal diseases, protozoa, parasitic diseases, and auto-immune conditions. I remember thinking, "We'll never know the cause."

Dr. Peterson said it was critical to get the pressure down. They started with a series of eye drops to lower the pressure. They drew blood for a tick PCR and CBC chemistry. The CBC chemistry was "unremarkable other than a decrease in globulins and a mild decrease in platelets." The eye drops did not work, so they administered mannitol through an IV to drain the excess fluid in Luna's eyes into her kidneys.

When I picked her up at 4 pm, Luna's left eye looked much better, but I could hardly see a difference in her right eye. I wished Dr. Peterson had told me what the pressure readings were after the mannitol treatment.

That night we started the home treatment regime. There were three eye drops (Latanoprost, Dorzolamide/Timolol, and Prednisolone Acetate), each with its own schedule, and two oral

Synopsis of Key Events

Jan. 11	First episode of blindness, lasted a few hours
Feb. 4	Second episode of blindness
Feb. 6	Diagnosis both eyes: anterior uveitis with secondary glaucoma
Feb. 10	Right eye enucleated
Feb. 13	Reaction fo Doxycycline
Feb. 18	Diagnosis left eye: well controlled anterior uveitis and secondary glaucoma
Feb. 21	Diagnosis pathology right eye: chronic glaucoma associated with goniodysgenesis
Mar. 2	First play
Mar. 4	Left eye enucleated
Mar. 10	Swelling: overnight at vet's
Ap. 1	Diagnosis pathology left eye: chronic glaucoma associated with goniodysgenesis
Ap. 6	First hike

FEATURES *continued*



Feb. 7, one day after the Mannitol injection: Luna's right eye is still in trouble. Her left eye is much better, but not good either.



Feb. 9 early in the morning before first set of eye drops.



Feb. 9 late afternoon, Luna was in ecstasy sitting on a bench beside me at the university where we paused on our walk just to be together.

meds (Doxycycline an antibiotic and Prednisone an anti-inflammatory). The eye drops were the very same ones prescribed to manage glaucoma in humans. Doxycycline was an “in case” drug to jump-start treating Luna should the tick PCR come back positive. I was instructed to discontinue the Previcox. The treatment was so complicated I had to write down when to give each eye drop and pill and then check them off as we did them.

Right eye not responding to treatment. It just wasn't meant to be. Luna's right eye was worse than ever. Early in the morning of February 9th, I had a text exchange with Dr. Peterson and sent her photos of Luna's eyes. She agreed the right eye was in bad shape. I asked if there was anything my local vet could do and her response was “they can remove the eye.” I knew it was the right thing to do for Luna's comfort.

The clinic had no more openings for surgery the next day, but Dr. Laney said she could do the surgery when the clinic closed for lunch. I was so grateful! I told her about a new research effort underway to study glaucoma in the Entlebucher and asked her if she would be willing to send Luna's enucleated eye and surrounding tissues to Dr. McLellan's lab at the University of Wisconsin-Madison. She said, “Yes, happy to!” You can read about the research effort in John May's article in the February 2021 Entlebook on p. 7 (see <https://forumnew.nemda.org/viewtopic.php?f=4&t=2746>).

Right eye enucleated February 10th. Pressure readings when I checked Luna in were 45 right eye and 33 left eye. Dr. Laney was not 100% confident the readings were accurate, especially for the right eye as the tonometer really did not “want” to give a reading on that eye. I left knowing Luna was in good hands.

The next morning, Luna was over-the-top excited when Dr. Laney brought her out to me. She sensed I was there the moment they stepped outside and I was standing by our car at least a hundred feet away. Dr. Laney laughed and said “she smells you” as Luna tugged like crazy and started vocalizing, telling me everything that happened the past 24 hours.

