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SHORT ORIGINAL ARTICLE

Clinical management and treatment of snakebite accidents in a hospital in Bolivia

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Keywords:
snakes; hemolytic; gingival hemorrhage; poisoning; antivenom (Source: MeSH - NLM).

ABSTRACT

Objective. To analyze the initial clinical management of patients with snakebites in a hospital in Bolivia. **Methods.** A quantitative, descriptive, and retrospective study was conducted at the Hospital San Francisco de Asís in Villa Tunari, Cochabamba. A total of 144 medical records of patients diagnosed with snake venom poisoning between January 1, 2022, and June 30, 2023, were included. Data on age, gender, signs and symptoms, type of snake, use of a tourniquet, antivenom, antibiotics, analgesics, and length of hospital stay were collected. Descriptive analysis was used to evaluate the data. **Results.** Most patients were women (51%) with an adult age range (27 to 59 years). A tourniquet was applied in 9.7% of the cases. The predominant signs and symptoms were pain (90%) and edema (70%). Tramadol was the most commonly used analgesic (39%) and cloxacillin the most frequently used antibiotic (45%). The Bothrops-Lachesis Antivenom was administered in 62% of the cases. Sixty percent of patients did not experience complications, and the average length of hospital stay was 4 days. **Conclusions.** This study highlights the importance of standardized and timely clinical management in snakebite cases, emphasizing the correct identification of the venom, pain management, rational use of antibiotics, and proper administration of the specific antivenom.

Manejo clínico y tratamiento del accidente ofídico en un hospital de Bolivia

Palabras clave:
ofidios; hemolíticos; hemorragia gingival; envenenamiento; suero antiofídico (Fuente: DeCS - BIREME).

RESUMEN

Objetivo. Analizar el manejo clínico inicial de pacientes con accidentes ofídicos en un hospital de Bolivia. **Métodos.** Se realizó un estudio cuantitativo, descriptivo y retrospectivo en el Hospital San Francisco de Asís de Villa Tunari, Cochabamba. Se incluyeron 144 historias clínicas de pacientes diagnosticados con envenenamiento por ofidios entre el 1 de enero de 2022 y el 30 de junio de 2023. Se recopilaron datos sobre edad, sexo, signos y síntomas, tipo de serpiente, uso de torniquete, suero antiofídico, antibióticos, analgésicos y estancia hospitalaria. Se utilizó análisis descriptivo para evaluar los datos. **Resultados.** La mayoría de los pacientes eran mujeres (51 %) con edad adulta (27 a 59 años). El torniquete fue aplicado en el 9,7 % de los casos. Los signos y síntomas predominantes fueron dolor (90 %) y edema (70 %). Tramadol fue el analgésico más utilizado (39 %) y cloxacilina el antibiótico más frecuente (45 %). El Suero Antiofídico Botrópico Laquésico (SABL) se administró en el 62 % de los casos. El 60 % de los pacientes no presentó complicaciones, y la estancia hospitalaria promedio fue de 4 días. **Conclusiones.** Este estudio resalta la importancia de un manejo clínico estandarizado y oportuno en casos de mordedura de serpiente, destacando la relevancia de una correcta identificación del veneno, el manejo del dolor, el uso racional de antibióticos y la administración adecuada del suero antiofídico específico.

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INTRODUCTION

Snakebite accidents, caused by venomous snakes, are serious and potentially life-threatening medical events [1,2]. These accidents represent a significant public health issue globally, regionally, and locally. Globally, an estimated 5 million snakebites occur each year, resulting in approximately 100,000 deaths, according to the World Health Organization (WHO) in 2023. In Latin America, around 200,000 bites are reported annually, with approximately 5,000 deaths, while in Bolivia, there are about 2,000 snakebites and between 20 and 50 deaths per year [3-5].

In the Chapare region, located in the tropical area of Cochabamba, where agriculture is the primary economic activity, workers are at greater risk of snakebite incidents. Working in fields and clearing dense vegetation exposes farmers to close encounters with venomous snakes, particularly those of the *Bothrops* genus, commonly known in the region as "Laripanoa". These workers face higher risks due to limited access to healthcare facilities and the scarce availability of antivenom in remote areas. Furthermore, agricultural practices such as walking in inadequate footwear—like sandals or open shoes—increase the likelihood of a bite [1,2].

The Laripanoa snake, the most common species in the region, is characterized by a medium to large size, reaching up to 1.5 meters in some species, with a robust body and a triangular head. It comprises numerous species and subspecies that exhibit varied body patterns and coloration, ranging from green to black, with dark bands that aid in camouflage. It has long, retractable fangs connected to venom glands capable of producing 20 mg of venom, with large specimens capable of over 200 mg [7-11].

