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# THE CENTRAL AFRICAN JOURNAL OF MEDICINE

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## ORIGINAL ARTICLES

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### Snakebite admissions in Zimbabwe: Pattern, clinical presentation and management

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#### Abstract

**Objective:** To describe the toxicoepidemiology of snakebite admissions to eight major referral hospitals in Zimbabwe.

**Design:** Retrospective and descriptive case review.

**Setting:** Four central hospitals (i.e., Harare, Parirenyatwa, Mpilo and United Bulawayo Hospitals) and four provincial hospitals (i.e., Gwanda, Bindura, Gweru and Mutare hospitals).

**Main Outcome Measures:** Parameters assessed for included patient demographics e.g. age and gender, length of hospital stay, circumstances leading to snakebite, season and time of day of bite, culprit species, clinical presentation, management before and after admission, and outcome.

**Results:** There were a total of 273 admissions due to snakebite. Over 60% of bites were to the feet and about 36% were to the arms and hands. The type of snake involved was recorded in 14.6% (40) the cases with puff adders (*Bitis arietans*) being the most commonly implicated species. First aid and other pre-hospital treatments were recorded in 38 cases with tourniquets employed in 24 cases (63.2%) and 13 patients visiting a traditional medical practitioner before going to hospital. There were similar proportions of males to females admitted with snakebite and the case fatality rate in this study was 2.9%.

**Conclusion:** Most bites from snakes in Zimbabwe occur to the feet and are probably from puff adders. The tourniquet appears to be the most commonly employed first aid measure for snakebite in Zimbabwe, and snakebite victims still consult traditional healers.

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#### Introduction

Of the approximately 2500 species of snakes that are found throughout the world, less than 200 are venomous.<sup>1</sup> However, a larger proportion of venomous snakes and snakebite morbidity occurs in tropical and subtropical areas, often encompassing developing countries.<sup>2,3</sup> To illustrate this, only one species of poisonous snake, the common European adder (*Vipera*

*berus*) is indigenous to Britain and accounts for about 200 hospital admissions annually with only a handful of deaths in the last century (12 by 1993).<sup>4</sup> On the other hand, the World Health Organisation estimates about one million snakebites on the African continent alone involving 500 000 envenomations with 40% being hospitalised.<sup>5</sup> and it has been estimated that snakebite causes about 100 deaths per day in India and Pakistan.<sup>3</sup> However, there remains a paucity of reliable data on the

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prevalence, incidence, morbidity and mortality of snakebite in developing countries.<sup>5,6</sup> In Zimbabwe, animal envenomation, in particular snakebite, has been identified as the fourth most important cause of hospital admissions to major referral hospitals due to toxic exposures after poisoning with pesticides, pharmaceuticals and household chemicals.<sup>7</sup> Of the approximately 76 species of snakes, belonging to seven families, that are found in Zimbabwe, only about 19 species are of medical importance with respect to envenomation.<sup>8,9</sup> These venomous snakes fall into four broad families, which are the Elapids (*Elapidae*), Vipers (*Viperidae*), Colubrids (*Colubridae*) and the African burrowing asps (*Atractaspis*) and have been extensively discussed elsewhere.<sup>9</sup> In the present work, the most extensive account of snakebite admissions to Zimbabwean health facilities, the pattern, and clinical presentation of snakebite in Zimbabwe is presented based on a retrospective survey of all cases of snakebite admitted to eight major referral hospitals in the country.

### Materials and Methods

The methods have been reported previously.<sup>7</sup> Retrospective case reviews were conducted at all Central Hospitals (Parirenyatwa, Harare Central, Mpilo and United Bulawayo Hospitals) and four of the seven Provincial Hospitals (Bindura, Mutare, Gweru and Gwanda Hospitals) for the period January 1998 - December 1999 inclusive. Data from Harare Hospital was incomplete for the months September and October, 1999 due to inadvertent deletion of records from the Record Department computer. Permission to conduct the study was granted by the Medical Superintendents of the respective hospitals, the Ethics Committee for Mpilo Hospital, and the Medical Research Council of Zimbabwe.

#### Retrieval of data.

The methods used in retrieving the case records varied from hospital to hospital, usually tracing records using relevant ICD-9 codes, then retrieving patients notes from the hospitals' record departments or, in the case of Bindura and Gweru hospitals, patient case notes were traced through hospital medical ward registers and the patient code used to retrieve the records from the Records Department.

