Respiratory Disease in Chelonians

Dr. Mike Corcoran
LafeberVet Continuing Education Webinar

Dr. Mike Corcoran (00:00:00):

Good morning, at least in California it's good morning. I saw we have people from all over. I'm really impressed Poland. I saw in Chile and I saw Gordon is here from Florida, so depending on where you are, not good morning, but good day. Bueno Diaz, Nial, cia. I'm running out of greetings there, but I'm glad everyone could join us today. I really appreciate that. And we're going to be talking about respiratory disease and chelonians, so hopefully we'll have a really good discussion here and I welcome people to put questions in the session for each thing and we'll probably try and answer questions a couple of different spots depending on where things are and then have a good q and a at the end.

(00:00:48):

I just want to talk briefly about my general approach. I do not work in academia, I do not work in research. My practice has always been private practice, clinical medicine and I try to approach everything I teach as a very practical approach for that status and I don't want to get down into the weeds into a lot of things that are not going to matter when it comes to treating the animal and discussing treatment plans with owners. So that is generally how I approach things is if this is not going to make a difference for the patient, then it's probably something we're not going to get into very much. If it's just fun trivia, I enjoy fun trivia and I may mention some things that are interesting to me just because I'm nerding out, but I'll make a note that in actual practice when we're looking at the disease condition, does this make a difference in what you're going to do?

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No. And if it does not make a difference in how you're going to treat, then I don't delve into things a great deal on that. I try to make everything that we talk about something that actually approaches. I'm also going to recognize that there are some people here who are in very large specialty hospitals that have access to advanced techniques and people who don't. And I'm going to try and cover the things that can work for both of those approaches and know when to go to the advanced things or if you don't have access to those at your practice, when to refer. And I'm going to put a disclaimer in that I put in disclaimer for all of my reptile talks. There are a lot of different species of these animals and even when we're just talking about turtles and tortoises, there are hundreds of different species that are adapted to very different environments.

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Even in clinical practice there are dozens that you will commonly encounter in practice and there are a lot of subtle differences between the species that will matter and realistically in an hour when we're trying to cover all of these topics, I may mention some here and there, but there are going to be a lot that we're just not going to be able to cover. So knowing that the species and thinking about what environment they're adapted to and studying up on the care of new species when you encounter them is going to be an important part of this. And not everything we talk about is going to apply to every animal that you see and that's just the reality of sure, we see dozens of different breeds of dogs, but they are all the same species of animal. Cats are all the same species of animal turtles and tortoises are not the same species.

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Talking about that. We're going to start with talking about anatomy because there is some anatomy that will matter in clinical practice. But I like to start a lot of my reptile talks, talking a little bit about where they fall in terms of each other and we're going back to the evolutionary tree and I think that does matter a lot when we're talking about reptile and amphibian medicine because again, if we're dealing with a dog or a cat or a horse or a cow, a lot of them look very different, but they're essentially very closely related

animals. They're all the same species. But when we get into reptiles, that's not the case. And there are things that we can't make assumptions on that you might expect to be able to like if we are treating a respiratory disease in a turtle, can we pull information that we know from a study on an iguana?

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Yes and no. If we look at the phylogentic tree here and where turtles and tortoises sit in the evolutionary status of these species, you'll notice crocodiles are actually far more closely related to birds then they are to turtles and tortoises and arguably even snakes or squamates which are snakes and lizards are at least as closely related to birds as they are to turtles and tortoises. So we are taking a little bit of a stretch if we get information that is designed for an iguana or a bearded dragon and try and apply it to turtles and tortoises. Now they are much more closely related to mammals, so it's not useless information, but you need to recognize that you are taking a step away from those and consider the differences in anatomy and disease conditions that they're exposed to physiology and all of those factors that do make them different.

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And if you don't have a study that is primarily done in turtles and tortoises, at least recognize that you need to think about these differences. So let's talk about some of these differences. One of the most important things is going to be of course the shell that makes them unique and with regard to respiratory disease that has a lot of serious implications. So if we look at the carpus, the carpus is essentially a very rigid bone that is comprised of primarily fused ribs and then we have it connected in most species, very rigidly connected by the bridge to the plaster on When we're talking about respiratory disease, a few things that has to factor. Now we don't have a flexible rib cage like we do in mammals or even snakes and lizards or crocodilians. So where we allow the rib cage to expand during respiration with turtles and tortoises, we don't get that chest expansion from the flexible ribs because they're very rigid.

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We also don't get abdominal movement because the abdominal, so the coelomic organs that we would associate with the abdominal organs of a mammal are also encased in the same rigid structure which only has cranial and coddle aspects for some flexibility in there. The lungs are going to occupy usually the dorsal area under the carpus and the lungs are then attached to the visceral organ by various tendons. So gravity helps keep things in place. There is also a pretty good attachment to the carpus of the lung structure as well for most species. Again, there are some species differences here, but for the most part it's pretty rigidly cased. We do have some that have hinges in the plaster on and can expand a little bit that way. We do have some turtles and tortoises that some species that have softer shells or we have nutritional problems that lead to softer shells, but for the most part we need to consider that it's a rigid space and we don't have that flexibility and we also don't have a diaphragm separating. We have close connection to the organ and not a great deal of room for expansion of other organs without interfering with the breathing structures.

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So what do they have for normal structures? Well, they do have NAS and they have both external and internal nares that we can examine and evaluate going from basically nose caudally will go through some of the anatomy. You can also see the glottis and they do have a glottis that anatomically looks pretty normal for a glottis of other animals. It's right at the base of the tongue and with an oral exam, you can see this in most animals, the glottis does line up pretty well to the internal nares of most animals. So they are to a good degree obligate nasal breathers. They can breathe, they don't, they're not like bunnies where the epiglottis is engaged behind the soft palate with normal anatomy to the point even when their mouth is

open they can't breathe. So when their mouth is open, the glottis can be exposed and they can breathe that way.

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But it's very unnatural for most turtles and tortoises to breathe that way. They are very much more designed to be nasal breathers. The relaxed position of the glottis is closed. So that has implications when we're going to be doing heavy sedation or you have an animal that for some reason is presenting comatose or more bun that we may have effects to breathing on that and we may need to get more positive control of the airway, the upper airway than we would in other animals in a clinical situation. And when we do that, we need to recognize that they do have a very cranial bifurcation of the trachea. So if we intubate too far down, we can very easily intubate a single lung. We also have closed tracheal rings in these animals, so we cannot use cuffed in tubes and again, there are species differences. Sometimes when you get partway down the trachea we may have open tracheal rings further down, but as far as I know, all the species I'm aware of have at least closed tracheal rings for part of the tracheal anatomy.

