Crushing snakes kill by blood constriction, not suffocation

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Death by suffocation seems like an awfully protracted way to go and death by suffocation in the grip of a boa constrictor's coils is the stuff of nightmares. Yet Scott Boback from Dickinson College, USA, wasn't so sure that suffocation was all there was to the boa constrictor's technique.

'It looks like the [prey] animals are gasping for air', says Boback, but in 1994, Boback's colleague, Dave Hardy, had proposed an alternative. 'What Hardy saw was the speed at which the animals were dying... they were dying way too quickly for it to be suffocation. He suspected that it was circulatory or cardiac arrest because of the speed at which death was occurring', says Boback. But there were few data to support Hardy's suggestion and, although hard-core members of the herpetology community were aware of the possibility, the rest of us were left clinging to the old-wives' tale that constricting snakes kill by suffocation: until Boback put the crushers to the test. He and his colleagues publish their discovery that boa constrictors rapidly shut down the victim's circulation. They suggest that the snakes kill their prey by cutting off the blood supply to the heart, brain and other vital organs causing their victims to pass out in a matter of seconds and die more quickly than if they were being suffocated in *The Journal of Experimental Biology*.

'We have been studying constriction for a number of years,' says Boback, explaining that he had measured the pressure exerted by snakes crushing dead rats in earlier experiments. However, to find out what was really going on inside the snake's victims, he had to measure blood pressure in living anesthetised rodents as they were squeezed. 'It was not

something that we took lightly and we wanted to make sure that the animals [rats] did not experience pain or suffer', says Boback. Having anesthetised a rat, Boback and his colleagues, Emmet Blankenship and Charles Zwemer - backed up by undergraduate researchers, Katie McCann, Kevin Wood and Patrick McNeal - inserted ECG electrodes and blood pressure catheters into the rodent's body before offering the sedated animal to a hungry boa constrictor.

Fortunately for Boback, the snake struck, aiming a bite at the rat's head and coiling its body around the rodent as it began to squeeze. And, as the team watched the blood pressure and heart rate data stream onto the computer, they were amazed to see the rat's blood circulation shut down in a matter of seconds. 'I remember being in the room and the students were looking at the data in disbelief that it happened that fast. We could see the arterial pressure go down, the venous pressure go up and we could see this right when the snake was doing it [squeezing]', says Boback. As soon as the rat's circulation stopped and the oxygen supply was cut off, the team could also see the rat's heart beating more and more irregularly. Boback suspects that without blood flow to the brain, any animal caught in the snake's coils probably passes out in a matter of seconds, before other critical organs begin to fail.

Boback also suggests that the boas provide a glimpse into the evolution of crushing behaviour in snakes. He explains that ancient snake species that had not evolved constriction were probably restricted to capturing small meals that they could subdue easily. However, once the earliest boas had developed their quicker constriction technique for despatching victims, they were free to scale up the size of meals, sometimes tackling animals that are even larger than themselves. 'By understanding the mechanisms of how constriction kills, we gain a greater appreciation for the efficiency of this behaviour and the benefit it provided early snakes', says Boback.

More information: Boback, S. M., McCann, K. J., Wood, K. A. , McNeal, P. M., Blankenship, E. L. and Zwemer, C. F. (2014). Snake constriction rapidly induces circulatory arrest in rats. *J. Exp. Biol*. 218, 2279-2288. DOI: 10.1242/jeb.121384