EDITORIAL

Pattern, First Aid and Complications of Snake Bite in Sudan

Imad eldeen O. Ahmed[1] and Awad R. Abdalla[1, 2]

1. Department of Surgery, Faculty of Medicine, University of Sinnar, Sinnar, Sudan
2. Head of the Department, Dean of the Faculty

Corrosopndace: Imad eldeen O. Ahmed

Abstract:

Aim: This study aimed at assessing the first aid management and types of complications arising from snakebite.

Patients and methods: A survey of snakebites cases admitted to Sinnar Teaching Hospital, Sinnar, Sudan was conducted between March 2011 and March 2013. The demographic and clinical details of each case were obtained using a questionnaire design to collect primary data from patients and their relatives and patient's, while, secondary data was collected from the hospital record. Data was analyzed using frequency tabulation.

Results: A total number of 111 cases of snake bites were reported during the period of study. The most common age group affected was 19-36 years. The highest number of incidents occurred during daytime from July to December, and lower limb was the major affected part of the body. 41.1% of the victims were farmers. Tourniquet was found to be the most commonly used first aid. The major observed complications were cellulitis and spontaneous bleeding. A mortality rate of 3.6% was reported.

Conclusion: Extensive use of tourniquet as a first aid measure is one of the primary causes of complications from snakebite. Correct first aid and scientifically based medical intervention are very important snakebite management mechanism and can reduce its complications considerably.

Keywords: Snakebites, First aid treatment, Complications, Treatment.

Introduction:

Snakebite is an injury caused by a bite from a snake, often resulting in puncture wounds inflicted by the animal's fangs and sometimes resulting in envenomation [(1)]. Ophitoxaemia is rather an exotic term that characterizes the clinical spectrum of snake bite envenomation. Of the 2500-3000 species of snakes distributed world-wide, about 500 are venomous [(2)]. Although the majority of snake species are non-venomous, venomous snakes are scattered throughout the world. Snakebites' envenoming and deaths are particularly important public health problems in rural tropics. People in these regions experience high morbidity and mortality rates due to poor access to health services. Even when provided, health services in these regions are often suboptimal, and, insufficient; particularly when it comes to antivenom, the only recognized and recommended treatment [(3)]. A large number of snakebite victims manage to survive, but, with either permanent physical sequelae arise from local tissue necrosis and, or, psychological sequelae. Since most snakebite victims are young [(4)], there is a considerable economic impact when they get disabled. Inspite of its serious socio-economic and psychological implications, snakebite does not receive the necessary attention from national and international health authorities, and for long time remains one of the neglected tropical diseases and research topics. [(3)]

The risk of being subjected to snake bite can be mitigated with several preventive measures, such as wearing protective footwear and avoiding areas inhabited by dangerous snakes [(1)]. The outcome of snake bites depends on numerous factors, including the species of snake, the affected part of the body, the amount of venom injected, and the health condition of the victim [(5)]. Assessing the exact damage of poisonous snakes in Sudan remains one of the very difficult and demanding tasks because of either lack or misleading hospital statistics. In Sudan most of snake bite deaths occurred shortly after the bite i.e. before the victim being

admitted to the hospital. It proves to be true in Nuba Mountains and some parts of Kassala Province. Other places recognized with sinister snake bite fatalities included Butana, Gezira irrigated area and Makwar.[6]
This research aims at assessing the first aid management and type of complications of snake bite developed by victims admitted to Sinnar Teaching Hospital from the nearby areas during the period from 2011to 2013.

Patients and Methods:

This is a retro and prospective study of the patterns, first aid and complications of snake bite victims admitted to Sinnar Teaching Hospital (STH). It was carried out at STH. Sinnar Teaching Hospital is located in Sinnar city - Sinnar State - and provides healthcare services to the city and the rural and urban communities in its surrounding. STH is the main referral center for cases of snakebite in Sinnar state.
All victims admitted to STH with snakebite from March 2011 to March 2013 were surveyed. In total one hundred and eleven victims were admitted to STH during this period, which made up the population of this study The condition of each snakebite victim admitted to the hospital was followed up right from the time of admission until the end of their hospital stay. A questionnaire was administered to collect data on each case either directly from the victims, or from their relatives. Secondary data is collected from the hospital records.
The demographic and clinical details of each case were recorded, and statistical analysis was conducted using the Statistical Package for Social Sciences, version 8.0 (SPSS).