#### Analysis of data.

Data extracted from case records included patient demographics e.g. age and gender, length of hospital stay, circumstances leading to snakebite, season and time of day of bite, culprit species, clinical presentation, management and outcome.

In order to give a clear picture of the clinical presentation of snakebite rather than later complications, only cases of 'acute snakebite' were used with presentation to the hospital on the day of or that immediately following the bite. Patients

presenting a day after the bite were included since most snakebites in Zimbabwe occur in the later hours of the day<sup>8</sup> and patients may only receive medical attention the following day. Cases where the date of the snakebite was not noted in the records were also excluded. In addition, all patients with co-existing illnesses were excluded from description of the drug management to prevent contamination with co-administered medicines.

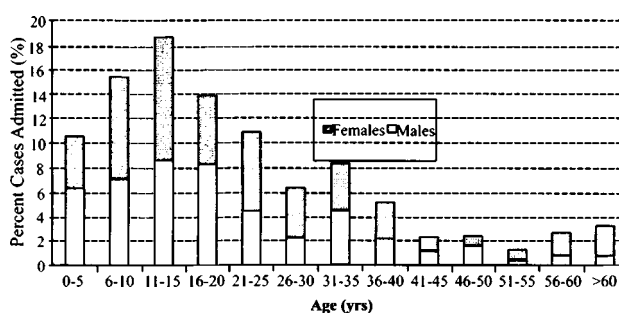
### Results

There were a total of 273 admissions due to snakebite, of which the type of snakes involved in the bites was recorded in 14.6% (40) of these. Puff adders were the most commonly implicated snake species (62.5%; 25) followed by cobras (22.5%; one Egyptian cobra [*Naja haje*]) and mambas (12.5%; one green mamba [*Dendroaspis angusticeps*] with the rest black mambas [*Dendroaspis polylepis*]). There was also a case of snakebite due to a burrowing asp (*Atractaspis* spp.), the only case where identification was made by a herpetologist.

#### Patient demographic details.

Similar proportions of males and females were admitted to hospital with snakebite (1:1; n=271) regardless of age group.

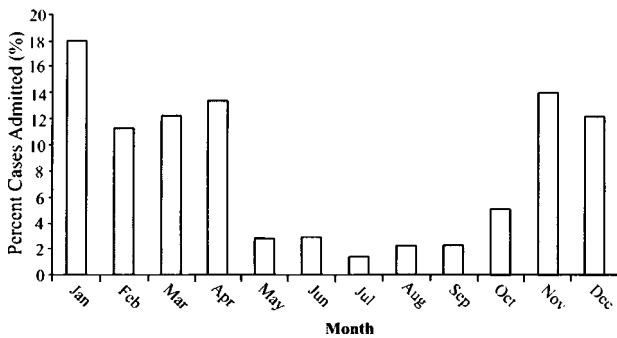
Figure 1: Age-sex distribution of admissions due to snakebite to the study hospitals (n=268 cases).



#### Bite circumstances and first aid

Most admissions (over 80%) occurred during the summer, wetter months of November to April, peaking in January (17.9%) (Figure 2). Where time of day was recorded (157 cases), most bites (68.1%) occurred between 18:00 and 24:00. The snakebite site was recorded in 224 cases with most bites to feet (61.2%), hands (19.2%) and arms (16.5%). First aid and other pre-hospital treatments were recorded in 38 cases with tourniquets employed in 24 cases (63.2%) and 13 patients (34.2%) visited a traditional medical practitioner before going to hospital. Other treatments included incision of the bite site with or without oral suction of the blood (5 cases) and washing of the bite site with soap and water (1 case).

Figure II: Seasonal distribution of snakebite admissions for 1998-1999 (n=273).



### Acute snakebite.

A total of 193 cases (70.7% of all snakebite admissions) met the inclusion criteria for 'acute snakebite'. Of the 60 excluded cases, the bite date was not recorded in 36, whilst in the remainder the patients presented two days or more after the snakebite. The patient demographic details for acute snakebite admissions were similar to those for all cases.

Data on clinical presentation was available for all but one case. Most patients (116 cases) suffered only local signs of snakebite of which swelling and local pain were most prominent. About a third (31.8%; 61) had systemic signs and symptoms e.g., vomiting and dizziness, with or without local signs (Table 1). In 15 cases (7.8%) there were no clinical signs or symptoms of envenomation. Bites attributed to puff adders (*Bitis* spp.; 17) displayed almost exclusively localised symptoms especially swelling. Swelling also occurred in six of the seven bites attributed to cobras (*Naja* spp.) with two patients presenting with dyspnoea. Ptosis and pain at the bite site each occurred in two of the five patients with mamba (*Dendroaspis* spp.) bites. The burrowing asp (*Atractaspis* spp.) bite was on the finger with the patient presenting with pain and a swollen hand.

