

## BroadcastMed | EMS Series\_ Nicholas Connors, M.D., FACEP

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Hi everybody.

I'm Nick Connors, one of the emergency docs and the medical toxicologist at the Medical University of South Carolina.

And today, I'll talk about snakes and arthropod envenomations.

So just as a general outline, we'll start off talking about the global burden of snake bites and the families of venomous snakes that we'll see worldwide, and then focus down on what we see within the United States.

We'll switch gears and talk about spiders and scorpions.

So globally, there is a very high burden of snake bite and snake envenomations.

And really, there's no place that people are safe from snakes other than Antarctica and the far northern regions.

There are no snakes in Ireland.

There are no snakes in Iceland or Greenland either, and there's no venomous snakes native to Hawaii.

So though those myths are true.

But pretty much everywhere else, including the whole Indian and Pacific Ocean, you're actually at risk for getting snake bites.

But where is the burden of disease?

Mainly in southern and eastern Asia.

There's a lot of bites with a lot of venomous snakes.

Also, Africa sees a lot of mortality and morbidity.

These are areas where medical care is not as advanced.

The treatments are not readily available, and you have lots of people walking through mainly agricultural areas without shoes.

And shoes and long pants are going to be really protective of folks when they come across a snake in the wild.

So all those things put together make snake envenomations really dangerous in those parts of the world.

One reason to talk about global snake bites is because we get all kinds of exotic snakes here.

So we have our local venomous snakes, and we worry plenty about those.

But you can go to any convention.

So we have two in South Carolina.

One of the states where it's totally legal to own a venomous creature, you go, you bring your family, and you walk into the back area of the convention center.

And in these little Chinese food containers are venomous snakes.

So here's a picture of an Eastern diamondback cross with a canebrake for the low, low price of \$350.

You can buy copperheads.

You can buy cotton mouths.

You know, some of them are less than \$100, so they're not super hard to get.

This is not regulated and it's not illegal.

So we can see exotic snakes that are sold both legally and totally illicitly as well.

So we can get snake bites from all around the world right here in the United States.

Going through some of the venomous families, we have-- colubridae is the family that includes things like garter snakes.

They're mostly small.

The king snake fits into this, and the king snake is one of our mimics for the coral snake that we'll talk about a little bit later on.

There is one that's particularly dangerous, it's the African boomslang, which is the tree snake in Afrikaans.

That's really the only dangerous one.

That's the bright green that you see in the picture.

Otherwise, you know, stateside, we don't worry about this class.

Next up is the atractaspididae.

These are in Northern Africa, in mostly kind of desert, dry areas.

They burrow into the ground and actually have the ability to kind of sideswipe their prey.

So this brings up one of the more remarkable features of snakes, is that they have pretty good control over their fangs, almost like they're an appendage.

So these snakes have independent control over each fang, and this species can actually put a fang out to the side and kind of headbutt their prey underground when they're right next to them.

Just for fun, this is the type of snake that Cleopatra is rumored to have killed herself with, the asp.

Water snakes, the hydrophiidae.

These are mainly in the Indian and Pacific Ocean.

They are not eels.

They are reptiles, so they come up for air.

They breathe.

Their tails tend to be very flat.

They've adapted to living in the ocean.

They catch fish, so their venom tends to be very neurotoxic, paralyzing something that would otherwise swim away so that they can grab it and eat it.

The venom is really potent.

And you'll see envenomations of these in little kids playing in the shallows, although you'll see these kind of out and around coral reefs.

You know, people who are doing some diving in the South Pacific, you know, will run into these from time to time.

The vipers are a big class.

And we have our old world vipers, which are the, quote unquote, true vipers.

And that's up in the top left.

That's the Russell's viper.

And then we have our pit vipers, which are the crotalids, which is what we'll spend a lot of time talking about in a second.

Those are mainly all of our-- almost all of our venomous snakes that we have in the United States on this includes the rattlesnakes.

The last class I'll talk about the elapidae.

So these are among the most venomous snakes in the world.

So these make up-- or within this class are things like the death adder, which is the top picture.

That's in Australia.

The next picture is the black mamba, which is pretty much the most venomous snake in Africa.

And then in Asia, the representative species under elapidae is the cobra.

So these are names you've probably heard.

These are, you know, responsible for significant morbidity and mortality where these guys are native.

We do have an elapidae in the United States, tends not to be as much of a problem.

