

Clinical Investigation

Haematological and Coagulation Profile in Snake Envenomation

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Abstract

Background: Coagulopathy is a common manifestation in cases of snake bite and its abnormality can be detected by blood coagulation tests. There are very few references in the literature related to coagulation parameter abnormalities after snake bite, evaluation of their seriousness and the length of the follow up period. Therefore we have undertaken this study to throw some light on the need of various coagulation tests and the duration of safe observation period after a suspected snake bite. **Methods:** 53 patients who experienced snake bite were enrolled in this study. Blood was drawn by a 23 gauge needle with syringe into K3EDTA and 3.2% sodium citrate vacutainers. The plasma was then aliquoted in ependoff tubes. The sample was analysed for complete blood counts and coagulation studies "PT, aPTT, TT and Fibrinogen" on admission and after 12 hours of admission to the hospital. **Results:** PT and APTT were prolonged in 14(26.4%) cases. Out of these 14 cases, 2 cases showed prolonged PT and APTT even after 12 hrs of admission. Thrombin time was prolonged in 17 cases (32%). Out of these, 3 cases were prolonged even after 12 hrs of admission. Fibrinogen concentration was decreased in 6 (11.3%). **Conclusion:** First line of coagulation markers (PT, APTT, fibrinogen and thrombin time) should be considered as first line of investigations for any suspected coagulation abnormality in snake bite patients and 12 hrs was the safe period to rule out any complications following envenomation.

Key words: snake bite, coagulation markers, PT, aPTT, TT, Fibrinogen.

Introduction

India is inhabited by more than 60 species of venomous snakes. Some of the most common species found in India are spectacled cobra (*Naja naja*), Common krait (*Bungarus caeruleus*), Saw scaled viper (*Echis carinatus*) and Russell's viper (*Daboia russelii*)¹. After being bitten by a poisonous snake, individuals may develop local pain, edema, systemic complications, acute renal failure, neurologic abnormalities, hemorrhage, infarctions and ultimately resulting in death². Coagulopathy is a common manifestation in some of these cases and its abnormality can be detected by blood coagulation tests. There are very few references in the literature related to coagulation parameter abnormalities after snake bite, evaluation of

their seriousness and the length of the follow up period. Therefore we have undertaken this study to throw some light on the need of various coagulation tests and the duration of safe observation period after a suspected snake bite. Envenomation is defined as occurrence of snakebite with the evidence of tissue damage, resulting in the spectrum of clinical symptoms and laboratory abnormalities from milder, localized injury of the tissue, to systemic illness including hypotension, neuromuscular dysfunction and coagulopathy³. Snake venom contains various types of enzymatic and non enzymatic toxins. Few toxins damage blood vessels and cause bleeding while others cause activation of coagulation factors and results in coagulation. Yet another type

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of venom causes sedation and neurotoxicity. Few types of snake venoms are cardiotoxic.

Materials and Methods

Blood samples from patients with history of snake bite are collected who are admitted in R.L.Jalappa Hospital and Research Center attached to Sri Devaraj Urs Medical College, Tamaka, Kolar beginning from Jan 2013 to June 2014. A total of 53 cases were collected. Detailed history, physical examination of patients, examination for various signs of bleeding from the site of bite, oral cavity, epistaxis and petechiae. Oral consent was taken from the patient. In case the patient is minor, consent was taken from guardians. Blood was drawn by a 23 gauge needle with syringe into K3EDTA and 3.2% sodium citrate vacutainers. The plasma was then aliquoted in endpoff tubes.

The sample was analysed for complete blood counts and coagulation studies "PT, APTT, TT and Fibrinogen" on admission and after 12 hours of admission. The patients were followed up for 24 hrs. PT and APTT was performed on these patients after 24 hrs of admission.

The tests were run using STAGO four channel coagulation instrument, *model Start* which detects the clot based on electromagnetic sensors. The instrument was calibrated according to the instructions given in the Stago Procedure manual using the calibrator provided along with the manual Kit.

Mc Nemar chi square test was done to demonstrate the association between the values at the time of admission and after 12 hrs of admission. The *p* values for PT, APTT, TT and fibrinogen when compared between the values at the time of admission and after 12 hrs of admission were < 0.001, < 0.001, 0.001 and 0.453 respectively. *p* value less than 0.05 was considered statistically significant.