Reaction to Doxycycline. About 4 am February 13th, Luna's soft whimpers woke me. She had vomited. And she kept vomiting, so many times I lost count. When Dr. Peterson did not answer my texts or voice messages, I called our local vet's emergency number. Dr. Laney called me right back, quickly determined it was a reaction to the antibiotic Doxycycline and had me give Luna half a Cerenia tablet from my stash of leftover meds... Luna vomited once more shortly after, this one with blood... and then, she was able to rest at last.

This was the day we were to drive to Albuquerque for our one-week follow-up exam. At the end of her work day, Dr. Peterson called. Here are some takeaways that helped me understand her thought process about Luna's case:

- The results of the tick PCR were negative.
- The next possible causes of uveitis to test were fungal infection, then auto-immune response. It would take a month or more to explore these causes.
- Luna's iris color was good on her first exam, which was another clue her uveitis was an acute onset.
- If we could resolve the uveitis, it was possible the glaucoma symptoms would disappear. However, while glaucoma was active, if it damaged the optic nerve, Luna would permanently lose her vision. This was why the glaucoma treatment was important so long as her eye responded to the drops.



Feb. 10, just before checkin at the clinic. This is my last photo of her right eye. Left pupil is too large.

FEATURES *continued*

- At Luna's next exam, Dr. Peterson hoped she would be able to see inside Luna's eye better than during the first exam and if so, she would be able to assess if Luna had any vision and the likelihood of it improving with treatment.

Having learned a lot about secondary glaucoma and uveitis earlier in the week, I doubted Dr. Peterson's logic and my gut told me she was not the person to help us. I had no doubt Luna was totally blind in her remaining eye and had been since February 4th. I often felt the eye-drop treatment was some insane exercise in false hope... although the drops helped her eye look better for a few hours, she was still blind. Why was I doing this?

Follow-up exam by the other ophthalmologist. February 18th, we took our second trip to Albuquerque for our rescheduled follow-up exam and we saw the other ophthalmologist, Dr. McLean. The pressure in Luna's remaining eye was 12, so in the normal range. Dr. McLean saw no active inflammation and still could not see Luna's retina. Her diagnosis and assessment were "well-controlled anterior uveitis and secondary glaucoma."

I asked what causes of uveitis beyond tick-borne diseases she ruled out and she added two more to the list: (2) lymphoma and other cancer because it was unlikely in a young dog like Luna and her blood work raised no alarms and (3) leptospirosis because it causes changes in liver and kidneys and Luna's blood work raised no alarms. And then she said we should wait for the biopsy results before testing for more causes of uveitis—I was especially happy to hear this.

I asked what were the chances some of Luna's vision could be restored, and she replied, "Bet it will not come back, but if it does, within 6 to 8 weeks. I had one patient recover some vision after six weeks." Hearing this, I had hope again.

Dr. McLean said to continue with the eyedrops and gave me a schedule to reduce the frequency. She recommended a recheck in one month.

Another rough day. Some days were easy and I felt optimistic, but never for long. February 20th started with vomiting bile (two times) and eye drops not being effective. I was certain Luna's vomit was a consequence of eye pain.



Both taken Feb. 12—left in the morning before eye drops, right in the late afternoon after two rounds of eye drops. The eye drops did not keep her left pupil at a steady small size. They worked quickly and then the effect faded, so her pupil went through a cycle of size changes every 24 hours.

Pathology report for the right eye. The diagnosis from Dr. McLellan at the University of Wisconsin-Madison was "chronic glaucoma associated with goniodysgenesis." The comments clarified that Luna's glaucoma was primary. Primary, not secondary, glaucoma—I was surprised even though John May told me he thought this would be the case. Did this mean uveitis was a non-issue?

Decision time for the left eye. February 22nd, I had a consultation with Dr. Laney to discuss what to do about Luna's left eye. We reviewed all the reports we had from Dr. Peterson and Dr. McLean, the pathology report on the right eye, and all the test results looking for possible causes of uveitis.

