

Short Communication

Non-venomous snakebites in the Western Brazilian Amazon

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Abstract

Introduction: In this study, we examined the clinical manifestations, laboratory evidence, and the circumstances of snakebites caused by non-venomous snakes, which were treated at the Regional Hospital of Juruá in Cruzeiro do Sul. **Methods:** Data were collected through patient interviews, identification of the species that were taken to the hospital, and the clinical manifestations. **Results:** Eight confirmed and four probable cases of non-venomous snakebites were recorded. **Conclusions:** The symptoms produced by the snakes *Helicops angulatus* and *Philodryas viridissima*, combined with their coloration can be confused with venomous snakes (*Bothrops atrox* and *Bothrops bilineatus*), thus resulting in incorrect bothropic snakebite diagnosis.

Keywords: Serpentes. Dipsadidae. Snakes. Ophidism. Envenomation.

Snakes from the families Colubridae and Dipsadidae are traditionally classified as non-poisonous, despite having the Duvernoy's gland and the capacity for producing toxic secretions, which eventually cause envenomations¹. The Duvernoy's gland, located in the supralabial region, posterior to the eyes, is considered equivalent and precursory to the venom glands in elapids and viperids¹. In these two families, two types of fangs can occur: aglyphous, indicating huge fangs without grooves or inoculating channels and opisthoglyphous, indicating a pair of grooved fangs located at the rear of the mouth¹. These types of fangs and the muscles associated with them are not efficient in the inoculation of venom when compared to elapids and viperids; however, there have been cases of fatalities from bites from some opisthoglyphous and some aglyphous species¹.

In Brazil, 27,000 snakebite incidents are registered annually, with a lethality rate of 0.43% and, in the Amazon, the highest

incidence of cases is recorded (56.1 per 100,000 inhabitants)². Of these, bites by non-venomous snakes are also computed (Boidae, Colubridae, and Dipsadidae) which, depending on the region, such as in Cuiabá (MT) for example, can represent up to 56% of cases³. At the Vital Brasil Hospital, in the Instituto Butantan (SP), approximately 32% of the snakes that caused the snakebites (brought in by the patients or their companions) corresponded to non-venomous species⁴. In a hospital in Uberlândia (MG), 19% of the patients showed no signs of envenoming or were bitten by non-venomous snakes⁵. Also, it is possible that some snakebites caused by viperids (*Bothrops* and *Crotalus*) are considered "dry bites" when the victims do not present any clinical or laboratory signs of envenomation^{5,6}; therefore, it is not necessary to use serum therapy—only patient observation. This demonstrates the importance of health professionals evaluating the need for serum therapy in cases of snakebites in which patients do not show signs of envenoming, thus avoiding possible allergic reactions and also the waste of antivenom.

Acre is one of the states with the highest incidence of snakebites in Brazil, 61.10 per 100,000 inhabitants² and the Upper Juruá in the extreme west of the Brazilian Amazon is also characterized by a high incidence of snake bites⁷. We present here cases of bites caused by the snakes Colubridae and

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Dipsadidae which were attended to at the *Regional Hospital of Juruá* in Cruzeiro do Sul (AC).

The study was conducted between June 15, 2017 and June 15, 2018 at the Juruá Regional Hospital located in the municipality of Cruzeiro do Sul (Acre) (07° 62' S; 72° 67' W), an area which has approximately 87,673 inhabitants⁸ and is located in the western Brazilian Amazon.

The clinical data regarding the manifestations from the envenoming of the victims and laboratory parameters were obtained from the observation of patients and medical records. When possible, the 20-minute blood coagulation test⁹ was performed with a blood sample collected from the patients.

Patients were interviewed to find out the circumstances of the incident and whether they recognized the snake that caused the poisoning by showing them boards containing color photographs of the most common snake species in the region. The snakes were identified with the aid of a regional book on snakes¹⁰. This research is part of the project "Snakes venomous and snakebites in the Cruzeiro do Sul region of the state of Acre" approved by the Committee of Ethics in Research with Humans of the Tropical Medicine Foundation by Dr. Heitor Vieira Dourado (authorization no. 2.084.630) on 26th May, 2017.

