

CLINICAL-EPIDEMIOLOGIC ASPECTS OF OPHIDIAN ACCIDENTS OCCURRED IN TRIÂNGULO MINEIRO REGION, MINAS GERAIS STATE, BRAZIL: RETROSPECTIVE CASE SERIES

ASPECTOS CLÍNICO-EPIDEMIOLÓGICOS DOS ACIDENTES OFÍDICOS OCORRIDOS NA REGIÃO DO TRIÂNGULO MINEIRO, MINAS GERAIS, BRASIL: ESTUDO RETROSPECTIVO

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ABSTRACT: Ophidian accidents constitute a serious problem of public health in the tropical countries. In Central and South America, most of the accidents are caused by *Bothrops* (90.5%), followed by the *Crotalus* (7.7%), *Lachesis* (1.4%) and *Micrurus* (0.4%) genus. The aim of this work was to evaluate clinical-epidemiological aspects of ophidian accidents reported and treated at the Clinical Hospital at Federal University of Uberlândia, in the central region of Brazil. In this study, 641 medical records from January 1999 to December 2013 were analyzed. The results showed that the accidents were more common in the afternoon, from October to April. The major bite occurrence frequency was attributed to the *Bothrops* (54.76%), followed by *Crotalus* (30.58%) and *Micrurus* (1.40%) snakes. Most of the victims were males (80.34%). The main anatomical regions bitten were the lower and upper limbs, 65.67% and 30.58%, respectively. Approximately 80% of the victims were treated in the first 6 hours after the accident.

KEYWORDS: Epidemiology. Ophidian accident. Snakebite. Triângulo Mineiro.

INTRODUCTION

Ophidian accidents are considered a neglected disease and a serious public health problem due to morbidity/lethality, difficult access to health facilities and antivenom shortage, especially in tropical countries (WHO, 1981; CHIPPAUX, 1998; PINHO and PEREIRA, 2001; KASTURIRATNE et al., 2008). It is estimated that ophidian accidents affect more than 2.5 million people annually in the whole world (WHITE, 2005) resulting in 100,000 deaths (CHIPPAUX, 1998).

In Latin America snakebite envenomation, most accidents are due to a species of genus *Bothrops*, although envenomations by *Crotalus spp* also occurs, particularly in South America (ROSENFELD, 1971; KAMIGUTI and CARDOSO, 1989; CUPO et al., 1991; GUTIÉRREZ, 2012). In Brazil, studies on ophidian accidents epidemiology attribute to *Bothrops* almost 90% of the poisoning cases, followed by *Crotalus* (7.7%), *Lachesis* (1.4%) and *Micrurus* (0.4%) snakes (BRASIL, 2001; CARDOSO, 2009). Among the Brazilian regions, the Southern is the most affected by snakebites (OLIVEIRA et al., 2009).

Brazilian epidemiological research of ophidian accidents began in São Paulo, with doctor Vital Brazil (Brazil, 1911). Thereafter, several

studies regarding ophidian accidents epidemiology have been performed by analyzing medical records (JORGE; RIBEIRO, 1992; RIBEIRO et al., 1995; CAIAFFA et al., 1997; BORGES et al., 1999; CARDOSO, 2000; AVILA-AGÜERO et al., 2001; FRANCO et al., 2001; SILVA et al., 2003; PINHO et al., 2004; MISE et al., 2007; BONAN et al., 2010). Ribeiro and Jorge (1997) performed the first study about aspects of snakebite epidemiology in Triângulo Mineiro region, Minas Gerais. Later, another study with data collected from 1993 to 1995 showed that ophidian accidents were caused mainly by *Bothrops moojeni* and *Bothrops neuwiedi* species and victims were mainly males, farm workers, bitten in the foot, leg, hand and ankle, during the months from October to March (SILVA et al., 2003).

