Canine Red Eye: External Causes

Amy J. Rankin, DVM, DACVO reviews common external causes for a dog to present to a veterinarian with the complaint of a "red eye," including conjunctivitis and corneal ulcers.

Speaker Bio:

Amy J. Rankin, DVM, DACVO received her veterinary degree from the University of Wisconsin in 1993. She then completed a rotating internship in small animal medicine and surgery at Oklahoma State University. Dr. Rankin spent 3 years in small animal private practice in Washington and Idaho, and then she completed an ocular pathology fellowship at the University of Wisconsin's School of Veterinary Medicine. She completed her residency training and master's degree at Purdue University and then spent 6 years in a private specialty practice in Milwaukee, Wisconsin before joining the faculty at Kansas State University in August of 2007. Dr. Rankin is currently a Professor of Ophthalmology at Kansas State University.

Learning Objectives:

1. Differentiate between conjunctival hyperemia, episcleral injection, and subconjunctival hemorrhage
2. Identify differential diagnosis for the three different types of ocular redness
3. Recall elements of treatment plans for conjunctivitis, superficial corneal ulcers, infected corneal ulcers and spontaneous chronic corneal epithelial defects

Slide 1

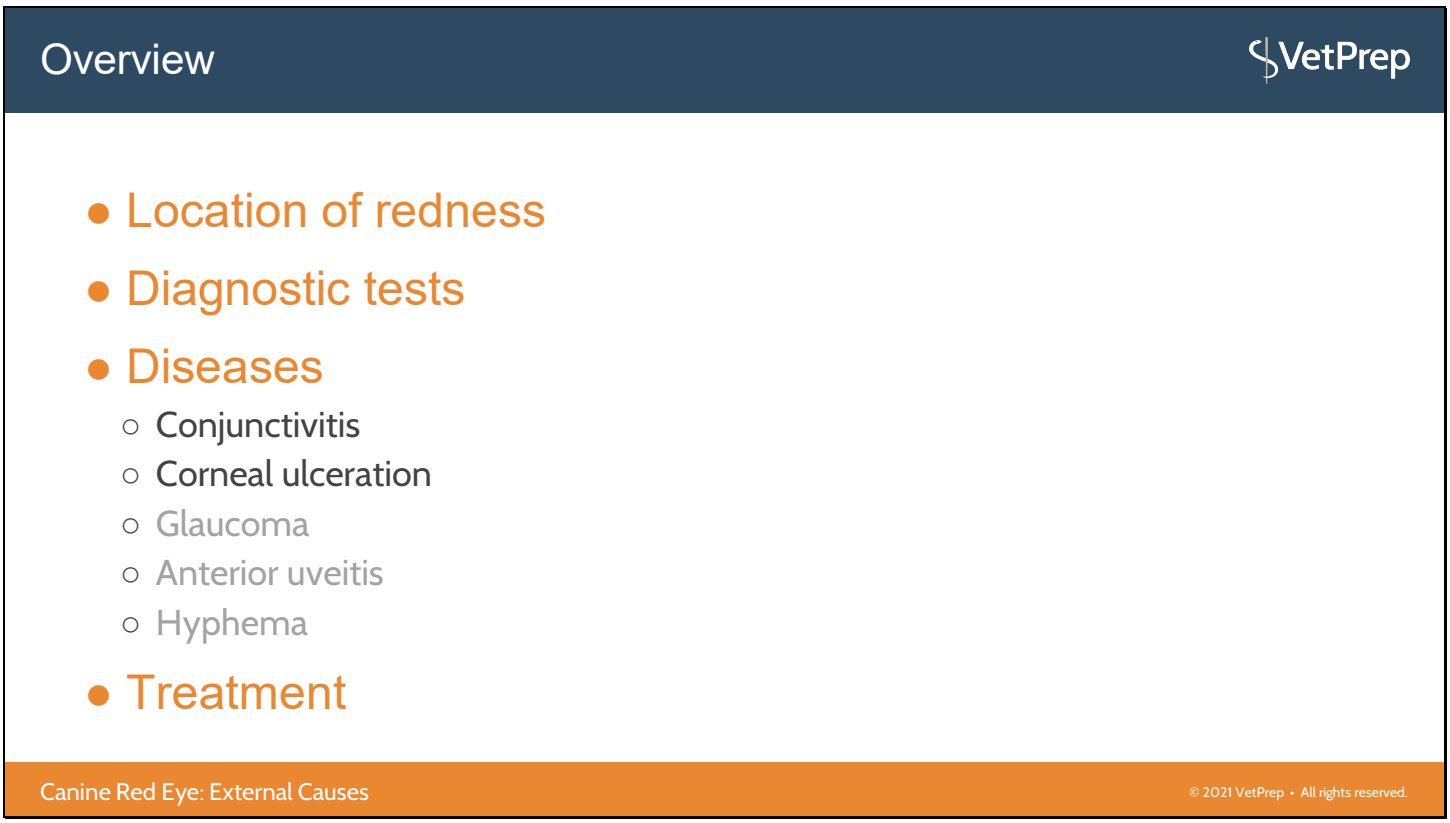
Canine Red Eye: External Causes

VetPrep

Amy Rankin, DVM, MS, DACVO

Hi. My name is Amy Rankin, and I'm a professor of Ophthalmology at Kansas State University. And today, I'm going to talk to you about different diseases on the outside of the eye that will cause a red eye in your canine patients. As you probably already know from practice, having a red eye is a common complaint that owners will bring a dog in for you to evaluate.

Slide 2



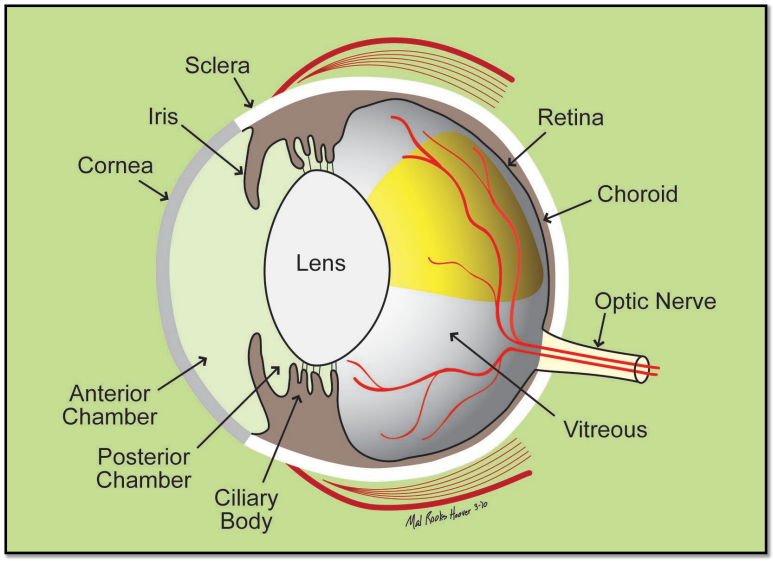
So in today's lecture, the first thing that I want to talk about is to give you some helpful hints to identify where the location of the redness is in the eye because having a red eye is really a pretty vague symptom or complaint that an owner will bring to you. And knowing the location of the redness or being able to identify where is red is going to really help you narrow down your differential diagnosis for that patient. Next, we're going to talk about different diagnostic tests that should be performed in a red eye in a dog and specifically, we're also going to spend some time talking about when it's not a good idea to do those diagnostic tests, when perhaps we could actually do some harm by performing those things. And then we're really going to concentrate on diseases on the outside part of the eye. So we're going to concentrate on conjunctivitis, as well as simple noninfected corneal ulcers, complicated infected corneal ulcers, and also indolent ulcers. I'm also going to hopefully try to throw in some communication tips to help you be able to convince owners to buy into your treatment plan so that they can treat their pet appropriately.

Slide 3

Location of Redness

VetPrep

- External
  - Conjunctiva
  - Subconjuctival space
  - Cornea
- Internal
  - Anterior chamber
  - Vitreous



Canine Red Eye: External Causes

Figure 1

So looking at the location of the redness, we can have redness on the outside of the eye or the inside of the eye. So redness on the outside of the eye can occur in several different places. It can be on the conjunctiva, which lines the sclera, as well as the front and back side of the third eyelid. And it also lines the inside of both the upper and lower eyelids.

We can also have bleeding into the space underneath the conjunctiva, so between the conjunctiva and the sclera. And we can also have redness on the cornea. We can have blood vessels that have grown in that something owners might be able to notice.

We can have granulation tissue that occurs on the cornea that will appear red. Sometimes we can have little hemorrhages that occur when those blood vessels are fragile. And again, that's something an owner might notice and bring to your attention.

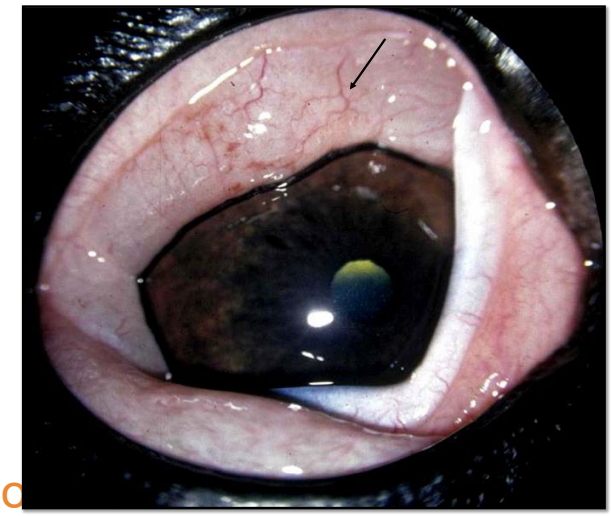
When we think about redness on the inside of the eye, it's usually they're located in the anterior chamber, which is that space between the cornea and the iris and the lens or it's in the very back part of the eye, so between the lens and the retina in the vitreous cavity.

Slide 4

Conjunctival Hyperemia

VetPrep

- Extensive branching
- Small blood vessels
- Lymphoid follicles
- Extraocular disease
  - Conjunctivitis
  - Keratoconjunctivitis sicca KCS
  - Follicular conjunctivitis
- Can occur with episcleral injectio



Canine Red Eye: External Causes

So looking at the different types of redness that we can see in our patients, conjunctival hyperemia is probably the most common type of redness that we're going to see and these tiny fine little blood vessels that have got a little arrow drawn to it on the picture on the right-hand side of your screen. And if you read in the textbooks they talk about these blood vessels being freely movable. You don't really need to touch them or try to move them to be able to convince yourself of that. You can tell it's conjunctival hyperemia, again, because they're really small caliber, and there's a lot of branching.

We can sometimes see lymphoid follicles associated with conjunctival hyperemia. And when we see this type of vascular pattern, we really should concentrate our efforts in diagnosing extraocular disease. So we should be thinking about conjunctivitis. Maybe this patient has dry eye disease or KCS. And then follicular conjunctivitis is a specific disease that we see in young dogs. And we'll talk a little bit about that in a couple of slides. It's important to keep in mind that conjunctival hyperemia doesn't have to occur just by itself.

We can also see that with the next type of redness that we're going to talk about, which is episcleral injection.

