

NEWS FROM THE PIT

Arizona Poison and Drug Information Center



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Shooting Blanks: Dry Bites in Arizona

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How much money are you willing to invest in home security? In the 21st century there are myriad ways to keep yourself safe. Just about everyone with a house at least has a lock on their door. Some folks then choose to invest in video doorbells, while others spring for professional security systems. Do you want cameras? Security doors? Motion detectors? Trained German Shepherds? The real questions are how much money you feel you need to invest in your own safety, and how much money you have to spend. Now here's the next question, which corners can you cut to save some money on security? Security systems are expensive, but if I put a sign on my yard that says "Protected by ADT" will that deter a thief? Security cameras often have to be wired through the house and need a dedicated recording device, all of which can get pricey. That said, if I hang a fake, but realistic-looking camera above my garage in a visible place, wouldn't that do just as much to convince a criminal to look elsewhere? Now you're reading this article because you're interested in snakes, not low-cost security measures, so let's talk about snakes.

NEWSLETTER HIGHLIGHTS

Dry bites: what are they, why do they occur, & how often they occur in Arizona

Image 1: Western Diamondback Rattlesnake (*Crotalus atrox*)

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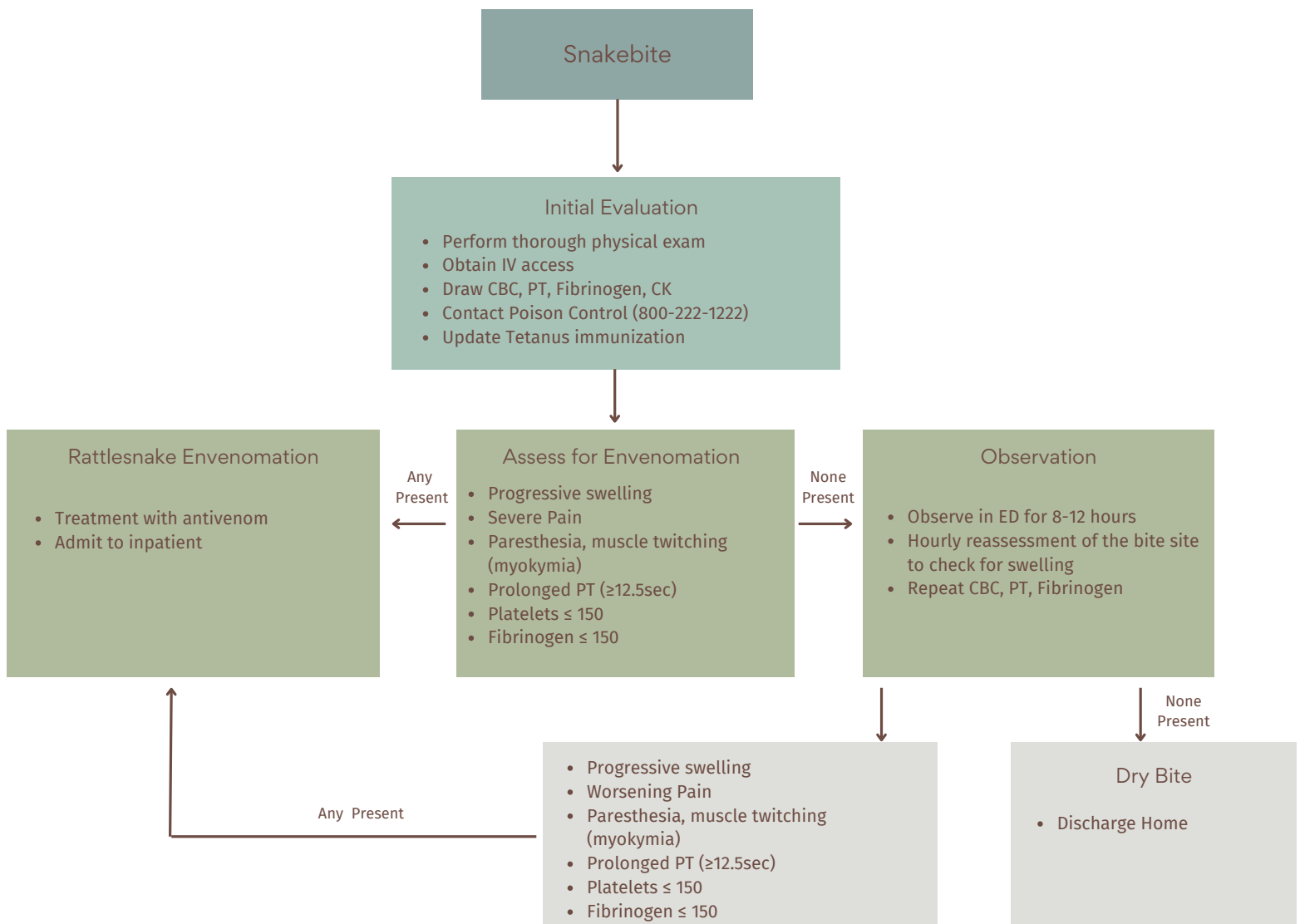
Just as you devote money towards your own safety, snakes devote their own resources toward security. Rather than the US dollar, a snake's currency is calories, proteins, minerals, and everything that they are able to extract from their diet. A rattlesnake's rattle is made from keratin, a protein, which the snake had to produce from something they've eaten. This is also true for venom. In fact, snake venom is very expensive, biologically speaking. Venom itself is made primarily from proteins, which the snake will need to gain from its diet, but the real issue of using venom for self defense is the fact that, until it synthesizes more venom, in theory, the snake would go hungry! In reality, snakes likely are able to control how much venom they use to prevent running empty, but the point remains, snakes have a biological pressure to avoid injecting all of their venom. Our rattlesnakes aren't big, muscular constrictors, they use venom to incapacitate and digest their prey. Thus if a snake bites me and injects all of its venom into my leg, it has to rely on its own stored fats and amino acids to produce new venom before it can hunt again, and if the snake doesn't have much of a reserve, that can pose a real danger. So maybe the snakes have the same idea for a security plan that I had above: fake it. If a rattlesnake bites me, regardless of venom, I'm probably going to run away and leave the animal be, so why would it even waste the energy and venom it would normally use to survive? If envenomation is a very expensive form of security for the snake, why doesn't the snake just bite me without injecting venom?