I told Dr. Laney the uveitis diagnosis was giving me nightmares. "If it is valid, could Luna have some awful systemic disease that could manifest itself in some other way than uveitis when both her eyes are gone?" We talked it through and agreed that the pathology finding of primary glaucoma meant the uveitis diagnosis was less of a concern, plus we had ruled out two more causes of uveitis—thyroid and diabetes.

She asked me how it was going with the eye drops. I told her, "Luna is totally cooperative. The problem is the drops are not keeping her pupil at a steady small size—they don't work that way. They work quickly and then the effect fades, so her pupil goes through a cycle of size changes every 24 hours. When it's larger, it's probably like a massive headache for her."

She nodded in agreement and told me 19 days of blindness suggested Luna would never recover vision in her left eye. We agreed enucleation of Luna's left eye was the most positive way forward. The surgery was scheduled for March 4th so Luna would have a total of three weeks to recover from her last surgery.

I hoped I would be able to manage the pressure in Luna's left eye for another 11 days. Thankfully, I'd become very attuned to when to add an extra dose of Latanoprost. It's the anti-glaucoma drug that is used to lower the pressure within the eye by increasing outflow of fluid; it causes intense constriction of the pupil.

First play! March 2nd, a day shy of three weeks after her first surgery, Luna was talking to me an unusual amount. I thought

FEATURES *continued*

maybe she was ready to play... I grabbed my camera and one of her favorite tug toys... led her into the great room where there is soft carpet and open space... and we played a little bit of tug. She really got into it!

I managed to get a video that hopefully you can watch at <https://drive.google.com/file/d/1jY5CGqqfjmjd1kYAGjLUH68qM94xsI0n/view?usp=sharing> (a bit topsy turvy in the beginning). It ends with me softly telling Luna "careful" because she was inching her hold on the toy upwards a bit too close to my hand for my comfort. This play was a major milestone!

Left eye enucleated March 4th. When I picked Luna up the next morning, I thought she looked more swollen than after the surgery on her right side. The swelling didn't bother Luna. She wolfed down her lunch. Then we took a walk and were outside for almost an hour. She had an impressive amount of energy. It was so good to have her back home and see her accepting each new stage of this journey we were on with nary a complaint. I was so impressed!

With each passing day, Luna's surgery site looked more swollen. March 8 was the fourth day post-op, so it seemed to me like it should have been looking less swollen. I needed some peace of mind, so we

went to the clinic. Dr. Laney agreed it was quite swollen but she wasn't concerned. She explained Luna's left eye had a better blood supply than her right one, so more swelling was to be expected for up to a week. She recommended applying a warm compress a few times a day, which I did.

More swelling, another overnight at the vet's. On March 10th, when I put Luna's lunch down for her, I saw three drops of blood on the floor and then I saw for the first time there were even more bloody spots on her crate pad from last night. After her lunch, she really did not want to walk, which was an even bigger red flag. She looked and acted miserable. Not a single whine though, such a trooper she was.

Back to the clinic. Dr. Laney gently pressed Luna's swollen eye lids and recommended she stay the night.

When I picked Luna up the next morning, her swelling was noticeably less. Dr. Laney said it would probably take a week for the swelling to end and that it was important to keep doing



Mar. 2—first play, two days before surgery to enucleate her left eye.

warm compresses at least three times a day until the swelling was gone. She sent us home with two meds: Previcox (a non-steroidal anti-inflammatory drug used as a painkiller) and Rilexine (an antibiotic).

Pathology report for the left eye. The diagnosis from the pathology of Luna's left eye was goniodysgenesis, the same as for her right eye. Dr. McLellan added a personal note to reassure me that it was "absolutely classic for primary glaucoma, with no other significant inflammatory/infectious or other disease seen by the time of enucleation." In other words, the uveitis diagnosis should no longer be a concern because glaucoma most likely caused the uveitis. What a relief it was to read this—it really brought me to a state of closure about the cause of Luna's blindness.