Epidemiological studies about ophidian accidents can reveal different profiles and concrete details of snakebites' epidemiology may disclose the main aspects of ophidian accidents and to provide data that could be used in campaigns to prevent accidents, elaborating health policies and planning treatment. The purpose of this work was to describe clinical-epidemiologic aspects of snakebite victims treated in a public hospital at Uberlândia (Minas Gerais State, Brazil), from 1999 to 2013.

MATERIAL AND METHODS

A descriptive and retrospective study of 641 medical reports from the Clinical Hospital at Federal University of Uberlândia (CHU), Minas Gerais State, Brazil was performed. Initially, medical reports were searched according to respective ICD International Statistical Classification of Diseases and Related Health Problems codes for ophidian accidents, from 1999 to 2013, excluding from analysis those with incomplete records. Data were collected in a standardized form and grouped into three categories: (1) aspects related to the patient (age, sex and anatomical region bitten); (2) aspects related to the accident (exposure location - rural or urban region; snake genus; time interval spent from snake bite till medical attention; year, month and hour of the day when the accident occurred; some inappropriate practices taken by the victim after being bitten); and (3) clinical-laboratorial aspects (symptoms; diagnostic; case classification; antivenom therapy; adverse effects). Data obtained in medical reports were tabulated and analyzed using Microsoft Excel. The present study was approved by the Research Ethics Committee on the Use of Humans of Federal University of Uberlândia (Approval number 510.556/2014).

RESULTS AND DISCUSSION

Ophidian accidents appear to be related mainly to climatic conditions and population exposure to the snake. In Brazil, the highest rate of reported snakebites occurred in a Southeast (28%), North (27%) and Northeast (24%) regions (Oliveira et al., 2009). From January 1999 to December 2013, 641 ophidian accidents victims were treated in the Clinical Hospital at Federal University of Uberlândia, which serves Triângulo Mineiro and Alto Paranaíba regions and as a reference hospital and local of antivenom administration.

More than 90% of the reported ophidian accidents occurred in the rural region and approximately 10% of the envenoming occurred in urban areas (data no shown). These results corroborate with previous findings from Uberlândia area (BRITES and BAUAB, 1988).

Table 1 shows ophidian accidents distribution according to the month and year of bite occurrence. Most of the accidents (70%) occurred from October to April, confirming data by Pinho et

al. (2004). According to Ribeiro and Jorge (1997), snakebite cases predominate in hot and rainy months. The Uberlândia climate is typical of Cerrado region, i.e., seasonal, where a rainy season, which lasts from October to March, is followed by a dry season, from April to September (SILVA; ASSUNÇÃO, 2004; KLINK; MACHADO, 2005). The seasonality of snakebites varies among Brazil regions; e.g., in Northern region, the ophidian accident occurrence is greater in the first months of year (OLIVEIRA et al., 2009).

During the rainy season, there is a consequent rise in the farming activities (BRASIL, 2001). In this period the farmers begin the land preparation and plantation for most cultures in Triângulo Mineiro region. Vegetation density increases, making difficult to identify the snakes in the environment. The increase in ophidian accidents is directly related to farming activities and high rainfall (FEITOSA et al., 1997; PINHO et al., 2004). This reinforces the idea that snakebite is a job accident, since its higher incidence coincides with rural workers activities.

Most of the snakebite accidents occurred in people aged 21 to 50 years (331 people, 51.6%) and male (515 people, 80.3%) (Table 2). The group of people aged 21 to 50 years coincides with the age range of economically active people. Although women have increased their participation in the work market, this phenomenon is more discreet in the rural sector (IBGE, 2001). In Northeastern Brazil, women work in agricultural activities as plantation and harvest, a situation that is less frequent than in Triângulo Mineiro region. In the Triângulo Mineiro region, the proportion of women affected by ophidian accidents was lower (19.7%) than women from the Northeast region of Brazil (24.4%), because in general, the Northeastern housewife helps considerably men in agricultural activities (FEITOSA et al., 1997).