Table I: Presenting signs and symptoms of snakebite: a) Common local symptoms of snakebite in Zimbabwe.

Symptom	Number (%) of cases (n=193)
Swelling	141 (73.4)
Local pain	70 (36.5)
Tenderness at bite	55 (28.6)
Warmth at bite site	22 (11.5)
Numbness at bite site	12 (6.2)
Minor bleeding from bite site	6 (1.6)

Table I: Presenting signs and symptoms of snakebite: b) Common systemic signs associated with snakebite in Zimbabwe.

Systemic signs and symptoms	Number (%) of cases (n=193)
Vomiting with or without blood	13 (6.8)
Dizziness	11 (5.7)
Headache	8 (4.2)
Pyrexia	8 (4.2)
Sweating	6 (3.1)
Abdominal pains	5 (2.6)
Restlessness	4 (2.1)
General body weakness	3 (1.6)
General body pains	3 (1.6)

### Drug treatment of acute snakebite.

Twelve of the 193 cases of acute snakebite involved patients with co-existing illness and were excluded from the analysis. In the remaining 181 cases, antibiotics were the most commonly used therapeutic intervention with 147 cases (77.3%) receiving at least one antibiotic. Antitetanus toxoid and analgesics were also used in a large proportion of the patients (52.5% each) (Table II), with paracetamol-containing analgesics commonly used. Opiate analgesics were not used in cases attributed to neurotoxic elapids. Other important drug therapies included systemic corticosteroids, antihistamines and non-steroidal anti-inflammatory drugs (NSAIDs) (Table II). Only 6 cases received polyvalent snake antivenom, with two patients not receiving any specific drug therapy.

Table II: Medicines used in management of acute snakebite.

Drug class	Number (%) of cases (n=181)
Antibiotics	140 (77.32)
Antitetanus toxoid	95 (52.5)
Analgesics	95 (52.5)
Systemic corticosteroids	59 (32.6)
Antihistamines	46 (25.4)
NSAIDs	43 (23.2)
Intravenous fluids	21 (11.6)
Other drugs	17 (9.4)
Snake antivenin	6 (3.3)
No specific drug therapy	2 (1.1)

## Discussion

Whilst snakebite continues to be of major concern in most developing countries, some researchers have cited a lack of reliable data on the prevalence, incidence, morbidity and mortality of snakebite in these regions.<sup>5,6</sup> This retrospective survey of eight major referral hospitals in Zimbabwe attempts to provide some meaningful clinicoepidemiological data with regards to snakebite in the Southern African region and in Zimbabwe in particular.

Studies from elsewhere have reported on gender differences in the proportions of snakebite victims.<sup>2,10</sup> In this study, snakebite involved males and females equally. Differences in gender ratios of patients admitted with snakebite often result from predispositions arising from occupational and/or cultural activities related to gender. For example, most bites from foreign venomous snakes in the US<sup>1</sup> and the UK<sup>10</sup> occur in males since there are more male than female snake handlers and males engage more in risk-taking behaviour. However, in various indigenous groups in Ecuador, females take more active roles in crop planting and are thus at a higher risk of snakebite.<sup>2</sup> The present study and other studies from Zimbabwe<sup>8,11,12</sup> have shown no gender differences in snakebite hospital admissions. It has been suggested that females are more prone to snakebite in Zimbabwe since they work in the fields, fetch firewood and water from the bush.<sup>13</sup> However, whilst this may be true for the rural areas, the same cannot be said for urban and peri-urban areas where this and the other studies<sup>8,11,12</sup> were conducted. Differences in gender distribution of snakebite admissions have however been reported at Triangle hospital in Zimbabwe, where the male to female ratio was 1.75:1.<sup>14</sup> This was attributed to the higher male workforce population at the sugar plantation where most of the bites occurred.

Most cases of snakebite occurred in the first four decades of life in line with other published data from Zimbabwe<sup>8,11,12</sup> and elsewhere.<sup>15,16</sup> This is the active age group who hence have higher chances of encountering snakes than the older and less mobile. Supporting other published literature for Zimbabwe,<sup>8,11,12</sup> fewer snakebites occurred in the winter months of June and July when snake activity is low because most snakes are hibernating<sup>9</sup> with the majority occurring in the rainy summer months.