Results:

During the period of the study, 111 cases of snakebite were reported. The profiles of the victims with respect to age, sex and residence are presented in table 1. The most affected age group was 19-36 years representing 41.4%. The male to females' ratio was approximately 2:1 with, 67.6% males and 32.4% females. 98.2% of the study population resided in rural areas (Table 1).
In terms of the victims' occupation, 46 cases were farmers. 30 cases were housewives and 12 cases were animal breeders representing 41.4%, 27% and 10.8% respectively. Around 84.7% of snake bites occurred outdoors, while, 15.3% occurred indoors (Table 2).
Almost three quarters of the bites took place during the day time (74.8%) compared to 25.2% at night (Table 2).
The majority of snake bites took place during the period from July to December. August witnessed the largest number of snake bites (18 cases) (Figure 1). 43 cases were admitted to the hospital after 1 to 6 hours of the bite, 27.9% were between 7 to 24 hours, and 18 cases were admitted after three days from the bite. 11.7% of the victims were admitted for 1 to 3 days after the bite and only 5.4% of the victims were admitted to the hospital in the first hour of the bite (Table 3).
Lower limbs were the most affected parts of the victims (93 cases) and the upper limbs constituted 18 cases (Figure 2).
Tourniquet was used as first aid treatment in 48 cases (43.2%), while traditional treatment and immobilization were used in 11and 10 cases respectively. There was no use of first aid in 41 cases representing 36.9% (Table 4).

EDITORIAL

Table 1: Distribution of Age, Sex and Residence

Age (years)	No. of Patients	Percentage
1 to 18	30	27.0%
19 to 36	46	41.4%
37 to 54	21	18.9%
More than 54	14	12.6%
Sex		
Male	75	67.6%
Female	36	32.4%
Residence		
Rural	109	98.2%
Urban	2	1.8%

Table 2: Occupation, Place of bite and Diurnal variation

Occupation	No. of Patients	Percentage
Farmer	46	41.4%
Housewife	30	27.0%
Animal breeders	12	10.8%
Others	23	20.7%
Place of bite		
Outdoors	94	84.7%
Indoors	17	15.3%
Diurnal variation		
Day	83	74.8%
Night	28	25.2%

EDITORIAL

Table 3: Time duration between snakebite and hospital admission

Time duration	No. of Patients	Percentage
< one hour	6	5.4%
1 to 6 hours	43	38.7%
7 to 24 hours	31	27.9%
1 to 3 days	13	11.7%
> 3 days	18	16.2%