Snakebite accidents involving victims over 50 years may be related to the high number of elderly people still engaged in agricultural activities and increase in life expectancy in Brazil in the last years (PINHO et al., 2004).

Most of the bites reached lower limbs (65.7%) followed by upper limbs (30.6%) (Table 3), reflecting snakes terrestrial habit (FONSECA, 1949). Simple practices, like using adequate protective clothing (leg protector, long boots, gloves, etc), could reduce significantly snakebites occurrence (BRASIL, 2001).

Table 1. Snakebite accidents according to time evolution, Triângulo Mineiro region, 1999-2013.

Month	Year															Total	
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	N*	%
<i>January</i>	4	8	6	2	3	2	6	8	5	6	4	5	8	3	2	72	11.23
<i>February</i>	6	5	4	6	1	2	3	3	1	3	6	1	11	7	4	63	9.83
<i>March</i>	3	5	5	4	2	3	4	3	8	5	3	5	5	9	1	65	10.14
<i>April</i>	3	5	3	7	8	4	4	6	6	1	7	6	7	2	1	70	10.92
<i>May</i>	1	4	7	4	1	4	2	1	2	2	3	3	2	1	2	39	6.08
<i>June</i>	3	0	1	3	0	3	5	3	0	4	1	1	4	1	1	30	4.68
<i>July</i>	1	1	3	1	4	2	3	2	2	3	3	1	1	1	0	28	4.37
<i>August</i>	3	3	2	4	4	1	1	3	3	7	5	5	5	1	1	48	7.49
<i>September</i>	4	6	9	2	2	2	0	2	4	0	3	3	5	1	1	44	6.86
<i>October</i>	5	8	1	7	9	2	4	2	3	1	1	7	1	1	1	53	8.27
<i>November</i>	4	4	9	3	3	4	7	6	3	5	4	10	4	2	1	69	10.76
<i>December</i>	0	10	2	11	5	4	2	3	8	1	0	6	2	1	5	60	9.36
Total	37	59	52	54	42	33	41	42	45	38	40	53	55	30	20	641	99.99

Table 2. Snakebite victims according to sex and age, Triângulo Mineiro region, 1999 -2013.

Age (years)	Sex		Total	
	Male	Female	N	%
0 - 10	42	32	74	11.54
11 - 20	73	17	90	14.04
21 - 30	95	13	108	16.85
31 - 40	91	22	113	17.63
41 - 50	91	19	110	17.16
51 - 60	60	14	74	11.54
61 - 70	46	7	53	8.27
71 - 80	12	2	14	2.18
81 - 90	2	0	2	0.31
91 - 100	0	0	0	0
101 - 110	1	0	1	0.16
N.I.*	2	0	2	0.31
Total	515	126	641	99.99

*N.I. = Not informed

Table 3. Anatomical regions affected in 641 snakebite patients, Triângulo Mineiro region, 1999-2013.

Região anatômica	N	%
Lower limbs	421	65.67
Foot	182	28.39
Ankle	67	10.45
Leg/Thigh	172	26.83
Upper limbs	196	30.58
Hand	156	24.34
Arm	40	6.24
Head/Neck	2	0.31
Buttock	3	0.47
N.I.*	19	2.96
Total	641	99.99

* N.I. = Not informed

Medical reports did not identify the snake genus in 58 out of the 641 cases investigated (Table 4). The snakes found in Triângulo Mineiro belong mainly to *Bothrops*, *Crotalus* and *Micrurus* genera and they show peculiar characteristics that permit their identification. In general, accurate snake identification occurs when the patient brings the animal to the medical center. However, when the animal is not brought, identification is guessed by analyzing the victim clinical manifestations. It was observed that *Bothrops* represents 54.8% of the ophidian accidents, *Crotalus* 30.6%, *Micrurus* 1.4% and non-venomous snakes 3.7%. Lethality was 0.16%, which does not correspond to the Brazilian reported average (0.45%) or to the Southeast region average (0.26%) from 1990 to 1993 (BRASIL,

2001). The lethal case in our series was due to only one case of bothropic accident.