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As we go further down, we do have two lungs. They're very spongy lungs and multi chambered s style of lungs that varies anatomically, some of them as little as three and I think the highest number that has been recorded is 11 different chambers to the lungs, all connected by the lower airway after it branches off that goes through and opens up and air rates those lungs. As far as surface area, we're talking about 10 to 20% of surface area to body mass compared to most mammal lungs. So we don't have as much surface area compared to the body size for gas exchange, but their metabolism just about matches that so it works for them pretty well. But like any other animal, when we have other conditions that increase the need for oxygen, we can out wear that capacity pretty quickly.

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Alright, so that's what they do have. What don't they have? Again, they don't have a flexible rib cage so we need to acknowledge that and be aware of that and they also don't have a diaphragm, so what they have in place of a diaphragm, the red areas on this image are some unusual muscles that we can see in there is the transversus thoracis muscle and the transversus abdominal muscle. Again, the lungs are attached pretty firmly to the top of the carapace in most species and then ventrally, they can have some ligamentous attachments to the stomach, to the GI tract, to the liver that helps kind of attach it to those organs. Now as these muscles, the transverses thoracis or transverses abdominis or other muscles similar to this depending on the species contract in one manner they open up, they expand the volume of the coelomic cavity and that causes the lungs to expand and take in air for gas exchange and then they contract in a contrary manner and compress that area down to expel the air.

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That means that for most species, inhalation and exhalation are both active processes unlike in mammals and a lot of other reptiles where inhalation takes muscular effort, but exhalation is a very passive relaxation of the muscles in normal conditions, even under normal conditions, most of them do require active movement of muscles for inhalation and exhalation. There are some species like aquatic species that the water pressure allows exhalation to be somewhat passive when they're in the water. But most of our species I would count on the fact that we're talking about an active process and that can factor into clinical pictures as well.

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Any questions really quickly that we've had on the anatomy that we can clear up before we move on? Just quick questions or are we good? Alright, I'm hearing nothing. So let's go on to our physical exam. Patient comes into us again, the most important thing with any reptile we do is get a good history. We want to go through the husbandry all the way through everything. Even if we're talking about a respiratory emergency, we want to get a thorough history to help rule out our diagnosis and get a good picture of the health of the animal and get some important information that we're going to need to form a treatment plan starting with husbandry because that matters when you're forming a treatment plan. Even if it is an acute situation, we need to know how well the animal has been cared for because that gives us a good idea of the overall health status and how much we're going to need to dedicate to improving the general health of this animal so it can deal with its respiratory disease.

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We also will need to make corrections to the husbandry and to nutrition to resolve some of these issues. Improper husbandry, improper nutrition can affect the function of the immune system. Vitamin A deficiency in a lot of the species can affect the condition of some of the cells lining along the external nares and affect how well they can breathe through their nares. It can affect the condition of their muscles. So all of that needs to be factored in when we're doing that and we need to make corrections to those things to ultimately get a resolution. We need to know if they've been exposed to other animals, if they live outdoors to help look for infectious versus non-infectious causes. Things like have they hibernated recently? Recent hibernation may have implications on the status of their immune system and how well that's reacting. Again, if they are outdoors, do they live in an area where there are scorpions that may have stung them?

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Do they have access indoors to free roaming where we may have chewed an electrical cord while we're trying to go for our fun grape on the floor or we're exploring and mistake something for that and maybe we have an electrocution or ingestion of something bad that will cause a condition that mimics a respiratory disease, but we need to be able to recognize that it is either an additional factor or it's something that the animal that's presenting for respiratory infection doesn't actually have a respiratory infection and we need to go about identifying the proper condition so we can give the proper treatment. The other thing is again, need to emphasize dozens of different animals that are adapted to different environments. So again, this is my snake who's being a stand in. I don't know why picked this, but some turtles and tortoises are adapted to forest land like temperate forests.

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We have species that live their entire lives in pretty much their entire lives in an aquatic environment and that may be freshwater or saltwater. We also have species that live in the desert and these animals going from one location to the other, we can go places and put on a coat or take off a coat, drink more water, drink less water and adapt pretty well. That's a benefit we have as mammals that reptiles don't necessarily have. So if their husbandry is not matching the conditions that they need in terms of humidity, in terms of temperature, in terms of substrate that they need to, those will all need to be corrected for a good overall health picture in any treatment plan, whether it's respiratory disease or anything else. Then we go to a hands-off exam and we really want to watch the behavior of the animal.

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We're also, it should be expressing some level of curiosity, should be moving around and exploring its little area. We can look at it. Sorry, I'm going to hit the sound. I thought that was already muted. So look for how their limbs are moving, what their level of energy is, but specifically for respiratory disease, take

a look at their nares. Watch for any discharge from the eyes, discharge from the nares, any stenosis to the nas that can be the result of vitamin A deficiency or traumas. Again, they're obligate nasal breathers pretty much so if there are stenotic areas or from even routine shed in that area, that can have an implication and kind of narrow down your focus on it. Look for the neck position. An animal that's into stress may have the neck very much extended outward. They may be expressing open mouth breathing and with open mouth breathing. That's a sign of pretty significant distress for these animals.

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Get as much information as you can even down to skin condition that can again tell you maybe their vitamin A status body. Look at the masseter muscles to get an idea of body condition, look at their color, get whatever information you can from a hands-off exam before you go because we all know with our turtles and tortoises we may have limited time there. Just a quick note, gular movement, so when they see the neck flaring as they're breathing, that is normal for these animals. They don't have gular air sacks or gular pouches like birds, but they do have neck movement that is a normal part of breathing in some aquatic animals, it's actually part of the breathing process, but for most of our species that we're seeing when we see the neck pumping, that's actually just helping olfaction so it's just they're smelling. So gula movement cannot be used as a definitive indication of respiratory distress like you can with the open mouth or the extended neck.

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So once we move to the hands-on exam, sometimes this is what we get, which is why we want to get as much information we can with the hands-off exam because then they boop slam in and good luck. But even here you can get a good look at the nares. So if this is how the animal comes to see you even on initial exam, you can get an idea how much limb movement there is coming at you when they're breathing. If you are doing a hands-off exam and they're doing that before you've even handled them, that's more concerning than doing that and you can usually get an idea if they're doing that and they're vocalizing at the time they're doing it and then you put them down and it kind of slows down that. Some of it may be behavioral, like an angry tortoise that doesn't want to be handled.