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This pair of photos shows day 6 after each eye was enucleated so you can see how much more swollen the left side was.



First hike!!! April 6th, Luna and I took our first hike since she went blind Feb. 4th, just two months before.

We went a little over four miles round trip on a jeep road, and along the way there were some challenges that turned out to be perfect—several stream crossings and rocks in places. There were lots of birds, butterflies, and many fabulous scents to check out. We took our time so Luna could sniff to her heart's desire! She was confident and energetic the entire time.

Hiking with her on leash the whole time was weird, but we both accepted the need for it.

I'd been hatching plans for several weeks for how we were going to hike again, so I had a lot of expectations building up to this day. And still, this day exceeded my highest expectations many times over... we saw not a soul... just the two of us doing what we both love...

I had an intense emotional moment early in the hike when it hit me with a profound joy that it *really* is not the end of the world when a dog goes blind... sense of smell, hearing, and touch rise to the occasion!

This hike was my turning point. In contrast, Luna's turning point was much earlier. The moment she became blind, she took everything in stride dealing with every challenge as best she could.

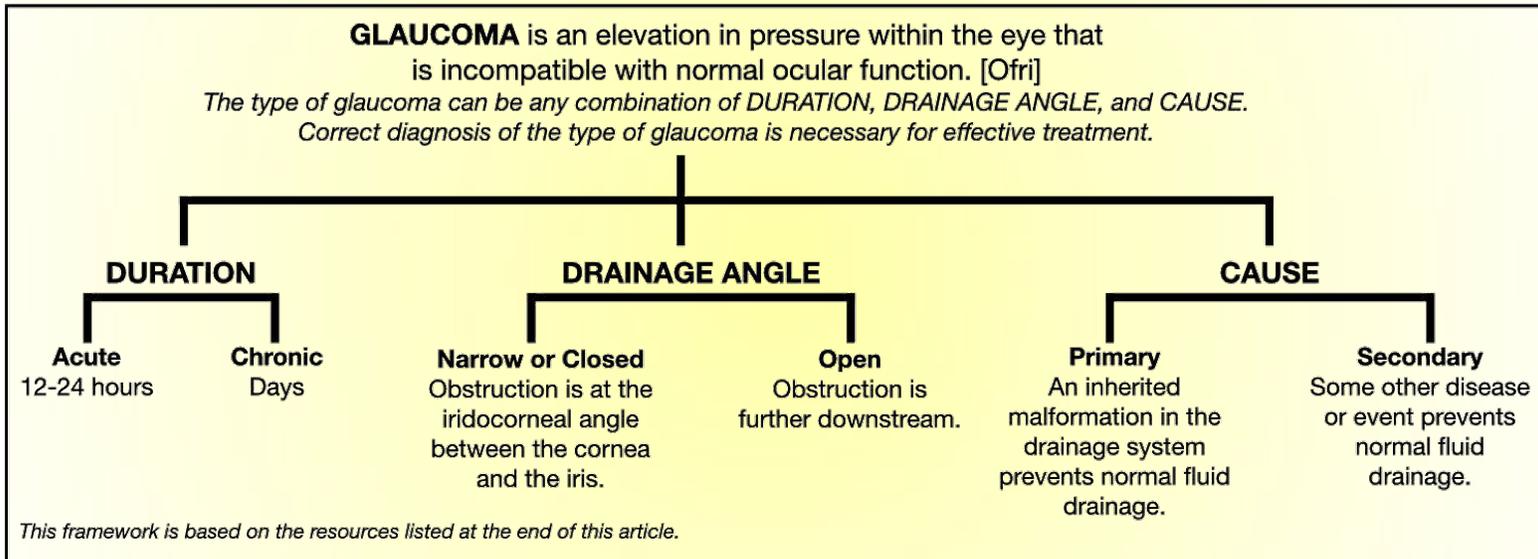
I do believe the day will come when Luna will once again hike off leash.