Importantly, colubrid snakes (most non-venomous) are common and diverse in Brazil and can cause diagnostic confusion. There are papers from Brazil on this problem, when antivenom was given to patients bitten by colubrids, putting them at risk of adverse reactions without any clinical benefit. Salomão et al. (2003) state that among all snakebites registered in the State of São Paulo and those caused by crotaline snakes in Uberlândia City, Minas Gerais State, approximately 40% did not develop symptoms of envenomation, possibly because the snake was non-venomous or, if it was venomous, the skin was not deeply punctured or no venom was injected (the so-called "dry bite").

Table 4. Ophidian accidents according to snake genus and case severity classification, Mineiro region, 1999-2013.

Snake Genus	Classification*					Total	
	Mild	Moderate	Severe	Death	N.I.**	N	%
Genus was not informed	58***	1	1	0	1	61	9.52
<i>Bothrops</i>	142	160	46	1	2	351	54.76
<i>Crotalus</i>	72	85	39	0	0	196	30.58
<i>Micrurus</i>	0	0	9	0	0	9	1.40
Non-venomous snake	24	0	0	0	0	24	3.74
Total	296	246	95	1	3	641	100

* Cases were classified according to the number of ampoules used by the patient, as by the Manual de Diagnóstico e Tratamento de Acidentes por Animais Peçonhentos (BRASIL, 2001). According to this reference, all accidents by *Micrurus* genus with clinical manifestations should be considered as potentially severe. For cases where there is no mention of ampoules amount used, we considered the classification obtained in the medical report; ** N. I.: not informed. It corresponds to those cases where there is no information neither treatment used (ampoule number) nor the case classification in medical records; *** There were two dry bites, classified as mild.

The severity of the snakebite depends on several factors such as: snake species, age of animal, amount of venom inoculated, victim body mass, anatomical region affected and time elapsed between accident and administration of antivenom, among others (FONSECA, 1949; BRAZIL, 1911; MOURÃO, 1971). Cases were classified according to severity as mild (296 people, 46.17%), moderate (246 people, 38.38%) and severe (95 people, 14.82%) (Table 4), in accordance with the ampoules number used by patients, as recommended by Manual de Diagnóstico e Tratamento de Acidentes por Animais Peçonhentos do Ministério da Saúde (BRASIL, 2001). Mild cases were mainly caused by *Bothrops* (142 cases, 48%), while, proportional to number of cases by snake genus, most of the severe cases were attributed to *Micrurus* and *Crotalus* snakes (PINHO et al., 2004). Crotalic venom is characterized by its neurotoxic and consequently systemic action, besides presenting myotoxic and

coagulant action (KAMIGUTI and CARDOSO, 1989; CUPO et al., 1991). Bothropic venom causes mainly local tissue damage, including hemorrhage, necrosis and edema (CAMEY et al., 2002). This difference in the venom action justifies the higher percentage of severe cases in victims of crotalic poisoning.

There were two dry bites that were considered to be mild. Hayes et al. (2002) affirm that dry bites are common in human accidents and estimate that 20-25% of accidents involving rattlesnakes and about 50% with other venomous snakes in the world would be dry bites. This happens because, in case of defensive strike, the inoculated venom amount is far less than the amount injected in a predatory one. Possibly, there had been more cases of these bites in our study, but this information is not always present on the medical records.

Table 5. Snakebites accidents according to the time elapsed between the accident and medical assistance, Triângulo Mineiro region, 1999-2013.