Slide 5

Episcleral Injection

VetPrep

- Congestion of episcleral vessels
- Intraocular disease
  - Anterior uveitis
  - Glaucoma

Canine Red Eye: External Causes

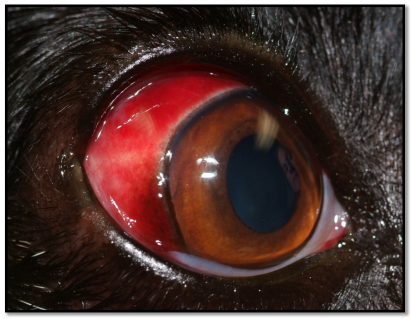
So episcleral injection is the opposite of conjunctival hyperemia. So conjunctival hyperemia, we've got those really small, tiny little blood vessels. Episcleral injection are much larger, thicker blood vessels, and they're usually not branching. They're a little bit straighter in their direction, and they occur like spokes on a wheel so they radiate from the limbus towards the back of the eye.
When we see episcleral injection, we really should not be thinking about extraocular disease. This is not a case of dry eye disease or a case of conjunctivitis. This is usually indicative of something going on inside the eye, so we think about anterior uveitis and glaucoma most commonly.

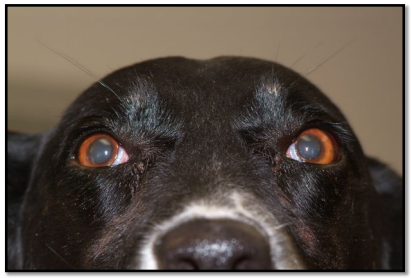
Slide 6

Subconjunctival Hemorrhage

VetPrep

- Strangulation
- Trauma
- Clotting disorders





Canine Red Eye: External Causes

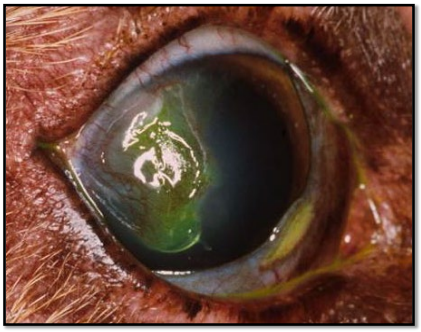
The next type of redness that we can see inside the eye actually doesn't have a vascular pattern at all. Subconjunctival hemorrhage is really just a sea of redness. So we've got blood that's trapped between the conjunctiva and the sclera. When we see this type of redness in the eye, we really should be thinking about very different differentials then the other two types of redness that we just talked about.
So this can happen with accidental strangulation. So I've seen this probably more often than I want to in dogs that have recently been to the groomer, usually within the last day or so, and the groomers tend to use these little slip leads around their neck. And if the patient happens to fall off the grooming table, they can be accidentally strangulated for a short period of time, and they can develop these type of hemorrhages.
Dogs that may be pulled really, really hard on a leash or get themselves tangled up if they're tied up outside, we can see this type of redness. We can also see it with trauma, so dogs that have been hit by a car, kicked by a horse. I work here in Kansas, maybe kicked by a beef cattle might be another thing that we might see, but a significant blunt force trauma. And of course, we can also see it with clotting disorders.
The picture on your computer is actually a dog that got into rodenticide toxicity, so he's got a significant amount of subconjunctival hemorrhages on both the front and the back side of his third eyelid, as well as in the bulbar subconjunctival space. And the picture on the bottom right, to me, I just love because he looks incredibly guilty. You know he ate the rodenticide poison, and that's actually how he looked post-treatment. So he did very well.

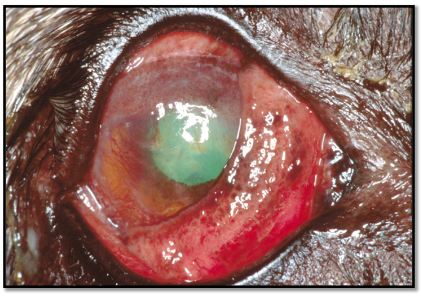
Slide 7

Corneal Vascularization

VetPrep

- Long branching vessels
  - Superficial corneal ulcer
  - Pannus
  - KCS
- Straight 360° blood vessels
  - Infected corneal ulcer
  - Stromal abscess
  - Anterior uveitis
  - Glaucoma





Canine Red Eye: External Causes

So the other type of redness that owners may bring their dog in for you to evaluate for is redness on the surface of the eye, around the conjunctiva. And we can see two different vascular patterns when we talk about corneal blood vessels. We can see these long, branching blood vessels. They're usually going to one specific area. For example, the picture on the top is a dog that has superficial corneal ulcers, and you can see all those blood vessels are coming laterally just to the area of interest.
We can also see it in panus, which is a disease we see in German shepherds. The slide on the bottom or the photograph on the bottom is an example of that. So there's multiple branching superficial blood vessels present. And we can also see this type of vascular pattern with dry eye disease or KCS.

Corneal Vascularization

VetPrep

- Long branching vessels
  - Superficial corneal ulcer
  - Pannus
  - KCS
- Straight 360 ° blood vessels
  - Infected corneal ulcer
  - Stromal abscess
  - Anterior uveitis
  - Glaucoma

Canine Red Eye: External Causes

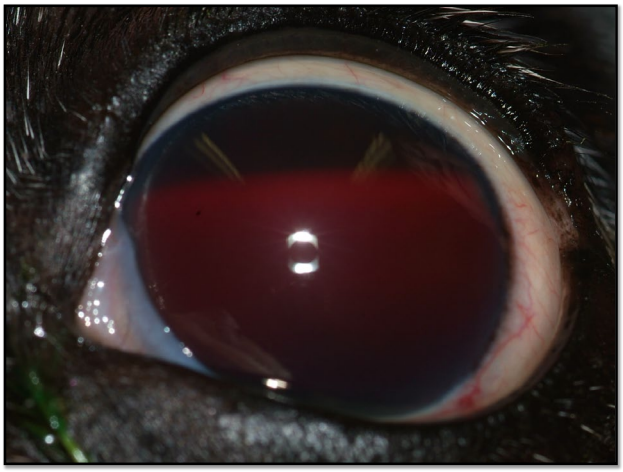
The other type of vascular pattern that we can see in the cornea are these straight blood vessels that come in 360 degrees around. This is also known as ciliary flush. I tend to think of this type of vascular pattern as the eye is calling in the entire army and the army is surrounding the enemy and the enemy in this case is usually something pretty significant. So it's an infected corneal ulcer, maybe it's a corneal stromal abscess. We can also see this the vascular pattern when we talk about diseases inside the eye, so anterior uveitis, as well as glaucoma.

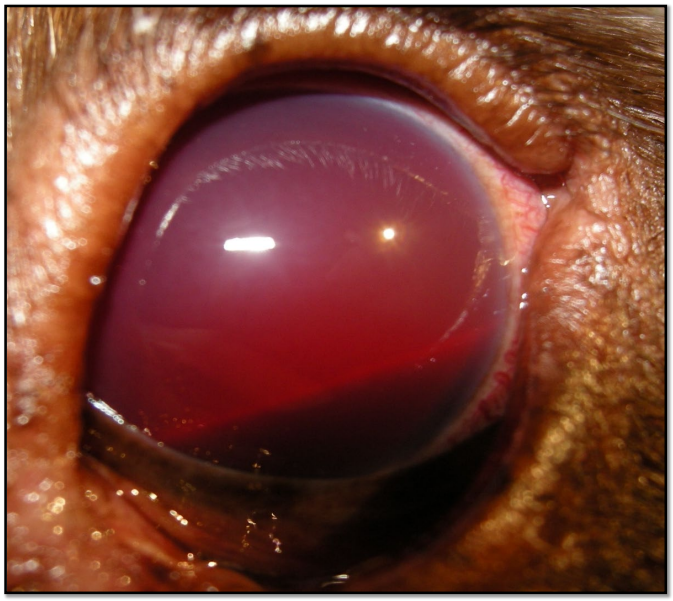
Slide 9

Hyphema

VetPrep

- Blood in anterior chamber





Canine Red Eye: External Causes

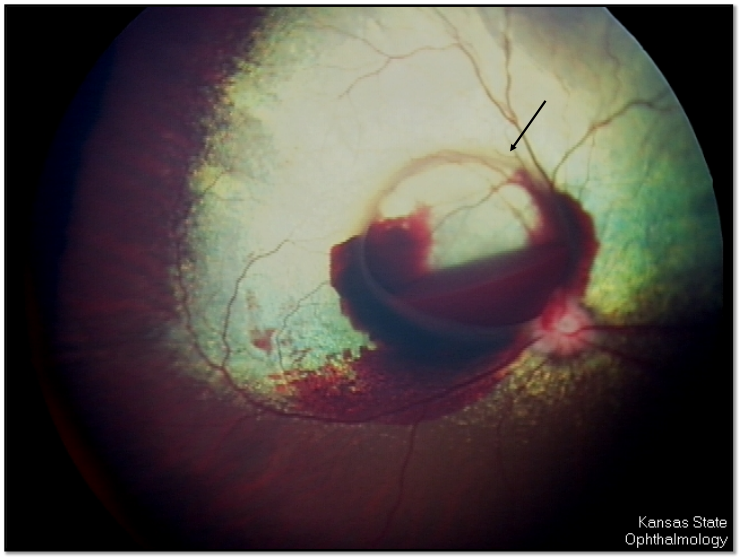
Next we'll shift gears a little bit and we'll talk about blood on the inside of the eye. So we can see hyphema, and that's blood in the anterior chamber and that can take on a lot of different appearances. So the picture on the left is a dog that has the blood completely settled out. It looks fairly clear above that flat line that you can see on the top of the anterior chamber.
And the picture on the right is a dog that probably was jumping all over the place as he came into the exam room. And some of that blood that settled on in the bottom is dispersed into the anterior chamber giving the rest of the eye that blood-tinged color. Well, we have a very fresh or very recent bleed that blood is going to look really bright red and with time, that blood is going to change color.
Just as you would expect, just like a bruise on your skin it's going to take on different appearances over several days to weeks. The same thing is true of hyphema. And sometimes if blood has been in there for a long period of time, it can take on this really dark appearance and we call it a black-ball hemorrhage. It just means it's old blood sitting in the anterior chamber.

Slide 10

Vitreal Hemorrhage

VetPrep

- Systemic hypertension
- Retinal detachment
- Trauma



Canine Red Eye: External Causes

Vitreal hemorrhage-- also sometimes owners might be able to notice that the pupil is dilated enough, and they can see blood behind the pupil. We tend to see this with systemic hypertension. We can also see it with a retinal detachment.
When that retina detaches, sometimes those tiny blood vessels can be torn allowing blood to seep in to the vitreous cavity, and we can also see it with trauma. So for example, animals that have had a bite wound or a crush injury to the globe sometimes can have vitreous hemorrhage. The slide on the right is an example of hemorrhage that's sitting in the vitreous, and that animal actually has a tear in the retina. You can see the arrow is pointing to that circular hole in the retina.