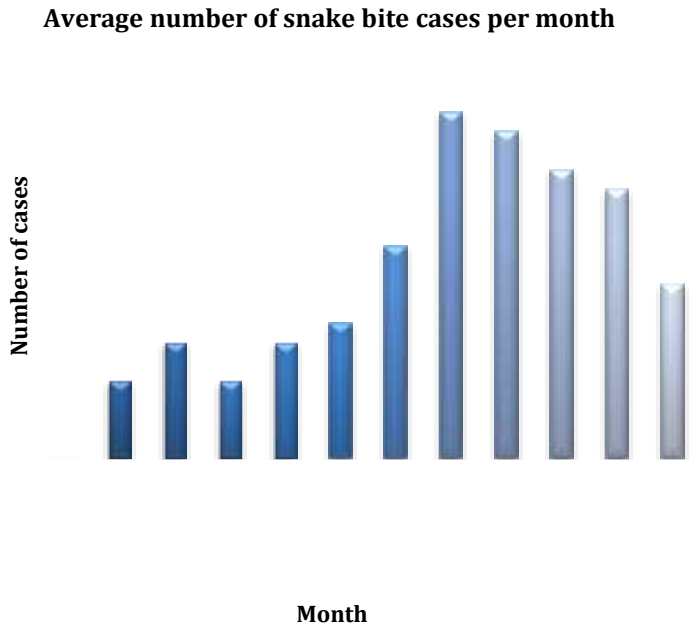

Fig. 1 Average number of snakebite cases per month

EDITORIAL

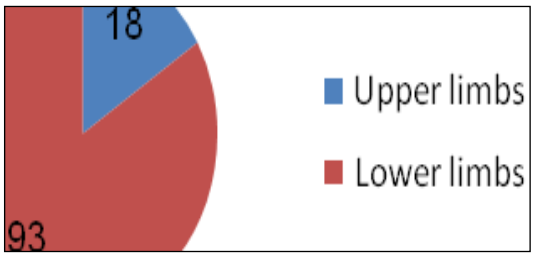

Fig. 2 Site of bite

Table 4: First aid treatment

First aid treatment	No. of Patients	Percentage
Tourniquet	48	43.2%
Incision and sucking	1	0.9%
Immobilization	10	9.0%
Traditional treatment	11	9.9%
No first aid	41	36.9%

(80.2%) of the victims presented with cellulitits ,while local swelling plus local pain and tenderness accounted for (89%) and(67%) cases respectively. This result concurred with the grade of envenomation with twelve victims fang marks and 4.5% of the cases presented with local bleeding (Table 5).
Spontaneous systemic bleeding was noticed in 30 cases as a generalized sign constituting(27%) of the total cases. Renal failure was recorded in 10 cases (9%) and respiratory failure constituted 1.8% (2 cases). Equal numbers of shock and neurological abnormalities (2 cases each) (Table 6).
Out of the 108 victims who received antivenom, two vials were administered to 82 cases (73.9%), 22 cases received more than three vials (19.8%), 4 victims received three vials, and only three cases received no antivenom. 93.7% of the cases (104 victims) showed response to antivenom and 6.3% of them showed no response (Table 7).
With the exception of one case, all other cases (99.1%) didn't show any reaction to antivenom. 88.3% of the victims admitted to the hospital improved, 9 cases were referred and 4 victims died representing 3.6% mortality rate among the study population (Table 8).

Table 5: Local signs and symptoms

Local signs and symptoms	No. of Patients	Percentage
Fang marks	12	10.8%
Local swelling	89	80.2

EDITORIAL

Local pain and tenderness	67	60.4%%
Cellulitis	89	80.2%
Local bleeding or bruising	5	4.5%
Blistering	2	1.8%
muscle necrosis	1	0.9%
Abscess	2	1.8%

Table 6: General signs and symptoms

General signs and symptoms	No. of Patients	Percentage
Spontaneous systemic bleeding	30	27.0%
Shock	2	1.8%
Respiratory failure	2	1.8%
Neurological abnormalities	2	1.8%
Renal failure	10	9.0%

Table 7: Treatment

Treatment		No. of Patients	Percentage
Antivenom	Yes	108	97.3%
	No	3	2.7%
Number of doses	No	3	2.7%
	Two	82	73.9%
	Three	4	3.6%
	More than 3	22	19.8%
Response	Yes	104	93.70%
	No	7	6.30%
Reaction	Yes	1	0.9%
	No	110	99.1%

EDITORIAL

Table 8: Outcome

Outcome	No. of Patients	Percentage
Improved	98	88.3%
Referred	9	8.1%
Died (type of snake)	3	2.7%
Died (complications)	1	0.9%

Discussion:

Sinnar state and its country side is famous for its agricultural activities which constitute the major source of income generations to the majority of the people there. Enjoying a warm and relatively humid weather, the soil in these areas constitute a very good hosting environment for different types of reptiles and dangerous insects. Moreover, snake bites are considered to be one of the major risk factor that threatens people's life in these areas.This study was conducted on snakebites victims in the period from 2011 to 2013.

The research findings revealed that the age group 19-36 years was the highly affected . These results support finding reported elsewhere [7,8]. This age group is relatively more active, consequently, highly subjected and exposed to snakebites. The number of male victims is twice that of the females. This finding concurred with the findings of other researchers [7, 9-18]. However, in a contradictory study Kasuali found females to be the dominant gender group. Another study that was carried out by researchers in Gezira state reported an equal ratio of males to females, taking into account that this study was limited to the age group 3 to 14 years [29]. The cultural traditions and life styles in local communities in the research area suggest that men are more likely to be outgoing than women, consequently, they are at higher risk.

