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CHARACTERISTICS OF CHILDREN AFFECTED BY SNAKE BITE AND SNAKE ENVENOMATION IN ABS HOSPITAL, YEMEN

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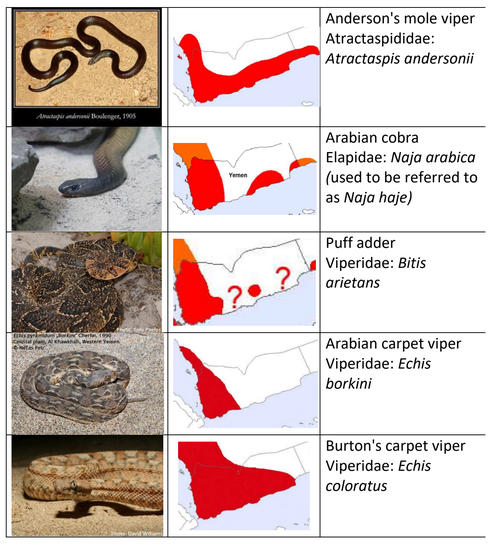
BACKGROUND AND OBJECTIVES

Every year, WHO estimates that around 5 million people are bitten by snakes, half of them are clinically significant bites and can result in life threatening situations, disability and death (WHO Snakebite envenoming factsheet). However, epidemiological information and access to adequate medical care, including safe and effective antivenoms, remains a challenge in many places. Venomous snakes are known to be present in the Arabian Peninsula, including several of highest medical importance according to WHO classification (figure 1). However, information on snakebite epidemiology and case management is scarce in Yemen, including in the paediatric population. Understanding how snakebite incidents occur in children, care pathways and how they are managed, is key to address potential preventive and therapeutic strategies for snakebite envenoming, as well as to advocate for access to safe and effective antivenom. MSF has been providing care to snakebite cases in Abs project in Yemen during the last years. We aim to describe the characteristics, management, and outcomes of children under 15 years old attending the ER after snakebite incident, in Abs hospital, Yemen, from 2021 to 2023.

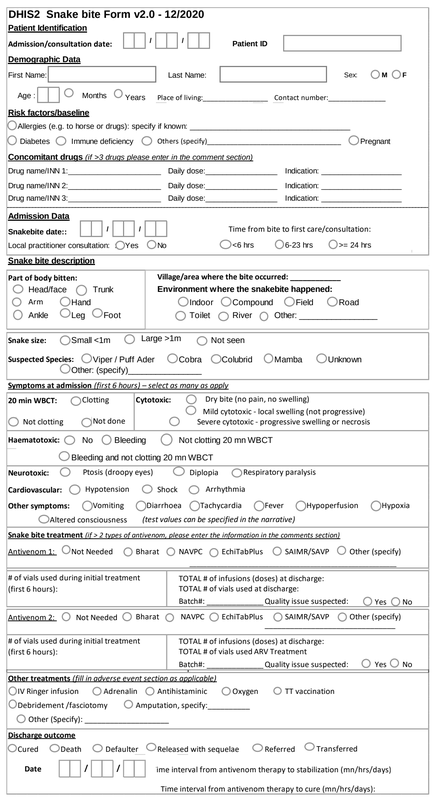
Figure 1: Snakes of highest medical importance in Yemen (Source: Snakebite data platform WHO and snakedatabase.org)



METHODS/STUDY SETTING

MSF Spain supports Abs hospital in Hajjah governorate in Yemen, providing free medical care to patients since 2015. A referral system has been set up to ensure referral from outreach activities and primary health care facilities. Snakebite cases are treated in the Emergency Room and transferred to the Observation Room for further stabilisation and treatment. Case management is based on a syndromic approach according to the clinical characteristics of the patients (figure 3). A health management information system (HMIS) in place, based on DHIS2 platform, collects routine aggregated data from the different activities. Since 2021, information on each snakebite case attended to in the hospital is included in a case report form (figure 2) that is uploaded in DHIS2, following MSF data protection standards. The inclusion criteria for the study were all cases recorded as snakebite in the individual dataset, under 15 years of age, from January 2021 until December 2023. The number of observations and their corresponding percentages were calculated in Microsoft Excel®

Figure 2: Case report form – Snakebite


DHIS2 Snake bite Form v2.0 - 12/2020

Patient Identification
Admission/consultation date: / / Patient ID

Demographic Data
First Name: Last Name: Sex: M F
Age : Months Years Place of living: Contact number:

Risk factors/baseline
Allergies (e.g. to horse or drugs): specify if known:
Diabetes Immune deficiency Others (specify): Pregnant

Concomitant drugs *(if >3 drugs please enter in the comment section)*
Drug name/INN 1: Daily dose: Indication:
Drug name/INN 2: Daily dose: Indication:
Drug name/INN 3: Daily dose: Indication:

Admission Data
Snakebite date:: / /
Time from bite to first care/consultation:
Local practitioner consultation: Yes No <6 hrs 6-23 hrs >= 24 hrs

