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# Predictive Value of Bedside Clotting Time in Determining the Volume of Antivenom in Patients Bitten by Snake

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**Abstract** Snake bite is a common problem in Nigeria and indeed in many parts of the world. [1] There seems to be a seasonal variation in the cases of snake bites that are reported. Although snake bite can happen anytime of the year, most reports are noted at the beginning of and during the period of rain. [2,3,4] This is when there is a significant change in the weather and the arrival of rain which fills the holes hence driving the snakes out and also for them to tap sun energy. During this time as well, farmers begin the usual farming season and hence increase in the risk of coming into contacts with several reptiles and rodents among which that with snakes has been noted to be the most dangerous of such encounters. [3] Snake bite can be fatal sometimes despite adequate attention but over the years there has been a decline in the mortality in some places due to prompt initiation of antivenom and other therapeutic measures including analgesics, antibiotics and tetanus toxoid. [2,5,6,7] However, it is of interest to note that it is not all such bites that are from snakes, it is not all bites from venomous snakes that results in envenomation needing the use of antivenom and by all means it is not all snakes that are venomous. [5] Antivenoms has been used from 20mls to 80mls to neutralise envenomation, there is paucity of data indicating the specific amount to be used in any condition of snake bites. [4,7,8] Dosages has been guided by the local and systemic indications for their usage and this may be confusing in rural areas. [8] More so that we have to use the same dosage regardless of the age of the patient since the amount of the venom injected into the host is the same considering the volume of distribution in children and adult or obese and the severely wasted individual. [7] Antivenoms whether monovalent or polyvalent are not entirely safe and sometimes anaphylaxis may happen despite adequate precaution. [6,8] Against this background, we tried to find a relationship between the clotting time done by the bedside and the volume of antivenom required by the patient. We tried to see if it could be possible to use the clotting time to predict the exact amount of the antivenom that will be required in cases of snake bite requiring envenomation. This we hoped may prevent the irregularity in the dosage of the antivenom and help standardize the use of antivenom in every hospital.

***Keywords:*** *clotting time, snake bites, antivenom*

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## 1. Introduction

Worldwide, it can be estimated that there are about 3000 species of snakes and they are particularly distributed in the tropical regions of Asia, Africa and America. Regional differences exists with reference to the species that are seen but climatic conditions, topography, domestic activities including occupations and hobby seems to influence our contacts with the snakes.

Also the distinction between venomous and non-venomous snakes is so ill-defined and may not be recognized by a large number of people because the site of snake alone is enough a reason for fright or flight for most people. None the less, bites by snakes should be regarded as potentially serious and should be assessed very well.

Overall, three particular families of venomous snakes are found in Nigeria. These are the Viperidae, Elapidae and the Colubridae. [2] Envenomation however has mainly been due to the carpet viper, spitting cobra and puff adders.

At a time in Nigeria, an incidence of about 497 per 100 000 per year is recorded with a mortality of about 12%. About 66% of bites are due to E.carinatus. Bites occur while farming, herding, walking but spitting cobras may attack asleep. [1,2,3]

Most affected population has been the rural dwellers and attacks has been mostly at the beginning of raining season.

Attacks has been reported in the day, night, indoor, around the leg, foot and hands. Features like swelling, pain and bleeding has also been frequently described by various patients. [6]

In the Indian subcontinent, central & south America and the United states of America with fair long history of snake bite management, no effort has been made to correlate the clotting time, the time of presentation and the volume of antivenom used to manage the patients. There seems to be paucity of data in this regard.

Certain population seems to be at risk like Children because of the curiosity, Farmers, People who walk barefooted or barehanded, Snake charmers, Hunter and those who work in snake farms and laboratories.

Despite all these, some regions are free of venomous snakes including the Antarctic, most of the islands of the Western Mediterranean, New Caledonia, Ireland, Iceland and possibly Chile. In other places though, venomous snakes are widely distributed up to altitudes of 2500m within the Arctic circle, in the Indian & Pacific oceans as far as north of Siberia, & in some fresh water lakes. [6,7]

## 2. Aim and Objectives

1. To determine the correlation between bedside clotting time and the quantity of antivenom required to treat patients with snake bite.
2. To determine other factors that may contribute to the prognosis of the patients.

## 3. Methods

### 3.1. Study Site

This study was limited to all the cases seen in Bingham University teaching Hospital within the duration of study. Bingham University Teaching Hospital is 250 bedded private teaching hospital that provides health services for patients mostly from Plateau state and surrounding states like Kaduna, Nasarawa, Bauchi, Taraba and Gombe states.