So what do we do when we have snake bites from these exotics?

Well, it happens any zoo that's certified by the Association of Zoo and Aquariums that has venomous creatures has to have antivenom available.

So we get antivenoms from places where these snakes are indigenous.

So the Thai Red Cross makes many of these.

Really, we get them from all over the world and kind of stock them in different areas.

So zoos all have to know where the antivenom is.

Many of the zoos stock them themselves.

And then we, through the poison center, we can locate where other antivenom are.

And there's actually an antivenom index to say where we can find antivenoms for rare and exotic snakes.

So in South Carolina, our repositories for these exotic antivenoms are going to be up in Colombia at the Riverbanks Zoo.

That has quite a bit of antivenom for all the venomous creatures they have.

And then Alligator Adventure, which also has a pretty extensive collection of venomous creatures, carries a lot of those antivenoms.

That picture was actually from Alligator Adventure's stash of treatments.

The other one that we will typically go to here in South Carolina is the Miami-Dade Venom Response Unit.

So they have, within their fire slash EMS system, they have this unit called venom one.

And they have, for whatever reason, taken an interest in antivenom and will distribute antivenom obviously through Miami-Dade county, but will also ship throughout the region.

So when we have weird or exotic snake bites, we will be able to look to them to see where we can get it, or if it's possible to get any antivenom.

So let's focus back on the United States and what bites we have here.

So in general, we have about 40,000 bites, but only about 5% or less of them are from actual venomous snakes.

We have very few deaths, so maybe 10 within the last 15 years.

But people who get snakes, I'm going to let the next clip kind of describe who that is.

Now to an offstate man who's recovering from rattlesnake bites he suffered while kayaking in the Edisto river with his brothers and a few friends over the weekend.

Fox Carolina's Margaret Burnquist traveled to the family home in Star to get the full story.

She's live in our newsroom with the very latest.

And Margaret, this is where the most read stories on our website right now.

Yeah.

It was originally thought that the rattlesnake fell from a tree and landed on the victim, but that's not the case.

Michael Adams' brothers say he actually grabbed the snake from the water during an annual trip they call a booze cruise.

They say Mikey is a bit of a wild man, but they can smile now knowing the 28-year-old is recovering at MUSC in Charleston right now.

Hey, was this one yours?

Unloading after a terrifying kayak adventure, Kyle Colquitt knows how fortunate his brother Mikey is to have survived it.

What kind of guy is your brother? A glorious idiot.

He's fun to be around.

He's a great guy, big heart.

But he's-- something stupid is about to happen, he's probably the one doing it.

Kyle says on Saturday evening, he was in the kayak with his brother Mikey when a reptile was spotted.

Somebody yelled that they seen an alligator, he decided he was going to go after it, and it turned out to be a snake.

And he still grabbed it.

He reached in and grabbed it.

It bit him three times in the hand, and then he grabbed it with this hand, and he turned around and said, well, it bit me.

And we started paddling.

Then Kyle says Mikey's hands started swelling, and they stopped at the first house they could see, home to a man whose daughter is an EMS first responder.

He gets out.

He docks, he's got the snake in his hand.

He goes running up into these people's yard while he's still holding it.

You could start to see his neck swelling, his lips started swelling, his hands were swelling, and all of his arms were swelling up.

His eyes were turning red.

He says, fortunately, an ambulance arrived within 10 minutes to transport Mikey to Colleton Medical Center along with the rattlesnake that bit him.

Oh yeah, alcohol has a lot to do with it.

Yeah.

Jesse "Cody" Adams is another of Mikey's brothers.

I would hope that he learns some kind of lesson from it.

I really do.

But I doubt it.

I really do doubt it.

He's pretty stubborn, thick headed, so-- And now that it looks like Mikey is going to be OK, the brothers say they'll never let him live this one down.

Oh yeah, forever.

He won't ever not hear the end of it.

Every year we go on a trip, we'll bring it back up.

Every time we see a snake, we'll bring it back up.

Now, the brothers say there's no question their kayaking trip will happen again next May, which will be the ninth straight year for that.

As for Mikey, I'm told there are concerns about possible nerve damage from the snake bite.

But he was released from ICU today, and if everything goes as planned, he'll be able to come home tomorrow or Thursday morning.

Margaret Burnquist, Fox Carolina News.

Snake bite victims are going to be male.

They're overwhelmingly going to be people who are intoxicated.

In general, they're going to be folks who were playing with snakes.