Diagnostic Tests

VetPrep

- Schirmer tear test
- Fluorescein stain
- Tonometry

Canine Red Eye: External Causes

So now that we've talked about the different types of redness that a dog may present for. Again, conjunctival hyperemia, we should think about external disease. Episcleral injection, we should be thinking about diseases inside the eye like anterior uveitis or glaucoma.
We've got subconjunctival hemorrhage, very different differentials for that type of redness. We think about strangulation or trauma or clotting disorders. Blood vessels on the corneas, another form of redness. And then we talked about hyphema and vitreous hemorrhage as well.
Again, all different areas where the eye can be red. And being able to identify where the redness is occurring can really help you narrow down your differentials for that case. Most cases of a red eye should have all three of these diagnostic tests performed.
So we should do a Schirmer tear test. We all know that a normal Schirmer tear test value is 15 millimeters of wetting or greater in a minute, usually between 10 to 15 is that gray zone for me. I usually have to stop and think, does this patient really have dry eye disease? Am I willing to start him on therapy that's potentially lifelong, and that decision-making process really occurs through several different things.
So for example, if a dog comes in and he has a corneal ulcer and his tear production is 12. So it's right smack-dab in the middle of my gray zone. But I know that if that dog has a corneal ulcer, that is the most painful that dog's probably ever been in his life with his eye. And the best you can do is make 12 millimeters of wetting in a minute.
That's horrible. That strip should be completely wet if everything were normal. So in a case like that I would diagnose that dog with dry eye disease because that tear production is inappropriate.
For me, any time we have a tear production less than 10 millimeters of wetting per minute, I'm going to diagnose that patient with dry eye disease. The other thing to look at when we look at that gray zone is, do

they have any clinical signs of KCS, and we'll talk about that in a few different sides. And it's also important to look at the other eye. So for example, if I've got a Westie in front of me and one eye has a tear production of 0 and the other eye has 12, I'm going to treat both of those eyes for dry eye disease because that eye with a production of 0, that dog has really showing me that he's got a problem a dry eye disease. Fluorescein staining, we do to evaluate for a corneal abrasion or a corneal ulcer. And of course, taking the intraocular pressure is important when we're diagnosing glaucoma, but it also is important when we're looking at patients that have an anterior uveitis because we expect the pressure to be lower than normal. The exception of when we should do all three of these tests, for me, is if we have an that has a very deep ulcer or an eye that we've already diagnosed a corneal perforation in.

In those cases, sometimes it's better not to perform these tests because we could actually make something potentially worse. So if they have a deep ulcer and we do a Schirmer tear test and they struggle, then we could cause that ulcer to rupture. Or if it's already ruptured and now we're trying to take our pressure and the patient is struggling or we accidentally hit the perforation site with our tonometer, we're going to cause it to re-rupture.

So in those cases, I would prefer just to rely on my ophthalmic exam skills and my ability to look at the eye to decide, do I think this patient has dry eye disease or not? Do they have any other signs of glaucoma? What else is going on inside the eye that I can help figure out the diagnosis versus risking doing any of these three tests.

Slide 12

Additional Diagnostic Tests

VetPrep

- Cytology
  - Diff-Quick stain

Additional diagnostic tests that can be done include cytology. So we can do cytology of the conjunctiva. We can also do cytology of corneal ulcers. It's important if you're doing cytology or taking a culture, which we'll talk about next, if we're doing it from an infected corneal ulcer, it's important to keep in mind that the best place to get our sample is actually not right smack-dab in the middle of the ulcer. That's actually probably the most dangerous place to take it because that's going to be the area that's probably the deepest. But it's also an area where you're usually going to get necrotic neutrophils, you're going to get bacteria that might not be multiplying. You're really going to have a much better sample if you take your sample from the periphery of that infected ulcer.

When we do a conjunctival or a corneal sample, we're always going to put topical proparacaine in the eye because that's going to make the patient a lot more cooperative to be able to get our sample. I've got three different instruments or tools that we can use to get a cytology sample. You can use the back end of a number 15 blade. Everybody's got those in their practice. When I use that for cytology sample, oftentimes I would take the little tin foil package that the blade comes in and wrap the tin foil around the sharp part of the blade. So I don't actually injure myself while I'm taking a sample. Never ever take a sample from the sharp part of the blade, far too risky.

In the center, I've got these little microbrushes. And I've got an example of a company that makes them on the right-hand side. These are really nice because they're fairly soft, little bristles, and they allow us to get samples from either the conjunctiva or the cornea. So they actually can pull a lot of cells off of those areas, but most importantly, they can also then release them onto our slide so we can stain them and evaluate them.

Using a cotton- applicator oftentimes does a good job at picking up the cells, but it really doesn't roll them out very nicely onto the slide. And then we've got a Kimura spatula, which again is just another tool that you can use to get a cytology sample.

Additional Diagnostic Tests

VetPrep

- Bacterial culture and sensitivity

Canine Red Eye: External Causes

So bacterial culture and sensitivity is another diagnostic test that we can do for conjunctivitis, as well as infected ulcers. To be honest, for most cases of conjunctivitis, I don't start with doing a bacterial culture and sensitivity. Oftentimes, I'm going to start them on what I think is appropriate therapy. And for those few cases that don't respond the way that I expect them to, maybe then I'm going to take a culture sample.

When we're dealing with a deep infected corneal ulcer, it would be a good idea to do a bacterial culture and sensitivity. But that being said, we all know how long it takes for us to get those results. It takes anywhere from three to five sometimes up to a week before we can get our results back and in that amount of time, oftentimes we've made some really good headway with our treatment plan or maybe this is a case that isn't going the way that we wanted to, we've had to resort to maybe enucleating the eye. For owners that are financially constrained. I really don't push for them to do a bacterial culture and sensitivity. I would prefer that they spend their money on the medications that we can use to treat their pet rather than submitting this test.

On the right-hand side of the slide, I've got pictures of the two different types of tips. So on the left is your standard culturette tip. On the right are these mini-tips. So if you see a lot of ophthalmology cases in your practice, these mini-tips are actually really nice because they're just a little bit smaller, a little bit easier to use when we're taking a sample from a corneal ulcer.

Conjunctivitis

VetPrep

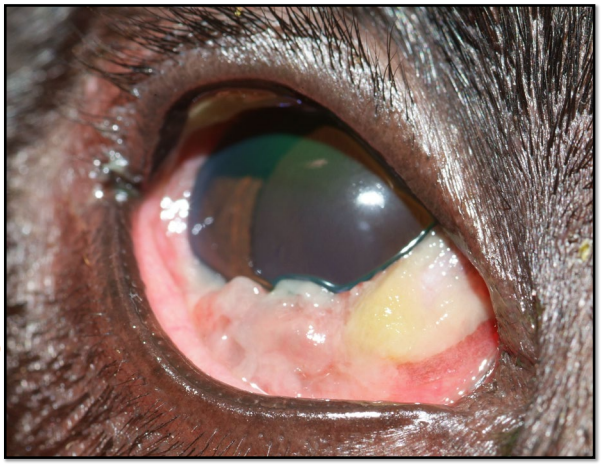
Canine Red Eye: External Causes

So now we're going to jump into the different diseases. So we're going to start by talking about different types of conjunctivitis that we can see in dogs. And then we're going to finish up the talk by going over different types of ulcers and how to manage them.

Conjunctivitis

VetPrep

- Rarely infectious
- Eyelid abnormalities
  - Entropion, ectropion
  - Eyelid tumors, eyelid lacerations
- Follicular conjunctivitis
- Keratoconjunctivitis sicca (KCS
- Allergic conjunctivitis/irritants



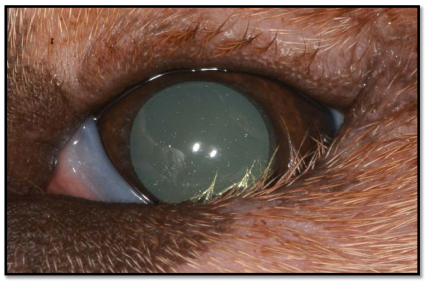
Canine Red Eye: External Causes

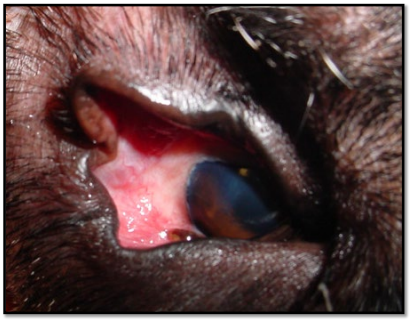
So conjunctivitis in dogs is rarely, rarely infectious, unlike in cats. Of course, you're all familiar with cats and feline herpes virus. That is by far and away the most common cause of conjunctivitis in that species. And cats also have other infectious diseases that will lead to a red eye, but in dogs that's rarely the case. Typically, conjunctivitis is due to something else. So for example, abnormalities with the confirmation of the eyelids. We can see it with follicular conjunctivitis, and we'll talk about that in a couple of slides. That's a disease that we tend to see in young dogs or puppies. We can see conjunctivitis with dry eye disease. And we can also see it when dogs have allergies or they're being exposed to different irritants in the air.

Eyelid Abnormalities

VetPrep

- Entropion
- Ectropion
- Eyelid tumors
- Eyelid lacerations





Canine Red Eye: External Causes

So when we look at the eyelid abnormalities that can cause a red eye, entropion is something that we should always evaluate for. Please always make sure that you can see both the upper and the lower eyelid margins. The example on the top portion of the slide is a dog that has lower lid entropion, and you can see you lose the eyelid margin as you move from medial to lateral. And he actually has hairs that are contacting the cornea. Imagine how uncomfortable that is. We've all had an eyelash or something getting to the surface of our eye, and it's really uncomfortable. And for dogs sometimes that can cause the conjunctiva to become red and inflamed. Typically, entropion is a young dog disease, usually less than a couple of years of age, but we can also see it at the other end of the spectrum. So when dogs get very old, sometimes they'll lose their retrobulbar fat and their eye will sink into their orbit, and they then can develop entropion.

We can also see conjunctivitis with the opposite of entropion, which is ectropion. So the is actually rolling out or flapping forward. The picture on the bottom is actually a St. Bernard that we did surgery on, and this dog actually had what's called diamond eyes. He's got both entropion and ectropion. So medial and laterally, his eyelids are rolling in. And then he's got these little notch-like defects of ectropion at the top and the bottom. On the bottom right-hand side of the slide is actually how he looked when we stretched his eyelid out. So he's got far too much eyelid tissue.

Eyelid Abnormalities

VetPrep

- Entropion
- Ectropion
- Eyelid tumors
- Eyelid lacerations

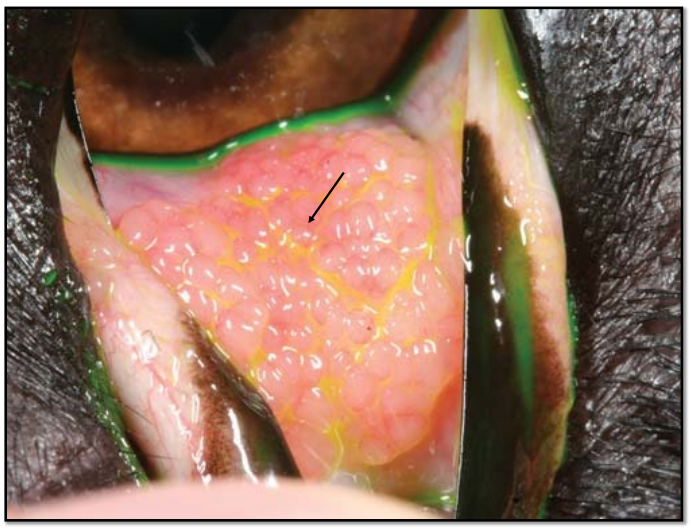
Canine Red Eye: External Causes

We can also see little eyelid tumors, whether it's on the inside of the eyelid or on the margin of the eyelid like the picture on the left. That can rub the surface of the cornea and cause a little bit of irritation. The most common type of eyelid tumor that we see in dogs are these benign little Meibomian gland adenomas, and this is a great example of that. They can look either pink, sometimes they can be a little bit pigmented or a mix of the two different colors, but they occur right on the eyelid margin. They usually have a cobblestone-like appearance. And we can also see it with the eyelid lacerations, and we've got an example of that on the right-hand side of the slide.