FEATURES *continued*

Types of Glaucoma

Glaucoma is not one simple condition. Correct diagnosis of the type of glaucoma is necessary for effective treatment and even then the treatments to save or restore vision may not work.

The framework below characterizes glaucoma in terms of its duration, the drainage angle, and cause. Based on my reading, these seem to be the three main aspects that define glaucoma type.



Since the type of glaucoma can be any combination of duration, drainage angle, and cause, there are at least eight types of glaucoma (I say “at least” because this is a simple framework):

Acute open primary	Acute open secondary	Chronic open primary	Chronic open secondary
Acute narrow/closed primary	Chronic narrow/closed primary	Acute narrow/closed secondary	Chronic narrow/closed secondary

My Understanding of What Happened

To better understand what we’d been through, I started by applying the framework to Luna’s two diagnoses.

- Feb. 6, Dr. Peterson’s diagnosis was “anterior uveitis OU (both eyes) with secondary glaucoma OU.” Applying the framework, this diagnosis is secondary glaucoma with an acute and severe onset of anterior uveitis being the event that prevented normal fluid drainage. Duration was not specified and the drainage angle could not be evaluated.
- Feb. 19, the diagnosis from the pathology of Luna’s right eye was “chronic glaucoma associated with goniodysgenesis.” Goniodysgenesis is narrow-angle primary glaucoma. [Ofri] Applying the framework, this diagnosis is chronic narrow-angle primary glaucoma.

These two diagnoses are very different. The first diagnosis was incomplete and wrong, and almost four weeks of treatment were based on it.

To understand how they could be so different, I consulted with Dr. McLellan. She gave me three insights:

- I asked if the uveitis part of Dr. Peterson’s diagnosis could still be valid with primary glaucoma. I still feared Luna had some awful systemic disease that would manifest itself in

some other way than uveitis. Dr. McLellan told me to relax. The pathology study normally detects if there is something systemic going on, such as a cancer. It would also detect something like a fungal infection.

- To test my understanding, I tried asking my uveitis question another way. “Is the sequence (A) primary glaucoma inherited, (B) anterior uveitis triggered (C) glaucoma attack what happened?” She said, “Nothing was found that suggests B triggered C; what almost certainly happened is A triggered C, which can then cause B.”
- Dr. McLellan volunteered that in Luna’s case, she could understand why the ophthalmologists thought uveitis caused secondary glaucoma. Because both of Luna’s eyes were hit, it was not possible to examine her eyes thoroughly enough to really understand what happened. It would have been so much easier to understand what happened if only one eye had been hit.

Acute glaucoma is a real emergency. For us, going to an ophthalmologist was an almost five-hour drive. We could not get help quickly enough to treat Luna’s glaucoma when it was in the acute stage. Luna was in the chronic stage (more than 24 hours) when she was examined by the Dr. Peterson, and yet it seemed to me that the treatment she received was more

FEATURES *continued*

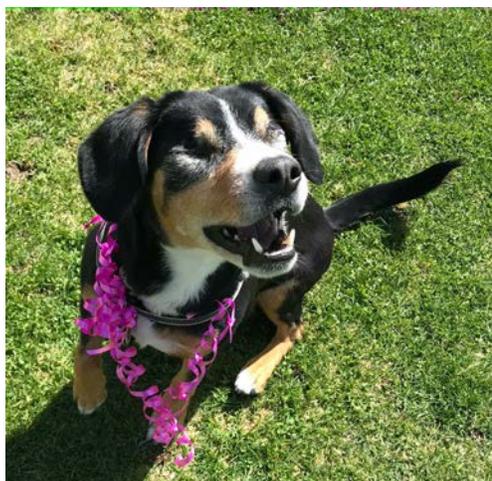
appropriate for acute glaucoma. Specifically, the mannitol treatment is typically used for acute, not chronic, glaucoma [<https://en.wikipedia.org/wiki/Mannitol>]. The mannitol treatment failed and the eye drops failed. For me, the saddest consequence was Luna endured extreme and unnecessary pain for four weeks while we followed the prescribed treatment.