During the study period, 133 victims of snakebites were treated at the Regional Hospital of Juruá. Twelve (9%) of them (eight confirmed and four probable) were caused by snakes that are considered non-venomous (**Table 1**). The snakes confirmed by their capturer or a photograph taken by the victims were four *Helicops*

angulatus, two *Philodryas viridissima*, one *Hydrops triangularis*, and one *Xenodon severus*, all belonging to the Dipsadidae family (**Table 1**, **Figure 1**). In seven cases (58%), at the site of the bite the marks were abrasive lesions and five cases showed signs of puncture (**Table 1**; **Figure 2**). In two cases, three ampoules (for *H. angulatus*) and four ampoules (for *O. fulgidus* or suspected *P. viridissima*) of *Bothrops* antivenom were administered due to prolonged blood coagulation time.

The *Helicops angulatus* species represented 36% of the snakes that were taken to the hospital, a result similar to the study carried out in Rio Branco (Acre)¹¹, where this snake also represented a significant percentage of the snakes brought to the hospital (58% of the specimens). All those who were affected were bitten in the evening between 19:00 and 19:40, since this snake is commonly active at night and at dusk¹⁰. Of those who were bitten by this snake, two had no symptoms and two cases reported mild symptoms with local pain. However, snakes of the genus *Helicops* present the Duvernoy's gland that can produce toxic substances, and are considered moderately venomous snakes, whose venom has proteolytic and neurotoxic components¹². Two patients bitten by the *H. angulatus* snake showed changes in coagulation time, and coagulopathy was observed in cases involving other species of the genus⁴. In one of these cases, besides the change in clotting time, there was also a change in bleeding time and irreversible clot formation. Due to these characteristics of altering blood coagulation time, signs and symptoms of envenoming and the coloration pattern (similar to *Bothrops atrox*), cases of bites from these snakes may be confused with *Bothrops* envenoming^{4,5,11}.

TABLE 1: Cases of snakebites caused by non-venomous snakes in Cruzeiro do Sul (AC)

WBTC	Species	Size Cm	Victim's age (years) and sex	Time	Symptoms	AR	Marks left
X	<i>H. angulatus</i>	35	9 F	19:00	no	foot	Abrasive
X	<i>H. angulatus</i>	50	8 M	19:15	no	foot	Abrasive
I	<i>H. angulatus</i>	57.9	20 M	19:30	pain	foot	Abrasive
I	<i>H. angulatus</i>	50	46 F	19:40	pain	foot	Abrasive
N	<i>H. triangularis</i>	85	50 M	2:30	Vomiting, headache, local pain	foot	3 punctures
N	<i>P. viridissima</i>	40	36 F	9:00	Pain, headache, vomiting	foot	1 puncture
N	<i>P. viridissima</i>	100	34 F	9:00	Pain, headache, vomiting	leg	Abrasive
N	<i>X. severus</i>	50	19 M	14:00	Pain, headache	arm	4 punctures
I	<i>O. fulgidus</i> or <i>P. viridissima?</i>	74	8 F	14:30	Paresthesia	legs	3 punctures
N	<i>O. fulgidus</i> or <i>P. viridissima?</i>	85	30 M	8:30	Pain, headache	foot	Abrasive
N	<i>O. fulgidus</i> or <i>P. viridissima?</i>	100	52 F	14:30	Pain, blurred vision	foot	Abrasive
I	<i>O. fulgidus</i> or <i>P. viridissima?</i>	70	83 F	8:00	None	leg	Abrasive

M: male; **F:** female; **Time:** time of the snakebite; **AR:** anatomical region of the bite; **WBTC:** X, not performed; **N:** normal; and **I:** incoagulable.

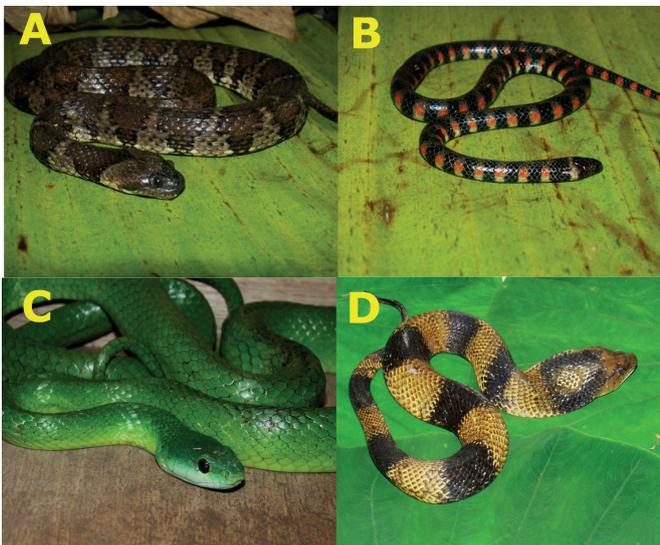


FIGURE 1: Non-venomous snakes related to snakebites in Alto Juruá; **A:** *Helicops angulatus*; **B:** *Hydrops triangularis*; **C:** *Philodryas viridissima*; and **D:** *Xenodon severus*. **Photos:** Luiz Carlos Turci.