Follicular Conjunctivitis

VetPrep

- Young dogs
- Lymphoid follicles
- Immune mediated
- Treatment
  - Neopolydex
  - Prednisolone acetate 1%
  - Neopolybac HC
  - Topical antihistamine OTC



Canine Red Eye: External Causes

So follicular conjunctivitis is something that we see specifically in young dogs, so usually it's a puppy disease. So less than a year of age, but I can see it in two, three, maybe even a four-year-old. I'm not going to let the age cut off my window of when I could diagnose this in a patient. Usually, the complaint is mild. The owner will come in and say, oh, he's just been having a small amount of discharge for the last couple of days or maybe it's been going on for a few weeks. He's got a little bit of redness, maybe a little bit of tearing. His symptoms really aren't all that bad, but they're just irritating. Sometimes it could be one eye sometimes a dog could have it in both eyes.

The key to diagnosing this disease is that you have to look at the back side of the third eyelid. If you don't evaluate the backside of the third eyelid, you're never going to be able to figure this disease out because that's the only location where something is abnormal. So the rest of the eye might be just mildly red, we've got a little bit of conjunctival hyperemia, maybe they've got a small amount of ocular discharge, but when you put topical anesthetic on the eye and pull that third eyelid out-- I've got the arrow pointing towards these little lymphoid follicles. So normally, the backside of the third eyelid should be nice and smooth, just like the front portion of the third eyelid. But here we've got this really raised cobblestone-like appearance. We tend to think follicular conjunctivitis is an immune-mediated disease. So these animals are young. They're being exposed to all these allergens in the air. And their body is just responding to it a little bit inappropriately, an exuberant response.

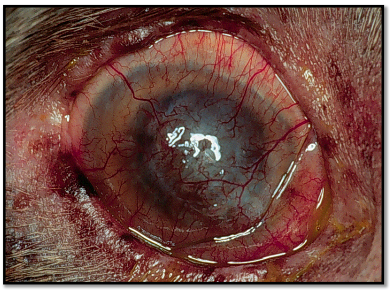
Treatment-- we usually will treat these with topical steroids to help decrease the immune response. Prednisolone acetate is probably the best anti-inflammatory that we have. NeoPolyDex would also be appropriate. And the frequency is really dependent on how bad it is, so maybe three to four times a day if it's moderate to severe, and less frequently if it isn't quite as severe. We could also use Neo-Poly-Bac with

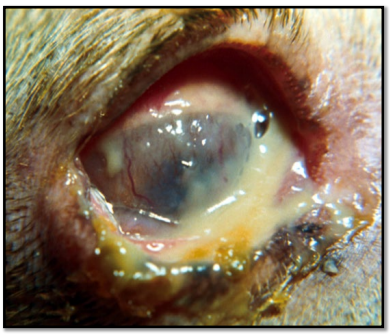
hydrocortisone if we've got a really mild case of it. And in some dogs, we'll try treating them maybe a little bit long term. Usually, we're going to start with a topical steroid to quiet everything down. But we could use a topical antihistamine for a little bit longer period of time once we get the disease under control. Over-the-counter products that are available. Things like Alaway or Pataday would be appropriate.

Keratoconjunctivitis sicca (KCS)

VetPrep

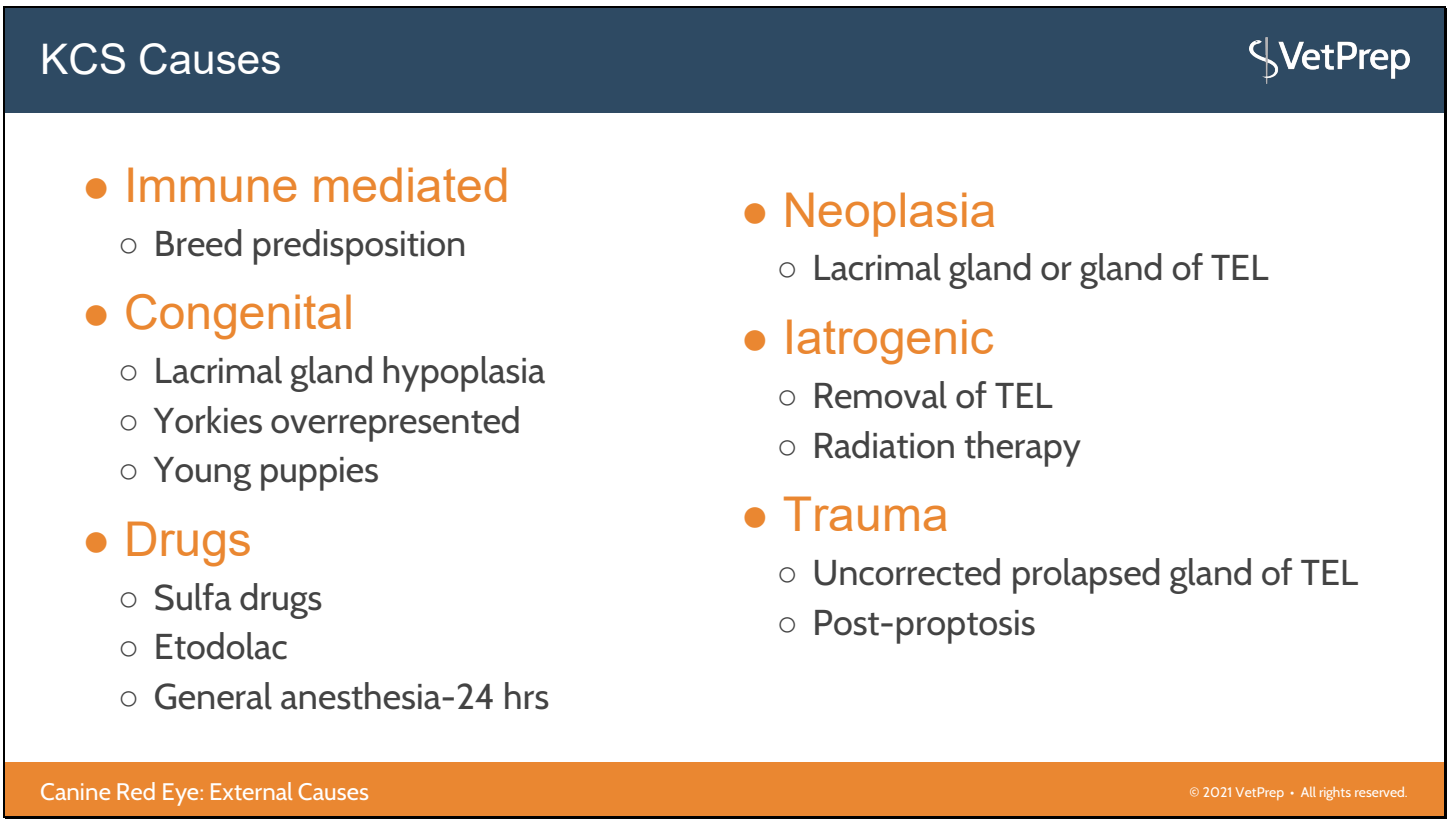
- Dry eye disease
  - Affecting ~1%
- Clinical signs
  - Conjunctival hyperemia
  - Mucoid/mucopurulent discharge
  - Corneal pigmentation/fibrosis
  - Dull appearance
  - Corneal ulceration
  - Secondary bacterial conjunctivitis





Canine Red Eye: External Causes

So next, I want to talk about dry eye disease or keratoconjunctivitis sicca. This is a fairly common disease that we see in dogs, and it's been reported to affect approximately 1% of the population. We've talked about this a little bit. The way we diagnose KCS is through using this year Schirmer tear test. Again, normal values are 15 millimeters of wetting per minute or greater. And between 10 and 15 is that gray zone, and then less than 10, I'm almost always going to diagnose them with keratoconjunctivitis sicca. So besides looking at our Schirmer tear test value, there are a lot of clinical signs that can also give us a hint that this patient has dry eye disease. Or in that case, when the tear production is that in the gray zone, we might look at these different clinical signs and still be able to diagnose them with that disease. So most of the time, these dogs are going to have a red-looking eye. They're going to have conjunctival hyperemia. They may have some blood vessels or some pigment. Maybe a little bit of scar tissue on their cornea. They may have a corneal ulcer that's present. A lot of times, they'll have this mucoid or gray discharge, but if they have a secondary bacterial component, that discharge will change from that gray appearance to something like what we see in the bottom photograph here where it looks more mucopurulent. The surface of the cornea will also look very dull and dry. So it doesn't have that nice glistening shiny appearance like most of our dog's eyes have.



When we look at different causes for KCS, by far and away, the most common cause is an immune-mediated attack of the lacrimal glands. So this is definitely a breed-related disease. So we see this in a lot of different breeds. It would be impossible for me to list all of them for you right now, but the most common breeds that we see it in are generally are small breeds. So we see it in Bulldogs, Bulldogs, Bulldogs. We see it in Pugs. We see it in Pekingese, West Highland White Terriers, but there's, again, a long list of breeds that are predisposed.

So the majority of the cases that you diagnose are going to be immune-mediated, but it's also important to keep in mind that there are a couple of other things that can cause dry eye disease.

So congenital KCS is one thing that I wanted to mention, because this has a very different signalment. So it's generally a very young animal. So for me, I usually see these dogs as puppies. So they're usually four months old, five months old, usually less than a year. And the common history is that their eye has always looked like this ever since they got the dog from the breeder. Usually, the breeder will send them home with a tube of ointment telling the owner that they have an eye infection. And the dog will have a waxing and waning discharge from the eye. It'll do a little bit better when it's on the ointment, and it's going to do worse when it's off of it. Usually, these cases have an absolute KCS, so the tear production is going to be zero. And there are certain breeds that are overrepresented, and by far and away, the most common are Yorkies.