A prospective 3-year study in Malaysia reported that snakebite was mainly an occupational hazard with most bites occurring during daylight, when more people are at risk.<sup>6</sup> However, this was not the case in this study. Other Zimbabwean studies<sup>8,12,13</sup> also found that most of the bites occurred after daylight. This pattern suggests that snakebite in urban and peri-urban Zimbabwe is not related to occupational farming activities. The most hazardous time for snakebite in Africa is the half hour before total darkness and the first two hours after dark, when night snakes emerge and are active on the ground.<sup>9</sup> This coincides with the time when workers are returning home or are going to their night shifts. However, since the exact activities involved were not recorded in the bulk of cases, a prospective study would be needed to confirm this.

Studies at Mpilo<sup>8</sup> and Triangle<sup>14</sup> hospitals in Zimbabwe, found most snake bites were to the lower limbs especially the feet. The same held true in the present study where over 60% of all the bites were to the feet. These results support an earlier suggestion that most bites occur whilst walking. One can also use the data to postulate on the species responsible for most

snakebites in Zimbabwe using a similar approach to that proposed for spider bites in Australia.<sup>17</sup> The bite site pattern suggests that bites from mambas and cobras are not that common since these snakes generally tend to bite higher on the leg. Bites to the feet could result from puff adders or less venomous species such as the garter snake (*Elopsoidae*), snouted night adder (*Causus defilippi*) and rhombic night adder (*Causus rhombeatus*) which cause only local symptoms of pain and swelling.<sup>9</sup> In addition, bites to the feet suggest a favourable prognosis since, theoretically, it would take longer for the venom to have systemic effects and become life-threatening. The foot as the most commonly encountered bite site also provides a good opportunity for preventative measures aimed at educating the populace on the importance of wearing closed shoes, particularly whilst walking at night in areas where snakebite is common, especially in the summer months.

In those cases where pre-hospital management was recorded, tourniquets were commonly used. Although there remains some debate, it is generally agreed that tourniquets should not be applied after bites from cytotoxic snakes such as the puff adder,<sup>9</sup> since concentration of the venom in a small area will cause severe tissue damage. However, for bites from the neurotoxic mambas and cobras it has been argued that this may be the best treatment.<sup>18,19</sup> However, expecting a lay person to distinguish between snakes with neurotoxic or cytotoxic venom may not be practical. Pressure bandaging has been widely advocated based on experiments by Sutherland and colleagues<sup>20,21</sup> on venomous Australian snakes. However, this method assumes that all snake venoms use the lymphatic system for distribution, and has been received with scepticism in Southern Africa where potentially lethal neurotoxic snakes such as the black mamba and cape cobra abound.<sup>22</sup> Moreover according to a recent World Health Organisation publication<sup>19</sup> this techniques has been described as demanding "special equipment and training and is not considered practicable for general use in Africa." However, whether such an approach is appropriate in this context may still require local studies.

A number of patients in the current work visited a traditional practitioner before presenting to the hospital. In South Africa, Newman and colleagues<sup>23</sup> reported that 90% of all snakebite victims presenting to a hospital in kwaZulu-Natal had used some form of traditional remedy prior to admission. However very little is known or documented about the types of traditional medicines and remedies that are employed by traditional healers in Zimbabwe, although some plant preparations have been reported as being used.<sup>24</sup> A prospective study such as that done by Newman and co-workers<sup>23</sup> in South Africa would therefore be useful in filling this gap of knowledge in Zimbabwe.

The fact that the bulk of the admitted cases of acute snakebite exhibited only local symptoms suggests that most cases involved less venomous snakes such as

garter snakes and night adders, although in cases of bites by very venomous snakes, only sublethal doses of the venom could have been injected into the victim. This is demonstrated by the cobra and black mamba cases, snakes which are generally well-known and have easily identifiable features and thus could be assumed to be identified with some degree of certainty by the layman. Of the systemic signs and symptoms that were present, most could have been as a result of adrenaline release due to anxiety and fear. These would include vomiting, dizziness and sweating. However other symptoms such as dyspnoea and ptosis as well as joint pains were most likely the result of true systemic envenomation. As a general rule, if systemic symptoms persist after 30 minutes then they are likely to be the result of the venom.<sup>25</sup> Since it was difficult to elucidate any spatial relationships, it was not possible to correlate the observed symptoms to systemic envenomation in this study.