Snakes generally don't want to bite you.

There's some aggressiveness to some of the rattlesnakes, and I'll talk about which ones.

But in general, any snake wants to get away from you.

The venomous snakes that do the envenomations in the United States are almost all going to be the crotalids.

These are going to be our pit vipers.

And within that group are our cotton mouths, our rattlesnakes, and copperheads.

All right, so things that make the pit vipers distinct is really the shape of their heads and that heat sensing pit.

So their heads look like a triangle, and those outpouchings on the side are actually the venom glands.

Looking at the profile, you'll see a kind of three different spots on them.

So you'll see their eye with an elliptical pupil, not that you should ever be close enough to see that.

You'll see a nostril up at the top, and then kind of midway down the face, you'll see this pit.

It's not a nostril.

That's the heat sensing pit.

And what I'm always reminded by is-- or are reminded of is-- you know, exhibits in the children's part of the zoo where they show you what a snake sees and show your heat signature on a wall and you dance around in front of it and the kids go crazy, that's really what the snake uses to sense its prey.

So, you know, some of them have decent eyesight.

They have a great sense of smell, although they are catching particles on the tips of their tongue and actually can locate which way it's coming from with their forked tongue.

They know if that smell is coming from the left or the right.

But they're also using heat signatures to find their prey.

Straight from the South Carolina Division and Natural Resources, we have 38 species of snakes found in South Carolina.

The coral snake, the Eastern Diamondback, the timber rattlesnake, the pygmy rattlesnake, the copperhead, and the cotton mouth.

Yes, we have six venomous snakes in South Carolina.

Those are the venomous ones.

So we'll go through those a little bit.

So on the top left, we have the timber rattlesnake.

That is actually the most aggressive, and some of these can be really nasty.

Not that they're going to chase you, but they're not going to be as docile or afraid of you either.

It is a rattlesnake.

There is some debate whether the timber rattlesnake should be broken up into two species between the timber rattlesnake and the canebrake, so that's another name you might hear for it.

The other interesting thing about this type of snake is that it can have some neurotoxic venom.

Generally, everything in the crotolid class is going to be a muscle and blood toxin in terms of their venom.

So they're going to cause lots of muscle breakdown.

They're going to cause coagulopathy and significant bleeding.

The timber rattler or the canebrake is the only one that can actually cause some respiratory paralysis and other neurologic symptoms.

We see that, also, maybe with the Mojave rattlesnake, but locally, the timber rattler or the canebrake is going to be the only one that causes those effects.

Next on the top right is going to be the cotton mouth.

So this is a snake that's used to actually fishing and eating amphibians in really swampy areas.

So the coloration can be really dark black to kind of a swampy brown.

The mouth is bright white, so that's how it gets its name, the cotton mouth.

And a lot of times it'll just surprise folks, because it's so well camouflaged.

It's not a fast snake at all.

It's like a boat, so it's short and stout.

You know, built to float on water, so it's not going to chase you and it's really not going to be much of a threat unless you're right near it.

It's certainly not a jumper.

The next one down in the middle of the page on the bottom is the copper head with that beautiful metallic coloration to it.

Those are going to live pretty much all over South Carolina.

They can make it into urban areas as well, because they really don't need very big prey to eat.

So anywhere that there's going to be frogs and stuff like that, which, you know, probably all but the most urban areas of the state is going to have little critters for these guys to live, and they'll travel into them.

The biggest of our venomous snakes within the United States is going to be the Eastern diamondback rattlesnake.

So this snake can get up to about six feet long.

Obviously, it needs bigger prey, so it needs big open areas to live.

So we won't see this in urban areas.

It needs kind of big, either foresty or grassy areas where it can find things like rabbits or really big rodents to eat.

Envenomation by this can be significantly worse just because the amount of venom delivered can be much higher.

The pygmy rattlesnake, on the other side of the spectrum, is really only about a foot long, all right, and we tend to not even worry about that because the envenomations are just not that significant, mostly due to a volume delivered issue.

So what is crotaline venom?

It's a soup of proteins that all do several things.

So imagine this is a snake with big front fangs, but no molars.

So this thing can't really chew up its prey.

So a lot of the venom effect that we see that the proteolids do is actually starting the digestion process outside of the body.

So it breaks down muscle, breaks down blood, and causes significant bleeding.

You know, some of that will cause death, but really, the snake biting the creature is going to cause most of that.