When I shared these conclusions with Dr. McLellan, she felt the treatment Luna received was justified. “It can be ‘worth a shot’ to try these treatments since Luna was just one day beyond the acute stage. There are surgical options for glaucoma that can help preserve vision, which we most often apply to the second eye. Unfortunately, in Luna’s case there wasn’t a real lag between the two eyes being affected so there was no opportunity to even consider this option for her.”

Luna and Gail Today

Before Luna became blind, she knew a lot of cues, and all of them have turned out to be useful, some of them extremely useful. For hiking, *behind me* and *you lead* are invaluable.

Communication. I’ve adapted how I interact with Luna. I use my voice and touch lots more. For example, to guide her, I use a combination of *touch* and *this way*. All I have to do is say *touch* so we make contact and then *this way* means stay in touch while I show you the way.



Birthday joy—I’m four years old!
April 21, 2021

I also talk to Luna a lot more, sometimes to explain complicated things to her. She always pays attention, cocks her head, and seems to understand so much. Sometimes she talks to me, like when I picked her up after her right eye was enucleated and she told me everything that happened while she was at the vet’s.

Meeting Strangers. Before Luna went suddenly blind, she was a friendly, out-going Entlebucher. She isn’t this way right now. She’s great with people she knows, but will bark when a stranger approaches, especially if the stranger says anything to her. Her alert behavior is totally understandable, but so un-Luna-like. We’re working on building back her confidence. A soft *quiet* or *easy* from me are two of her newest cues. With every passing day, she’s more at ease around strangers.

Using Touch. It’s fascinating to me how Luna uses her sense of touch. This is especially noticeable when she negotiates

elevation changes. For example, when going up or down stairs, she will test the first stair with her right front paw to determine the elevation change, then the rest of her feet just know what to do.

How Can We Be More Proactive?

More than 40 breeds are genetically predisposed to goniodysgenesis. There are genetic tests for some breeds. For example, see https://www.animalgenetics.us/Canine/Genetic_Disease/BCG.asp for details about the Border Collie. We’re not as far along in understanding the genetics of glaucoma in the Entlebucher. We don’t even know if it is a recessive or dominant trait.

Since we do not have a genetic test for glaucoma in the Entlebucher, what can we do? We don’t have a lot of choices—we have to rely on gonioscopy testing. Gonioscopy is a technique used to evaluate the iridocorneal angle so it helps to determine a dog’s predisposition for glaucoma [Beeman].



To be clear, gonioscopy is not a perfect tool. Dr. McLellan explains two limitations [resource 8, p. 5]:
(1) there is no widely accepted scoring system for recording observations and
(2) the examiner cannot view structures in the eye that are deeper than the pectinate ligaments and that can also contribute to drainage blockages.

Until we have a genetic test for the Entlebucher, gonioscopy is the best diagnostic tool we have and we must use it.

- Be sure your ophthalmologist knows you want a gonioscopy before starting the exam as the test must be done before the drops for dilation are administered. Please know gonioscopy is not included in the OFA eye exam so you have to request it specifically and pay extra for it.
- If abnormalities are present and detected early, medical treatment can be initiated that might prevent or reduce the risk of future problems.
- Because the angle changes over time, gonioscopy must be done regularly. Dr. McLellan highly recommends annual gonioscopy for all Entlebuchers.
- Request a full report of the gonioscopy findings for your records.

FEATURES *continued*

When your Entle has any of the signs of glaucoma (increasing redness, discharge, squinting, cloudiness, unequal pupils, blind), get a thorough eye exam *immediately*.** And remember to take the results of all the gonioscopy exams done on your Entle—this information will be invaluable. If I had had just one gonioscopy on Luna, her first diagnosis would have been more accurate.