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You can look for stenosis in the nares, you can look for discharge even with this, but then sometimes we move on to low stress handling techniques, ideally maybe dimming the lights a little bit, giving them some time to come out or if we need to grabbing some drugs and getting a little bit sedation so we can do a more thorough hands-on exam and what we want to evaluate on those, we want to get an oral exam for most of these animals unless it is causing severe distress to do so because this can tell you so much about what's going on. You can get a good look at the internal nares very easily from an internal exam. I'm assuming that my pointer is working here and you can see right here are the internal nares. You can look for redness and discharge in that area. You can see if there's any swelling affecting that breathing.

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And then ventrally, this is an 18-gauge catheter in a small animal going into the airway. So the glottis is located right here at the base of the tongue and you can see where it lines up well with the internal nares. You can also get a good look at the overall mucosa and with some conditions like some of our viral diseases, we will see oral lesions associated with those and that may give you an indication or suspicion for a viral disease rather than bacterial or fungal or non-infectious causes. We also want to do a palpation, the prefemoral area. You can get a good idea if there are masses in there, if there are any large eggs, uroliths, if there's ascites that may be affecting the volume of material that's in the shell and causing

compression of the lungs. Can look at the limbs for any signs of trauma that may factor into the overall clinical picture.

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Look at the body condition. Again, masseter muscles in most species are a pretty good indication and pretty well association for the species that we looked at for looking at body condition. One thing we cannot do, we cannot effectively auscultate, so we can't listen to the heart, we can't listen to the lungs. Sometimes you can get a doppler and get some sound of the heart, but I would not count on being able to get any kind of lung sounds on these animals and you're going to have very limited information to the heart sounds on these animals. So that means we need to go on and do some diagnostics to give us that information, right, so you can get a really pretty good picture of the upper airways and the level of distress and the overall health with a physical exam to look at lower airways and completely rule out mimicking areas. You need the history, you need the physical exam and you also need some diagnostics.

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The cornerstone for these diagnostics I'm going to say is imaging. Imaging is the best way to evaluate the lower airway. It can give you a good look at the lungs but also the trachea and the bronchi and get a look at the picture of the lower airways. It can also help look for other conditions that may lead to respiratory signs which are not a primary respiratory disease. So you can sometimes evaluate heart size, you can look for enlargement of other organs, you can look for ascites. Again, looking at the density of the bones may give you an idea how well their calcium metabolism is holding up. You may see mineralization of other organs that give you impressions of things, but evaluation of the lower airways, pretty much we do need some kind of imaging and I will say again, I try to be a very practical person and realize not everybody has all the toys that you can use, but with turtles and tortoises and respiratory disease, if you have access to ct, CT is the way to go.

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And I will even do that as my initial diagnosis. Diagnostics if I'm suspicious of any lower airway disease. I know even 10 years ago if we had talked about this would've been like come on CT, who can do that? But I would say in most larger areas, in a lot of the larger metropolitan areas, we are seeing a lot more CTs. We're seeing the smaller CT units that are being affordable even for a lot of general practices in different areas and those also allow for fluoroscopy. Some of those units allow for fluoroscopy, so you may be able to utilize that same unit to actually evaluate the process of the breathing and look at it from a dynamic perspective. But CT does allow very good 3D modeling of the lungs. It gets good imaging of the spongy anatomy in the lungs and it can find smaller lesions. So if there are small focal lesions it can locate those and give you a good way to map that, to seek further diagnostics down.

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And doing a CT turtle, her tortoise is amazingly easy. Overall like I would say most of the ones I've done, I've done awake or with mild sedation and a very advanced style of restraint technique that I call an upside down cup or bucket, especially if I'm evaluating respiratory signs, I don't necessarily if there's a little bit of limb movement, if I'm not evaluating the limbs, that's okay as fast as the scan occurs, I can still with an animal awake with a little bit of mild sedation, you can do this with very little stress to the animal and you can get a very fast image that can again be used for 3D modeling and you can go through and get very detailed look at the lungs. It also allows you to evaluate a lot of the other organs that have similar radio density. So where you may get this, here's the lung and here's the gray of everything else that we can with ct.

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Get distinction of the heart from the liver, from the GI tract, from the kidneys, which you're not going to see necessarily very well on radiographs and get a better image of health. I do find it easier than I thought it would be in practice to get owners to be on board with this when I had access to the machine. The first thing is about pricing. You want to be sure that you're priced similarly, it should be more expensive than radiographs, but if it's in the neighborhood of a three view x-ray, it's usually pretty easy to talk 'em into it. And again, if we're not needing to do fluids and anesthesia and everything else is built into a lot of other cts, the conversation at my old practice would commonly be I can get three radiographs for you for about $450 and I'll be able to tell you maybe this is what's going on for 600, I can do a CT and that's essentially like I'm taking dozens of different images and then combining them in a computer model into a 3D image and I can tell you exactly what's going on in the lungs.

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Yes, it's 30% higher, it's another $150, but for that instead of three views, you're getting 300 views and a 3D model and I can really tell you what's going on and we can be a lot more detailed about the treatment. Now again, still not everybody has this, not has a place to refer to this or you may not have clients that would agree and you go to radiographs and radiographs can still be very useful. But I would say this is an area where we want to have access to horizontal beam. Christophe Mons published this article in JAVMA in 2013 and I love these images. Talk about a picture being worth a thousand words. This picture shows why horizontal beam is so important when evaluating the lungs of a turtle or a tortoise. The green area is the lungs and a and B, you can see evaluation of the lungs in an animal that is in stern recumbent.

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So in a normal position and run through a CT and then modeled. Now if you translate that to using a horizontal beam, that's how well the lungs are going to be expanded For a horizontal beam C and D, the animal is turned on its side like if we can't move the unit to horizontal beam and we're taking a lateral in left lateral or right lateral recumbent for the animal and aiming the beam from directly above to the plate under the table the image that you're going to get. And you can see the dependent lung on that because we don't have a diaphragm and we have those connections to visceral organs. The visceral organs shift with gravity and displace the dependent lung and actually deflate the lung to a great deal but also then will cause this overlap. So there's nothing to keep the organs in the ventral half of the animal with no diaphragm.