And the digestion happens, but while the snake is working on getting its mouth around the creature into its gut, eventually.



The actual names of these venom components are not all that important.

It's really just the fact that these are-- there's not one thing in here.

There's many proteins that are all doing different things, between local tissue damage, coagulation effects, effects on platelets, and there's some that have some neurotoxic effects.

Like I said, that was going to be the timer rattler or the canebrake.

So what clinical manifestations do we get when somebody actually gets bit?

We're going to see fang marks.

And then locally, you're going to get things like swelling.

You might have weakness of that extremity, and then pain, lots of bruising.

On you can get paresthesias and fasciculations.

You can get big vesicles full of blood.

And then you can also get systemic signs, so sweating, heart rate and blood pressure changes, nausea, vomiting, light headedness.

That's where the venom is kind of affecting the whole body, not just that extremity.

All right, things that are going to get checked we'll talk about once we get to the hospital.

So in terms of what we're doing before folks get to the hospital.

So if you're out there, somebody gets bit by what you think is a venomous snake while you're hiking, really the main goal is to get them to the hospital.

People will say that the best treatment for a snake bite in the field is car keys.

All right, you're not doing anything with them other than putting them in the car and driving them to the hospital.

We'll talk about things not to do, but in the meantime while you're getting there, marking what the front edge of the swelling is and timing it is going to be most helpful to evaluate whether this is a real envenomation or whether this is something more akin to a dry bite.

There's all kinds of recommendations for what to do in terms of a snake bite in the field.

There's a lot of don'ts, all right?

There are venom extractors, which is basically a glorified suction cup.

It doesn't work.

You're not going to be able to suck out the venom.

The venom delivery apparatus, which is a big fang, spreads the venom out within the tissue.

It is not just sitting there in a little pocket, easy to be sucked out.

So don't suck it out with your mouth.

Don't you waste money on a venom extractor.

Ice is actually shown to be somewhat harmful.

Unclear exactly why.

Maybe it causes some vasoconstriction and stops the body from dealing with the venom itself.

In any case, snake bites do worse with ice.

Certainly don't electrocute the snake bite.

You're not going to dissociate the proteins or something like that by hooking up that wound to a car battery.

And then bringing in the snake or killing the snake and bringing parts of it in are not generally helpful, all right?

If somebody can give us a general description of what kind of snake this is, we can go from that.

There's two reasons why we don't actually need the snake.

First, you know, I don't want a live snake in the emergency room.

I don't want anybody else trying to get bit.

And next, not every venomous snake injects venom.

We have a certain percentage of dry bites, and some reports it's up to 15, 20%.

You know, remember, a snake doesn't eat a lot.

It's a cold blooded animal.

It takes a lot of energy for the snake to make venom.

So for a snake to use its venom on you, it has to be really scared, all right?

I don't want to say older, wiser snakes, but that's-- you know, we can think along those lines.

Will not waste venom on something that's not going to be prey.

So there are a percentage of dry bites where you see the fang marks, you see a little bit of local swelling, but we don't end up seeing significant venom effect.

And really, that's what we're going to base the treatment with antivenom on, whether we see progression of venom effect in either the blood or the swelling to the limb.

So even if it is a venomous snake, even if you bring in a headless Eastern diamondback, it doesn't necessarily mean that that person is absolutely going to get antivenom, all right?

It's really going to be their clinical signs and symptoms.

So we don't need snakes in the emergency room.

So when they show up, what are we worried about?

The same things as we always do.

We're going to worry about their airway, breathing, and circulation.

If this is somebody who went out to kiss the snake and has a bite on their face, you know, that is absolutely an airway issue, and we have got to worry about whether their lips, or mouth, or tongue, or cheeks, or neck are going to swell up and, you know, whether we need to protect their airway before that happens.

The next thing is, we're going to be deciding on whether somebody needs antivenom.

And I've already kind of talked about how we're going to do that.

In terms of the workup, we're going to check lab.

So specifically, a complete blood count.

We're going to be looking at the hemoglobin and the platelets.

We're going to check their coagulation factors, namely the [? prothromentime. ?] We're going to check things like fibrinogen, and then we're going to look for [? myoglobin ?] and [? protenary ?] in the urine, all right?

We're going to look at the wound, all right?

We're going to do some wound care, see if there's any-- you know, if there's a fang that needs to come out, if there are signs that a fang might have gotten stuck or lodged within the skin.