Snake bite description
Part of body bitten: Head/face Trunk Arm Hand Ankle Leg Foot
Village/area where the bite occurred:
Environment where the snakebite happened: Indoor Compound Field Road Toilet River Other:

Snake size: Small <1m Large >1m Not seen
Suspected Species: Viper / Puff Ader Cobra Colubrid Mamba Unknown Other: (specify)

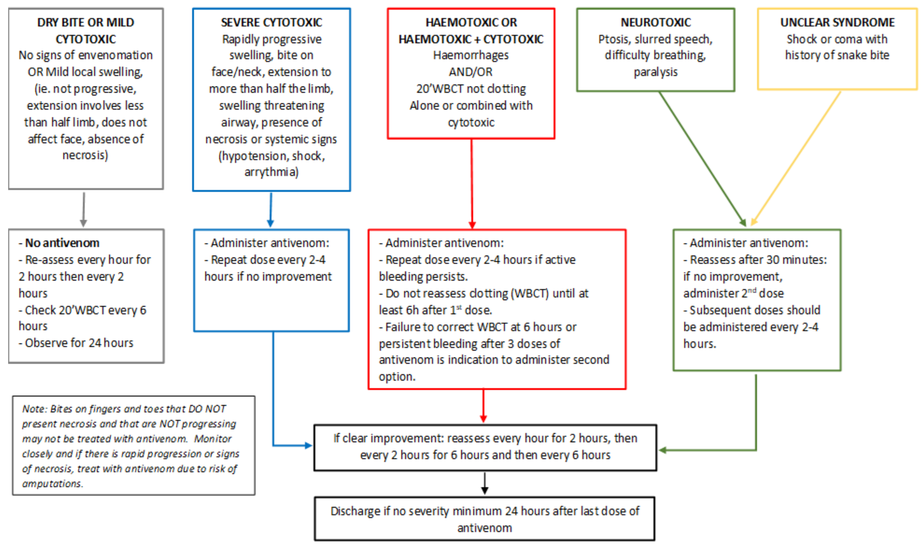
Symptoms at admission *(first 6 hours) – select as many as apply*
20 min WBCT: Clotting Not clotting Not done
Cytotoxic: Dry bite (no pain, no swelling) Mild cytotoxic - local swelling (not progressive) Severe cytotoxic - progressive swelling or necrosis
Haematotoxic: No Bleeding Not clotting 20 mn WBCT Bleeding and not clotting 20 mn WBCT
Neurotoxic: Ptosis (droopy eyes) Diplopia Respiratory paralysis
Cardiovascular: Hypotension Shock Arrhythmia
Other symptoms: Vomiting Diarrhoea Tachycardia Fever Hypoperfusion Hypoxia Altered consciousness *(test values can be specified in the narrative)*

Snake bite treatment *(if > 2 types of antivenom, please enter the information in the comments section)*
Antivenom 1: Not Needed Bharat NAVPC EchiTabPlus SAIMR/SAVP Other (specify)
# of vials used during initial treatment (first 6 hours): TOTAL # of infusions (doses) at discharge: TOTAL # of vials used at discharge: Batch#: Quality issue suspected: Yes No
Antivenom 2: Not Needed Bharat NAVPC EchiTabPlus SAIMR/SAVP Other (specify)
# of vials used during initial treatment (first 6 hours): TOTAL # of infusions (doses) at discharge: TOTAL # of vials used ARV Treatment Batch#: Quality issue suspected: Yes No

Other treatments *(fill in adverse event section as applicable)*
IV Ringer infusion Adrenalin Antihistaminic Oxygen TT vaccination
Debridement /fasciotomy Amputation, specify:
Other (Specify):

Discharge outcome
Cured Death Defaulter Released with sequelae Referred Transferred
Date / / ime interval from antivenom therapy to stabilization (mn/hrs/days)
Time interval from antivenom therapy to cure (mn/hrs/days):

Figure 3: Syndromic management algorithm, MSF



RESULTS

282 cases of snakebite envenoming registered in the database matched the inclusion criteria (from a total of 804 cases recorded in that period). 37% of the cases were female. Half of the incidents happened in the field, while 26% indoors and 13% in the compound where the person was living. When asked about the body part where the child was bitten, 159 children reported injuries in the foot, and 95 in the hand, there was no reported bite in the face (figure 4).

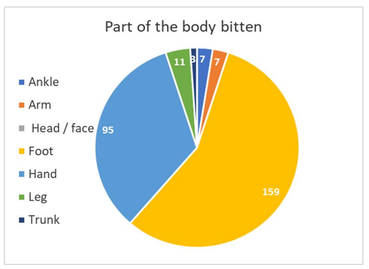
Most cases (85%) sought care within the first 6 hours after the incident. Snakes shorter than 1m were reported in 74% of the cases and not registered in 20%. The whole blood clotting test after 20 minutes (WBCT20') was done in 99% of the cases, with positive results (not clotting normally after 20 minutes) in 39%.

