

# Pharmacoepidemiology of Snake Bite Cases at a Tertiary Care Teaching Hospital in Odisha

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## ABSTRACT

**Introduction:** Snake bite is a neglected but widely distributed public health problem. It results in significant morbidity and mortality in many active young people which can be reduced with proper awareness, first aid and prompt hospital management. The present study institution is the only referral hospital in southern Odisha, serving most of the rural area cases, where the patients are mainly farmers or labourers. Odisha has a high number of fatalities accounting to 1000 snakebite deaths per annum. Not only has the rural and agricultural preponderance contributed to high mortality, but the lack of transportation service and loss of golden hour of treatment are the reasons.

**Aim:** To assess the demographic characteristics, pharmacological interventions, with special reference to drug utilisation and risk factors associated with fatal outcomes in snake bite cases.

**Materials and Methods:** This was a prospective, observational and hospital based study, carried out at emergency OPD and medicine IPD of MKCG MCH, Brahmapur, Odisha, from April to October 2016. Two hundred sixty cases of snake bite were included in this study, who satisfied the selection criteria and patient/ relative agreed to give written informed consent. Data regarding sociodemographic characters like age, sex, occupation, rural or urban area, of residence time elapsed after snake bite till hospitalisation, drug use and treatment outcome in terms of cure and death were collected in a case record form from hospital

record and by interviewing to the relatives. The categorical data were expressed in percentage and risk factor associations were analysed by Chi-square test and Odds' Ratio.

**Results:** Out of the 260 cases, 56% cases belonged to 30-60 years of age group and maximum number were males, accounting for 60% (156) cases. Majority of cases i.e., 85% (221) were from rural areas, of low socio-economic background i.e., 77% (200) and mostly illiterate. Prior to hospitalisation 58% (150) patients were treated using local remedies like traditional ayurvedic medicine or traditional healer. The case fatality was significantly associated with time elapsed from snake bite to administration of ASV, complications and initial dose of ASV for treatment and was observed to be 6.1% in this study population. Cobra bite constituted 16% of cases which had a significant association with mortality ( $p < 0.001$ ). Majority of cases (92%) received ASV within 1-6 hours and were significantly cured. But the patients who were treated with ASV after 6 hours i.e., 7.6%, showed significant association with fatal outcome ( $p < 0.001$ ).

**Conclusion:** This study observed a direct association between different risk factors like delay in ASV administration, development of complications and initial dose of ASV and mortality. The study emphasises the need for improvement in transportation and ambulance service and proper sensitisation of general public with reference to appropriate first aid measures and undue reliance on traditional healers.

**Keywords:** Anti snake venom, Poisonous snake bite, Rational drug utilisation, Risk factors

## INTRODUCTION

Snake bite is a widely distributed and neglected problem which results in the death or chronic disability. In 2015, 'WHO' stated that incidence of snakebite was five million worldwide per year [1].

In India about 200,000 persons become victimised to snakebite and around 50,000 die every year. Snake bite is an important yet neglected public health issue in many tropical countries [1,2].

Exact figure of snakebite and deaths are not known in Odisha as well as in India. Snakebite remains an underestimated cause of accidental death in modern India due to underreporting of cases [3]. It is estimated that 2500 to 6000 cases of snakebite occurs in Odisha annually and about 400 to 900 succumb to death (around 1000 snakebite deaths per annum in Odisha) [4].

Fatality due to snake bite is due to wide species variation, shortage of antsnake venom (ASV), poor compliance with treatment protocols, lack of public education and clear policy to deal with the problem [5]. Common Indian cobra is found in large numbers in Odisha along with another species of cobra, called Monocled Cobra. Other poisonous snake species in Odisha are Krait and Russel's viper. Banded Krait bites occur rarely but Indian antivenom has no neutralising effect against this

snakebite [4]. Proper first aid and timely medical treatment can reduce morbidity and mortality caused by snake bite [6]. Lack of information about simple measures for prevention, occupational hazards and appropriate firstaid measures, magnify the risk. The time elapsed after the bite is of vital importance, because with the passage of time more venom gets bound to the tissues and is thus, less manageable for neutralisation by ASV. High mortality can be attributed to loss of crucial golden hour and late onset of treatment [7].

On this context, this study was carried out to assess the demographic features and effect of pharmacological interventions with special reference to drug utilisation according to 'WHO' criteria and risk factors attributed to fatal outcome in snake bite cases.

## MATERIALS AND METHODS

It was a prospective, observational hospital based study conducted from April-October, 2016. Out of total of 660 cases of snake bite, admitted to the hospital during the study period of 6 months from April to October, 2016, 260 cases could fulfil the inclusion criteria and were selected for the study. The consents were obtained in informed consent form from the patients.

**Inclusion criteria:** Diagnosed cases of poisonous snake bite, more than or equal to 18 years of age and both male and female were included in the study.

**Exclusion criteria:** Below 18 years of age, scorpion bite, suspected cases of snake bite, non-poisonous snake bite cases.