Study population: All patients with snake bite from August 2013 to August 2019 constituted the population studied.

Study design: This study was both retrospective and prospective cohort study

### 3.2. Sample Size

All the cases reported were analysed as there is a significant variation in the cases due to the season and also the fewer reports seen.

#### 3.2.1. Sampling Method

All cases of snake bite presenting in the hospital in the period of the study were recruited consecutively into the study.

#### 3.2.2. Inclusion Criteria

All cases of snake bites were recruited in the study without any age limit.

### 3.3. Exclusion Criteria

Cases without documented clotting time or volume of antivenom used were not recruited.

### 3.4. Method of Data Collection

All cases of snake bites that presented to the hospital were documented. A detailed history of duration before presentation, site of bite, place and time as well as measures taken before presentation and previous use of antivenom amongst other things were also documented.

Bedside clotting time done in two separate glass test tubes were considered appropriately done and noted as well as the volume of antivenom used before discharging the patient.

Medical records of suspected cases were also retrieved and reviewed and the extricated data analysed.

Bedside clotting time was recorded by the attending doctor while interacting with the patient. This was repeated every 6 hours until the patient is stable and the clotting time is within the normal range.

### 3.5. Method of Data Analysis

The obtained data was analysed using the SPSS version 22. Pearson's product moment correlation was used to find the correlation between the clotting time of the patient and the quantity of snake antivenom required to treat the patient.

### 3.6. Duration of Study

The study was conducted within 6 years beginning from August 2013 and August 2019.

### 3.7. Funding

This study did not place any financial burden on the patient and the institution. This study was also not sponsored by any firm. The Author declares no conflict of interest.

### 3.8. Limitations and Constraint

Poor documentation of data of some patients actually affected the total number of cases recruited and this impacted on the statistics negatively.

### 3.9. Ehtical Clearance

**Ethical** clearance for the study was sought from the research and ethics committee of the Bingham University Teaching Hospital. There was no harm done to the patient due to the study as no additional clinical procedure was required outside of what was needed for the management of the patients.

## 4. Results

A total of 44 patients were eventually recruited for the study. Out of this, 28 were males (63.6 %) while the remaining 16 were females (36.4 %) as shown in Table 1 below.

The reported sites of bite included the leg (56.8 %), foot, ankle Hand and finger as shown in Table 2 above. Also

from Table 2 above, a total of 29 patients (65.9 %) had evidence of fang marks and envenomation as shown.

**Table 1. Showing frequency distribution of the gender of the patients**

| | Frequency | Percent |
|---|---|---|
| MALE | 28 | 63.6 |
| FEMALE | 16 | 36.4 |
| Total | 44 | 100.0 |

**Table 2. Showing the frequency distribution of the site of bite, fang marks and envenomation**

| Site | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| LEG | 25 | 56.8 | 56.8 |
| FOOT | 10 | 22.7 | 79.5 |
| ANKLE | 1 | 2.3 | 81.8 |
| FINGER | 1 | 2.3 | 84.1 |
| HAND | 7 | 15.9 | 100.0 |
| Total | 44 | 100.0 | |
| FANG MARKS | | | |
| YES | 29 | 65.9 | 65.9 |
| NO | 15 | 34.1 | 100.0 |
| Total | 44 | 100.0 | |

Some of the symptoms described by the patients were pain alone, pain and swelling, painless swelling, bleeding at bite site while some had no symptoms at all as shown in Table 3 below.

**Table 3. Showing the frequency distribution of the symptoms described by the patients**

| | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| PAIN AND SWELLING | 24 | 54.5 | 54.5 |
| PAIN | 10 | 22.7 | 77.3 |
| PAIN SWELLIN AND BLEEDING | 1 | 2.3 | 79.5 |
| BLEEDING | 2 | 4.5 | 84.1 |
| SWELLING | 1 | 2.3 | 86.4 |
| PAIN AND BLEEDING | 1 | 2.3 | 88.6 |
| NONE | 5 | 11.4 | 100.0 |
| Total | 44 | 100.0 | |