Majority of cases were classified as purely cytotoxic syndrome (66%), 15% as haematotoxic, less than 5% presented signs compatible with neurotoxic syndrome, while 28 cases were considered dry bites. Antivenom was used in 246 cases (87%). Out of 276 cases where information was available, 85% were discharged as cured, 6% were referred to higher level of care, 6% were defaulters, and 8 cases had sequelae after discharge. Only one death was reported during the study period. Full characteristics of snakebite cases in children can be seen in Table 1.

Table 1: Characteristics of snakebite cases in children under 15y, Abs Hospital, Yemen (2021-2023)

		N	%
Number of cases	Under 15	282	35.0
	>15	522	65.0
	Total	**804**	**100.0**
		N	%
Sex	Male	179	63.5
	Female	103	36.5
	Total	**282**	**100.0**
Environment where the snakebite happened	Compound	38	13.4
	Field	137	48.9
	Indoors	75	26.5
	Road	27	9.5
	Toilet	2	0.7
	Others	3	1.0
	Total	**282**	**100.0**
Size of snake	<1m	209	74.0
	>1m	17	6.0
	N/A	56	20.0
	Total	282	100.0
Time from bite to consultation	<6h	235	83.3
	6h-24h	28	10.0
	>24h	15	5.3
	N/A	4	1.4
	Total	**282**	**100.0**
Test WBCT 20'	Clotting	170	60.3
	Not Clotting	109	38.6
	N/A	3	1.1
	Total	**282**	**100.0**
Type of syndrome	Dry bite	28	10.0
	Cytotoxic	187	66.3
	Haematotoxic (+/- cytotoxic)	44	15.6
	Neurotoxic	12	4.2
	N/A	11	3.9
	Total	**282**	**100.0**
Antivenom used	Yes	246	87.2
	No	30	10.6
	N/A	6	2.2
	Total	**282**	**100.0**
Outcome	Cured	233	82.6
	Death	1	0.4
	Defaulter	17	6.0
	Released with sequelae	8	2.8
	Referred	17	6.0
	Total	282	100.0

Figure 4: Distribution of bites



DISCUSSION

In Abs project, approximately one in every three cases of snakebite happened in children less than 15 years old, more frequently male. To our knowledge, there is only one published study on epidemiology of snakebites in this region, showing similar findings suggesting that potential barriers for accessing health care deserves further investigation (Haidar et al, 2012). While half of the incidents occurred in the field, 40% were reported in the compound or indoors, the majority in exposed foot or hand. This is very relevant information for developing health promotion and education strategies to prevent incidents. There are basic interventions than can reduce the exposure and risk of snake attacks (figure 5), although further studies are needed to guide evidence-based recommendations (Rodrigo et al, 2024).

Quick access to healthcare is also key to reduce the risk of severe envenomation (Guile et al, 2023). In our project 85% of the cases arrived within 6 hours after the incident. This shows good functioning of the referral system and access to the hospital, however there is a need to understand the reasons why some arrived after 6 hours, increasing risk of poorer outcomes.

The choice of antivenom depends on the type of snake, however this is usually unknown. MSF implemented a syndromic approach for case management, that helps to overcome this challenge. We found similar distribution as in other studies, mainly cytotoxic cases, with smaller proportion of haematotoxic and less than 5% neurotoxic. According to our findings, patients were managed with supportive treatment and antivenom in most of the cases, the majority of them with positive outcomes and low rate of deaths (early access may also have contributed to this). Rate of adverse events related to antivenom was low and no fatal adverse outcome was recorded. In other studies, lower percentage of cases requiring antivenom were found, therefore adherence to algorithm requires monitoring.

Our study shows that snakebite envenoming remains an important public health issue in Yemen, with high incidence in children. Preventive strategies can help to reduce this burden, at very low cost. Quick access to healthcare should continue to be a priority, in addition to training of staff for quality case management, including the use of antivenoms. Nevertheless, it is necessary to ensure access to safe, effective and affordable antivenoms adapted to the snake epidemiology of Yemen.

Figure 5 Example of health promotion messages

What can you do to prevent snakebite?

- Be vigilant at night and after rain/flooding.
- Avoid animals indoors (e.g chicken), unprotected food or rubbish (which brings mice/rats) which can attract snakes.
- Sleep under tucked-in mosquito net – avoid sleeping on the floor
- Clear rubbish and undergrowth around the house
- Avoid walking at night without light
- Wear closed shoes or boots for agricultural activities
- Keep grass short on the compound
- Do not handle, threaten or attack a snake, even if it looks dead (the bite reflex can remain for up to one hour after death)!
- Be careful when swimming and when sorting fish (water snakes)

ETHICS STATEMENT

This descriptive study is based on routinely collected programmatic data. MSF OCBA Medical Director has granted an Ethics exemption for presentation at the MSF Paediatric Days and approval for submission was also granted by the Abs Hospital Director.

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