The reason why it's important to be able to diagnose congenital KCS is that our treatment plan is a little bit different. This type of KCS rarely responds to topical drugs to help increase tear production. Doesn't mean that we shouldn't try it because it would be great if I were wrong and it wasn't due to congenital KCS and they responded, that would be fantastic. But oftentimes, these dogs are candidates for a parotid duct

transposition where we actually take the parotid duct from the mouth and we reroute it to the lower eyelid so every time the dog salivates, now they're going to lubricate their cornea. That's always a last treatment option for any type of KCS. So it's only used for when we've exhausted our medical therapy.
There are certain drugs that we can prescribe as veterinarians that can cause dry eye disease. So sulfa antibiotics will cause a reversible dry eye disease. I think it's important to have that talk with owners when you start them on TMS., that while it's a great antibiotic, it treats a lot of different bacterial infections, it has a rare side effect of causing dry eye disease. You don't want to scare them into not using the medication, but you want to make them aware at the same time that their dog could have this complication. So if they notice any squinting, any discharge from the eye, if the eye looks different in any way, they probably should stop that antibiotic and give you a phone call. And it's important for you to remember that if this happened once to a patient, if they had this reaction to a sulfa drug, it's going to happen again when they're on a sulfa drug again. So that patients should never be placed on that drug again.
This is also probably a good time to take a baseline Schirmer tear test value in that patient before you start them on sulfa drugs. EtoGesic or etodolac is an oral nonsteroidal that's commercially available for dogs. I don't think it's used as frequently now as it had been in the past. This is the opposite of sulfa drugs. So while we can get a dog to recover their tear production after they've been on a sulfa antibiotic, we cannot do that after they've been on EtoGesic. This generally causes an absolute permanent KCS. So very different scenario.
I put general anesthesia on this list, but it really truly doesn't cause dry eye disease. The reason I put it on here was for you to be aware of the fact that whenever we administer general anesthesia, we know that that tear production can be abnormal for up to 24 hours after. So the reason why that's important is if you have an animal that already has dry eye disease, it's important to lubricate them a little bit more frequently for that first day post-general anesthetic. But it's also an important reminder for us as veterinarians not to take the Schirmer tear test value after they've just recovered from general anesthesia. If you take a Schirmer tear test value and you get a normal number, fantastic. That's great. We can believe that normal number. But if you measure their Schirmer tear test value and you get a value of 6 or 7, we don't know what to do with that. Is it 6 or 7 because they've had a general anesthetic or is it 6 or 7 because that's really their resting tear production? So it's important to keep that in mind. Ideally, measure the Schirmer tear test value if you're going to in a patient before you anesthetize them.
Other causes of dry eye disease, although less common than the things we've already talked about would be neoplasia of the glands that produce the aqueous portion of the tear film. As veterinarians, we can also cause dry eye disease, not just by administering sulfa drugs or EtoGesic, but if we remove the third eyelid or if we remove the gland of the third eyelid, that can predispose them to developing dry eye disease. The dogs that developed cherry eye as an abnormality are also the same breeds that we see for dry eye disease later in life. So it's important not to remove a prolapse gland of the third eyelid.
Radiation therapy is also another cause of dry eye disease. And we could also see it with trauma, so an uncorrected cherry eye or post-proptosis.

KCS Causes

VetPrep

- Systemic metabolic diseases
  - Diabetes mellitus
  - Hypothyroidism
  - Cushing syndrome
- Infectious
  - Canine distemper
  - Leishmania
- Debilitation/dehydration
  - Transient

There are also some systemic metabolic diseases that can make a patient a little bit more susceptible to developing dry eye disease. For example, diabetes, Cushing's syndrome, as well as hypothyroidism. Infectious causes, although you would never diagnose a dog with KCS and turn around and think, boy, I wonder if you have an infectious disease. It's usually the other way around. It just fits with their other systemic abnormalities that we can see with canine distemper or Leishamania, and of course, animals that are severely dehydrated can have a transient decreased tear production.

KCS Causes

VetPrep

- Neurogenic KCS
  - Parasympathetic loss CN VII
  - Ipsilateral dry nose

- Neurotrophic KCS
  - CN V-ophthalmic branch
    - Decreased corneal sensation
    - Decreased tear production

Canine Red Eye: External Causes

And then there are two neurologic diseases that we can see with KCS. Neurogenic KCS is a loss of the parasympathetic innervation to the lacrimal land, and it also causes an ipsilateral dry nose. That's really how we diagnose this condition. And that happens because the parasympathetic nervous system innervates the lacrimal gland, but it also innervates the nasal gland, which helps keeps that nasal mucosa nice and moist.

We can also see KCS when we've got problems with cranial nerve V, the trigeminal nerve. So if an animal can't sense or feel their cornea, they're going to have a reduced tear production.

KCS Treatment

VetPrep

Drug	Category	MOA	Frequency	Misc.
Cyclosporine	Lacrimostimulant	T-cell inhibitor	BID-TID	Optimmune® Compounded 1 or 2%
Tacrolimus	Lacrimostimulant	T-cell inhibitor	BID-TID	Compounded 0.02 or 0.03%
Artificial tears gel/ointment	Lacrimomimetic	Substitute for tears	PRN	Optixcare GenTeal Severe Formula
Topical antibiotic	Treats secondary bacterial infection/overgrowth		TID-QID pulse therapy	

Canine Red Eye: External Causes

So before we talk about treatment for KCS, I just want to mention that when you're having this communication with your client, it's really important to set their expectation where it should be. Every other disease that you've probably treated in their dog, you've put them on antibiotics for two weeks or three weeks or maybe you've done a short course of pred for something, but they know that there's always an end in sight. That is not what's going to happen when we're treating dry eye disease. Most of the time when we initiate therapy for dry eye disease, it's going to be lifelong. So it's important to have that discussion with them right at the very beginning when you make that diagnosis.
It's also important to let them know that the drugs that we're going to start them on, cyclosporine or tacrolimus, sometimes it can take several weeks, sometimes even up to three months before we can see a response. So again, you're just setting the bar where it should be so when they come back to you they're not disappointed if the tear production hasn't increased dramatically in the first couple of weeks.
So usually when we treat KCS, there are several different drugs that we're going to administer, and there are usually three different things. So I'm going to put them on something to increase tear production, either cyclosporine or tacrolimus. Put them on an artificial tear product, as well as a topical antibiotic, at least initially when I first diagnose them with dry eye disease.
So cyclosporine is available as an ointment which is 0.2% cyclosporine in Optimmune. That's the FDA approved drug, and that's actually what you should start most of your patients on. If they have a very severe form of dry eye disease or if an animal doesn't tolerate Optimmune or an owner has difficulty administering an ointment versus a drop, you can have a compounded in either 1% or 2% solution.
Tacrolimus is a compounded medication. Tacrolimus is a lot stronger than cyclosporine, so we'll use a 0.02% or a 0.03% solution, two to three times a day as our normal treatment plan. When I recommend

an artificial tear product, I like to give them something specific in mind. So I recommend Optixcare. That's something if they have an Amazon account that they can order or if they happen to go to any drugstore Walmart, Target grocery stores that carry eye products, I'll tell them to get Genteal Severe Eye formula.

Neurogenic KCS Treatment

VetPrep

Drug	Category	MOA	Frequency	Misc.
Pilocarpine-topical	Lacrimostimulant	Direct acting parasympathomimetic	BID-TID	Compounded 0.1%
Artificial tears gel/ointment	Lacrimostimulant	Substitute for tears	PRN	Optixcare GenTeal Severe Formula
Topical antibiotic	Treats secondary bacterial infection/overgrowth		TID-QID pulse therapy	

When we're treating neurogenic case, it's a little bit different. So we're going to start them on something that increase their tear production by administering a direct-acting parasympathomimetic drug, so pilocarpine. Pilocarpine is becoming more difficult to obtain from human pharmacies because it's not being used as often in human ophthalmology, so we oftentimes will have this drug compounded in a very weak formulation so 0.1%.
In the past, we used to administer pilocarpine orally to patients, and I think that can be a little bit risky. For example, there have been some deaths that have been associated with the use of oral pilocarpine particularly in small patients. Again, we also need an artificial tear product, as well as a topical antibiotic where we're treating neurogenic KCS.

Corneal Ulcers

VetPrep

Canine Red Eye: External Causes

So next, we're going to shift gears, and we're going to talk about corneal ulcers. There are several different questions that we need to ask ourselves when we're faced with a corneal ulcer.

Corneal Ulcers

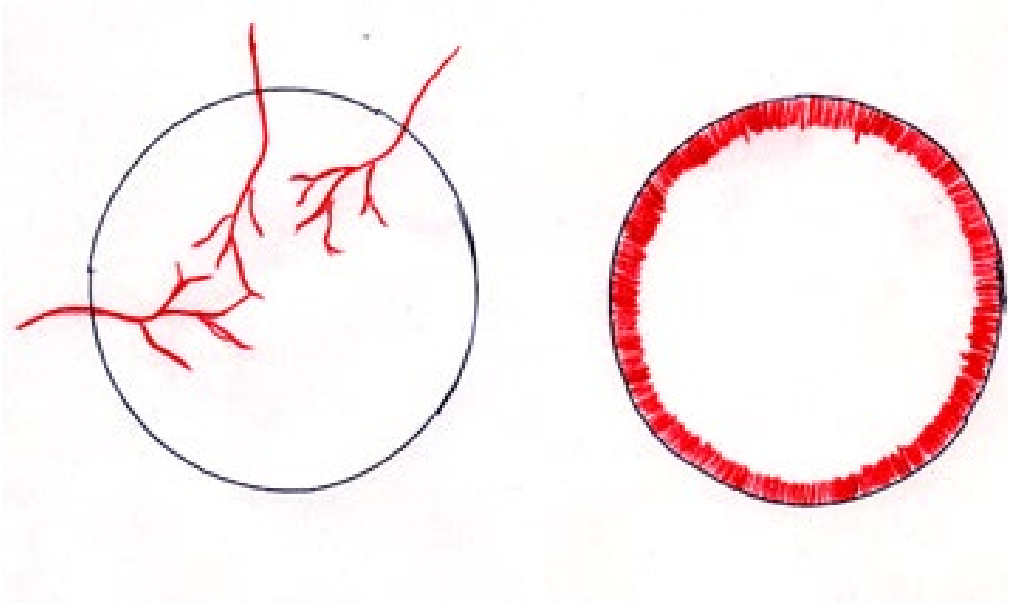
VetPrep

- Superficial or deep?
- Infected?
- Perforated?
- What caused the ulcer?
- How am I going to manage this ulcer?

Is it superficial or deep? Is it infected? Has the ulcer already perforated? And then we need to decide is there something that's underlying that causes ulcer? And then we need to decide is this something we want to manage medically or is this something we should refer for a surgical procedure?

Superficial or Deep?

VetPrep



Canine Red Eye: External Causes

So the vascular pattern can give us a really big hint if it's superficial or deep. So we've talked about this before when we talked about the blood vessels that grow into the cornea. The superficial blood vessels will come in just towards the area of interest. So in general, that's going to occur more often with a superficial ulcer. A deep infected ulcer is usually going to recruit blood vessels from 360 degrees around. So we're going to see that very different vascular pattern.

Corneal Ulcers

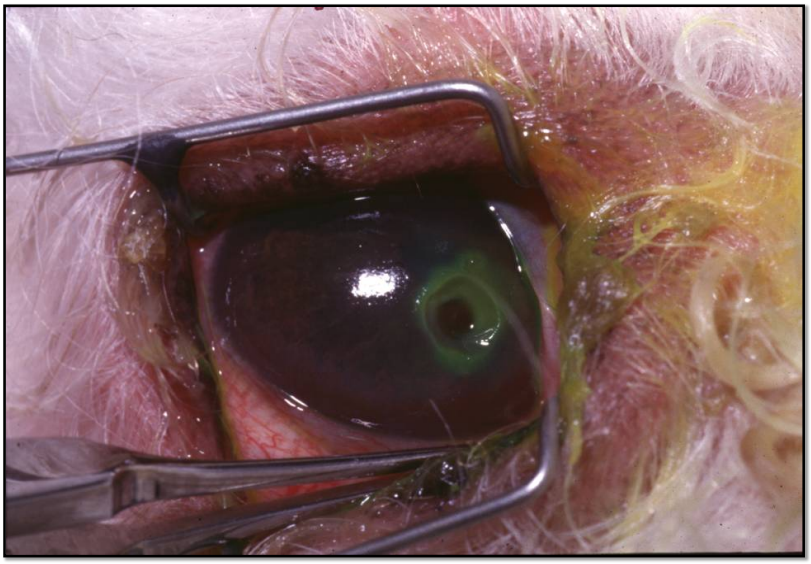
VetPrep

Canine Red Eye: External Causes

This is an example of a dog that's got a superficial corneal ulcer, and you can see those fine branching blood vessels that are coming just to the area of interest. The best way to be able to tell if something is superficial or deep is really not just relying on the vascular pattern, but using your own eyes. Do you see a divot or a crater in the cornea?