Since the area of the research is most likely agricultural, the majority of the preys were farmers; this result is in concurrence with former findings [11, 17]. Farmers are exposed to snake bites more than others as they spend most of their time working in the farms, therefore, snake bites are the primary occupational hazards for them. Housewives were found to be the second victims group, this is probably because in rural areas both men and women are working in farms and agricultural activities to earn their living expenses or improving their family income.

Most of the bites occurred outdoors which is similar to previous findings by other researchers [8, 9]. Snakes usually reside away from residential and populated areas, but taking into account that some houses are built on farming lands, the likelihood of indoors contact with snakes is more likely to happen so frequently. This justifies the high number of indoors incidents. The majority of bites took place during the day time because most agricultural activities took place during this time. In addition to the fact that snakes are more active at day time. The study revealed that time of bite (day or night) and breeding habits of the snake are not correlated to outcome [31]. This confirms the findings of other investigators [7, 8, 9, 11, 14, 15, 17]. The highest number of the snakebite cases was reported from August to December. This period of the year witnesses the climax agricultural activities, farmers are very busy with the harvesting season. Humid lands thick plants and grass coverage creates a good place for rodents, which in turn attract the snakes in search for a prey. Therefore, in this period frequent snakebites are highly expected. This finding is supported by a study

EDITORIAL

carried out locally in Gezira state [29] and in India [28]. The lower limbs are commonly involved since they are the first to be in contact with the snake during walking or working in the field. The use of the upper limbs in everyday farming activities as tools for picking things up verify the slightly high percent of upper limbs attack. Reid however asserts that the age of the victim and part of body bitten has no relation to outcome. [30]

In the majority of victim cases, tourniquet was used as a first aid measure. This is in concurrence with previous studies by Bawaskar in western Maharashtra, India [19] . Despite the fact that it proves to be ineffective, but, it remains the inherited first aid practice in most countryside communities. The number of victims who does not receive first aid is very close to the previous category, this can be attributed to the lack of awareness about first aid or to the wrong concept that first aid might worsen the situation. Immobilization as a first aid technique retards the spread of the venom from the site of bite. Several studies were carried on this mechanism [20, 21, 22, 23]. In this research the percent of the use of immobilization as a first aid technique was relatively low and approximately equivalent to the traditional treatment This implies the absence of the health care awareness in the research area.

In this research, complications were observed in a considerable number of cases. For example, 30 cases developed spontaneous systemic bleeding two of them went into shock, 9 cases developed acute renal failure, two cases developed nuerological abnormalities and two developed respiratory failure. Our findings are concurred with a previous research which showed that the majority of the victims have developed DIC. [29]

Acute renal failure is one of the serious complications of snake bite, which can be caused by hemoglobinurea, rhabdomyolysis or septicemic shock. It was found that out of a total 864 cases of snake bite admitted to Jinnah Postgraduate Medical Centre (JPMC) during the period from 1990 to 1999, 72 developed acute renal failure, either at presentation or during hospitalization [22]. After a bite from any venomous snake, the victim should be moved beyond striking distance, placed at rest, kept warm and transported immediately to the nearest medical facility [23]. The cross tabulation of the outcome versus the time duration between snakebite and hospital admission revealed that it has a significant impact of the early presentation, since the chance for developing complications increases with late admission to the hospital. This became obvious from the number of the referred cases where 5 out of 18 cases developed renal failure after more than 3 days of presentation compared to 2 out of 49 cases admitted during the first 6 hours. Despite the fact that there were 3 deaths cases due to neurotoxicity during the same period of time. Neurotoxic type of snake requires immediate medical intervention. Late presentation after snakebite can be attributed to different social, cultural and biological factors such as lack of awareness, traditional intervention and healing method, the difficulty or lack of transport or due to the late onset of symptoms. Antivenom is mainly used in the management of snake bite. In this study, it was found that out of 97.3% of the cases who received antivenom, 88.3% improved. On the other hand, all deaths (4 cases) didn't respond to antivenom, the death was either due to the type of snake or to complications.