### Study Procedure

Relevant data were collected from emergency OPD, IPD and ICU of medicine department in a specially designed case record form. The data were taken from bed head tickets of the patients and by interviewing the patients/relatives. The demographic features, first aid, snake bite details, clinical signs and symptoms, investigations, were recorded at the time of admission and followed up daily during the stay in hospital. Drug utilisation details like ASV administration and other drugs used were also noted as per the WHO criteria [6]. Outcome measures such as mortality, morbidity in terms of complications like Acute Renal Failure haematotoxicity, impending respiratory failure were recorded.

### STATISTICAL ANALYSIS

The data were analysed by using statistical software SPSS ver-21. The categorical data were expressed in percentage where as risk factor associations analysed by Chi-square test with Odd's ratio. A p-value <0.05 was considered significant.

### RESULTS

It was observed that maximum cases were from >30 year of age group (84%) with male predominance (60%). Majority (85%) of cases were from rural areas. The major fraction of the study population included farmers and labourers i.e 80%; 77% cases came from low socio-economic background and 58% cases had gone to traditional healers before hospitalisation [Table/Fig-1].

S No.	Demographic parameters	n (%)	
1	Age (yrs)	<30	42 (16)
		>30	218 (84)
2	Gender	Male	156 (60)
		Female	104 (40)
3	Location	Urban	39 (15)
		Rural	221 (85)
4	Housing	Pucca	219 (84)
		Kucha	41 (16)
5	Literacy	Literate	223 (86)
		Illiterate	37 (14)
6	Occupation	Farmer	95 (37)
		labourer	117 (45)
		Others	48 (18)
7	Socio-economic status (income/month in Rs)	<6000	200 (77)
		>6000	60 (23)
8	First visit	Traditional healer	150 (58)
		Hospital	110 (42)
9	Awareness about free health services (medicine and transport)	No	154 (59)
		Yes	106 (41)
10	Awareness about first aid	No	156 (60)
		Yes	104 (40)

**[Table/Fig-1]:** Demographic characteristics of patients with snake bite. n=260, data expressed in numbers and percentage

All patients (100%) were prescribed with ASV and antibiotics whereas 38% cases received atropine and neostigmine. Around 15% cases administered with steroids and 88% patient received proton pump inhibitors. About 90% cases were provided tetanus toxoid coverage. No generic medicines were prescribed [Table/Fig-2].

Out of total 16 deaths in this study, deaths attributed to cobra bite was 81% which was statistically significant ( $p < 0.001$ ). Cases who received treatment with ASV after 6 hours of snakebite carried a mortality of 56% which was statistically significant ( $p < 0.001$ ) compared with that of before 6 hours. Snake bite with complications was associated with significant mortality i.e., 50% in comparison to cases without complication ( $p < 0.001$ ). Out of total 260 cases of snake bite, 94% (244) cases recovered completely. During the management, 33% (85) cases developed complications such as cellulitis (26) Renal Ailments, Acute respiratory failure (ARF) (31) (20). It was also observed that cases of cobra bite, who received <10 vials of ASV as initial dose, were significantly associated with mortality [Table/Fig-3].

### DISCUSSION

In our study the fatality rate was found to be 6.1%. In the study by Majumdar et al., the fatality ranged from 1.73 to 13.5% (West Bengal, India) [8] and 5.1-6.5 in Odisha [3]. Majority of cases (84%) were above 30 years of age with mean age 40yrs which is corroborated with other study result by Sharma et al (mean age 33 years) [9]. People in this age group are commonly involved in farm and labour activities making them vulnerable to snake bites. Farmers and labourers comprised maximum percentage of cases in this study and by virtue of their outdoor activities were more prone to snake bites [9].

Male patients constituted 60% of cases, in line with observations made by David et al i.e., (69.4%) and Mohapatra B et al., (59%) [3,10] as they are more commonly involved in outdoor activities like farming and other manual labour. Maximum cases (85%) were from rural areas and low socio-economic status (77%). Similar trend was observed by Sharma N et al., [11]. This is the only tertiary care hospital in southern part of Odisha and having patients mostly from rural areas who earn their livelihood by farming and daily wages. So snake bite cases are more associated with low socioeconomic status and rural area in this study. Though most of the cases were literate i.e., 86% (mostly primary level of education), they showed lack of awareness and inadequate response to first aid measures (60%) in cases of snake bite. Almost 59% of the participants were not aware about Govt. initiatives like free medicine and ambulance service.

A large percentage of cases were first treated by traditional healers (58%) prior to hospitalisation delaying ASV administration, similar to observations made by Pandey et al., (41%) [12]. In this study we could establish a significant association of various risk factors like snake species, bite to needle time, complications, number of initial vials used, with fatal outcome.

Maximum deaths had occurred due to cobra bite (13) followed by viper (3) that is similar to other studies [4,13]. Bite to needle time denotes duration between bite and administration of ASV. An 8% of cases arrived after 6 hours with a death rate of 56% and an average delay of 3.2 hours which is in line with study done by Menon et al., [14]. This delay can be attributed to lack of awareness, undue reliance on traditional healers and quacks and poor transportation.