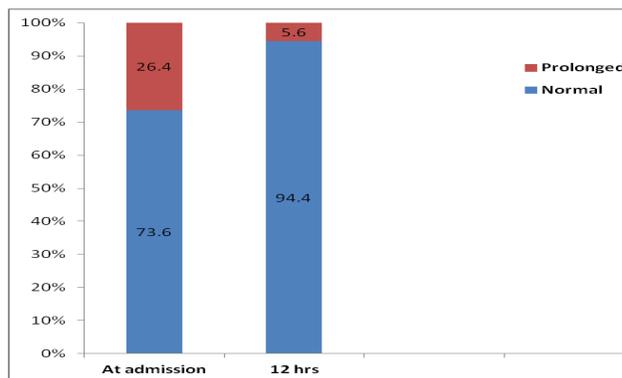
Results

Total number of snake bite cases admitted in casualty was 146. Out of these 146 cases, only 53 cases had signs of envenomation which was included in our study. 33 (62.2%) out of 53 cases showed mild envenomation and 20(37.7%) cases had severe envenomation. Age of the patients ranged from 17-85 yrs. Most of them were males with male to female ratio of 1.7:1. 49.1% of the patients were admitted during rainy season between May and august. 69.9% of cases were bitten in the night. The most common site was lower extremities. Platelet count was

decreased in 4(7.5%) cases and all these cases remained prolonged 12hrs after admission. The common complications seen in these cases were bleeding (18.8%), neurotoxicity manifesting as giddiness and unconsciousness (15%), cellulitis (3.6%) and local tissue reaction (62.2%). PT and APTT were prolonged in 14(26.4%) cases. Out of these 14 cases, 2 cases were prolonged even after 12 hrs of admission (Table 1 & 2). Thrombin time was prolonged in 17 cases (32%). Out of these, 3 cases were prolonged even after 12 hrs of admission (Table 3). Fibrinogen concentration was decreased in 6(11.3%) cases. 3 cases were prolonged even after 12 hrs of admission (Table 4).

Pro-thrombin time	At admission		After 12 hrs	
	Fre-quency	per-cent	Fre-quency	Per-cent
Prolonged	14	26.4	2	3.7
Normal	39	73.6	51	96.3
Total	53	100	53	100

Table 1: Comparison of Prothrombin time at the time of admission



with 12 hrs after admission.

Figure 1: Comparison of PT at Admission and 12 hours following admission.

APTT	At admission		After 12 hrs	
	Fre-quency	Per-cent	Fre-quency	Percent
Abnormal	14	26.4	2	3.7
Normal	39	73.6	51	96.3
Total	53	100	53	100

Table 2: Comparison of APTT at the time of admission with 12 hrs after admission.

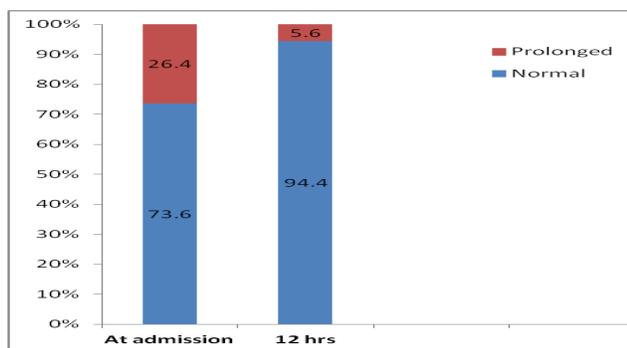


Fig 2: Distribution of normal and abnormal APTT at admission and after 12 hrs of admission.

Thrombin Time	At admission		After 12 hrs	
	Frequency	Percent	Frequency	Percent
Abnormal	17	32	3	5.6
Normal	36	68	50	94.4
Total	53	100	53	100

Table 3: Distribution of cases showing thrombin time abnormalities at admission and after 12 hrs of admission.

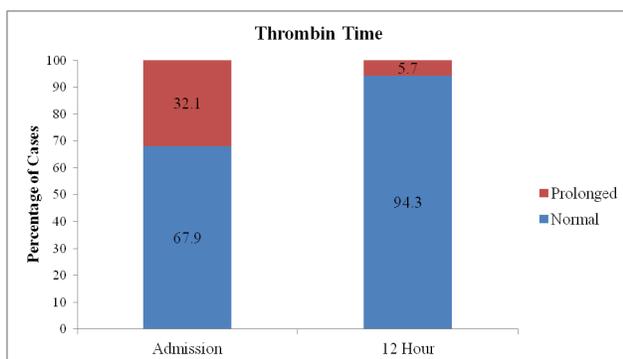


Fig 3: Comparison of Thrombin Time at the time of admission with 12 hrs after admission.

Fibrinogen	At admission		After 12 hrs	
	Frequency	Percentage	Frequency	Percent
Decreased	06	11.3	3	5.6
Normal	47	88.7	50	94.4
Total	53	100	53	100

Table 4: Comparison of fibrinogen concentration between patients at the time of admission and after 12 hrs.

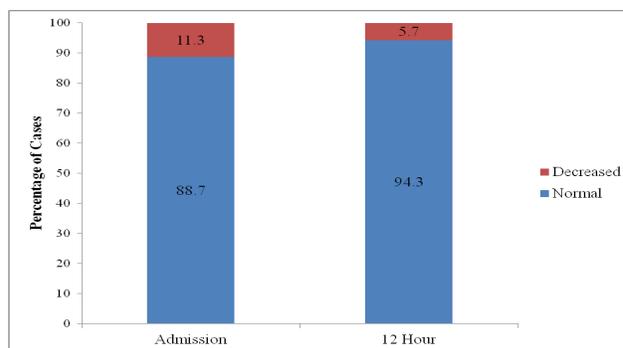


Fig 4: Distribution of cases according to Fibrinogen abnormalities.