And then, you know, we'll do some wound care there.

We're going to watch that wound every 15 to 30 minutes and see if the swelling around it is extending.

And that's where we're really looking for the effects of the venom, if this wound goes from the hand to the wrist, to the arm, and then starts crossing over major joints like the elbow.

That's when we're going to start pulling the trigger on antivenom.

We'll look for neurovascular status.

You can absolutely get compartment syndrome from snake bites, it's just very, very rare.

All right, so just to take a step back, protection from snake bites really can be achieved with regular pants and regular shoes.

You don't need any special equipment.

You don't need Kevlar or anything like that.

Their fangs aren't really designed to go through regular clothes.

So it'd be really rare for a snake to get through a hiker's pants, and certainly not a hiker's shoe or boot.

It's really folks who are out hiking in things like sandals or wearing shorts and they get above the boot line or above the shoe line that we see effects.

Or, of course, when people put their hands down to see the snake.

So along those lines, it's very hard for the snake to get into the deeper compartments.

So the swelling we see is usually very superficial and doesn't cause major compartment injury or elevated compartment pressures.

All right?

With that said, we can check compartment pressures and just confirm that if we're really concerned that we're not feeling a pulse, that we're losing, you know, neurologic function in terms of tingling or noticing weakness in that extremity.

All right.

If we don't see any major effects from a bite, and we've watched the patient for about eight hours, their labs look OK, we're not seeing any significant swelling and certainly no progression of it, that's a patient we can probably send home, assuming that they're willing to come back and able to come back should symptoms worsen.

You know, and those are the cases where we assume it was a dry bite.

But they do have to be observed for some time.

All right.

In terms of antivenom, what we have right now is CroFab.

This is sheep antibody, and the sheeps are immunized with venom from the Eastern diamondback, the Western diamondback, the Mojave rattlesnake, and the cottonmouth.

All right?

It is basically half of an antibody, the top half.

So if you imagine the antibody as kind of a Y shape, it's just the upper V of that, cutting off that little stem that usually is used to trigger a full immune response.

So that top Y, that top part of the antibody, will bind onto some of those proteins in the venom and stop them from causing an effect, and cause the immune system to start the process of degrading them.

Interesting things about antivenom is that it's a much simpler protein than the venom is.

So what we can see is recurrence of venom symptoms as the body degrades the antivenom before the venom is totally gone.

All right, so you wouldn't want to give antivenom to someone who's got a papaya or papain allergy.

That's one of the proteins used to cleave that top V part off the full Y antibody.

It comes from papaya, so you can't use that.

The indications, like I said, are going to be major abnormalities in bleeding or platelet function, or progression of swelling across a major joint.

The initial dose is going to be four to six vials, intravenously over one hour, all right?

And then repeat dosing until we get control.

The traditional dosing of this has included maintenance dosing with two vials every six hours.

Although there's some data that suggests that maybe we just do it kind of on an as needed basis once initial control is reached, and that's still a little bit up in the air.

Other things that are up in the air is there is a new antivenom coming out.

So this will be a little bit longer lasting, and the hope is that it will require less frequent dosing.

Full data has not been released yet, and we don't have this fully commercially available yet, but it is something coming down the road.

Antivenom is expensive, all right?

It's at least \$800 a vial for the hospital to get.

And whatever the hospital marks it up for a patient is a whole other story.

I mentioned the four species that the CroFab is directed against.

Whether you have full cross reactivity with another species is a little bit up in the air, although it seems like that CroFab will treat all crotalid bites.

There are hypersensitivity reactions, so some are related to the rate that the antivenom goes in.

Some look like anaphylactic reactions, though they're probably not, because very, very few people have actually seen antivenom before.

But they're a good group of people that will develop itching, and hives, and all those symptoms that go along with an allergic reaction.

There are folks that develop things like serum sickness with fever, rash, and joint aches within the first few weeks after treatment.

All right, and then there is kind of the recurrent effects, which is probably more of the venom sticking around longer than the antivenom does.

In the picture, this is a woman who was bit, treated with antivenom, got better, her labs look good, and then over the course of two days, had increasing bruising, was found to have a hemoglobin down to three or four, and platelets of one.

So the venom can cause recurrent symptoms.

And those people need to come in and get retreated with antivenom.

All right.

So we'll switch gears to the elapids now.

And these are the most colorful snakes we have here in the US.

These are our coral snakes.