Immediately after a bite from *Bothrops* snakes, local inflammatory symptoms may appear, such as intense pain, edema, blisters, and necrosis at the bite site. The venom of snakes from the *Bothrops* and *Lachesis* genera can also cause thrombocytopenia and coagulation disorders. Ultimately, damage to the capillary basement membranes, combined with thrombocytopenia and coagulation alterations, leads to severe hemorrhages not only at the bite site but also in other areas of the body, such as the gums or the gastrointestinal tract [2,3].

In cases of envenomation from *Crotalus* and *Bungarus* genera, the venom can affect the nervous system, causing muscle paralysis, blurred vision, dyspnea, and even respiratory failure, which can be fatal if not treated promptly [3, 5].

The long-term risks of snakebite envenomation include secondary wound infections, systemic complications such as renal damage or multiple organ failure, and permanent sequelae like disability resulting from severe necrosis or amputations [2,3,5].

The management of these patients must begin in the pre-hospital setting, followed by general measures and the administration of medications by healthcare personnel in primary care centers, as well as the administration of antivenom at referral hospitals [2,3,5].

In Bolivia, antivenoms are produced by the Instituto Nacional de Laboratorios de Salud and also supplied by the Instituto Biológico Argentino. The amount of antivenom administered depends on factors such as the snake species involved, the amount of venom injected, the location of the bite, and the general health status of the victim [3,6,7-11].

Rapid identification, timely clinical management, and appropriate treatment are essential in snakebite incidents. Immediate medical care is crucial to minimize the risk of serious complications or death. Therefore, the objectives of this study were: to analyze the initial clinical management of patients with snakebite envenomation, to identify the most prevalent complications resulting from these accidents, and to describe the clinical management and treatment characteristics for snakebite cases.

METHODS

Study type and area

This study followed a quantitative, descriptive, and retrospective design, conducted at the Hospital San Francisco de Asís in Villa Tunari, Cochabamba, Bolivia, during the year 2023.

Population and sample

The study included a census population of 144 medical records. Inclusion criteria consisted of medical records of hospitalized patients diagnosed with snakebite envenomation who received treatment between January 1, 2022, and June 30, 2023. Exclusion criteria included medical records of patients referred to tertiary care centers and those not meeting the inclusion requirements. No sampling technique was applied, as the study encompassed the entire available set of medical records.

Variable and data collection instruments

Data collection techniques involved the review of medical records. The data collection instrument was a structured questionnaire that included: age, sex, signs and symptoms, type of snake, use of a tourniquet, type and quantity of antivenom administered, initial antibiotics and analgesics, complications, and length of hospital stay.

Data collection technique and procedures

Information was gathered by manually transcribing the data from medical records into an electronic spreadsheet application. A documentary review technique was applied, based on the analysis of medical records of patients treated for snakebite incidents at the hospital. Relevant information was manually transcribed into an electronic spreadsheet (Excel 2016) for further analysis.

Data analysis

Descriptive statistical analyses were applied, including absolute and relative frequencies, to characterize the patient population and their clinical management.

Ethical considerations

This study adheres to the regulations outlined in Chapter XIX of the Code of Medical Ethics and Deontology of the Ministry of Health of Bolivia. Additionally, the confidentiality of information was ensured through the anonymization of patients' personal data, in accordance with established bioethics and data protection regulations. Prior to accessing the medical records, formal authorization was obtained from the hospital institution, ensuring compliance with ethical and legal principles in the handling of sensitive data.

RESULTS

Regarding demographic characteristics, 49% of the patients were male and 51% were female. The patients' ages ranged from 9 to 77 years, with the majority being between 27 and 59 years old (see Table 1). A tourniquet was applied in 14 cases (9.7%), while it was not used in 130 cases (90.3%).

The most commonly used analgesic was tramadol, and the most frequently administered antibiotic was cloxacillin. The antivenoms administered included Bothrops-Lachesis Antivenom (SABL, by its Spanish acronym) in 62% of the cases and Bothrops-Crotalus Antivenom (SABC, by its Spanish acronym) in 9%. In 29% of the cases, the epidemiological report was unavailable; therefore, BIOL® Polyvalent Antivenom, produced by the Instituto Biológico Argentino, was used. The number of vials administered ranged from 4 to 10 (see Table 2).

