ORIGINAL ARTICLE

THE SPECTRUM OF SNAKEBITE INJURIES FROM WOUND INFECTION TO ACUTE RESPIRATORY DISTRESS SYNDROME

Mehreen Afsar Jadoon, Mohsin Khan*, Zeeshan Ahmad, Yasir Aziz*, Sultan Wahab*, Nighat Jamal, Faiza Khan*****

Department of Medicine, *Pulmonology, Ayub Teaching Hospital, Abbottabad, **Department of Medicine, Khyber Teaching Hospital, Peshawar, ***Department of Medicine, DHQ, Teaching Hospital, Abbottabad, Pakistan

Background: Snakebite envenoming is a medical emergency recognized as category A neglected disease in tropical areas of Pakistan. Objective of this study was to determine the minor injury to major damage in snake envenomed patients. **Methods:** This cross-sectional study was conducted in Emergency, Medical, Surgical, and Intensive Care Units of Ayub Teaching Hospital, Abbottabad from Jan 2022 to Sep 2024. The non-probability convenient sampling technique was applied for data collection. The snake envenomed patients aged 16–60 year were included. The data was analysed on SPSS-21 for characteristics of snakebites and complications, and $p<0.05$ was taken as significant. **Results:** A total of 52 patients were seen, 23 (44%) belonged to District Batagram with the mean age of 35.6±15.4 Years. Skin oedema was observed in 30 (58%), skin ulceration in 6 (11%), while 16 (31%) had normal skin appearance. Five (10%) patients had paresthesias, 3 (6%) had nerve palsies. Nine (18%) patients had ARDS complicated by septic shock and needed ventilator support. Fasciotomy was done in 8 (15%) patients and DIC alone was found in 6 (12%) patients. All patients complicated by ARDS and multiple organ failure died during admission with mortality of 12%. **Conclusion:** Systemic complications and end-organ damage secondary to snakebites is not rare. ARDS is most deadly complication of snakebites. The mortality of snakebites is double as compared to previously reported.

Keywords: Acute kidney injury, Acute respiratory distress syndrome, ARDS, Envenomation, Snakebite

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INTRODUCTION

Snakebites are the major risk to the health of 5.8 billion individuals around the world.[1] In Pakistan, prevalence of snakebites is typically predominant in rural areas. Every year thousands of cases occur with many fatalities due to limited access to medical emergency and anti-venom. Particularly affected regions are Sindh, Punjab and Balochistan.[2] Snakebites carry a high financial burden for the people who are affected and often cannot be met and drives families further into poverty and causing considerable fear and anxiety in other family members. In June 2017 snakebite envenoming was recognized in the highest category (A) of Neglected Tropical Diseases (NTD) and approved that the mortality and morbidity associated with this disease chiefly in tropical and subtropical regions have been underrated and hence a coordinated response is needed internationally.[3]

It is difficult to approximate morbidity, disability and mortality as a result of snakebite due to a number of reasons, for example, snakebite is most prevalent in underprivileged agricultural communities who have poor access to health care where specific data is not collected. In 1954, WHO attempted to enumerate deaths as a result of snakebite envenoming based on inadequate data and reached at 30,000 to 40,000 deaths per annum.[1] More recent attempts (better but still incomplete data) provide broad approximation of 81,000 to 138,000 deaths resulting from 1.8 to 2.7 million cases of envenoming and up to 5.4 million snakebites.[4] Institute for Health Metrics and Evaluation estimated that there were 79,000 deaths due to bites from venomous animals in year 2016, with an uncertainty range of 56,800 to 89,400[5], which is less than that in other studies.[1,6,7]

Snake venoms are mixture of toxins. As a defence strategy, the toxin is injected through snakebite or is sprayed into eyes or on mucosal surfaces to kill the prey by affecting various cell receptors. Snakebite envenoming can result in multi organ or multi system disorders. It can cause local tissue damage including swelling, oedema and necrosis, damage to eyes leading to blindness, damage to nerves and neuromuscular transmission blockage resulting in muscle paralysis including muscles vital to breathing. Indirect effects can be on multiple organs and systems. Toxins may affect pregnant mother and foetus due to bleeding and placental dysfunction. The effects of snakebite envenoming on body depends on specie of snake and types of toxins in the venom. There is a wide variety of snake species, some are venomous and some are not.