Medical attention (hours)	Accidents occurrence				Total	
	Morning	Afternoon	Night	N.I.*	N	%
N.I.**	10	12	2	32	56	8.74
00:00 – 00:30	18	27	10	0	55	8.58
00:31 – 01:00	54	71	42	2	169	26.36
01:01 – 02:00	52	56	45	4	157	24.49
02:01 – 06:00	57	49	32	3	141	22.00
06:01 – 12:00	6	15	7	2	30	4.68
12:01 – 24:00	2	6	5	0	13	2.03
> 24:00	1	3	2	14	20	3.12
Total	200	239	145	57	641	100

Most of the ophidian accidents occurred in the afternoon (239 cases, 37.3%), followed by those which occurred in the morning (200 cases, 31.2%) and at night (145 cases, 22.6%) (Table 5). Although Brazilian snakes have predominantly vespertine and nocturnal habits, their thermoregulation is done in the diurnal period, and that is why some animals look for sunny environments (SILVA, et al., 2003). Once humans and snake habits are coincident (MISE et al., 2007), 68.5% of the accidents occurred during the day.

The time between snakebite and medical care is very important for the accident prognosis. Complications such as necrosis and acute renal failure can be avoided when medical care is fast, which substantially reduces morbidity and mortality (FISZON; BOCHNER, 2008). Almost 60% of victims received medical attention up to 2 hours after being bitten and about 81% of them were assisted before completing 6 hours (Table 5). Immediate medical attention is due to the awareness regarding ophidian accidents risks. Another factor which contributes to this is the easy accessibility and displacement of highways in the region.

The most common clinical manifestations presented by envenoming victims assisted by the Clinical Hospital at Federal University of Uberlândia in the case of bothropic accidents were: pain, swelling, erythema, local or systemic (gingival) bleeding, developing into bubbles, abscess, necrosis, compartmental syndrome and acute renal failure. In crotalic accidents were: edema, paresthesia, hyperemia, headache, dizziness, numbness, sweating, drowsiness, nausea and vomiting, developing into myasthenic facies, palpebral ptosis, diplopia, blurred vision, myalgia, dysphagia, dark urine and acute renal failure. Finally, in cases of *Micrurus* genus accidents, clinical manifestations included: pain, edema, paresthesia, developing into palpebral ptosis, diplopia, myalgia and vomiting. These findings agree with what is determined by Manual de Diagnóstico e Tratamento de Acidentes por Animais Peçonhentos do Ministério da Saúde (BRASIL, 2001).

Among 641 victims assisted by the Clinical Hospital of Uberlândia, 446 (69.6%) received antivenom therapy and in 139 cases (21.7%) medical reports did not describe any therapy. Antithropic serum was applied to 64.3% of them, followed by anticrotalic and antielapidic sera (35% and 0.7%, respectively). On average, patients who have received antielapidic (11.3 ampoules) and anticrotalic (10.5 ampoules) sera were given larger amount of ampoules than patients who received

antithropic serum (6.2 ampoules). This probably occurs due to the severity of elapidic and crotalic envenomation.

The total average of ampoules was 9.3 per patient. This average can be considered high compared to Brazilian parameters of 5.6 ampoules per patient, which is recommended by the Ministry of Health as the standard quantity of ampoules for the treatment of snakebites (BRASIL, 2001). Although the Ministry of Health recommends a standardized dosage for the *Bothrops* poisoning treatment, for example, there are variations in ampoules average used across Federation Units: Rio Grande do Norte (3.3 ampoules/patient), Santa Catarina and Espírito Santo (4.0 ampoules/patient), Pernambuco (7.3 ampoules/patient) and Federal District (8.3 ampoule/ patient). This variation may be related to specific clinical-epidemiological aspects of the snakebites in each region and etiologic agents involved (MISE et al., 2007).

Another important finding is that in São Paulo State, in 2005, the antivenom therapy occurred in 80% of snakebite cases, with an average of 6.6 ampoules/patient. In some Federation Units, more than 95% of patients received antivenom therapy. So, it is probable that a significant percentage of these cases may have received unnecessary antivenom therapy (NICOLETI, 2010), which can cause financial waste, undue hospitalization, risk of secondary infection, adverse reactions to antivenom therapy, and denotes lack of health professionals familiar with the antivenom therapy. In our study, medical records registered 17 cases of adverse reactions to antivenom therapy.