The observed signs and symptoms included pain in 90% of patients, edema in 70% (see Figure 1), gingival

Table 1. General characteristics of the census population

Demographic characteristics	n = 144	
	Freq.	%
Sex		
Male	71	49
Female	73	51
Age group		
Childhood (0-11 years)	6	4
Adolescence (12-18 years)	6	4
Youth (14-26 years)	12	8
Adulthood (27-59 years)	81	56
Older adult (60+ years)	35	24
Elderly (75-90 years)	6	4

Table 2. Treatment administered to patients with envenomation

Pharmacological treatment	n = 144	
	Freq.	%
Analgesics		
Tramadol	56	39
Ketorolac	33	23
Paracetamol	20	14
Metamizole	16	11
None	19	13
Antibiotics		
Cloxacillin	65	45
Amoxicillin	22	15
Ceftriaxone	14	10
Clindamycin	12	8
None	31	22
Antivenom		
Bothrops-Lachesis (SABL)	89	62
Bothrops-Crotalus (SABC)	13	9
BIOL® Polyvalent Antivenom	42	29

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Figure 1. Edema in the right lower limb

Figure 2. Gingival bleeding secondary to snakebite envenomation

bleeding in 15% (see Figure 2), blisters in 8%, cellulitis in 5%, as well as other symptoms such as headache, dizziness, and paresthesia in 7%.

In terms of complications, 40% of patients (58 individuals) presented at least one complication. Among these, 19% developed coagulopathies, gingival bleeding was observed in 13%, cellulitis in 5%, and other types of hemorrhage in 3%. The average hospital stay was 4 days, ranging from 1 to 8 days.

DISCUSSION

Most patients included in this study belonged to the adult age group (27–59 years), a finding consistent with other Latin American studies. For example, Lopes [2] reported that over 54% of snakebite victims fell within this same age range. However, other studies in the region have reported a higher proportion of cases among males. In contrast, this study showed a more balanced distribution between sexes [10–15,26].

Table 3. Complications secondary to snakebite envenomation

Complications	n = 144	
	Freq.	%
Coagulopathies	28	19
Gingival bleeding	19	13
Cellulitis	7	5
Other hemorrhages	4	3
No complications	86	60

The use of tourniquets was low (10%) compared to other studies reporting usage rates of up to 20%, which reflects the population's awareness of proper snakebite management in pre-hospital settings [14,17].

Tramadol (39%) was the most frequently administered analgesic, aligning with practices described in other studies that use opioids for snakebite-related pain management. However, it is concerning that 23% of patients received ketorolac, a nonsteroidal anti-inflammatory drug (NSAID) that increases the risk of hemorrhagic complications due to its antiplatelet effects [18].

The administration of antibiotics followed a pattern similar to other investigations, with cloxacillin being the most commonly used. The absence of antibiotic use in 22% of cases reflects a conservative clinical assessment regarding the need for antibiotic therapy [19].

SABL was the most widely used antivenom (62%), being the most specific for the *Bothrops* genus, while SABC is more specific for the *Crotalus* genus and less so for *Bothrops*, and is associated with more frequent adverse reactions such as cutaneous rash. These reactions generally subside with antihistamines and subsequent administration of SABC at a reduced drip rate. These data are consistent with previous studies conducted in tropical regions, which show a preference for genus-specific antivenoms. The

variation in the number of vials administered reflects the severity of envenomation and the patient's clinical response, as shown in Table 1 [20,29].

The prevalence of pain (90%) and edema (70%) is consistent with the existing literature. The presence of blisters and gingival bleeding in lower percentages aligns with other studies, although some report higher prevalence rates [21].

Sixty percent of patients did not present complications, an encouraging rate that coincides with some studies, although others report higher rates of severe complications, especially in critical cases. Complications such as gingival bleeding and cellulitis observed in this study are also consistent with the literature, although in varying proportions [22,27,28].

The average hospital stay was 4 days, which is comparable to durations reported in other studies, where hospitalization typically ranges from 3 to 7 days depending on envenomation severity and therapeutic response. Notably, no mortality was recorded in this cohort, suggesting a favorable prognosis associated with the clinical management strategies implemented [23-26].

Conclusions

The initial clinical management showed that the use of opioids such as tramadol, antibiotics such as cloxacillin, and the timely administration of specific antivenom are key strategies for improving outcomes and reducing hospital stays. The limited use of tourniquets suggests a low level of knowledge regarding recommended pre-hospital practices. The most prevalent complications were gingival bleeding, blisters, and cellulitis, which were associated with factors such as the snake species involved and the time to treatment. However, 60% of patients experienced no complications, reflecting the effectiveness of clinical management. It can be concluded that this study confirms the importance of timely and appropriate clinical care, reinforcing the need for medical training, standardized treatment protocols, and the availability of specific antivenoms to optimize care in the region.

Recommendations

Compared to other studies, this research highlights the importance of promoting educational talks on snakebite prevention and pre-hospital management, as well as continuing to refine hospital practices and clinical management protocols to improve the quality of care in response to such incidents.

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Authorship contribution

AAA: Conception and design of the study, data analysis and interpretation, manuscript writing, critical review, and approval of the final version.

GKV: Critical review of the manuscript and approval of the final version.

DAAR: Conception and design of the study, data analysis and interpretation, manuscript writing, critical review, and approval of the final version.

JCFP: Conception and design of the study, critical review of the manuscript, and approval of the final version.

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