Corneal Ulcers

VetPrep



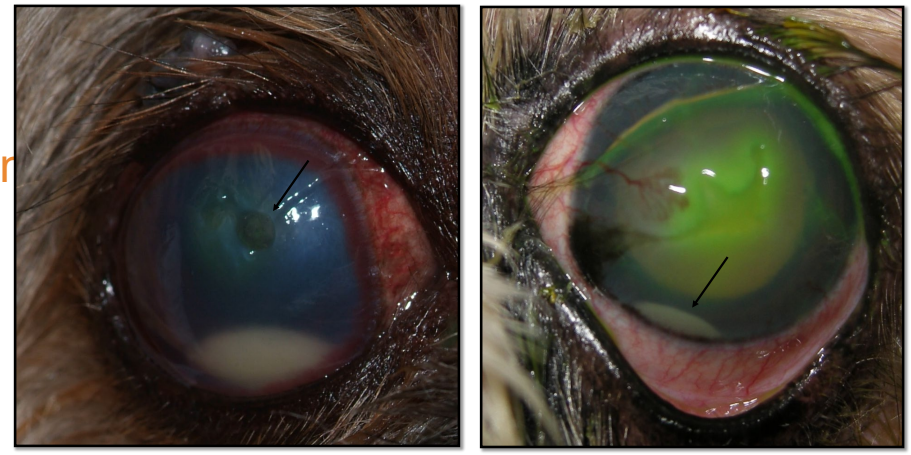
Canine Red Eye: External Causes

So for example, this is a dog that has a descemetocele that's been stained. Fluorescein is only going to stain the stroma. So that's why we get this donut or ring-like appearance. It doesn't stain the epithelium or descemet's membrane, but you can tell when we look at this photograph, that there's actually a divot or a crater in the cornea.

Signs of Infected Corneal Ulcer

VetPrep

- Depth!
- Cellular infiltrate
- 360° vascularization
- Corneal melting
- Hypopyon
- Pain



Signs of an infected ulcer. This is something that is really, really important. This is where you, as a veterinarian, can have a huge impact on how this case is going to go. I don't mean to say that every infected ulcer that you diagnose, if you diagnose it early enough is going to go well. But you're going to have a much better chance if you can tell that's infected right from the start because our treatment plan for a noninfected versus an infected ulcer are very different.

So clinical signs of an infected ulcer include depth. A corneal ulcer has to be infected if there's any depth at all. That doesn't mean that a superficial ulcer can't be infected. We need to look for those other clinical signs, but if it's deep, it's absolutely infected.

Other signs of infection include hypopyon. We've got an example of that in both of the eyes on the slides. We've got purulent material in the anterior chamber. We can have corneal melting or a malacia where it's soft or jiggly in appearance.

Again, they have the 360-degree vascularization. If we have any cellular infiltrates, if the bed of the ulcer looks yellow or white, that again is another sign of infection.

Signs of Infected Corneal Ulcer

VetPrep

- Depth!
- Cellular infiltrate
- 360° vascularization
- Corneal melting
- Hypopyon
- Pain

This is just another example of an infected deep corneal ulcer. We've got a ring of blood vessels coming 360 degrees around. And you can tell by looking at this photograph. Even though you're not looking at the patient in front of you, but you can tell that there's a divot or a crater right in the center of the cornea.

Perforated Corneal Ulcer

VetPrep

- Fibrin plug
- Uveal prolapse
- Hemorrhagic clot

If the ulcer has already been ruptured, there's going to be something usually plugging the hole. It's not going to be just a clear hole. You're not going to be staring into the anterior chamber. It's going to be plugged either with iris, and I've got an example of that in the slide here. That's what all that brown material is. Or it could be a fibrin or hemorrhagic clot that's filling that area. I always hate it when an owner calls me and we've been managing a deep ulcer medically, and they call me and they say, oh, it looks great today. It's actually bulging forward. And it's never a good thing. It usually is not going to heal by having something bulging forward. That usually is an indicator to me that it's probably ruptured.

What Caused the Ulcer?

VetPrep

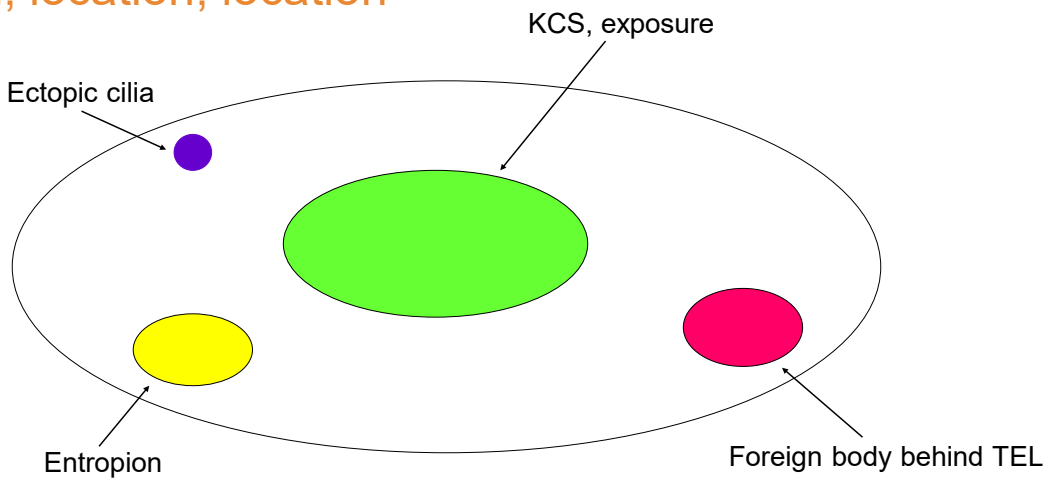
- Trauma
- KCS
- Eyelash disorders
- Exposure
- Foreign body

So in every case of a corneal ulcer, we should always look for a cause for the ulcer. But keep in mind that the majority of the time, we're not going to be able to sort out what caused this ulcer. It's important to look for it though, because if we don't address that underlying cause, we're never going to get that ulcer to heal or it's going to be recurrent.

What Caused the Ulcer?

VetPrep

- Location, location, location

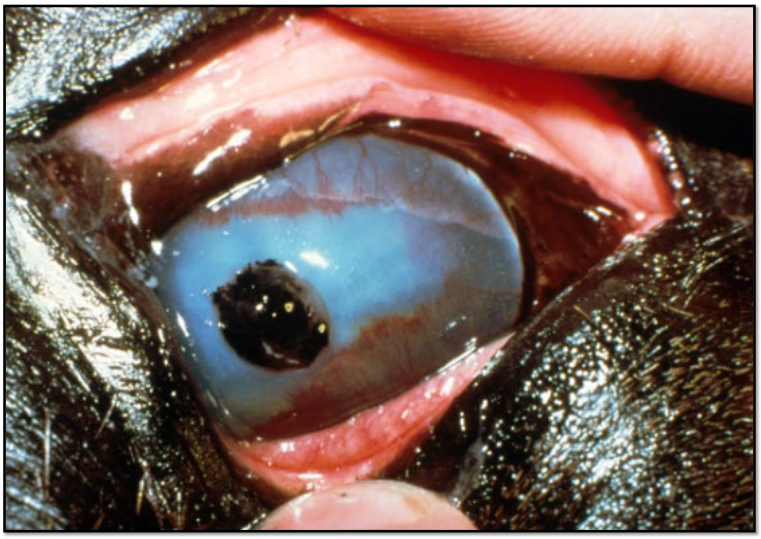


The location of the ulcer can sometimes give us a really big clue as to what caused the ulcer. So KCS or exposure, for example, an animal that was undergoing anesthesia that maybe didn't have enough ocular lubricant placed, that ulcer is usually going to occur right in the center of the cornea. If we've got a foreign body behind the third eyelid, the ulcer is going to be ventromedial. Ectopic cilia are usually these tiny little circular ulcers, and they're usually at the upper part of the cornea because that's the most common spot for an ectopic cilia, but it could be along the lower part of the ectopic cilias on the lower eyelid. A typical history with an ectopic cilia is that they had an ulcer, and then you've placed it on, let's say, Neo-Poly-Bac for a few weeks and it's healed. And a few weeks later, it's going to come back. Maybe then somebody else in your practice saw it and change the antibiotic to gentamicin. It's going to heal again, and then it's going to come back a third time. The reason why it keeps healing and then recurring is that the ulcer is only going to be present when that hair is there, and it's just like a hair anywhere else in the body. It's going to go through all those different stages. When that hair falls out, the ulcer is going to heal. And when it starts to grow again, it's going to recur. Entropion is going to occur again, either on the upper or the lower portion of the cornea depending on if it's the upper or the lower eyelid that's affected.

Corneal Foreign Body

VetPrep

- Plant material
- Superficial
  - Cotton swab
  - Irrigation



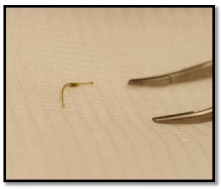
Iowa State University

Corneal foreign bodies are a great way to get a corneal ulcer. This is an example of one that's been there for quite some time. We've got a lot of blood vessels that have grown in. It's important to keep in mind that these blood vessels don't start to grow in until usually three to five days after the insult, whether it's an ulcer or a foreign body that's present, and they grow about a millimeter a day. The reason why it's important to keep that in mind is you can give owners a rough idea of how long that ulcer has been present. So when they bring that dog to you right from the groomer, and they notice that he's got this deep ulcer and they think that had happened at the groomer's office, you can reassure them or attempt to reassure them that this did not happen because of something that occurred at the groomer's.
It's actually been there for a week or longer. Most of the foreign bodies that you're going to see are these tiny little seed hulls, and they're fairly easy to remove. Just put some topical anesthetic on the eye and you can use either a small forceps or a cotton swab and simply pull them off. Sometimes they're suctioned on there a little bit, so it may take a little bit of effort to remove them. You can also irrigate them and have included in your reference list a paper by Amber Labelle that goes over how to perform that for me. I tend to use either small forceps or a little cotton swab because I find that a little bit faster to deal.

Corneal Foreign Body

VetPrep

- Plant material
- Superficial
  - Cotton swab
  - Irrigation



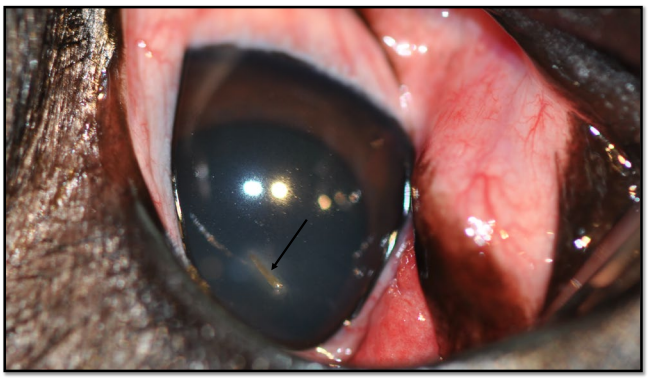
Canine Red Eye: External Causes

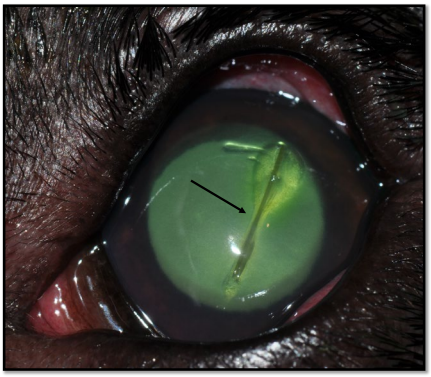
You can also see other types of plant material other than the seed hulls. The arrow is pointing towards this tiny little piece of vegetative material that's embedded in the upper conjunctiva and every time the animal blinks, it's sweeping across the surface of the cornea leading to an ulcer.