Soft tissue infections are the major complication of snakebites with local envenomation. The proteolytic properties of snake venom cause extensive tissue destruction and devitalisation. This of course predisposes the wound to bacterial infection from the snake's indigenous oral flora.[24]

Although bacteria are the major cause of wound infection in snakebite victims, the role of prophylactic antibiotics to prevent their formation is debatable [25]. Antibiotics are usually not routinely recommended and a trial did not show the need for them [26]. In this research, cellulitis was reported in a number of cases. This can be related to the large number of victims who received first aid treatment. Also the use of unclean tools is found to be a common risk factor for infection. The venom effects of swelling and blistering are commonly mistaken for bacterial infection. In this research more than 60% of the cases received first aid treatment; however, inappropriate first aid measures might worsen the case. This can be observed from the high number of tourniquet and traditional treatment compared to the few number of cases who received

EDITORIAL

immobilization. A recent study carried out in Gezira state (Sudan) reported that the traditional interventions are more likely to increase the local wound complications [29]. Norries et al conducted a study on a simulated snakebite scenario, reported that, the inability of physicians and lay people to appropriately apply pressure immobilization incease the incidence of compilications. [26]

A mortality of 3.6% was observed in this research. The available literature mentions the mortality to be between 0.4% to 15%. [7,11-15, 27]

Conclusions and recommendations:

Extensive use of tourniquet as a first aid measure is one of the primary causes of complications from snakebite.We recommend: health education to local people to use support of the limb as first aid and to wear protective foot care and to come as early as possible to health care provider. Correct first aid and scientifically based medical intervention are very important snakebite management mechanism and can reduce its complications considerably.

References:

1. Kasturiratne A, Wickremasinghe AR, de Silva N, Gunawardena NK, Pathmeswaran A, et al. Estimating the global burden of snakebite: A literature analysis and modelling based on regional estimates of envenoming and deaths. PLoS Med 2008; 5(11): 1591-1604
2. Mathew J. L., Gera T. Ophitoxaemia (Venomous snakebite)[Internet]. 2000. Available from: http://www.priory.com/med/ophitoxaemia.htm
3. Kasturiratne A, Wickremasinghe A. R, De Silva N, Gunawardena N. K, Pathmeswaran A, Premaratna R, Savioli L, Lalloo D. G, De Silva H. J. The Global Burden of Snakebite: A Literature Analysis and Modelling Based on Regional Estimates of Envenoming and Deaths. PLoS Med 2008; 5(11): e218. doi: 10.1371/journal.pmed.0050218
4. Hansdak SG, Lallar KS, Pokharel P, Shyangwa P, Karki P, et al. A clinic epidemiological study of snake bite in Nepal. Trop Doct 1998; 28: 223–226.
5. Gold, Barry S.; Richard C. Dart, Robert A. Barish. Bites of venomous snakes. The New England of Med. 2002; 347 (5): 347–56.
6. Corkill, N. L. Notes on Sudan Snakes: A Guide to the species represented in the collection in the Natural History Museum, Khartoum. Sudan Government Museum (Natural History). 1935 Publication No. 3
7. Hati AK, Mandal M, De MK, Kukerjee H, Hati RN. Epidemiology of snakebite in the district of Burdwan, West Bengal. J Indian Med Assoc. 1992; 90: 145-147.
8. Bhardwaj A, Sokhey J. Snakebites in the hills of North India. Nat Med J India 1998; 11: 264-265.
9. Bhat RN. Viperine snakebite poisoning in Jammu. J Indian Med Assoc. 1974; 63: 383-392.
10. Saini RK, Sharma S, Singh S, Gupta VK, Pathania NS. Primary pathological fibrinolysis in saw-scaled (*Echis carinatus*) viper bites. J Assoc Physicians India. 1984; 32: 391-393.
11. Saini RK, Sharma S, Singh S, Pathania NS. Snakebite poisoning: A preliminary report. J Assoc Physicians India. 1984; 32: 195-197.
12. Sharma SK, Khanal B, Pokhrel P, Khan A, Koirala S. Snake bite– reappraisal of the situation in Eastern Nepal. Toxicon 2003; 41: 285-289.
13. Chippaux JP. Snakebite epidemiology in Benin (*in French*). Bull Soc Pathol Exot. 2002; 95: 172-174.
14. Ribeiro LA, de Campos VA, Albuquerque Mde J, Takaoka NY. Snakebites in the state of Sao Paulo, Brazil (in Portuguese). Rev Assoc Med Bras. 1993; 39: 47.
15. Kulkarni ML, Anees S. Snake venom poisoning: Experience with 633 cases. Indian Pediatr 1994; 31: 1239-1243.
16. Sutherland SK. Deaths from snakebite in Australia 1981-1991. Med J Aust. 1992; 157: 740-746.
17. Bochner R, Struchiner CJ. Snakebite epidemiology in the last 100 years in Brazil: A review (in Portuguese). Cad Saude Publica. 2003; 19: 7-16.
18. Spiller HA, Bosse GM. Prospective study of morbidity associated with snakebite envonmaton. J Toxicol Clin Toxicol. 2003; 41: 125-130.