And finally, tell your breeder if your Entle is diagnosed with primary glaucoma. Your breeder can then notify all owners with littermates that their Entles should be evaluated in case they also inherited glaucoma. This community effort is how we can be more proactive and protect the breed for now.



Luna and her littermates on day 9.

Luna is the second puppy from the right.

Puppies' eyes are closed for the first 10 to 14 days... Luna's blindness is kind of like her first two weeks of life... Luna has experience functioning with blindness... Luna has advantages now that she did not have then—a well-developed sniffer, hearing, and touch. Think about it...

Eventually we'll have a genetic test for glaucoma in the Entlebucher. Then we can breed with more confidence. I can also imagine CRISPR-based treatments that could safeguard the eyesight in dogs that have inherited glaucoma by editing their "bad" inherited genes. This scenario is exciting and scary... a great topic for another article by someone more knowledgeable than I am!

For now, please, let's all do our part and use gonioscopy to protect the breed as best we can.

** Per Dr. McLellan, "Entles are affected by a breed-related primary, closed angle glaucoma associated with acute, blinding spikes in pressure in the eye. If pressure is not controlled quickly, glaucoma can then become chronic and the chance of regaining any vision becomes very poor.

Like any other breed of dog, Entles can also develop glaucoma secondary to other diseases in the eye like complete cataract, inflammation and infections (uveitis), or trauma to the eye."

Acknowledgements

Although this account put Luna and me in the spotlight, many people helped us navigate a path through the confusion, uncertainty, and stress. I'm grateful to my mom, my sister, my son, Luna's breeder Jen, our vets Dr. Laney and Dr. Allred, Dr. McLellan a board-certified veterinary ophthalmologist and researcher at the University of Wisconsin-Madison, our human and dog friends in our small town, and our many NEMDA and Foundation friends.

Suzanne Olszowiec taught me how to teach Luna *pretty eyes*, and Luna caught right on. She sat in front of me with her head perfectly raised and her glaucoma-ridden eyes open and ready for eye drops. I no longer had to put any pressure on Luna's tender eyes to hold her lids open.

Dr. McLellan read a draft of this article and gave me many explanations that I have included in this final version of the article. Many of us in NEMDA and the Entlebucher Preservation Foundation have our fingers crossed Dr. McLellan will receive research grants to study gene mutations that cause glaucoma in the Entlebucher. In fact, we've written letters of support for her grant applications.

Resources

Here are a select few of the many articles that helped me learn about glaucoma.

1. Beeman, T. (2004). Glaucoma. Entlebook, Sept. 2004, pp. 3-4.
2. May, J. (2021). Glaucoma: Oda's journey and hope for the future. Entlebook, Feb. 2021, pp. 6-8.
3. Ofri, R. (2020). An overview of canine glaucoma. Retrieved from <https://www.dvm360.com/view/an-overview-of-canine-glaucoma>.
4. Olszowiec, S. (2019). Glaucoma: diagnosis, treatment, and Entle adaptability. Entlebook, Nov. 2019, pp. 2-5.
Comments: Great introduction to glaucoma with diagrams that helped me understand the drainage system.
5. Petersen-Jones, S. (n.d.). Canine goniodysgenesis. Retrieved from <https://www.dog-health-guide.org/caninegoniodysgenesis.html>.
6. Reinstein, S. (n.d.). Acute glaucoma: a true emergency. Retrieved from <https://todaysveterinarypractice.com/ophthalmology-acute-glaucoma-true-emergency/>.
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8. (n.a.). (n.d.). Goniodysgenesis and glaucoma in border collies. Retrieved from https://www.animalgenetics.us/Canine/Genetic_Disease/BCG.asp.
9. (n.a.). (2019). Primary Angle-Closure Glaucoma is Focus of Genetic Studies in Dogs, Purina ProPlan Dog Update, Volume 17 (Spring 2019), pp. 2-7. To download, use <https://www.purinaproclub.com/resources/dog-articles/breed-updates/dog-update-spring-2019>.