Development of complications (ARF, respiratory depression) carried a mortality rate of 50% which was lesser than that of other studies, probably due to better first aid measures and earlier onset of ASV administration [15]. Late onset of treatment and high venom load are the main factors leading to development of complications [16].

WHO recommends 100 mL of ASV as initial dose for neuromuscular snake bites [6]. In this study 39% cases of cobra bite received less than 10 vials as initial dose amounting to 69% mortality. Inadequate availability of ASV in Govt. hospitals, lack of proper training of health

S No.	Drug	No. (%) of prescription	Route of administration	Govt. Supply/ purchased	From EDL (%)	Generic name (%)
1.	ASV	260 (100)	IV	GS (100%)	100	0
2.	Antibiotics	260 (100)	IV	GS (100%)	100	0
3.	Atropine	98 (38)	IV	GS (100%)	100	0
4.	Neostigmine	98 (38)	IV	GS (100%)	100	0
5.	Corticosteroids	40 (15)	IV	GS (100%)	100	0
6.	Antihistaminics	80 (31)	IV	GS (100%)	100	0
7.	Ondansetron	120 (46)	IV	GS (100%)	100	0
8.	PPI	230 (88)	IV	GS (100%)	100	0
9.	TT	235 (90)	IM	GS (100%)	100	0

**[Table/Fig-2]:** Pattern of drug use in snake bite cases.

n=260, data expressed in numbers and percentage, EDL: Essential drug list; PPI: Proton pump inhibitors; TT: Tetanus toxoid

Parameter	Sub-parameter	n (%)	Death (n%)	Chi-sq	p-value	OR (C.I-95%)
Type of snake Total death (16)	NP (cobra)	41 (16)	13 (81)	13.8	<0.001	0.09
	HL (viper)	71 (27)	3 (19)			
Cured	All types	148 (57%)	0%			
Bite to needle time	<6 hrs	240 (92)	7 (44)	55.6	<0.001	26.7
	>6 hrs	20 (8)	9 (56)			
Site of bite	Limbs	250 (96)	16 (100)	0.683	0.408	0.676
	Trunk	10 (4)	0			
Complications	With	85 (33)	16 (100)	16.99	<0.001	0.259
	Without	175 (67)	0			
Initial no. of ASV vials used (cobra)	<10	16 (39)	9 (69)	7.29	< 0.05	0.148
	≥10	25 (61)	4 (31)			

**[Table/Fig-3]:** Risk factors associated with mortality.

n=260, data expressed in numbers and percentage, NP: Neuroparalytic; HL: Haemolytic  
Total no. of deaths=16

professionals could be responsible for under dosing. The worldwide production capacity of ASV is well below the needs and it is the only specific treatment available in present scenario [5].

Prophylactic antibiotics was given to all the cases, but might be irrational, as there was no added benefit, rather a possibility of side effects and development of drug resistance. WHO does not recommend the use of prophylactic antibiotics in the management of snake bite cases [6]. Atropine and neostigmine was given only in 38% cases of neuroparalytic poisoning, which was in contrast to 'WHO' guide line which stated that trial of anticholinesterase to be performed in every patient with neurotoxic envenoming [6]. Inj. Tetanus Toxoid was given to 90% of cases similar to observations made by Omogbai et al., that recommend routine anti-tetanus prophylaxis as most of the snakes carry *Clostridium tetani*, in their oral flora, and punctured wound of snake bite may lead to tetanus [17]. Corticosteroids were used in 15% of cases. As per the WHO, hydrocortisone is used by some physicians prophylactically to prevent hypersensitivity reaction due to ASV, but not significantly effective compared to antihistaminic (promethazine) alone [6].

## LIMITATION

The data collection was purely hospital based which could not provide actual estimates of cases who did not report to the hospital or treated outside. No toxicological analysis was performed in case of neuroparalytic or haemotoxic snake bite. Diagnosis was purely on the basis of clinical examinations and under the discretion of treating physicians. Proper identification of the species of the snake could not be found out which could provide some epidemiological information about the type of snakes prevalent in this region and enable better snake bite management. The ASV quality and concentration in terms of consistency could not be ascertained and led to considerable variability in the study results.

## CONCLUSION

This study highlights the fact that snakebite is an occupational hazard, as most of the patients were farmers and labourers. The risk factors such as time between bite and treatment, snake bite related complications and adequate dose of ASV determine the treatment outcome. This calls for an urgent need for sensitisation of general public as well as health professionals about first aid, management of snake bite and its consequences. Health care system should be strengthened enough to make the community, easily accessible to the available hospital facility and provide sufficient quantity of ASV for management of snake bite cases.

We recommend provision of standard treatment guide line and its strict adherence in the management of snakebites as a means of using adequate amount of ASV while limiting unnecessary use of antibiotics and steroids.

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