Snake venom are complex natural secretions that contains many chemicals including more than 100 enzymes, proteins, peptides and inorganic cations like potassium, calcium, sodium, zinc, iron and magnesium. Among them phospholipase A_2 or lecithinase plays an

important role in pathogenesis of systemic envenomation.[8,9] The composition of snake venom depends upon different factors like snakes' specie, sex, habitat, external temperature, season and age of snake. In Pakistan the risk of bites is high in season of Monsoon due to alteration in external environment and habitat. A recent study claimed that 17% snakebite injuries get complicated by severe systemic illness and end-organ damage.[10]

The present study aimed to estimate various injuries, complications resulted from envenomation of snake bites, and their outcome.

MATERIAL AND METHODS

This prospective cross-sectional study was conducted in Ayub Teaching Hospital, Abbottabad. The duration of study was from Jan 2022 to Sep 2024. Non-probability convenient sampling technique was used for sample collection. The sample size was calculated with WHO calculator with estimated frequency of 17% complications in snakebites and absolute precision of 10% at 95% confidence interval. The estimated sample size was 50.

The ethical approval was obtained from Hospital Ethical Committee. The data was collected on pre-designed written questionnaire. Patients aged 16–60 years, presenting with complaints of snakebites were included in the study. The patient with snakebite were admitted in medical on-call department for anti-snake venom (ASV), clinical monitoring and lab investigations at least for 24 hours. Patients who were shifted to other departments (Surgical and ICU) for procedures like fasciotomy or ventilatory support were followed till discharge. The patient who refused inclusion, or age <14 years were excluded from the study.

The demographic variables, wound characteristics, systemic signs and end-organ assessment were recorded. To access the mental status Glasgow Coma Scale was used. Berlin Criteria was used to classify acute respiratory distress syndrome (ARDS), i.e., Pao_2/FiO_2 ≤300 mm of Hg or CPAP ≥5 Cm of H_2O.

Data was analysed on SPSS-21. The categorical data was presented as Mean±SD, while qualitative data was presented in frequency and percentages. Chi-square and Fischer exact test were applied, and $p<0.05$ was taken as statistically significant.

RESULTS

A total of 52 patients were seen of whom majority 23 (44%) belonged to District Batagram. Most of the patients were in the age range of 16–65 years with the mean age of 35.6±15.4. Rural and urban population was affected almost equally (52% *vs* 48%). Most (60%) of the patients presented within initial 24 hours of the incidence. Fang marks were identified clinically in 46 (88%) patients. The common time of bites noted was morning (27%) and (29%) evening. The most common places of incidence were streets (44%) followed by fields (31%). The most common snake identified by patients was viper (14%) while 38% of snakes were not identified. (Table-1).

Out of 52 patients 30 (58%) had skin oedema, 6 (11%) had skin ulceration while 16 (31%) had normal skin examination. Among neurological symptoms 5 (10%) patients had paresthesias, 5 (10%) had nerve palsies, 32 (62.7%) had normal mental status, 12 (23.5%) were anxious, 5 (10%) were drowsy, and 2 (4%) were comatose.

Out of 52 patients 31 (61%) had muscle pain and 22 (43%) had deranged muscle creatinine kinase level with mean range of 853 U/L (176–4,000). Deranged Alanine Transaminase level was found in 6 (17%) patients with mean value of 257 U/L and acute kidney injury in 8 (15%) patients with mean creatinine level of 1.48 mg/dL. Nine (18%) patients had acute respiratory distress syndrome complicated by septic shock and ventilator support in medical ICU. Fasciotomy was done in 8 (15%) patients and DIC alone was found in 6 (12%) patients. All patients complicated by ARDS and multiple organ failure died during admission in medical ICU. (Table-2).

Table-1: Demographic and clinical characteristic features of patients presented with snake bites (n=52)

Variables		Frequencies (%)	Variables		Frequencies (%)	Variables		Frequencies (%)
Address	**Abbottabad**	7 (13)	**WBC**	**Deranged**	24 (47)	**Haemorrhagic Syndrome***	**Gum bleed**	4 (8)
	Batagram	23 (44)		**Normal**	28 (53)		**Petechia**	7 (13)
	Haripur	4 (8)	**Prothrombin time**	**Deranged**	34 (65)		**Haematuria**	12 (23)
	Manshera	16 (31)		**Normal**	18 (35)		**Unknown**	29 (56)
	Kohistan	2 (4)	**Creatinine**	**Deranged**	11 (21)	**Steroid received**	**Yes**	12 (24)
ALT	**Deranged**	6 (12)		**Normal**	41 (79)		**No**	40 (76)
Area	**Rural**	27 (52)	**Muscle CK**	**Deranged**	22 (43)	**Paresthesias**	**Yes**	5 (10)
	Urban	25 (48)		**Normal**	30 (57)		**No**	47 (90)
Patient mental Status	**Alert**	33 (63)	**Total ASV ampule**	**Zero**	6 (11)	**Discharge status**	**Died**	6 (12)
	Anxious	12 (23.5)		**5–10**	27 (52)		**Improved**	30 (60)
	Comatose	2 (4)		**11–20**	17 (33)		**Referred**	2 (4)
	Drowsy	5 (10)		**>21**	2 (4)		**Treated**	14 (24)