Despite the existence of data on the venomous snakes found in Zimbabwe<sup>11,14</sup> and Southern Africa,<sup>9</sup> the culprit snake responsible for the bite in most admissions to hospitals in Zimbabwe is seldom known.<sup>8</sup> In most cases, the bite victims do not recognise or see the snake (especially at night), let alone kill and present it for identification. This problem has been reported elsewhere in the world.<sup>26</sup> In this study, the identity of the snake involved was recorded in 14.6% of the admissions, a lower proportion than that reported for Mpilo Hospital in Zimbabwe (26.5%) over a two and a half year period.<sup>8</sup> However, it is important to note that in most cases of snakebite, the identity of the culprit snake is based on the patient's, companion's or doctor's report and seldom on expert herpetological advice. Nevertheless, some species of snakes with characteristic behaviours such as the puff adder (*Bitis arietans*), the cobras (*Naja* spp.) and the black mamba (*Dendroaspis polylepis*) are relatively well-known by Zimbabweans and hence chances that an ordinary citizen would be able to identify them are greater.

#### **Drug therapy of snakebite.**

In line with other studies of snakebite in Zimbabwe,<sup>8,13</sup> antibiotics were the most commonly used pharmacological intervention. Antitetanus toxoid was also extensively used and is recommended in the treatment of all cases of snakebite in Zimbabwe according to the national guidelines.<sup>27</sup> Analgesics were also used in more than half of the cases and are also widely recommended for pain resulting from snakebite except in the case of neurotoxic bites where opioid analgesics should be avoided.<sup>28</sup> In this study, opioid analgesics were not used in cases associated with bites from the neurotoxic elapids or with serious signs of neurotoxicity suggesting that physicians at the major referral hospitals in Zimbabwe are aware of the dangers of using these drugs in neurotoxic snakebite.

Systemic corticosteroids were also widely used, probably as an aid to reduce the inflammation arising from the snakebite. The use of these drugs has been

advocated in the past for the management of cobra<sup>29</sup> and mamba bites,<sup>30</sup> supposedly to alleviate the neurotoxic effects, as well as for viper bites.<sup>31</sup> However, their role in the management of snakebite has not been reviewed or evaluated and hence it is difficult to comment on their use in this study. Non-steroidal anti-inflammatory drugs were probably justified since they may reduce pyrexia that may result from snakebite<sup>14</sup> as well as provide analgesia and anti-inflammatory activity.

Snake antivenin is the only effective and specific antidote for snakebite and is strongly recommended for venomous bites which have led to systemic toxicity.<sup>32</sup> However, only six patients received antivenin in this series. This may show the relatively non-serious nature of most of the snakebite cases, but may reflect a poor availability at some of the hospitals. In two cases where antivenin was ordered by the physician, it was not available from the hospital pharmacy. Both patients survived on simple supportive therapy. In addition, due to the anaphylactic reactions that are associated with antivenin, physicians may be reluctant to employ this therapy even in cases where it would be lifesaving. In this study, none of the five deceased cases received any antivenin. A study to investigate the availability and perceptions toward the use of snake antivenin is necessary to determine the reasons for this low antivenin use.

The case fatality rate (CFR) in this study was 2.9% which was lower than the 5% reported by Muguti *et al.*<sup>8</sup> for Mpilo hospital but higher than the 1.8% reported in two earlier studies in Zimbabwe<sup>12,13</sup> and the 0.4% reported by Blaylock<sup>14</sup> for a hospital in Triangle. The differences in CFR may be related to antivenin use. Whilst antivenin was used in 3.1% of all cases of acute snakebite and 2.2% of all admitted cases in this series, there was no antivenin present at Mpilo hospital at the time Muguti<sup>8</sup> and colleagues conducted their study and antivenin use was higher in the previous studies by Kasilo and Nhachi<sup>12</sup> (21.2% and 32.5%). However, antivenin use in the study by Blaylock (3.6%) was comparable to that of this study a CFR of only 0.4% was reported. This may reflect inherent variability with Blaylock's work which was based at a single hospital whilst the present work is based on data from eight different hospitals countrywide.

While hospital presentation of snakebite has been examined previously in Zimbabwe, the present study is the most comprehensive across levels of hospital care and provides an updated clinicoepidemiological picture of snakebite in Zimbabwe. This provides a basis for studies looking at more indepth issues of snakebite, not only in Zimbabwe, but elsewhere.

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