In this study, confirmed cases of *Philodryas viridissima* bites had a proportion of 19%, where victims were bitten during the day (in the morning), a time at which this snake is active¹⁰. The bite signs observed showed only one puncture, and also signs of various punctures, such as an abrasive lesion, which portrays characteristics of the type of opisthoglyphous dentition¹. Patients who were bitten by this species had more evident envenoming symptoms and experienced vomiting, pain, and headache. This is a snake that, like *Helicops* spp., also has the Duvernoy's gland and may cause symptoms of envenoming⁴. The signs and symptoms presented confer with those described for the genus^{13,14,15}, where the victims reported pain, bleeding, edema, erythema, and ecchymosis, but not headache and vomiting. There are few reports of snakebites by *P. viridissima*¹⁴; the majority of bites in the genus is caused by *P. olfersii* and *P. paragoniensis*^{13,15}. The headache and vomiting observed in all cases of *P. viridissima* bites in this study may be associated with specific venom characteristics of this species. In all confirmed cases, there was no change in clotting time, which is somewhat expected for species of this genus, as is also reported in other studies^{13,15}.

In this study, four cases (33%) were considered probably caused by *Oxybelis fulgidus* or *Philodryas viridissima*, where the victims reported having been bitten by green-colored snakes whose size ranged from 70 to 100 cm, all of them being bitten during the day, in lower limbs and with abrasive signs or in circumstances and environments characteristic of the activity of these species. The time of the snakebites' occurrence coincides with the greater activity of these snakes, since they are diurnal¹⁰. In addition, the punctate and arcuate lesions left by the snake are characteristic of these species¹³. The symptoms that arose in the victims—pain, headache, and blurred vision—may be present in incidents caused by Colubridae and Dipsadidae snakes. In two of these cases, there was incoagulability in the WBTC 20 test, which is unexpected for *Philodryas* spp.^{13,14,15}.



FIGURE 2: **A:** Abrasive injury to an 8-year-old child due to bite by *Helicops angulatus*; **B:** Injury caused by the bite of *Philodryas viridissima*. **C:** Injury caused by the bite of *Xenodon severus*. **Photos:** Ageane Mota da Silva.

In the snakebite caused by *Hydrops triangularis*, the patient had mild local pain, headache, and nausea. The popular name given to the “surucucu-de-brejo” or “surucucu-traíra” snake may be related to the aquatic environments where it is found¹⁰. In this case, there was no change in coagulation time. The patient received no antivenom, though this had been prescribed before the researchers could confirm the causative species.

One case of snakebite involving *Xenodon severus* was recorded (12.5% of the total); this is an aglyphous snake with enlarged and well-adapted fangs for preying on Bufonidae toads¹⁰. The lesion of the bite presented four punctures, which is associated with the type of dentition of the animal. There was no change in coagulation time or other alterations in the laboratory data for this case.

In four cases of non-venomous snake incidents in this study, there was an unnecessary use of antivenom. The snakes *Helicops angulatus* (similar to *Bothrops atrox*) and *Philodryas viridissima* (green coloration) may be confused with venomous species of the region causing misdiagnosis. Thus, it is recommended that when the snake is not taken to the hospital, the medical team must take into account the lesions left by the snake⁶, together with the clinical and laboratory evaluation of the cases, monitoring evolution taking into account the particularities of the venom of non-venomous species (for example, change in coagulation time). Antivenom can reverse fractions of envenoming by snakes of the genus *Philodryas*, but its efficacy is highly discussed, and symptomatic treatment is recommended¹⁵.

Through this study regarding non-venomous snakes implicated in snakebites reported in the Upper Juruá region (AC), the circumstances of the snakebites and the clinical manifestations produced were described. In this regard, it was found that the frequency of bites caused by snakes which are considered to be non-venomous during the study period was 9%. The main non-venomous snake involved in snakebite incidents was *Helicops angulatus*, with a frequency of 50% of cases confirmed for this group. The possibility of an alteration of the coagulation time in patients bitten by *H. angulatus*, besides the pain and edema that may arise, may contribute to the misdiagnosis of the snakebite. In the cases of *Philodryas viridissima* bites, the symptoms were more intense when compared to the cases of *H. angulatus* bites, although no case presented alterations in coagulation time.