This brings us to my topic for this month: dry bites. A dry bite is a bite from a venomous creature during which no venom is injected. There are several reasons why this may occur. The snake may have used up its venom during a recent hunt (unlikely), the snake may have an infection within its venom glands preventing it from producing venom, the snake may have an obstruction in its venom duct preventing it from injecting, or most importantly, the snake may have decided not to waste venom on its target. If the snake can scare away a threat with a dry bite, then there is no need to waste any venom at all. Now theoretically, this makes sense. There is no way a snake could incapacitate me with a single bite so quickly that I don't kill the snake, any bite, regardless of venom delivery, is done to scare me away.

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Now from a healthcare perspective, this presents a challenge. If a patient comes in with two pinprick wounds in their toe and says a rattlesnake bit them, do I pull the trigger and give antivenom? How do I know it was a rattlesnake and not a harmless garter snake? How do I know it wasn't a dry bite? This is where being an astute clinician comes in. There is no lab test for venom in the US, rather, when diagnosing dry vs wet bites, we are looking for signs of what the venom does to the body. Our previous articles have covered this in more detail, but to condense it, there are three basic pillars of snake envenomation: cytotoxicity, hemotoxicity, and neurotoxicity. Cytotoxicity is tissue destruction presenting as swelling, and blisters (bullae) that occur at the bite site and then spread as the venom distributes into the tissue. Hemotoxicity is represented by a destruction of the body's inherent clotting factors, which can be seen on coagulation labs, significant bruising or bleeding at the bite site may suggest hemotoxicity before labs can result. Our rattlesnakes aren't especially neurotoxic as compared to species from the Elapidae family, but severe pain, pain distal from the bite site, tingling, and a metallic taste in the mouth are all signs of neurotoxicity. I can only diagnose a dry bite if I have a patient who was bitten by a confirmed venomous snake, and has absolutely no signs or symptoms of envenomation after a generous waiting period, usually twelve hours. Below is an example of an algorithm we use to diagnose a dry bite, it's a somewhat lengthy process.