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So they'll shift downwards with gravity and then up the shell. And if we look at these two images at the bottom, I'm going to be honest, these are not the same animal for if you look at the shape of the shell, we have the nice, you have different shape on the shell, but this is a pretty good comparison of what side-by-side would look like. The right would be how much lung you can generally expect to see with horizontal beam. And on the left side that is how much it can look different with those visceral organs compressing one lung and getting into the way and overlapping the healthy lung and considering the sac structure of the animals, a lot of the pathology will start in the ventral aspect of the lung. So when we get overlap, that really matters a lot. So if you can use horizontal beam, that's very much going to be a more important thing.

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Ultrasound is something that people don't think about a lot and obviously evaluating the lungs ultrasound is not very useful unless there is a lot of fluid and then you're going to see it. But what it can do, you can

get into the thoracic inlet and get images of the heart. You can even see a little bit of the liver in that area. You can get into the prefemoral fossa, look for eggs, look for large masses that may be putting pressure up against the lungs and occupying space. You can see ascites and maybe even get a fluid sample of the ascites, be able to do coelomocentesis and get sample of ascites there. And so it's not necessarily that ultrasound is helping you look at respiratory disease, but again, we have a lot of these things that can mimic respiratory signs by being space, occupying masses or and compressing the lungs and you can use ultrasound to effectively look at some of those and go through.

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And then I'm going to add endoscopy into imaging and we're going to come back and talk about endoscopy with treatment too. But endoscopy is really good, especially as a follow-up. If you've already done your radiographs or your CT and you identify a very specific focal lesion, endoscopy is a great tool to get into that focal area and get more information. So it does require anesthesia because you need them to be still and to get good images, but also you're drilling through bone, you're going to go through the carapace to get the scope in place and so you're drilling through bone, it's kind of painful. We want them to be at a good anesthetic plane for that. Always do imaging first and use the CT or the radiographs to guide the location.

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Again, the lungs are going to remain inflated on their own. They are attached to visceral organs. They're used to being inside this rigid thing. So when you drill through the carapace, it's not going to immediately deflate, it will stay inflated. The manual ventilation is just because again they going to have closed glottis, they are not going to have control over all of their muscles. And inhalation and exhalation are both active processes. So we want to control ventilation to keep them healthy. So keep in mind you are opening into the lungs and you're manually ventilating. If you use gas anesthesia as part of this, it can leak out. So if you have anyone in the area that may be pregnant or has health concerns for that, be careful and try and minimize it anyway for the fact that isoflurane and all those gases are very strong greenhouse gases and we want to be responsible for the environment as well.

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But when we get in, not only can we get good pictures of what the lung looks like, we can go in and get biopsy samples, we can sample any fluid in there for cytology. We can also grab samples of lung tissue for culture or molecular diagnostics and we can get that. And then under treatment, we'll talk about this more, but you can actually when you go to close this, instead of just placing a Telfa® [pad] or a Tegaderm and epoxying that in place, you can also put things like treatment catheters in the area that can be lined up to place medications directly on specific lesions once you get the information back. So endoscopy can be a good tool for these guys as well.

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And then finally, tracheal wash and tracheal wash is something that can be done almost anywhere if you are providing sedation for imaging or for other sampling even as they're waking up, you can place a sterile tracheal tube, get a red rubber or a feeding tube in and just infuse sterile saline down into the lungs. Five to 10 mils per kg, which I know it sounds like a tremendous amount and like you're water boarding them, but you'll recover a lot less than you put in because of leakage around the trach tube and around the tube that's coming in. So you do need to do that large amount. You infuse it, you move them around a little bit, pivot them, let gravity kind of move it around the lungs and collect whatever sample you can and then tilt them head down, try and recover that fluid.

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The fluid you get back should be kind of hazy or even have good juicy chunks in it. Then you've got a good sample and you can submit that for cytology. You can also submit it for culture and molecular diagnostics. If you're submitting it for culture and you have a case that is very refractory to treatment, it has already been through a number of antibiotics without success, don't forget that we can have other things. I've seen fungal infections in a number of turtles, especially aquatic species, so don't forget your fungal cultures or again that's going to be covered with molecular diagnostics and we can potentially even see parasitic issues. So cytology is going to help get at those. Don't forget to do the cytology with that fluid and not just the culture. Finally looking at overall general health CBC to look at the status of the immune system.

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Chemistry can tell you do we have anything going on with the liver or kidneys that may be contributing to this electrophoresis. Albumin can be a negative acute phase protein and the globulins can be a good indication of how the immune status is functioning with different things. So it's good to like while we're getting sedation and getting your imaging, go ahead and draw a blood sample and use that on there. Finally, there are a few specific pathogens that I do think are important. These are not academic procedures for these. This is a very good thing to keep in mind as a practical consideration for your treatment in our land-based tortoises, especially desert tortoises, think of mycoplasma. Mycoplasma is going to be a very common cause of recurrent upper respiratory infection. It can cause scarring, it can cause stenotic nerves. It can cause damage to the actual mucosa and again, you have to have very specific drugs to treat mycoplasma.

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It's also going to become a recurrent infection. So that's good information for the owners to have. And then we have some viral agents. Again, if you see oral ulceration, that can be an indication of herpes virus. Most of you don't see sea turtles. Herpesvirus is not, is what's associated with papillomas in sea turtles. So just mention that one. It's good fun, nerdy information to love, but also as you're scouring the literature, realize sea turtles are very well represented in the literature and everything you find for herpesvirus may not correlate well to what herpesvirus in a red-eared slider is going to do. And then ranavirus is another virus that I would recommend testing for. In this image you can see that nastiness to the tongue and some of the oral lesions that you'll see with ranavirus. So those are good to know. Again, herpes virus is going to become something that can be recurrent and can be spread to other animals in the collection as well as mycoplasma.

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Alright, moving on to treatment. So, of course, injectable medication, antibiotics. Antibiotics ideally should be based on culture and sensitivity, even if you're doing a tracheal wash or a pulmonary wash if you're using something that looks like mycoplasma. Enrofloxacin is one of the treatments. So enro, doxycycline and azithromycin are the medications we think of for mycoplasma. When we use enrofloxacin, we want to dilute it. It has a very low pH and when injected in the muscle we can see muscle necrosis. If you use the pectoral muscles and dilute it, we're distributing that. We're adjusting the pH a little bit with the saline and buffering that a little bit by diluting it and then we're also spreading it out over a larger muscle so that it has a better opportunity to heal. Oral medications can be used but they can be difficult and we want to be aware of stress for the owner that could relate to reduce compliance as well as stress for the animal that could suppress its immune system and make things more difficult for their healing.