Corneal Foreign Body

VetPrep

- Deep foreign body
  - Referral





Iowa State University

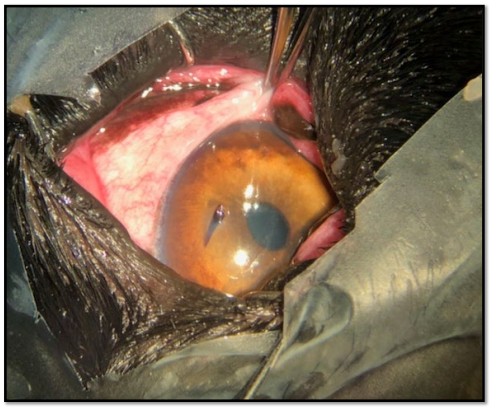
Canine Red Eye: External Causes

And we can also see deep foreign bodies as well. Usually, these are probably best handled if possible if the owner is amenable to referral to an ophthalmology practice because some of these will require surgical removal. This is an example of one that was removed using a small little needle. Sometimes we have to make an incision over the top of the foreign body in order to remove it.

Corneal Foreign Body

VetPrep

- Deep foreign body
  - Referral

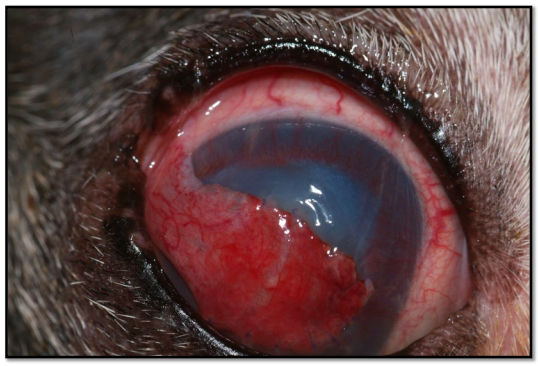


Most of the foreign bodies that we see are not penetrating, but every once in a while, we'll get surprised. So this is an example of a thorn that's embedded into the cornea. And of course, on the right, we've got a dog that's tangled with a porcupine. These really ideally should be referred because once we remove the foreign body, we have to close the wound primarily.

Corneal Ulcer Treatment

VetPrep

- Medical therapy
  - Noninfected ulcer
  - Infected ulcer
- Surgical therapy
  - If greater than ~50% depth or severe infection
  - Conjunctival graft, corneoconjunctival transposition, corneal transplant, amniotic membrane graft



Canine Red Eye: External Causes

So next, let's talk about medical therapy for corneal ulcers. We're going to talk about how we treat a noninfected ulcer, as well as how we treat an infected ulcer. And again, this is where you, as a veterinarian, can make a huge impact on the outcome of this case by recognizing that it's infected and setting them on the right course of therapy.

Surgical therapy is reserved for ulcers that are generally about 50% depth or more or if they have a very severe infection. So ideally, if an owner is amenable to referral, this would be a good time to refer them for potential surgery. A conjunctival graft is probably one of the more common procedures that we do to provide some tectonic support to the ulcerated area, but it also brings in a blood supply in order to get it to heal.

There are certain cases that you're going to see in practice where probably medical therapy or a surgical therapy by an ophthalmologist is not something that's going to be in the best interest for that pet. So if we have a horribly infected corneal ulcer or if we have a very large perforation, really sometimes the best thing that we can recommend for them is enucleation. And that can be a really hard discussion with some owners.

I've had owners burst into tears in the exam room because we're talking about removing their pet's eye, and that's really not at all what they thought we were going to recommend. So I usually try to give them enough time to calm themselves down explain to them that I know this isn't something that they wanted to have happen, but really emphasize that we can make their pet feel better by doing the enucleation. And honestly, dogs don't care if they have one eye, two eyes, or three eyes, it doesn't matter to them. They're really going to be much happier if we can get them over this painful condition.

Superficial Corneal Ulcer Treatment

VetPrep

- **Broad spectrum antibiotic**
  - Neomycin/bacitracin/polymyxin B ointment
  - Neomycin/bacitracin/gramicidin solution
  - Tobramycin 0.3% solution
  - Treat TID to QID
- **Mydriatic therapy**
  - Treat "reflex uveitis"
  - Decrease pain
  - Topical 1% atropine (SID to BID)
  - Contraindications-KCS, glaucoma

Canine Red Eye: External Causes

So for treating a noninfected superficial corneal ulcer, we need a topical antibiotic, usually just three to four times a day. Our goal is prophylactic. We want to prevent it from getting infected. So we can use NeoPolyBac. We could use NeoPolyGram, which is a solution, tobramycin. The one thing that I would really advocate is for you not to use what I'm going to call a bigger gun. So I would avoid using a topical fluoroquinolone. Avoid using something like chloramphenicol because we're just going to be asking for a resistant bacterial population to generate. So it's important not to use those big guns on a noninfected ulcer. We're almost always going to recommend using topical atropine to treat reflux uveitis. That's going to paralyze the ciliary body, which is what spasms are causes, and the animals become uncomfortable. When they have a corneal ulcer, usually will treat once or twice a day with atropine. The exception to that would be dogs that have an inappropriately low tear production or animals that have dry eye disease and also animals that have glaucoma. Because if we give them atropine and we dilate the pupil, we're going to decrease aqueous humor outflow even further and increase their IOP.

Superficial Corneal Ulcer Treatment

VetPrep

- Analgesic/anti-inflammatory therapy
  - Systemic NSAIDS
  - Opioids
  - Gabapentin
- Prevent self trauma
  - Elizabethan collar!!!!

It's important to recommend pain medication as well. So depending on the patient, we might use a combination of these medications or maybe we'll just use a single one. So systemic NSAIDs, opioids, and gabapentin are all arsenals that we have available to make animals feel better. And it's also important to recommend an E-collar. I can't tell you how many times I've had owners tell me my dog doesn't like an E-collar, my dog won't wear an E-collar. I have found that to be true very rarely. I've only had maybe one or two dogs that I can remember in the last 20 years of doing ophthalmology where the patient really truly didn't tolerate wearing an E-collar. Usually, it's more of an owner issue. So I tell them that it's important to wear an E-collar because I don't want them to rub at it. That makes it easier for it to get infected and harder for us to get this ulcer under control, if they're going to rub at it. The type of E-collar that we prefer are these really hard, sort of rigid, plastic cones. And it should extend just beyond the extent of their nose so they can't rub their eye.

Cone of Shame

These are some examples of inappropriate cone of shame. The dog on the left is something that actually came to me. He had a corneal also in his left eye. And you can see easily, even though he's wearing this kid floatie around his neck. He can easily still rub that eye. He can rub it on furniture, rub it on people, so we replaced it with a hard cone. Same thing with the soft flexible collars or these little inflatable cones that go around their neck. Ideal for other things in veterinary medicine, but really not appropriate for most of our ophthalmic diseases.

Superficial Corneal Ulcer Treatment

VetPrep

- Recheck in 5-7 days
- If the ulcer has not healed
  - Change the diagnosis...not the antibiotic!!
- If the ulcer has not resolved
  - Underlying cause
  - Ulcer is infected
  - SCCED (indolent ulcer)

So for a superficial corneal ulcer, generally, we're going to recheck them in five to seven days. If everything is normal, all ulcers should heal usually in a week or less. If that ulcer has not healed, this is not a good time for us to change our antibiotic therapy because our antibiotic actually is not doing anything to help this ulcer to heal. It's actually just there to prevent infection. In fact, any antibiotic that we put on the eye is actually probably going to slow down wound healing, not only the drug itself, but also the preservatives that are present in that product. So it's important for us to change our diagnosis, not the antibiotic, if that ulcer hasn't healed by that first recheck. If the ulcer hasn't healed within a week, I'm usually going to look for an underlying cause. Maybe I missed it. Maybe this dog did have an ectopic cilia, or he's got a small foreign body behind his third eyelid. Maybe he's got the inability to blink or he's got dry eye disease. Something else is going on that's causing this ulcer not to heal properly. Maybe the ulcer is infected and I missed it on the first visit or maybe it became infected between that first visit and the first recheck, or maybe the dog has an indolent ulcer. That's another reason for it not to heal in an appropriate amount of time.

Infected Corneal Ulcer Treatment

VetPrep

- Antimicrobials-cytology/culture
  - *Pseudomonas aeruginosa*
  - *Streptococcus* spp.
  - *Staphylococcus* spp.
  - Ofloxacin AND tobramycin or 5% cefazolin
  - q1 to q2 hr initially
  - Ophthalmic solution

Canine Red Eye: External Causes

So when we talk about treating an infected corneal ulcer, our treatment is definitely going to be different than our prophylactic treatment of a noninfected ulcer. We're worried about certain organisms. Pseudomonas, Staph and Strep are probably the three most common types of organisms that we're going to see in an infected corneal ulcer in a dog.

Usually, my empiric therapy before I get my culture and sensitivity back if we were able to submit one for that patient is going to be a topical fluoroquinolone, so either ofloxacin or ciprofloxacin. And I'm usually going to combine it with something else, depending on the case. So it really depends on the severity of the case. If I see rods in my cytology, I'm probably going to choose an aminoglycoside like gentamicin or tobramycin.

If I see cocci, I'm going to be thinking maybe it's a Staph or a Strep infection. And I'm going to use something good for gram-positive organisms like 5% cefazolin. And that's something that you can compound in your practice from the IV powder using artificial teardrops to dilute it.

It's important to recommend treating every one to two hours initially when we diagnose an infected ulcer, and this can be difficult for a lot of owners. And I think this is a time as a veterinarian we need to be empathetic towards their feelings and their lifestyle as well. It would be really difficult, in fact, it's impossible for me to treat my own dog every one to two hours because I work for a big portion of the day. So I think we have to help owners find a solution to that problem. The one thing I would encourage you not to do is if an owner says, oh, wow, every one to two hours I can only treat three times a day, I think it's really important for us not to then back down and say, OK, three times a day, let's try that and we'll see you back in a week because I can tell you how that's going to go. It's probably going to go pretty horribly. So it's important to find other alternatives. The one thing you could offer is for them to maybe drop off at

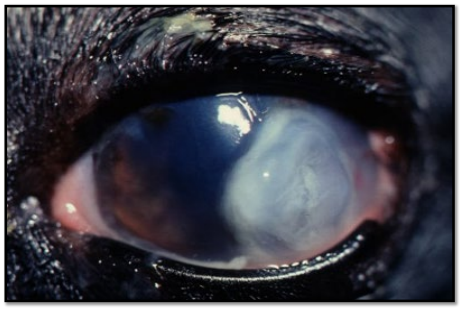
your clinic every morning and you can hospitalize the dog for the day and, of course, charge an appropriate fee for that. And you or your staff can medicate that patient every one to two hours. When they go home, then the owners can take over it. Sometimes I'll talk to owners about giving two or three drops in the morning. If someone can come home at lunchtime, and then again starting up again when they get home. If there are multiple people in the house, maybe everyone could set their alarms on their phone for different hours and everybody can share in the medication treatment plan. You can see if they have neighbors or friends that could stop by and treat during the day when they're at work. Maybe you've got a medical boarding facility in your area that might be able to do some of the treatments during the daytime as well. And at the end of the day, usually what I will tell owners is just to do the best that they can. I understand it can be hard when they've got a work schedule. They've got children. They've got a lot of other things going on in their life, but this is a time when we really need to encourage them to treat very frequently because it's going to make a huge difference in the outcome.