In some cases, the symptoms and description of green-colored snakes, were confused with *Bothrops bilineatus smaragdinus* or with *Bothrops atrox*, as occurred in cases of bites involving *Helicops angulatus*, may have influenced the diagnosis of a *Bothrops* snakebite, leading to the decision to use antivenom. For this reason, the dissemination of information through training, the need for a more accurate look at the diagnosis of the circumstances of the snakebite, the evidence of the injuries, and the clinical and laboratory manifestations that arise is recommended.

The act of bringing the dead snake that caused the snakebite, or even photographing it, is important in order to facilitate the diagnosis, and in the case of a non-venomous snake, it is also fundamental in view of the fact that it will avoid the unnecessary use of antivenom, as well as other medicines, but it does not exclude the need for observation.

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Conflict of Interest

The authors declare that there is no conflict of interest.

REFERENCES

- Weinstein SA, Warrell DA, White J, Keyler DE. "Venomous" Bites from Non-Venomous Snakes: A Critical Analysis of Risk and Management of "Colubrid". 1da ed. London: Elsevier; 2011. p. 336.
- Chippaux JP. Epidemiology of envenomations by terrestrial venomous animals in Brazil based on case reporting: from obvious facts to contingencies. *J Venom Anim Toxins Incl Trop Dis*. 2015;21:13.
- Carvalho MA, Nogueira F. Serpentes da Área Urbana de Cuiabá, Mato Grosso: aspectos ecológicos e acidentes ofídicos associados. *[Cad. saúde pública*. 1998;14(4):753-63.
- Salomão MG, Albolea ABP, Almeida-Santos SM. Colubrid snakebite: a public health problem in Brazil. *Herpetol Rev*. 2003;34(4):307-12.
- Silveira PVP, Nishioka SA. Non-venomous snakebite and snakebite without envenoming in a Brazilian teaching hospital, analysis of 91 cases. *Rev Inst Med Trop São Paulo*. 1992;34(6):499-503.
- Nishioka AS, Silveira PVP, Bauab FA. Bite marks are useful for the differential diagnosis of snakebite in Brazil. *Wilderness Environ Med*. 1995;6(2):183-8.
- Bernarde PS, Gomes JO. Serpentes peçonhentas e ofidismo em Cruzeiro do Sul, Alto Juruá, Estado do Acre, Brasil. *Acta Amaz*. 2012;42(1):65-72.
- IBGE. Censo demográfico. Instituto Brasileiro de Geografia e Estatística (2018) Censo Demográfico. 2018. [updated 2018; cited 2018Nov10] Available from: <http://www.ibge.gov.br>.
- Warrell DA, Looareesuwan S, Theakston RDG, Phillips RE, Chanthavanich P, Virivan C, Supanaranond W, Karbwang J, HO M, Hutton RA, Vejcho S. Randomized comparative trial of three monospecific antivenoms for bites by the Malayan pit viper (*Calloselasma rhodostoma*) in southern Thailand: clinical and laboratory correlations. *Am J Trop Med Hyg*. 1986;35(6):1235-47.
- Bernarde PS, Turci LCB, Machado RA. Serpentes do Alto Juruá, Acre - Amazônia Brasileira. Rio Branco: EDUFAC; 2017. p. 166.
- Moreno E, Queiroz-Andrade M, Lira-da-Silva RM. Características clínico epidemiológicas dos acidentes ofídicos em Rio Branco, Acre. *Rev Soc Bras Med Trop*. 2005;38(1):15-21.
- Estrella A, Rodriguez-Torrez AR, Serna L, Navarrete LF, Rodrigues-Acosta A. Is the South American water snake *Helicops angulatus* venomous? (Linnaeus, 1758) (Dipsadidae; Xenodontinae) *Herpetotropicos*. 2011;5:79-84.
- Ribeiro LA, Puerto G, Jorge MT. Bites by colubrid snake *Philodryas olfersii*: a clinical and epidemiological study of 43 cases. *Toxicon*. 1999;37(6):943-8.
- Means B. Ophidism by the green palm snake. *Wilderness Environ Med*. 2010;21(1):46-9.
- Medeiros CR, Hess PL, Nicoleti AF, Sueiro LR, Duarte MR, Almeida-Santos SM, França FOS. Bites by the colubrid snake *Phylodryas patagoniensis*: A clinical and epidemiological study of 297 cases. *Toxicon*. 2010;56(6):1018-24.