We do have an Eastern and a Western coral snake.

They live in very different climates.

Both are very warm, so these are going to be very southern snakes.

So Florida has quite a few elapids, and many of our elapid bites, although elapid bites-- although I will say that elapid bites are very few and far between.

And then places like Arizona, New Mexico, where it's much drier also has the Western coral snake.

They make up about up to 1% of the bites each year, and it's probably actually less than the number of exotic snake bites that we get.

They look like a worm in terms of identifying them.

Their head has none of that triangular shape to it that you'll see in the crotalids.

It's really hard to tell the front from the back.

It almost looks like Slimy from Sesame Street, just different colors.

They're not very large.

You know, maybe 18 inches or so.

And they spend most of their time underground, and they actually hunt other snakes.

Their fangs are very different from the crotalids.

Whereas the crotalids have those giant scary snake fangs, that elapids have a row of pretty small teeth, all right?

And almost need to chew on you for a while before they actually envenomate.

So the people who actually get envenomated by this are people who are playing with them, people who are out doing gardening and digging and don't notice that they're getting bit for a minute.

There's actually a case of a school kid in Florida who, you know, was out playing, digging in his yard, found one, brought it home, put it like in a little terrarium and was playing with it as a pet when he got bit.

So it can happen.

They're not very aggressive.

They're really small and not particularly aggressive.

You can see this is the head herpetologist up at the Riverbank Zoo in Columbia.

And he's handling it.

Now, those are special gloves.

Those are Kevlar gloves.

He frankly said, there's no need for Kevlar here.

These teeth-- you know, if the teeth of an Eastern diamondback don't require anything more than just regular fabric, certainly the teeth of a coral snake don't require it.

But, you know, their procedures are to use those gloves.

In any case, they're something you can handle.

They're relatively small, and they're very non aggressive.

The venom is very different, all right?

This is not going to cause muscle or blood toxicity.

This is going to be a neurotoxin.

So around the bite, there may be some local swelling and a little bit of pain, but really, the symptoms are going to be things like cranial nerve deficit.

So, you know, problems with the eyelids, double vision, difficulty swallowing, difficulty speaking.

And then, you know, as it progresses, difficulty breathing as the toxin affects the diaphragm.

So these are folks who would typically need intubation or antivenom.

The interesting thing about the antivenom with the coral snake is that nobody makes it anymore in the United States.

So we have a few batches that are left that the FDA keeps extending the expiration date that was initially applied to them.

You know, with the assumption that most of the antivenom is actually still in there, and the expiration dates are kind of more of a requirement for anything that's stocked in for human use.

There are lots of studies going on now that are showing that maybe we should be waiting until people develop symptoms.

Whereas prior teaching, when we were flush with antivenom, was treat anybody who had a coral snake envenomation.

Now, with antivenom being limited, we're thinking, maybe we'll wait and see if people develop symptoms and then treat.

So if someone does come in with a coral snake envenomation, we're really watching them at least overnight to see if they develop any sort of neurological symptoms.

And if they do, at that point, we would pull the trigger on treating them.

So we'll switch from snakes to spiders.

One fact about spiders, all of them have venom.

But there's only a very few that actually pose a risk to people, because the venom delivery apparatus, you know, it's all in the jaws.

Most of them can't actually get through human skin.

So it's really the only ones that can get through skin and deliver venom to us that are actually cause of problem.

The biggest one that we worry about is the black widow.

So you can see the black widow female and the male next to each other.

She's about up to a centimeter long, and he's obviously much smaller than that.

She is the one that you will typically get bites from, and is much more aggressive.

And she's the one that has that reddish fiddle shape on the abdomen.

There are a lot of species related to the black widow.

So this is the Latrodectus, and all of them will have kind of similar venom.

And, you know, in different parts of the United States and actually different parts of the Americas, different Latrodectuses will have different markings on them.

Some are more of a yellowish stripe.

Some just look like kind of two dots almost, but they all have kind of the same venom effect.

It is neurotoxic, so there's not going to be much pain at the site, although this isn't a subtle bite.

This is a centimeter wide spider biting with fangs, so it hurts when it happens.

And there will-- you know, in many cases, there are fang marks.

But the major problem with these bites is that they cause severe muscle contractions.

So these are the old cases of someone being rushed to the operating room for an appendectomy because their abdomen was rigid, with totally tensed abdominal muscles.

And when somebody examined them, you know, and the case was typically a kid who didn't report a spider bite or didn't put that together.