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So I'm going to advocate for esophagostomy tubes and I don't know if any of my residents are on, but they're probably sick of hearing about this. Other people I've taught are like, okay, we get it. Esophagostomy tube. Because I talk about these all the time. If you are sedating a turtle or a tortoise for anything, you should always think of an esophagostomy tube placement and whether or not it'll be useful, even if they're eating now, they may not eat once they're on medications. They may not eat when they're being handled daily for treatments, when they're getting fluids. They may not eat in the hospital. You may want to control nutrition, you may want to use oral medication. So anytime you have them sedated, even under injectable sedation, think of an esophagostomy tube. They're very easy to place, just like placing in a cat.

(00:43:43):

If you haven't done it in a reptile, the procedure is very similar. Small incision through the neck over a pair of forceps, pull the tube in, flip it around, put it down into the stomach, take your placement rads to see where it is and use a finger trap suture method and then just tape it to the thing. It's very also easy to teach owners to use this, teach them to troubleshoot it at home, teach them to clear it with a little bit of Sprite or Seven Up or something if it gets obstructed, but gives you good control over oral medication as well as nutrition as they're going through their treatment process. Fluids, of course, oral fluids, you can have, I talked about esophagectomy tubes yet esophagostomy tubes are great for doing oral fluids in the hospital and at home, but again, if you're saying mild dehydration, the oral route is still feasible.

(00:44:43):

You've sedated them for imaging and for blood. You can also pass a stomach tube and do some oral fluids as they're recovering and they're awake enough to avoid problems. Sometimes you do need to go to intravenous and interosseous catheters. There is a great article that I have highlighted down here by Dr. Divers and team talking about jugular venous catheters in the jugular for chelonians and it works quite well. So you can have a central line placed in the jugular catheter and get good control of everything, good medication administration and sampling as well. You can also use the long bones in the limbs or the bridge carapace or the gular scute carapace in some animals for intraosseous catheters placement. And then subq fluids can be given cranially and caudally where the arrows are indicating. I do not recommend intra fluids. It can go into fat bodies, it can go into a large egg, it can go into a visceral organ.

(00:45:55):

You can lacerate organs, so I don't recommend those. But subcutaneous fluids are pretty easy to do in these as well. Nutritional support, if they're eating already, you may just need to monitor it. But I do recommend to owners when they're going through treatment to get a scale and weigh them at home at least every three to four days. And if there's more than 5% weight change, either way get in and make sure have them watch stool production, how much food is going. Again, if you have any concerns at all, put an ES ostomy tube in. If you've sedated them for anything else, it's easy to do and gives you good control for treatment. Pain control, we've already discussed NSAIDs, pneumonia can be quite painful in humans. It's an extremely painful process. And then when we look at some of these oral lesions that we get with ranavirus or with herpes virus, it's no wonder they're not eating.

(00:46:58):

So I even think of sometimes short term topical treatment with bupivacaine or I've heard a couple people talking about using orgel, very tiny amount of orgel on those lesions just to give some pain relief because a lot of pain in these. Then finally awesome paper. I don't know if Dr. Carone is on or Dr. Boyer, but they

recently published a really great article looking at choanal flushes that are very useful for our guys with mycoplasma. So you sedate them and get them in dorsal recumbent. And for the study they packed the oropharynx with cotton just to prevent aspiration. And then again, you open the mouth, you can get a really good look at where the internal nares are and they did 15 mil flush of saline into the choanal slit and just let it drip right back out through the nares to clear mucus and debris out of the nares and then took a medicated flush, which again is three mls total. 0.4 of that is the 22 mg per kg.

(00:48:14):

enro. 0.2 mls of the two mg per ml dexamethasone and then 2.4 mls of saline to make it three mls total. One ml went into each side of the internal nares and then 0.5 into each external nare to get good coverage. And you're getting enro directly to an area where the mycoplasma is concentrated. So you're hitting that infection and you're also getting some dexamethasone infused in there to cut down some of the swelling in their study. It did have a hundred percent elimination for the animals in the study and I believe they did five infusions. I should have written this down, but I think they did five infusions and then if they still had discharge, did some additional ones. But this is very effective treatment and it was done every three to five days. Dr. Caron, if you're on, I know you're just like, dude, read this before you talk about it.

(00:49:15):

But I do recommend, I believe it was just actually in the most recent journal of Herpetological Medicine and Surgery. If not, it was the one before that. So it was published pretty recently and a great evaluation of this technique that's really well utilized. Nebulization I think is underutilized. I quite often use gentamicin or amikacin. Sometimes we use amino to open the airways clinically I see a lot of effectiveness of this and it gets medication directly to the source. And then finally we talked a little bit about the treatment catheter. So after we go in with endoscopy, this little black.is representing the drill over the focal area. We've gotten our samples just as we're about to epoxy that close. Sometimes the site is small enough, you can even use something like an IV catheter, put it in there. So the end of the catheter is directly on the focal lesion that you may want to administer antibiotics or antifungals to, and you can epoxy that in place.

(00:50:28):

You may need to surround it with something else. Sometimes I will build epoxy around the catheter itself and allow that to dry so it's got a large enough area to cover the hole and then put it in place. Or you may run it through, you may pack sterile gauze around the area and cover that with a Tegaderm patch or something like that. Then it can be pulled when the treatment is done, close it up with the regular Tegaderm and epoxy to do that. If your sampling method is on a rambunctious animal and needs some additional protection. There was an article a few years ago in JHMS talking about taking things like a urine sample cup with the bottom cutout and epoxying that around specifically for aquatic turtles that had open lesions on there to allow them back in the water but still allow access to the treatment area so you can epoxy a sample cup around it and protect it, but get good use for things there. Finally, the most important treatment is follow up. Always follow these animals up days to a couple of weeks at the most, recheck any abnormal diagnostic findings, assess your treatment plan and adjust as needed.

(00:51:49):

Alright, so that is my presentation, just shy of the time. Good, perfect. We got some time for some Q and as

Dr. C. Pollock, LafeberVet (00:51:58):

We sure do. Thank you so much Dr. Corker and that was amazing. And let me just stop your share or takeover share I should say. And I'm going to get this other

Dr. Mike Corcoran (00:52:11):

One up. Alright, I'm stopping mine. There we go.

Dr. C. Pollock, LafeberVet (00:52:15):

All right, excuse me. Okay, so I'm just going to briefly go over some housekeeping and then we have some great questions for you. So first, this webinar is approved for one hour of continuing education credit. All attendees will receive two email campaigns later today. So I'll just briefly say that the first campaign just basically confirms your continuing education credit that will be submitted to A VSB. The second campaign will be sent to all registrants and it will include information or links to the quiz and the evaluation form if you would like to test your knowledge. And this is optional, links to the quiz are posted on the screen are also available in the chat box. And a direct link to the quiz is also available on Dr. Cor Corrine's lave webinar page. Now just please know that Levette uses an automated grading system. So to take the quiz, you will need to first register to create a free lave account and then verify your email address.

