Venomous Snakes Have Copper Heads – The Antivenom Seems Made of Gold

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> Every great story seems to begin with a snake.
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> -Nicholas Cage

Exposure to nature, and unstructured play and exploration, has great value for child development. Summertime allows children to embrace nature by visiting parks, going on hikes, and splashing through creek beds. Of course, we share those environments with other plants and creatures that may cause rashes, sting, or bite – including snakes.

Most pediatricians in Pennsylvania have never had the opportunity to care for a child with snake envenomation, but globally, snakebite is a socially unjust public health tragedy. The World Health Organization considers snake envenomation injury to be a neglected tropical disease and estimates that 400,000 to 2,000,000 people are bitten by venomous snakes each year with 20,000 to 100,000 annual deaths (audio podcast available here).

Pennsylvania is home to three native venomous snakes: the copperhead, the timber rattlesnake, and the eastern Massasauga rattlesnake. The experts at The Poison Control Center at The Children's Hospital of Philadelphia help families and health care providers assess and care for snakebites in eastern Pennsylvania and throughout Delaware. The summer of 2014 is proving to be an active snakebite season, and several children have been hospitalized after being bitten.

Towards the end of July a 13-year-old boy was running in his Delaware back yard and was bitten by a startled snake. He arrived to an emergency department (ED) with two distinct fang marks near his ankle, a fair amount of pain, and some swelling of his lower leg. A good number of clinical decisions followed including whether or not to treat this boy with antivenom; and, if so, how and where to do it.

> Always carry a flagon of whiskey in case of snakebite and furthermore always carry a small snake.

-W.C. Fields

The pit vipers of Pennsylvania and Delaware may cause local tissue injury including pain, paresthesia, swelling, ecchymosis, and necrosis; and may cause systemic coagulopathy. Reassuringly, the copperheads most common in Delaware and believed to have bitten this teenager rarely cause systemic toxicity. A quality clinical pathway exists to guide the treatment of North American pit viper bites and suggests antivenom be given to patients with "swelling that is more than minimal and is progressing." Such wording leaves some uneasy subjective decision making in the hands of the physician.

Is a less swollen limb worth the economic cost associated with antivenom administration? Functional outcomes data is still being collected. It is also unclear how the cost of antivenom therapy is to be borne. A Time.com headline exclaimed, "Snake bite costs North Carolina couple $89,000 hospital bill," and joined other sensational news stories including hospital charges of $143,000 in San Diego, $55,000 in New York, and similar striking reports from around the country.

My colleague, Dr. Evan Fieldston, MD, MBA, a pediatrician and health services researcher at The Children's Hospital of Philadelphia's PolicyLab, is lead author of a new study in *Hospital Pediatrics* that helps to illuminate some of these issues. The analysis suggests that it may be prudent to reevaluate a commonly used "Observation Status" billing system that often doesn't reflect the resources committed to treating these patients. The resource-utilization study examined 2,755 children treated for the toxic effects of venom at 33 U.S. children's hospitals, of whom 211 were hospitalized as inpatients and 124 under observation status. The mean costs attributed to children receiving antivenom under observation status were $17,665 as compared to $3,001 for children in observation status for other diagnoses. Dr. Fieldston notes that, given the clinical resources necessary and the financial consequences for both patients and hospitals when antivenom treatment is provided, it is possible that snake envenomation care does not meet the spirit of criteria that the federal Centers for Medicare & Medicaid intended for observation status.

Experience evaluating snakebite victims seems invaluable in clinically gauging the severity of envenomation injury, and in consultation with the experts from The Poison Control Center at CHOP the snake-bitten boy with progressive swelling was treated with antivenom as an inpatient. Full recovery is expected, but limb dysfunction may persist for a week to a year. Antivenom is a precious commodity that may save limb or life: health services research will help to define the best practices with respect to utilization of this resource.

"A snake came to my water-trough

On a hot, hot day, and I in pyjamas for the heat,

To drink there."

"And I was truly afraid, I was most afraid. But even so, honoured still more

That he should seek my hospitality

From out the dark door of the secret earth."

-D.H. Lawrence, "The Snake" (video reading available here)