Table-2: Comparisons of complications in patients of snake bites

Parameters		ARDS (n=1)	AKI (n=6)	DIC (n=2)	DIC+AKI (n=4)	Fasciotomy +AKI (n=2)	ARDS+AKI+DIC+ Haemorrhagic syndrome (n=8)	*p*
Address	**Abbottabad**	-	-	-	-	-	-	0.09
	Batagram	1	4	-	-	-	8	
	Haripur	-	-	2	-	-	-	
	Mansehra	-	2	-	4	2	-	
	Kohistan	-	-	-	-	-	-	
Total ASV ampoules	**5–10**	-	2	2	2	-	2	0.008
	11–20	1	4	-	2	2	4	
	≥21	-	-	-	-	-	2	
Haemorrhagic Syndrome	**Gum bleed**	-	-	2	-	-	2	0.000
	Petechiae	1	4	-	-		2	
	Haematuria	-	2	-	4	2	4	
Discharge status	**Died**	-	-	-	-	-	6	0.000
	Improved	1	4	-	2	-	1	
	Referred	-	2	-	-	-	1	
	Treated	-	-	2	2	2	-	

DISCUSSION

In the present study the mean age of sampled population was recorded as 35.6 years while Zafar J *et al*[9] from Islamabad, Pakistan reported the mean age of their patients as 30 years. This can be due to difference in geographical areas and difference in urban and rural population. In the current study 52% population was rural while Zafar J *et al*[9] reported 78%.

We observed haemorrhagic syndrome in 44% of cases in form of petechial rashes, haematuria and gum bleeding while 15% of cases got complications of severe haemorrhagic syndrome accompanied by ARDS. Zafar J *et al*[9] observed haemorrhagic syndrome in 58% of their patients. The difference in frequency and degree is probably due to late presentation from far flung areas, as majority of our population was from Batagram (44%), and may be due to nature of snake toxin. We observed that 10% population developed neurotoxicity while Zafar *et al*[9] reported neurological signs in 13% and nerve palsies in 7.5%. Many patients of Zafar *et al*[9] belonged to Kashmir while our study had no patients from Kashmir. Common snakes found in Kashmir valley are Levantine fame with local name of *Gunas* which causes haemotoxicity more than neurotoxicity.[11] An older study done in Thar region also reported complication haemorrhage in 68% of cases while bleeding diasthasis in 27% of cases; despite severe complications only 0.5% mortality was reported.[12] We observed the total mortality of 12% while Zafar J *et al*[9] recorded 5% mortality. The big difference in mortality could be due to end-organ involvement in our patients because all patients who died developed acute respiratory distress, haemorrhagic syndrome and multiple organ involvement. A recent study from India observed that snakebites with acute kidney injury have greater mortality.[13] This justifies the reason of high mortality in our study as 21% of sampled population in our study had AKI. A study by Saleem K *et al*[10] reported 2.7% mortality and highlighted that all cases of mortality were due to vasculotoxic snake bites. An older study done in Ayub Teaching Hospital reported 8% mortality.[14]

We recorded the complication secondary to snakebite in detail but certain parameters still need further evaluation and elaboration. All variables are not possible to be compared with the local literature due to scarcity of data on snakebite complications.

CONCLUSION

Systemic complications and end-organ damage secondary to snakebites is not rare. Almost both rural and urban population are equally affected by snake envenomation. ASV is relatively safer as no adverse effects were recorded. More than half of sample population encountered the complications which were preventable by immediate care. Haemorrhagic syndrome with ARDS is the commonest complication. Respiratory distress syndrome is deadly complication of snakebite. The mortality of snakebites in our setup is almost double compared to previously reported.

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Address for Correspondence:

Dr Nighat Jamal, Department Medicine, Unit D, Ayub Teaching Hospital, Abbottabad, Pakistan. **Cell:** +92-334-5099931
Email: drnighatjamal2020@gmail.com

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MAJ: Concept and design
YA: Data Collection
FK: Drafting and data entry
MK: Data analysis, critical review
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NJ: Drafting and proof reading

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