(00:53:13):

But again, the quiz is completely optional. Just your attendance is all that's required to earn continuing education credit. Please also know that a erase approved recording of today's session will be posted next Tuesday, May 27th. And I'm telling you this because once that happens, the personalized continuing education certificate that you can download after passing the quiz will be updated to read non-interactive, but you're always welcome to contact lave and request a personalized certificate as well. Now for written details on everything I just said about the quiz, the evaluation form and the recording, you can also download the housekeeping PDF available in the chat box. So just in case that's helpful, we're just about ready to begin the question and answer session. Just a quick reminder to enter your questions or comments using the q and a feature, not the chat box. I'll try to check both, but it's easier to lose them in the shuffle in the chat box.

(00:54:07):

Just to forewarn you also please know that although we certainly hope you'll be able to stay for the question and answer session, this is not considered part of the complete presentation and is not required to earn continuing education credit. And finally, we will make every effort to answer all questions entered through whatever you entered in the q and a or the chat box. But if time runs out, we'll follow up by email and these answers will be posted to Dr. Corcoran's webinar page in LA Fever Vet at a later date. Okay, so I'm going to try, unless something has been upvoted a lot to just go through the different categories. We had a few questions that were entered on anatomy after you started the next section.

Dr. Mike Corcoran (00:54:50):

Sorry about that. But looking at it like for time I it's probably better. We waited anyway.

Dr. C. Pollock, LafeberVet (00:54:54):

Yeah, I talked more than I thought I was going to. I think they had to have a little bit of time to percolate their questions, but Susan asked, does the bronchus divide into bronchi going to each division of a lung and is there a permeable membrane between each compartment?

Dr. Mike Corcoran (00:55:07):

So yes, the bronchi do divide into each lung as far as permeable membranes, yeah, they are. They do communicate to some degree, not completely. So those 11 chambers, yes they do communicate, they're all connected by the bronchus, but they are somewhat compartmentalized to, you can have focal disease processes in different things. And again, standard disclaimer, there are hundreds of different species and everything is going to be a little bit different for every species, but it can kind of compartmentalize disease in one of those chambers to some degree.

Dr. C. Pollock, LafeberVet (00:55:49):

Thank you. Sam asked, are the muscular bands on the ventral surface of the lungs, the transverses muscles you described?

Dr. Mike Corcoran (00:55:58):

Okay, I'm not an anatomist. I wish I could answer that, but again, I'm going to just cop out of that one with my, there's a lot of species difference and that was kind of an example from a paper talking about one species in focusing those animals. But the musculature is I think the biggest, for me, the clinical takeaway is there's not specifically a diaphragm in there and there is muscular involvement in inhalation and exhalation in general, but not something so rigid that ascites or large masses or displacement of GI doesn't affect breathing, doesn't affect diagnostics.

Dr. C. Pollock, LafeberVet (00:56:39):

Thank you.

Dr. Mike Corcoran (00:56:39):

Sorry, I can't give you a better answer than that. Not without looking things up.

Dr. C. Pollock, LafeberVet (00:56:44):

No, that's no problem. Thank you. Let's see, we have a couple of upvoted questions, but they're all therapy. So I'm going to go ahead and do a couple of the diagnostic ones and then we'll go down to the therapy questions. I think. So Sam wrote, if CT is not available, how accurate is the cranial coddle view versus the lateral view for radiographic evaluation of pneumonia? And then I guess it's two part question, so I'll just add the rest. What is the interval recommended between first diagnosis and follow-up radiograph?

Dr. Mike Corcoran (00:57:14):

Yeah, so if you're using radiographs, I think you always need three views. I don't think it should ever be a choice between cranial coddle and lateral. I think you need the dv, cranial coddle and lateral all. And again, they really should be horizontal beam to evaluate, but you need all of that three view is kind of the minimum two orthogonal view that you talk about for mammals. I think three views are the absolute

minimum for evaluating the lungs radiographically in there. And then the follow-up depends on how distressed they are. If they are not oxygen dependent, I would say we're probably going to wait at least two or three weeks to see some radiographic change in that. If they're pretty significantly affected though I may recommend hospitalization or if they're going to go home, I want to see them within a few days and just see that we're getting some kind of response to the initial treatment if they're in distress.

Dr. C. Pollock, LafeberVet (00:58:20):

Thank you. And would the same timeframe be used for CT If you're following up?

Dr. Mike Corcoran (00:58:26):

Yeah, CT maybe if there are unlimited pockets, yes, I would say the same frame. If I have images on ct, I may actually come back again if they're stable enough, come back a couple weeks later and if they can't afford another CT, at least get some imaging of the focal area with radiographs and then follow up with another CT later if possible.

Dr. C. Pollock, LafeberVet (00:58:55):

Thank you. Angela asks, what laboratories do you utilize for your PCR samples? Is there any you would recommend?

Dr. Mike Corcoran (00:59:05):

I love University of Florida, of course. I would say pretty much the samples end up going the same place you can submit to a place like Moichor or Avian Labs and they get forwarded onto the appropriate labs. And then I end up submitting all of mine through Moichor and I believe they're submitted, they're forwarded to Minnesota or Wisconsin. One of the universities, I don't remember, but I know PCR, university of Florida has a very good wildlife lab, veterinary molecular diagnostics. I think it does a really good job and I think they have a respiratory panel with all of these put together as well.

Dr. C. Pollock, LafeberVet (01:00:00):

Thank you.

Dr. Mike Corcoran (01:00:01):

For the US and overseas, I have no idea. Apart from Canada, Europe, Poland, I saw somebody from Poland, somebody from Mexico. I have no idea. I'm sorry.

Dr. C. Pollock, LafeberVet (01:00:13):

Okay. We have a couple of questions that were related to physical exams. I'm going to throw them under diagnostics. Lisa wanted to know, wrote, I commonly see bubbling of the eyes and red footed tortoises, which are otherwise acting normal. Can this be normal due to lack of nasal lacrimal ducts?

Dr. Mike Corcoran (01:00:30):

I think so with those, yeah.

Dr. C. Pollock, LafeberVet (01:00:31):

Okay. Thank you. And Rodrigo wanted to know if you've seen any association or correlation between respiratory disease and pyramid. Pyramid?