**Table 4. Showing the activities engaged in before the attack**

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| BATHING | 5 | 11.4 | 11.4 | 11.4 |
| CLEARING A BUSH | 1 | 2.3 | 2.3 | 13.6 |
| DEFECATE IN THE BUSH | 1 | 2.3 | 2.3 | 15.9 |
| FARMING | 11 | 25.0 | 25.0 | 40.9 |
| FETCHING WATER | 2 | 4.5 | 4.5 | 45.5 |
| MICTURATING | 1 | 2.3 | 2.3 | 47.7 |
| PICKING FOOD | 1 | 2.3 | 2.3 | 50.0 |
| PICKING STONES | 2 | 4.5 | 4.5 | 54.5 |
| SITTING OUTSIDE | 1 | 2.3 | 2.3 | 56.8 |
| SITTING BAREFOOTED | 1 | 2.3 | 2.3 | 59.1 |
| SITTING ON A STONE | 1 | 2.3 | 2.3 | 61.4 |
| STANDING ALONE | 1 | 2.3 | 2.3 | 63.6 |
| WALKING AROUND HOME | 12 | 27.3 | 27.3 | 90.9 |
| WALKING IN THE FARM | 1 | 2.3 | 2.3 | 93.2 |
| WALKING,STEPPED ON IT | 1 | 2.3 | 2.3 | 95.5 |
| WALKJING | 1 | 2.3 | 2.3 | 97.7 |
| WATCHING TV IN HIS ROOM | 1 | 2.3 | 2.3 | 100.0 |
| Total | 44 | 100.0 | 100.0 | |

Certain activities were engaged in before the attack took place such as walking, batting or picking wood or stones as shown in Table 4 below.

Certain descriptions were given concerning the snakes such as black, brown, short or long. These descriptions were found not to be very consistent and could not be used to identify the types of snakes found in our area.

The Pearson Correlation test gave a p-value of 0.921 implying that there is no association between clotting time and number of anti-venom used as shown in Table 5 below.

**Table 5. Showing pearson correlation**

| | | CLOTTING TIME | NO. OF ANTIVENOM USED |
|---|---|---|---|
| CLOTTING TIME | Pearson Correlation | 1 | .015 |
| | Sig. (2-tailed) | | .921 |
| | N | 44 | 44 |
| NO. OF ANTIVENOM USED | Pearson Correlation | .015 | 1 |
| | Sig. (2-tailed) | .921 | |
| | N | 44 | 44 |

Similarly, the time of presentation and number of antivenom used were also found not to be related as shown by the correlations in Table 6 below. The P-value for Clotting time verses number of anti-venom is 0.181 showing no association. Similarly, p-value of 0.21 shows no association between time of presentation and number of anti-venom used.

**Table 6. Showing correlation of clotting time, time of presentation and volume of antivenum used**

| | | | CLOTTING TIME | TIME OF PRESENTATION AFTER | NO. OF ANTIVENOM USED |
|---|---|---|---|---|---|
| Spearman's rho | CLOTTING TIME | Correlation Coefficient | 1.000 | .138 | .206 |
| | | Sig. (2-tailed) | . | .372 | .181 |
| | | N | 44 | 44 | 44 |
| | TIME OF PRESENTATION AFTER | Correlation Coefficient | .138 | 1.000 | .210 |
| | | Sig. (2-tailed) | .372 | . | .171 |
| | | N | 44 | 44 | 44 |
| | NO. OF ANTIVENOM USED | Correlation Coefficient | .206 | .210 | 1.000 |
| | | Sig. (2-tailed) | .181 | .171 | . |
| | | N | 44 | 44 | 44 |

## 5. Discussion

From the above results, we noted that majority of the people bitten by snake during the period of study were males with a percentage of 63.6. This is not surprising because men are more active at home, on the farm and hunting and would most likely be called in the event of siting a snake around the home.

Different parts of the body had been described as the sites of bites such as the leg, foot, ankle, finger and hand. These also has to do with the activities engaged in by the patients during the attack. Those who were walking or sitting would more likely be bitten at the lower limb while those picking up objects like woods or digging and probing into holes bare-handed would more like to have been bitten in their upper limbs. No bites were reported in other body parts like the trunk or face which could have happened during sleep.

In about 66 % of the patients it was possible to identify the presence of fang marks and document evidence of envenomation, very critical facts in management consideration. In the remaining 34 %, it was not possible to do this and therefore some other means must be used to support the diagnosis of poisoning before commencing antivenom.