They would go to the operating room thinking that this was a perforated appendicitis and find kind of a normal appendix, and then, you know, in retrospect, somebody does kind of a more thorough physical exam and finds the two fang marks.

A lot of hypertension associated with that significant pain and sweating.

In terms of treatment, there's a little bit of wound care, but really not that much.

It's two tiny little fang marks.

We always give tetanus, but really, it's sedation and pain control.



There is an antivenom for black widow bites.

The evidence is not super convincing that it relieves pain all that much over our normal pain control.

So using opioids, you know, whether it's morphine, or [? lauded, ?] or something like that to treat the pain in addition to something to calm folks down, will have similar effect to giving the antivenom, at, really, a fraction of the cost.

Again, this is going to be an immune directed antivenom.

So an antibody directed specifically at the venom coming from these black widow spiders, and the cost of that is pretty significant.

The other spider we tend to worry about is the brown recluse.

And this picture gives a really nice indication of why we call it the fiddle back.

You can see kind of the body of the fiddle right there over the head and the mouth, and then it's got that one little part over the back that kind of makes the bow of the fiddle.

They're tiny.

They live in, like, piles of wood.

And typically, you know, these are bites that people won't even really notice.

And actually, there is a species similar to a brown recluse or within the same family in Mexico and South America whose name is translated as, like, the little brown spider who lives in the picture frame.

So these are kind of all over the place.

They're not particularly aggressive.

There are stories of folks moving into houses that are totally infested with these, and they save them up and put them in jars, and no one ever gets a bite.

So, you know, they're not super aggressive.

The red kind of delineates where these spiders generally live.

So they're going to be, you know, southern, midwest, and southeast.

All right?

We definitely have these somewhat in South Carolina.

We don't see lots of bites from them.

Although every person who's ever had an abscess thinks that they've had a spider bite, because of the skin manifestations that these guys cause.

So, you kind of have a painless bite, so you may not even recognize it.

And then there's a little bit of itching, a little bit of tenderness, some redness around it, and it starts to get a little swollen.

Then you get, like, a little bit of a vesicle with some redness around there, and then the vesicle will actually to necrose and create a eschar.

And the necrosis can be fairly extensive.

You know, up to 10 centimeters, in some cases, requiring a skin graft.

There are some systemic manifestations.

But really, the skin is what we're most commonly seeing.

The systemic effects will be things like nausea, fever, chills.

There are really severe cases in kids of hemolysis, where they're totally breaking down every red cell they've got, and the physicians are very frantically trying to pump these kids full of blood.

And there are several deaths reported to this systemic toxiscelism.

so this hemolysis from a brown recluse bite.

It's not particularly common.

The bites in general are not common, and then that hemolysis this is not common either, but it does occur.

In terms of treatment, we don't really have any good ways to treat this other than supportive care.

Things like dapson, cyprohepdatine, hyperbarics have been attempted.

So you can look at the data from one trial on the left where all those agents did no better than placebo, and then on the right, it looks hyperbarics at varying doses did a little bit better in terms of how big the wound was.

So I think the jury's still out.

In no way is this a reason for emergent hyperbarics.

I don't think there's good enough evidence for that.

All right, so these wounds are going to get cleaned.

Perhaps cool compresses help, but we don't have any evidence to suggest that.

And then it's just kind of watching and over time.

And really, what you want to do, you want to think of these like frost bite, where you don't want to get the surgeon involved too early because they're actually going to heal better than they look initially.

So several weeks to a month down the road, potentially, this person would need a skin graft.

But excising everything and debriding the whole area that appears necrotic at first ends up doing a little bit more damage than good.

And all the other treatments that are directed at it, whether it's steroids, or dapsone, or hyperbarics, those are all pretty experimental.

So we'll switch from spiders to scorpions.

Scorpions are a species, they're kind of a elongated arthropods that have a venom delivery apparatus in their tail.

The tail is actually officially part of their abdomen, and it's got this little tesselon at the end of it that actually collects the venom and then injects it.

There is no scorpion bite, really.

And the pincers don't do anything other than grab their prey and hold it in place while the venom is injected from the tail.

Scorpions live all over the world, and there are some places where they're really a problem, and their venom can cause up to-- or envenomations in children have a mortality rate of, like, 50%.

Those tend to be in Northern Africa, in the Middle East.

There are pretty nasty scorpions as well in Asia.