Discussion

This study showed 26.5% incidence of snake bite in age group of 26-40 yrs and 35.8% incidence in 41-55 yrs of age group. (table 3). Most of the farmers working in the fields (including females) belong to the age group of 26-55 years. The reason being, these age group persons are in their productive years and there is more chances for them to come in contact with the snakes while working in the fields and become victims to snake bites. Males showed a higher incidence (64%) as compared to females (36%) which may be because predominantly males were involved in farming (table 4). This is in accordance with another study done by Hayat AS⁴ who also saw increased incidence of snake bite in male gender but the M:F ratio in his study was 4:1.

Most of the patients were from the rural area. More vegetation in rural areas and which may be conducive ecology for the reptiles to inhabit. Most of our snakebite (49.1%) cases occurred during the period of May to August which is also the monsoon season and that might be the reason of increased activity of snakes and hence increased incidence of snakebite cases. Most of the cases (69.9%) occurred at night in our study, when the person is either sleeping or walking around in the dark to switch on the pump to fill water in the fields as electricity comes in night time in rural areas and may accidentally step on the snake. This finding was different from another study done by Hayat AS⁴ who noted a 40% occurrence of snake bite cases in night.

In this study we found out that the most common site of snake bite was lower extremity (64.1%) which was in accordance with the study done by Hayat AS⁴ who found it to be 80%. In this study we found out that thrombocytopenia was present in 7.5% of the snake bite patients which continued to be the same after 12 hrs while in another study done by Moriarity et al⁵ showed that thrombocytopenia was present in 14.3% cases in his study. Out of 53 patients, 7 patients developed

neurotoxicity. 3 patients developed both haematotoxicity and neurotoxicity. This may have happened as the venom may have contained both hematotoxic and neurotoxic components. Since most of our patients had haematotoxicity, and local reaction in the form of swelling and redness it can be concluded that viper bites are much more common than cobra bites in this region of Karnataka state.

Most common local reaction we observed was swelling at the site of bite. Fang marks were identified in all the cases. The most common bleeding manifestation that we observed in our study was bleeding from the site of bite and petechiae. This was considered as an evidence of systemic envenomation. Bleeding was continuous in patients having severe envenomation and experienced considerable blood loss due to the coagulation disorder. 4 of such patients needed blood transfusion. In other patients bleeding was mild. Neurological symptoms were observed in 7 patients.

Among these 3 patients had combined features of haematotoxicity and neurotoxicity. These patients had continuous bleeding from the site of bite with ptosis. 3 patients had only neurological symptoms with respiratory distress. Remaining one patient developed ptosis and difficulty in speaking and swallowing. 66% of the patients were admitted within first 6 hours of the bite, 30% in between 6 - 24 hours of the bite and 4% came after 24 hour with severe complication of bleeding manifestation. Most of our patients were admitted within 6 hours of the bite. It can be concluded that this may be due increased awareness of people regarding complication and availability of treatment for snakebite in hospital. In a study done by Gaus et al, 54 cases had mild, 26 had moderate and 10 had severe envenomation. This was in concordance with our study where 33 cases had moderate and 20 cases had severe envenomation.⁶

In a study done by Graham et al he concluded that combination of INR, APTT, CK level and serial neurological examination within 24 hrs is sufficient as safe observation period. Whereas in present study, we found out that combination of PT, APTT, TT and fibrinogen levels for a period of 12 hrs can be considered as reliable indicators to exclude envenomation. In a study done by Dempfle et al⁷ he concluded that intra venous administration of anti snake venom resulted in normalized coagulation parameters within 48 hrs whereas in the present study we saw that 51 out of 53 cases showed normalization of coagulation markers 12 hrs after administration of anti snake venom.

Conclusion

First line of coagulation markers (PT, APTT, fibrinogen and thrombin time) should be considered as first line of investigations for any suspected coagulation abnormality in snake bite patients. If there is any abnormality in the first line parameters, then second line of specific markers can be entertained if required, to pinpoint the level of defect.

PT and APTT were the first abnormal test result after snake envenomation. 12 hrs observation was the safe period to rule out any complications following envenomation if the coagulation tests return to normal with Anti snake venom. There was no significant changes in the RBC indices (MCV, MCH, and MCHC) and platelet indices (MPV, PCT, PDW) after snake envenomation except platelet count which was low in 4 out of 53 cases which may be due to toxic effects of venom on platelets.

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Conflict of interest: The authors claim to have no conflict of interests in the context of this work.