Several symptoms were also described ranging from pain at the bite site alone to pain and swelling around the bite sites, bleeding from the site, pain and bleeding as well as swelling alone. Of note is the fact that 11.4 5 of the patients had no symptoms at all casting doubt as to whether they were actually bitten by snakes or something else especially if the bites happened in a poorly lit area or in the night.

Some activities were described by the patients before been bitten. Some were working on the farm, some bathing, others were picking foods or stones. Of interest was a particular patient who was watching television in his living room before been bitten. The description given to the snakes included black, brown, short or long, fat, thin or thick brown or black. They were actually not helpful in deciding the particular species of snakes or in deciding whether the would have been envenomed by them.

The study has also found no correlation between the bedside clotting time and the volume of antivenom used as well as the time of presentation and the volume of antivenom used in the attacks. Antivenom had been used in a haphazard and unregulated way. Sometimes the volume used were patient determined largely due to cost. In some occasions availability was the issue responsible for the volume used. Antivenom was not always available in the hospital and some patients bought from other shops outside the hospital facility.

Aghahowa SE and Ogbevoen RN reported the use of one hundred and thirty-six vials of polyvalent antivenom in the management of 129 patients that reported with snake bite from 2000 to 2011 in a teaching hospital in Nigeria. This was over a 12 year period also without any correlation to beside clotting time. [9]

It could have been possible to find a more scientific method of determining the volume of antivenom that would be required by individual patient and hence prevent unwanted doses and possible dangerous side effects that may be fatal sometimes. It is difficult if not impossible to estimate the exact amount of venom injected into the host by the snakes as this may be affected by the age of the snakes, the time of the day or whether the snakes was provoked or eaten.

Antivenom had been indicated if there were systemic envenoming such as: Impaired consciousness of any cause, Hypotension & shock, abnormal ECG, & other evidence of cardiovascular dysfunction, Neurotoxicity, Generalized rhabdomyolysis, evidence of severe intravascular haemolysis or evidence of renal failure and haemostatic abnormalities such as spontaneous systemic bleeding, acidosis with leucocytosis with WBC 20,000 and above and or elevated enzymes.

Local indications used were local swelling more than half the bitten limb, extensive blistering or bruising, Known necrotic venom, rapidly progressive swelling, bites on digits & into other light fascial compartment.

Bedside clotting time is very easy to do and can be done even in the remote areas with poor facilities. It has been a cardinal feature that distinguishes between who gets antivenom or not. It can readily be done by the bedside in the emergency room or on the wards by the attending clinician or nurse. If this study had proven a correlation between the clotting time and the volume of antivenom used it would have been possible to guide the use of antivenom in a safe and scientific way.

In a study by Eric k et al in Benin City Nigeria in 2003, out of the 435 patients seen over a 20 year period, only 297 (68.3%) had polyvalent antivenom given before discharge home. An important observation from the study also was the lack of any mortality from snake bites during the period of study.

It is arguable from the above therefore that it may be possible that antivenoms are over prescribed and over administered even when they are not needed. [10]

The results obtained in the study might have been affected by lack of proper documentation and the inability to track the patients as they are not bound by any law to receive hospital care compulsorily if they have been bitten by snake.

Another factor to consider is the small population size. This can be explained by the seasonal variability in the presentation and the competitive local management options that are non orthodox and readily available to the patients such as the use of black stones and local ointments and anti- toxic solutions.

The time of presentation when correlated with the volume of antivenom used also seems of less importance as this borders on the complications like advancing tissue necrosis or bleeding and may not in actual sense be of any influence. Some patients presented very late to the facility and were not still given antivenom due to lack of evidence of envenomation again casting doubts as to whether they were actually bitten by snakes.

It is a well-known fact that patients who presents early to a health facility gets evaluated quicker and the decision is made faster as to whether there is a need to use antivenom or not. Such patients have the best prognosis and have less complications provided the facilities needed are available and given promptly, especially the antivenom.

It may be possible in the future to identify a method to quantify the volume of antivenom used in snake bite as well as the volume of venom injected into the host as well. These findings will guide scientifically the use of such a life-saving but also a dangerous medication and prevent unnecessary exposure to it.

## 6. Conclusion

We can conclude from this study that for now there is no significant correlation between the bedside clotting time and the volume of antivenom used to restore neutrality of function in patients bitten by snakes in Nigeria.

## 7. Recommendation

A larger population, rural and hospital based study should be carried out to see if the correlation between the clotting time, Time of presentation to the hospital or receiving health care and the volume of antivenom used exists.

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