EDITORIAL

19. Bawaskar HS, Bawaskar PH. Profile of snakebite envenoming in western Maharashtra, India. Trans R Soc Trop Med Hyg 2002; 96: 79-84.
20. Anker, R.L., Staffon, W.G., Loiselle, D.S. and Anker, K.M. Retarding the uptake of .mock venom. in humans. Comparison of three first aid treatments. Medical Journal of Australia, 1982; i: 211-214
21. Tun-Pe, Maung-Maung-Thwin, Myint-Myint-Than, Aye-Aye-Myint, Kyaw Myint and Thein-Than. The efficacy of compression immobilization technique in retarding spread of radio-labelled Russell.s viper venom in rhesus monkeys and .mock venom. NaI131 in human volunteers. Southeast Asian J. Trop. Med. Pub. Hlth, 1994; 25: 349-353.
22. Haider A. Outcome of acute renal failure following snakebite. J Coll Physicians Surg Pak 2000; 10:384-6.
23. Dart RC, McNally J. Efficacy, safety and use of snake antivenoms in the United States. Ann Emerg Med 2001; 37: 181-8.
24. Goldstein EJC. Bites. In: Mandell GL, Bennett JE, Dolin R, eds. Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases. 4th ed. Philadelphia: Churchill Livingstone, 1995: 2765-9.
25. Kerrigan KR, Mertz BL, Nelson SJ, Dye JD. Antibiotic prophylaxis for pit viper envenomation: prospective, controlled trial. World J Surg 1997; 21:369-72; discussion 372-3.
26. Norris RL, Ngo J, Nolan K, Hooker G. Physicians and lay people are unable to apply pressure immobilization properly in a simulated snakebite scenario. Wilderness Environ Med 2005; 16: 16-21.
27. Seneviratne SL, Opanayaka CJ, Ratnayake NS, Kumara KE, Wickrama WA, de Silva HJ, *et al.* Use of antivenom serum in snakebite: a prospective study of hospital practice in Gampaha district. Ceylon Med J 2000; 45: 65-8.
28. Monteiro FNP, Kanchan T, Bhagavath P, Kumar GP, Menezes RG, Yoganarasimha K. Clinico-epidemiological features of viper bite envenomation: a study from Manipal, South India. Singapore Med J. 2012; 53(3): 203-207.
29. Elbashir M. T, Nug F. A, Mohmmed O. T, Yaseen D. E, Bader Elmaarif M. S, Allam T. M. Snake bite in Gezira: revision of 63 Envenomed children. Gezira J of Health and Sci. 2012; 8 (1): 16-29.
30. Reid HA, Thekaston RDG. The management of snake bite. Bull WHO. 1983; 63: 885-895.
31. Russell FE. Snake venom poisoning. Philadelphia JB Lippincott Company. 1980; 235-285.