It is also important to report that seventy (10.9%) out of the 641 victims treated at CHU used popular practices such as tourniquets, drinking alcohol with garlic and tea of okra seeds or applying yolk and diesel oil on the bitten region. Slashing the wound (perforation), squeezing and sucking out the venom from the region bitten were practices also verified (Table 6). These practices are attributed to culture in this region. Fortunately, in our paper these incorrect attitudes taken by victims appeared to be smaller than the figures reported by Silva et al. (2003). In that study, the authors analyzed 92 snakebites cases from 1993 to 1995 and found that 73 (79.3%) patients practiced some treatment before medical assistance. This difference can be explained by a greater understanding that such attitudes not only do not help in the treatment, as they can cause worsening, leading to secondary infection state. It is necessary to better inform the population, mainly the rural areas residents, on the appropriate conducts and conducts to be avoided in cases of snakebite.

Table 6. Treatment taken before medical assistance by 70 snakebite victims, Triângulo Mineiro region, 1999-2013.

Treatment	N	%
Tourniquet	31	44.28
Squeezing/Suction	6	8.57
Incision/Perforation	4	5.71
Topic use of substances*	9	12.86
Oral use of substances**/medicaments***	3	4.29
Ingestion of alcoholic beverage	13	18.57
Local antiseptics	3	4.29
Serotherapy refusal	1	1.43
Total	70	100

* Substances: diesel oil, tobacco, gasoline, coffee, alcohol, egg; ** Garlic, okra seeds tea; *** Analgesics/anti-inflammatory drugs.

Several medicinal plants, such as *Schizolobium parahyba*, are used against ophidian envenomation by people of Triângulo Mineiro region. This plant presents an elevated potential to inhibit the main toxins of snake venoms from *Bothrops* and *Crotalus* genera (MENDES, et al., 2008, VALE, et al., 2008). Despite of this, it is not indicated appropriate to use other treatment besides antivenom therapy, the only one effective against ophidian accidents treatment.

Thus snakebite information is fundamental for elaborating health policies and planning drug supplies. However, epidemiological studies of

snakebite in some regions are scarce, either due to the fact that only a few regions have reliable systems to report this pathology or due to health authorities' poor awareness.

ACKNOWLEDGEMENTS

Authors are thankful to the Statistics and Medical File Sectors of Clinical Hospital at Federal University of Uberlândia for disposing medical records to analysis. The Writing Center of University of Tennessee, USA, for the English review.

RESUMO: Os acidentes ofídicos constituem um sério problema de saúde pública em países tropicais. Nas Américas Central e do Sul, a maioria dos acidentes são causados pelo gênero *Bothrops* (90,5%), seguido por *Crotalus* (7,7%), *Lachesis* (1,4%) e *Micrurus* (0,4%). O objetivo deste trabalho foi avaliar os aspectos clínico-epidemiológicos dos acidentes ofídicos registrados e tratados no Hospital de Clínicas da Universidade Federal de Uberlândia, na região central do Brasil. Neste estudo, foram analisados 641 prontuários médicos de janeiro de 1999 a dezembro de 2013. Os resultados mostraram que os acidentes ofídicos foram mais comuns durante o período da tarde, de outubro a abril. A maior frequência de ocorrência das picadas foi atribuída às serpentes do gênero *Bothrops* (54,76%), seguido por *Crotalus* (30,58%) e *Micrurus* (1,40%). A maioria das vítimas foi do sexo masculino (80,34%). As principais regiões anatômicas acometidas foram os membros inferiores e superiores, 65,67% e 30,58%, respectivamente. Aproximadamente 80% das vítimas foram tratadas nas primeiras 6 horas após o acidente.

KEYWORDS: Acidente ofídico. Epidemiologia. Picada de serpent. Triângulo Mineiro.

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