Again, in the US, we've kind of gotten off the hook here a little bit.

So the one we do worry about is the bark scorpion.

This tends to live in the southwest in drier, warm climates.

So Arizona, New Mexico, California.

These guys are relatively small.

So, you know, two to three centimeters.

One interesting thing is they will [? floress ?] under a UV light.

So, you know, folks camping out outside Phoenix who bring a UV light with them will see these critters just kind of walking around.

They're out there.

They do make it into folks' boots and shoes and stuff like that.

So you folks who have spent a lot of time in Arizona know to kind of knock out their shoes before putting them on.

When we're talking about envenomations due to scorpions here in the United States, we worry about effects on the somatic skeletal muscles.

So you see effects on, you know, arms and legs moving uncontrollably.

We do see effects on the cranial nerves and the muscles of the face, so we see eyes roving around uncontrollably, and difficulty speaking and swallowing.

The least severe are just local effects where the investigation happened.

Next would be paresthesias far away and pain.

And then effects on either the somatic skeletal muscles or the cranial nerves.

And the most severe have all of that.

So paresthesias, pain, and loss of control of, really, all the muscles of the body.

So those in the face and head, and then those throughout the body.

And really, having seen one or two of these, it's really dramatic.

The one case I saw of this was a woman who went to visit family down in Mexico.

Packed her bags, came back up and flew into New York City.

Was unpacking her bag, and a scorpion came out.

You know, so she brought it back with her.

It did envenomate her, and she quickly got sick.

She had no control over her arms and legs.

She was awake, but couldn't converse, because she had no control over the muscles of her head and face.

I will show you how miserable this looks.

This is a case from out in Arizona describing the ping-pong pupils.

So this little boy has no control over where his eyes are looking, and he's totally awake for this.

And, you know, the last second before the clip ends, he just looks so miserable.

If you pair that with total loss of control of the muscles of the extremities, I think you have a better picture of what severe scorpion envenomation can look like.

In terms of management, do a little bit of wound care-- again, tetanus.

But for this, we have a really good antivenom.

So it is again a F(ab) fragment.

We use it with systemic toxicity.

And really, in all small kids, because they are at most risk for having severe outcomes, including death from these envenomations.

There is a shortage of this, although it's getting a little bit better.

And really, places that see lots of scorpion envenomations are going to stock this.

So we don't have many of these in South Carolina.

There would be ways to get it would be coordination through the poison center and working with folks through the anti venom index to get that in town if we really had one.

The data on the antivenom and what it's able to do is really striking.

So this is from the New England Journal when the antivenom was-- or the effects of the antivenom were published.

And really, the thing to focus on is the cumulative midazolam dose in mgs per kg.

So in the folks who got antivenom, the mean dose of midazolam given it was 0.07 milligrams per kilo.

So imagine that for a 70 kilo average human, that's going to be about 5 milligrams total.

Whereas the folks who didn't get the antivenom, their average was 1.77 milligrams per kilo.

So, you know, that's about somewhere in the 100 range, if we think about it as a 70 kilo person.

And there were folks in that group, if we look at the range, who got 4 milligrams per kilo.

So four times 70, we're talking about 280 milligrams of midazolam compared to, really, 5.

So that's how much sedation is going to be required to kind of keep these people at bay while the venom is working, as opposed to just getting the antivenom and just being done with it.

So in that case I was describing where the woman who unpacked her suitcase and got envenomated, came into the hospital, her dad was really upset because we were in New York and we didn't have access to the antivenom.

And he said, you know, down in Mexico, where the whole family lives, we just get the antivenom and then people go home from the hospital.

And this woman was, you know, admitted to the ICU with all kinds of drips, and still, we had difficulty controlling her.

So the antivenom really works and it does a great job.

There is a little bit of an issue with antivenom and whether insurance covers that, and this is true for CroFab.

I imagine this will be true for the new crotalid antivenom, [? anavip, ?] it'll be called, is that how insurance deals with it, and whether they consider it a required medication or not.

But there are definitely cases in Arizona of folks getting massive, massive hospital bills to pay for the antivenom, because it's not covered.

With that said, the antivenom does wonders and actually works beautifully in scorpion envenomations.

If there are questions, please feel free to email me.

My email here at MUSC is connorsn@musc.edu.

So that's C-O-N-N-O-R-S-N@musc.edu, and I'd be happy to answer questions where I can.

Thanks so much.