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Now we already know that snake behavior varies depending on whether they are biting to feed or to defend themselves. With a feeding bite, the snake is striking a prey animal with the hope of killing it and digesting it for food. In these situations it is in the snake's best interest to use a large volume of venom to kill the prey quickly and improve the odds that the snake gets to eat it. Feeding bites are rarely important to me because none of my patients are rodents, that said, we will occasionally see particularly nasty envenomations which occur when a snake owner is feeding their pet rattlesnake and the snake mistakenly strikes the owner rather than the delicious rat they have been delivered. Most often, when a human is bitten, the snake is trying to defend itself, so this is called a defensive bite. Envenomation behavior has been studied using human models, and snakes have been shown to deliver different amounts of venom depending on the size of the snake, species, target, and number of strikes. Honestly though this doesn't make too much of a difference to us. Really any envenomation from a rattlesnake is enough to merit a visit to the emergency department, expensive antivenom, and an even more expensive hospital stay. Only a truly dry bite, with no venom delivered whatsoever, will change how the patient gets treated.

Now how often do dry bites occur? This question is actually fairly difficult to answer. Every time I read about dry bites I see a different number, ranging from almost never to around forty percent of bites! Now how do we get so much variety? A few different factors are probably at play. One possible cause is that different snakes have different rates of dry bites. Put simply, some species of snakes, like those in the elapid and colubrid families, are more likely to deliver a dry bite than other species. This may be behavioral, but anatomy plays a role as well. Rattlesnakes are vipers, which have the most impressive venom delivery apparatus of the snake world. In addition to long, hollow fangs and large, muscled venom glands, vipers have fangs attached to a mobile maxillary bone, allowing the fangs to rotate for optimal positioning during a bite, making it more likely for the snake to land a successful bite. Elapids and colubrids on the other hand, have fangs attached to a stationary maxilla, meaning if the snake isn't striking from the perfect angle, their fangs may never make adequate contact with the target. Colubrids (like the boomslang or our own hognose snake) have fangs toward the rear of their mouths, making it even more difficult for them to successfully envenomate a human.



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Snake identification may also play a role in these numbers. In many countries, venomous snakes and nonvenomous snakes look pretty similar, and in the heat of the moment a person will have a difficult time recalling exactly what the snake looked like for identification. In those cases the treating physician really can't tell if the patient suffered a dry bite, or was just bitten by a harmless snake. Even here in Arizona, where most of our venomous snakes have rattles, in the heat of the moment it's not always easy to get a good look at the snake and we have to work with very limited information much of the time. Another factor is how often we at the poison control center are contacted for a dry bite. We prefer to be called for every snakebite and are happy to give advice, but in some healthcare facilities we will only be called once a patient looks like they need antivenom, and some people will be bitten by a snake and choose not to seek healthcare, and wait at home and see what happens (I would not recommend this approach). Obviously, if we aren't called on these, we can't keep track of the true number of dry bites in Arizona. At the end of the day the diagnosis of dry bite will always be inaccurate, and we can only make an educated guess based on the calls we receive.

So how often do Arizona rattlesnakes give dry bites? Not very often. Our data suggests that around 6% of Arizona snake bites are dry. Much higher rates of dry bites may be thrown around, and in these cases it is important to remember that very often the patient will never see a snake, and come to an ED out of concern for a possible snake bite that was truly a cactus, some other creature, or a skin infection. In those cases, the patient's chart may read "snakebite" when no bite occurred, and no antivenom was given, so when chart reviews are performed, plenty of patients, even over 20% sometimes, will be charted as rattlesnake bites which don't receive antivenom, and may be mistakenly considered dry bites.

So what do we do with this information? Hopefully nothing. I hope it goes without saying that nobody should ever assume a snake will deliver a dry bite, doing so will more likely result in a very real envenomation, because as our numbers suggest, that's not something that our snakes are prone to doing. Really this should make sense. Earlier in the article I used the metaphor of home security, but honestly, that isn't a very good depiction of what the snake goes through when encountering a human. Despite their reputations, our rattlesnakes are very weak, delicate animals. They are much smaller than any human child, their scales offer no protection, they have a skeleton essentially made of toothpicks, and they can't outrun us if they tried to escape. One errant footstep is enough to kill or permanently injure a rattlesnake, so if a person stumbles over a snake (or purposefully bothers one), we really shouldn't be surprised that the snake does everything in its power, venom included, to defend itself. At the end of the day, that snake doesn't want to meet us, and most of us probably feel the same. If, however, that doesn't go so well for you, AZPDIC is only ever a phone call away at 1-800-222-1222.

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