Dr. Mike Corcoran (01:00:44):

Never mind, I can't say that I necessarily associate that other than pyramiding does indicate some kind of husbandry deficiency, especially during development. And then could we have problems with development of the lungs? Yes, that's reasonable to assume if we're not getting proper nutrition, that improper nutrition, improper lighting and proper humidity, improper heat, all of those things that go into pyramiding, will that affect the immune system and make us more prone to infections, more prone to other diseases? Absolutely, yes. So I would say it's correlation, but a direct correlation between the two. I don't know that I would say so other than just pyramiding is an indication that something is or was wrong with husbandry that could affect the overall health of the animal and leave them more prone to other diseases.

Dr. C. Pollock, LafeberVet (01:01:37):

Sure, thank you. There were a couple of questions related to antibiotic therapy and the first one was from Jose who wanted to know what dilution you would recommend for, I guess specifically in reflexes in that you mentioned?

Dr. Mike Corcoran (01:01:51):

Yeah, Enro, I dilute pretty far at least five to one. If the volume that I'm going to be administering to the animal allows, I like a nine to one dilution just to really counter that pH as much as I can.

Dr. C. Pollock, LafeberVet (01:02:08):

Thank you. And Kamara wonder what would be the general recommended duration of antibiotic treatment? And she also wondered based on their metabolism, what is the frequency? And I suppose you could just refer to a formulary, but is there a general regimen

Dr. Mike Corcoran (01:02:21):

That you can Yeah, because each antibiotic is going to be different. There are some that like enrofloxacin for most species is going to be every 24 hours, sometimes every 48 depending on the species. CEF Adine for example, is usually every 72 hours, so the medication will dictate the interval. Most of the time duration though is going to be long-term. If we're treating an infectious, like a bacterial pneumonia in turtle or tortoise, it could be months. I would say I start with at least four weeks and see where things are progressing and I continue treatment two weeks past clinical resolution and radiographic resolution.

Dr. C. Pollock, LafeberVet (01:03:10):

Okay, thank you. Emily asked or she wanted to know what did you mean by using a Sprite or seven up to clear the ESOP ostomy tube and she wondered also if the sugar could affect them in any negative way.

Dr. Mike Corcoran (01:03:21):

Yeah, so that is just an old trick. If you get a food clog at the end of a feeding tube, sometimes infusing a little bit of a soft drink mixture in there will help break that up. And I don't know whether it's you're

putting pressure and expanding those bubbles and pushing it through. I don't know if it's the horrible acidity of those drinks. So do I worry about the sugar? Not with the amount that I'm doing. I worry about the acidity, a little bit of it. But you're using, again, a small amount of the mixture to do that. So I don't worry a lot about it. And it's generally getting to a choice between that or pulling the tube and placing a fresh tube in. Sure.

Dr. C. Pollock, LafeberVet (01:04:09):

Thank you. Thomas asked, is there good evidence to define incubation periods for viral or mycoplasma disease agents? He's looking for relevance for creating a quarantine or recommending a quarantine period for *Gopherus.*

Dr. Mike Corcoran (01:04:24):

I don't know. I don't know of studies specific to that, but with all reptiles in general, I recommend minimum 60 days quarantine. I think it's very reasonable to go 90 days. I think past 90 days, you're probably going to see something. But again, we're talking about Mycoplasma. I would say part of that quarantine should be considering testing and see if you get any shedding during nonclinical times. I would say Mycoplasma is something that recrudesces and shipping and coming to a new environment suppresses the immune system. So if you're going to see an outbreak, it's not a guarantee that you're going to see it during quarantine, but that's kind of the prime time that you're shipping the animal. You're stressing it, you're putting it in a new environment. It probably is in a quarantine cage, which doesn't have as much enrichment as a normal cage. It's being handled by new people. So if you're setting up good conditions just inadvertently to cause a break. And if you see any discharge, I would test for mycoplasma before introducing them, but I would say at least a 60 to 90 day quarantine before letting them into a thing. But specific incubation periods, I don't know that because you can't have subclinical infection in there too. So I don't know that we have any strict correlation with the exposure versus clinical signs.

Dr. C. Pollock, LafeberVet (01:06:08):

Thank you. We had a couple of questions come through about nebulization. Kathy wanted to know if you've used F 10?

Dr. Mike Corcoran (01:06:16):

I have used F 10 in some animals. I don't recall if I've used it in turtles and tortoises, but yes, I've used it in some animals. It's scary the first time you do it right? You read that and you're like, this is like a floor cleaner. Holy crap, why am I doing? It's scary when you first do it, you're like, why am I doing this? But yes, I've used it.

Dr. C. Pollock, LafeberVet (01:06:41):

Thank you. Ian wanted to know how long do you recommend doing nebulization and is there a difference in the length of treatment between debilitate and more healthy and how frequent do you nebulize?

Dr. Mike Corcoran (01:06:54):

That

Dr. C. Pollock, LafeberVet (01:06:54):

Was a three part question

Dr. Mike Corcoran (01:06:56):

And a lot of that is clinical judgment. I don't think I would say that I rely on nebulization as a sole treatment most of the time. Usually what I'm using, usually when I'm using Nebulization, it's a little bit more affected animal or I'm using a medication that I want to try and avoid some systemic effects because we can get higher concentration in the lungs. At least we can tell ourselves that it's probably not getting the same systemic thing. So if we're treating with Gentamicin or Amikacin, I can add that into the mix and know that I'm getting probably pretty good concentration in the lungs and at least less systemic penetration to it. If they're being hospitalized and they're going to be in oxygen because they're distressed, I might as well nebulize with some gentamicin while I'm waiting for culture results. It's still a medication that is not used as frequently because of its concern for the kidneys.

(01:08:04):

And so more often I see it still have good sensitivities than some of the other drugs. At least I get to do that while I'm waiting for the cultures and continue on or use it as an adjunct to other medications to get things under control. And how long of the duration? Clinical judgment, if you have something that says gentamicin is sensitive to it, for example, I may continue that on for the entire four weeks and have the owners do a setup at home where they buy a little plastic container and cut a hole on it and put the pet in there twice a day and nebulize and go through it. It may be something I use three or four times in the hospital to just get them over that hump.

Dr. C. Pollock, LafeberVet (01:08:55):

Thank you. Jason added on a question about volume, but generally it's a dose, right? Or milligrams per kilogram. So it's

Dr. Mike Corcoran (01:09:03):

Size

Dr. C. Pollock, LafeberVet (01:09:04):

Dependent.