It's important to use an ophthalmic solution rather than an ointment because the petrolatum base in the ointment can be irritating if it gets inside the eye. So if we've got a deep infected ulcer, if that ulcer happens to rupture, we don't want to get that base inside the eye.

Infected Corneal Ulcer Treatment

VetPrep

- Anticollagenase agents
  - Autologous serum/plasma
    - Treat q1 to q2 hr initially
    - Keep refrigerated up to 2 weeks
  - Others: EDTA, N-acetylcysteine, ilmostat, tetracycline
- Topical atropine 1% (SID or BID)



Canine Red Eye: External Causes

This is a time when we also use something that's going to prevent melting, so a product that has anticollagenase and antiproteinase activity. So usually, we'll use topical serum or plasma. We can draw blood either from that patient or in some cases and in fact, most of my cases, I tend to get blood from somebody else, especially if I'm treating a small dog with a deep, infected ulcer. The last thing I want to do is try to draw blood from them as sterilely as possible. I think it's easier to get it from another patient. Here at K-State, we tend to use equine serum on our dog and cat ulcers. So you can use serum from different species on your canine patients. Just like topical antibiotic therapy, we need to be very aggressive with our anticollagenase therapy. So we usually treat them at the same frequency as our antibiotics. So initially every one to two hours. Once we draw that serum, we can store in the refrigerator for up to two weeks as long as it stays nice and cold. So if the owner takes it out and they leave it out overnight or if they leave it on the dashboard of their car, they should throw it away. Also, if it becomes contaminated. So if they touch the dropper bottle tip or the syringe tip to the surface of the eye or the skin or they drop it on the floor, you should recommend that they discard that and come back for another source of serum.

There are other things on the list that can also be anticollagenase, which are used a lot less commonly, for example, topical tetracycline. It's really only available commercially in an ointment form, so not appropriate to use for an infected ulcer, and topical EDTA and acetylcysteine are topically irritating, so not used very commonly. Just like a noninfected ulcer, we're also going to recommend atropine therapy with the same caveats. We don't use it for dry eye disease or glaucoma patients.

Infected Corneal Ulcer Treatment

VetPrep

- Oral antibiotics
- Oral NSAIDS/opioids/gabapentin
- ELIZABETHAN COLLAR AND RESTRICT ACTIVITY!
- Recheck in 24 to 48 hours

And we also are going to use oral antibiotics. That's something that's different from treating a noninfected ulcer. So we'll put them on either Clavamox and enrofloxacin as long as their body size is appropriate and the owners can afford it because as you know can be quite expensive for a larger dog. Oral antibiotics are good for an infected ulcer because they usually have blood vessels that are growing into the cornea. So we can have a source of antibiotics from the bloodstream. We can also have those oral antibiotics will get into the tear film, so they'll bathe it from the front of the eye, but they'll also get into the aqueous humor so it can bathe the ulcer from the back side of the cornea as well. Just like with a noninfected ulcer, we need some pain control, as well as an Elizabethan collar. And we usually tell owners to restrict the activity so no tight neck leads. We'll have them place a harness on if possible. Really only going outside to go to the bathroom. No roughhousing, no running, jumping things like that. And ideally, we want to recheck these patients usually within one to two days to see how they're doing.

SCCED

VetPrep

- Spontaneous Chronic Corneal Epithelial Defects
- Boxers
- Middle/older age dogs
- Chronic
  - Weeks to months
- Epithelial lip

Next, we're going to talk about a certain type of ulcer. This is called an indolent ulcer. It's also been called SCCED, which stands for spontaneous chronic corneal epithelial defect. This type of ulcer is most common in Boxers, but we can also see it in middle and older age dogs of really any breed. Usually, this ulcer has been there for several days, maybe weeks, sometimes even up to months before it's diagnosed. And the hallmark of this ulcer is it's got this loose epithelial lip.

SCCED

VetPrep

Canine Red Eye: External Causes

So this is an example of an indolent ulcer. And I've got a little black arrow that's showing that loose epithelial lip. So you can see a loose epithelial lip on a descemetocele or a deep, infected ulcer. That is not an indolent ulcer. By definition, an indolent ulcer is epithelial only. So it's very superficial. It's got this loose lip of nonadherent epithelium. When you stain at the center part, it's going to be bright green because we've got exposed stroma. And then the periphery of the ulcer is going to have this faint, hazy green because fluorescein is going to leak underneath that epithelial lip.

Corneal Debridement

VetPrep

- Topical anesthetic
- Dilute povidone-iodine solution
- Sterile eyewash

Canine Red Eye: External Causes

The key to treating this, we treat them just as we would for a noninfected corneal ulcers. Our treatment plan or our medical plan would be exactly the same, but we need to do something to encourage healing. So we'll apply topical anesthetic. We'll use a dilute povidone-iodine solution, usually a 1 to 50 dilution, as well as sterile eyewash to clean the eye. And then we'll take a cotton-tipped applicator and debride the cornea. When you're doing this, I use a sterile cotton-tipped applicator. And you have to put enough pressure on the cornea like you're erasing something on a piece of paper. And it's important to keep in mind that you cannot remove healthy epithelium. So if you're debriding this and the entire cornea peels away, that's OK. You need to do that you cannot physically remove healthy epithelium with just a cotton-tipped applicator. It is difficult for me to remove healthy epithelium with a blade when we're doing corneal surgery underneath the microscope.So you cannot remove healthy epithelium. So if it peels off, it needs to come off. But if while you're debriding this cornea, all of a sudden you realize, wow, this feels really soft or the ulcer is becoming a little bit deeper, then you need to stop because I'd be concerned that that ulcer is infected.

Grid Keratotomy

VetPrep

Canine Red Eye: External Causes

The other thing that we'll do to promote healing is a grid keratotomy or a diamond burr keratotomy. And this is a short video. This is actually on a cadaver. So the eye is going to be a lot softer than it will be in practice, but we're using a 25 gauge needle, and we're just scratching the surface of the cornea. You can see the person holding the needle is holding it relatively flat along the surface of the cornea. And we're just making this little grid-like pattern, but it really doesn't matter if it's a grid. What you're trying to do is just cause a little bit of scar tissue to form to allow that epithelium, when it grows across, to have something to hang on to it. By definition, these indolent ulcers have a problem with wound healing. That epithelial layer is going to migrate over the ulcer, but it can't heal down to the stroma. So this procedure will help encourage healing. This is something that you can do in practice always with topical anesthetic on board, probably with a sedative and maybe even a brief general anesthetic in an uncooperative patient. It's important to do this without the owner in the exam room. I would have them step out. This is something you need to do in a quiet place so the dog isn't looking around. You don't want a lot of barking dogs or cats making noise while you're doing this procedure. And this procedure, again, is only appropriate for an indolent ulcer. So if you have a Boxer in front of you that's had an ulcer for several weeks, it's superficial epithelial only, then I think you can be pretty confident that you're doing the right treatment. This should never be done on an infected ulcer. It should never be done on a deep ulcer either.

Grid Keratotomy

VetPrep

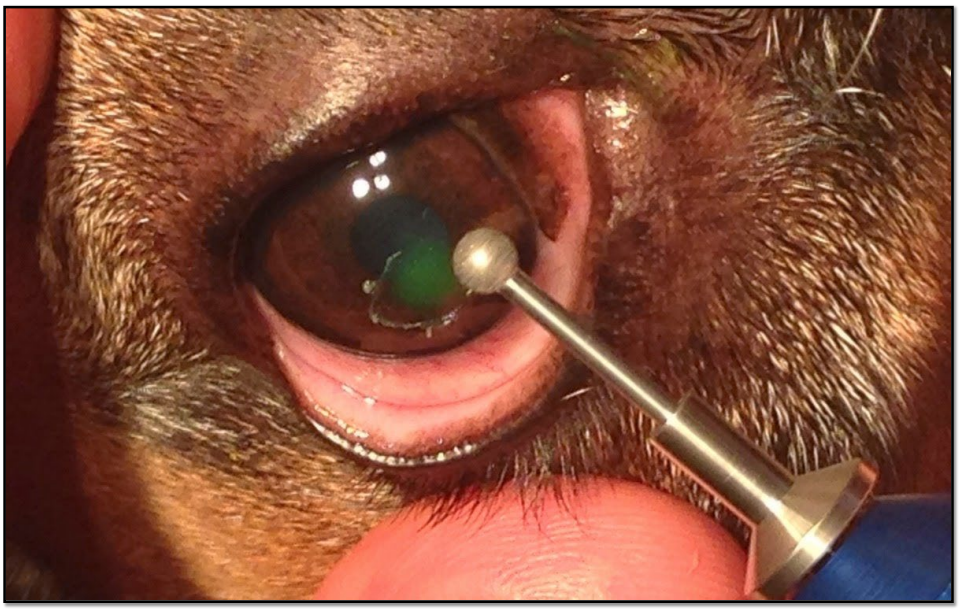
Purdue University

Canine Red Eye: External Causes

And this is how it should look when you're done with your grid keratotomy. You should just be able to barely see these tiny little lines that you've made in the cornea. What you don't want to see is that tissue flayed open, but you can see the tiny little scratch marks, and I've got a little arrow that's drawn to one. Oftentimes, these ulcers will have quite a bit of blood vessels that have grown into the area, so having a little bit of blood-tinged tears for a couple of days is actually normal.

Diamond Burr Keratotomy

VetPrep



Canine Red Eye: External Causes

This is just a picture of a diamond burr, which is something that most ophthalmologists will do to promote healing for an indolent ulcer. The healing success rate between a grid keratotomy and a diamond burr keratotomy is very similar. So the majority of them will heal with one procedure. Every once in a while, we'll have a patient that's a little difficult and we'll need to do a second or maybe even a third procedure. The goal behind doing a diamond burr keratotomy is exactly the same as the grid keratotomy, just causing a little bit of scar tissue to form on that anterior surface of the stroma to allow that epithelium to have something to grab onto.

SCCED Treatment

VetPrep

- Topical broad spectrum antibiotic (TID to QID)
- Topical atropine 1% (SID to BID)
- Elizabethan collar
- Oral NSAIDs/analgesics

- DO NOT DO A GRID KERATOTOMY IN CATS!!!!!!

And again, our treatment plan is going to be exactly the same, a topical antibiotic three to four times a day, atropine, Elizabethan collar to prevent them from traumatizing their cornea, pain control. It's also important to keep in mind that we do not perform a grid keratotomy in cats. When cats get an indolent ulcer, our treatment plan is going to be different for them because we know that it can lead to the development of a corneal sequestrum.

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Thank You!

VetPrep

Canine Red Eye: External Causes

And I would like to thank you for your attention.

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