Dr. Mike Corcoran (01:09:05):

So usually I'm looking at say roughly like 50 mgs per kg of gentamicin as an example, and I'll dilute it into a total of five to 10 mils and just nebulize the entire amount. But I look at what the single injectable dose would be and dilute that out for a five to 10 M total volume and nebulize them with that. And the key is you want to make sure the vapor is getting to them. So if you're in a very large oxygen cage and it's only misting in that one area, then you want someone to be right up kind of in their face with it or you want to put them in a smaller container that really fogs up. It should look like San Francisco Bay for the turtle or a nice happy Seattle morning. And if it doesn't look like that, then it needs to be put right up in their face.

Dr. C. Pollock, LafeberVet (01:09:59):

Thank you. Ryan asked, how have you seen many aquatic turtles like Raiders, sliders with large A can cephalon worm infections in their intestines? And if so, have you associated these infections with any symptoms like lethargy?

Dr. Mike Corcoran (01:10:17):

Occasionally, yes. I would expect a heavy parasite burden can cause effects of food effects of nutritional effects can cause inflammation to the GI tract that affects absorption. So yeah, I would not be surprised by that

Dr. C. Pollock, LafeberVet (01:10:40):

Here. Angela wanted to know if you can feel comfortable placing both the jugular IV catheter and a feeding tube in the same patient at the same time?

Dr. Mike Corcoran (01:10:50):

One in one side the other and the other side make sure they're properly labeled. I heard a story of, I've heard stories of inadvertently somebody mistakenly putting food into the jugular catheter of a cat and having a very profound, very bad outcome. So make sure they're labeled, put one on one side, one on the other side, banners them up. Absolutely. They can both be used together.

Dr. C. Pollock, LafeberVet (01:11:22):

Thank you. And I just found two questions in the chat box that I'll do and then we'll be done I think. And if I find anything else I will email you. But George wanted to know what drugs do you recommend for minor sedation and do you have dosages for these ethnic patients? And I didn't actually message George. I would recommend Dr. Navarra's webinar recording on brace approved on this topic because it's a big topic, but if you had any go-tos that you would recommend to George as far as things that you regularly use.

Dr. Mike Corcoran (01:11:58):

I mean, I would say ballpark overall. My most common is a combination of midazolam, dexmedetomidine, and ketamine.

(01:12:14):

And the actual doses vary somewhat dependent on the species of the animal. Alfaxalone can be useful. My principal issue with alfaxalone with a lot of them, especially when we're talking the large guys for one cost, if you're talking about a 50 pound Sulcata or even a 50 kilogram Sulcata, in some cases it could be cost prohibitive to an owner, but also alfaxalone the volume gets to be a challenge for, IM injection that for animals, but I would say that cocktail is my probably most common, but I will also sometimes use alfaxalone. I will use telazol sometimes in the larger animals, telazol mixed with ketamine in some of the larger animals. So it does vary and I would say that webinar and then also looking at your formularies or even reaching out on the A RAV members Facebook page or to other veterinarians who have worked with the species before, that kind of thing. There will be some variance.

Dr. C. Pollock, LafeberVet (01:13:20):

Thank you. And then the final question that I found was from Vanessa who asked during your discussion of computed tomography if contrast was advisable

Dr. Mike Corcoran (01:13:31):

For respiratory disease itself? I don't always need that. If you see a focal lesion that could be something neoplastic or granulomatous, yes. But if we're just talking about suspicion of pneumonia, not necessarily, especially if we're talking about taking one that's in a little bit of respiratory distress and just doing mild sedation and getting a quick image and I don't want to place, don't necessarily want to place a catheter for giving that and you can get good images of the lung parenchyma without that. If you have something that would be a contrast uptaking something or you run them through and you find a very large, so mass that's putting pressure up against the lungs and affecting the ability for it to expand, then yes. But just that and that also again allows, see, I saw somebody put a comment like 600 is really cheap for a CT and it is where I was at 600 was the ct.

(01:14:35):

Most of the time we did a radiologist interpretation, which would be on top of that. But if I'm evaluating for lungs, I didn't always send it to a radiologist for evaluation. And then we're not talking about anesthesia, catheter placement fluids and everything else that make it be those kinds of things. If I had a rabbit and I'm looking at the nasal cavity and I'm anesthetizing them heavily and I have them on gas anesthesia and I have them on fluids and I'm doing ECG monitoring and everything else, that's a $2,000, $3,000 ct. But if I'm just taking a awake turtle and running them through a scan with maybe a little bit of midazolam and I'm just looking at the images myself to see if the lungs are clear and if there's no lesions that I'm concerned about that was 600 drugs and in that case I'm not going to do contrast because I have not sedated them heavily enough to get a catheter in place. And certainly if I see something I'm concerned about that, I may get the radiologist look at it and we may talk about later. We need to sedate and do contrast and see what's going on.

Dr. C. Pollock, LafeberVet (01:15:54):

Thank you. Thank you so much for everything, Mike. This has been fantastic. Thank you so much. Before we close, you have anything to add?

Dr. Mike Corcoran (01:16:03):

Anything to add? I don't think so. I'm just looking through and seeing who I know here. Yes, and I saw somebody here did catch the last question on my tests, my test questions. I think I emailed you about that. It needs to be not

Dr. C. Pollock, LafeberVet (01:16:23):

Okay,

Dr. Mike Corcoran (01:16:24):

I

Dr. C. Pollock, LafeberVet (01:16:24):

Will

Dr. Mike Corcoran (01:16:25):

Check that out. Question number six needs to be

Dr. C. Pollock, LafeberVet (01:16:26):

Out. Yes, I saw Kavita's comment and I will definitely check that out.

Dr. Mike Corcoran (01:16:30):

Yeah, I'd emailed you but I didn't know if that crossed our emails. But yes, thank you for catching that and reminding me you have sun in Seattle today. Really awesome. It does. I used to live there. It does get sunny. We just like to tell the tourists that it rains all the time so that we can keep the beautiful area to ourselves when we live

Dr. C. Pollock, LafeberVet (01:16:48):

Up there out to yourselves. That sounds fantastic. Well thank you and thank you all for attending this LafeberVet Webinar Respiratory Disease in Chelonians by Dr. Mike Corcoran. This is Christal Pollock of LafeberVet signing off and wishing you a great day or whatever else that's may be. Thank you so much, Mike. Bye now.

Dr. Mike Corcoran (01:17:05):

Thank you everybody.