

# Diagnosis of envenomation by Russell's and *Echis carinatus* viper: A clinical study at rural Maharashtra state of India

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## SUMMARY

**Background:** Envenoming by vipers *Russell's* and *Echis Carinatus* are common accidents faced by farmers and labors. Both viper venom toxins alter coagulation mechanism in the victim. The dose of snake antivenin to neutralize the venom is empirical and varies. Though the clinical manifestations in both vipers bite envenoming are nearly similar but dose of antivenin required is more in *Russell's viper*. We studied in detail about the correlation of clinical manifestations and confirmed species of snake. **Methods:** Cases of vipers snake bites admitted for last two successive years were studied. Analysis by local manifestations, systemic involvement, 20 minute whole blood clotting test (20WBCT), identification of snake responsible for clinical effects are confirmed by the snake species brought by victims or bystanders, in case of where victim saw the snake but failed to kill. The victims identified from pictures of big four poisonous snakes (*Russell's viper*, *Echis carinatus*, Cobra, and krait). Further confirmation from the species responsible is done by showing the hospital preserved specimen to identify the culprits. **Findings:** About 77 cases of viper bite studied of these 57 has clinical syndrome suggestive of *Russell's viper* (RV) bite, one has dry bite, 23 victims brought the killed specimen confirmed RV, of these 18 identified the specimen picture and 5 wrongly locate the species in pictures, 20 victims correctly identified the hospital preserved specimen while 3 failed to recognize. There were 28 patients who saw the snake while bitten but failed to kill, of these 20 patients identify correctly the species on picture while 8 failed to identify. Only 22 correctly identified the culprit by looking at the hospital preserved specimen and 6 were confused. One dry bite victim correctly identified the bitten snake species in picture and hospital preserved specimen. **Interpretation:** In viper bite poisoning clinical pictures and hospital specimen help to confirm the species are highly supportive for clinical diagnosis.

**Keywords:** Antisnake venom, echis carinatus, Russell's viper

## Introduction

Envenoming by venomous snake evokes a acute time limiting life threatening medical emergency often faced by villagers in tropical and subtropical countries.<sup>[1]</sup> High rainfall and humid climatic condition a pleasant environment for vipers snake (*Echis carinatus* and *Russell's viper*) to flourish.<sup>[2,3]</sup> High incidence of envenoming by *Echis carinatus* reported from Jammu state.<sup>[3]</sup> while envenoming by *Russell's viper* seen throughout south -East Asia. Maharashtra

incidence of Russell viper bite is 70 per 100000 inhabitant with fatality 2.4 per 100000 per year.<sup>[4]</sup> Because of poor transport facilities and blind faith of villagers, majority of victim initially report to the *Tantrik* this result in delay hospitalization contribute to high morbidity and fatality.<sup>[5]</sup> Early administration of adequate antivenin arrest the progression of severe envenoming, minimum venom reach to renal tissue and help to reduce the morbidity and mortality.<sup>[5,6]</sup> *Echis carinatus* and *Russell's viper* snake bite is 55% and 48% respectively reported from rural Maharashtra.<sup>[7,8]</sup> Similar reports are from Jammu<sup>[3]</sup> and other part of south Asia.<sup>[9]</sup>

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Total dose required to neutralize the injected venom by snake differ from species to species. The average dry weight of venom

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injected at strike is 13 mg in *Echis carinatus* and 63 mg in *Russell's viper*.<sup>[10]</sup> Newly posted medical officers are unaware of the signs and symptoms of venomous snake poisoning, and ignorance regarding initial dose of antivenin to be administered varies with species of vipers. In rural India trained snake catchers are encouraged by government of Maharashtra for to protect the snakes. Venomous and non-venomous snake pictures are disposed in villages and villagers are well aware that the treatment differ, and depends upon the species hence majority of victims or bystander always accompanied with the killed specimen of culprit.

In absent of specific antigen detecting ELISA kit for to recognizes circulating venom and the species of snake involved, one has to depends upon the evolved clinical syndrome, identify the killed species or by showing the pictures of species or preserved specimen in case of victim saw the snake or did not brought the killed specimen.<sup>[11]</sup> We report here the correlation and diagnostic specificity of clinical syndrome, snake picture and hospital preserved specimen.

## Patients and Methods

We studied cases of suspected or confirmed viper *Echis carinatus* (EC) and *Russell's* (RV) bite poisoning during last two years. The detail demographic study, time of bite, site of bite, season of bite were analyzed. Clinical syndrome consists of fangs marks with active blood oozing from abrasions of fangs, development of edema and its extension, ecchymosed, blebs over the site of bite, regional lymphadenitis, active external bleeding may or may not be present. 20MBCT test showed no clotting of blood 2-3 ml of blood is collected in a new dry glass test tube, not washed with detergents, kept for 20 minutes. And then look for development of clot, absence of clotting of blood suggestive hypo fibrinogenemia.<sup>[7-10,12]</sup>

**Killed specimen-** were studied and identified by zoologist.

**Pictures posters-** We prepared posters of photographs of local venomous snake found in this area, and victim is shown the pictures and allowed to take their own time to identify the snake bitten to him. The rate of confirmation of snake in picture is confirmed by identifying the killed specimen. In case of snake is killed but failed to bring the specimen or only saw the snake bitten is correlated with identification of pictures and clinical syndrome. All cases were shown the preserved specimen *Echis Carinatus* and *Russell's viper* for to identify the culprit.

Details are given in Tables 1-3.

Table confirmation of species [Table 4].

## Results

About 76 snake bite cases studied, out of these 57 were bitten by RV, 73% are male, and 52% are from age group 21-40 years. 85% cases occurred during Manson and early winter (June to December) season. 64% had snake bite to lower extremities. 61% victim reported between 6-12 AM.

Out of 57 cases of RV bite 24 victim could manage to kill the snake of these one has dry bite, 18 victims identified the RV photograph, while 5 confused and failed to identify. While 20 victims exactly identified the RV from the hospital preserved specimen of snake. 20 victim had clinical manifestations suggestive of RV bite. All the 28 patients saw the bitten snake but did not attempt to kill it. Of these 20 recognized and localized the culprit in photographs [Figure 1], 8 were confused to identify while 22 victims identified the RV specimen. 5 did not see the snakes but they suffered and had clinical syndrome suggestive of poisoning by RV.

Out of 19 cases suspected *Echis carinatus* bite 14 brought the specimen [Figures 2 and 3] of these 9 correctly recognized on photographs, 10 correctly identified from hospital specimen. 5 victims saw the snake of these 4 correctly identified in photographs and hospital specimen.

## Discussion

We report here the correlation of clinical syndrome and possibility of species involved by studying the killed specimen brought by the victim or by showing the photographs of snake for to identify and further confirmation by recognizing the

**Table 1: Age wise distribution of snake bite cases**

Age group In years	Russell's viper		Echis Carinatus	
	Male	Female	Male	Female
<20	5	8	5	0
21-40	24	7	6	2
41-60	9	2	5	1
>60	1	1	-	-
Total	39	18	16	3

Average age-Russell's viper 1-60 (32.38), Echis Carinatus 9-55 (32.73)

**Table 2: Month wise distribution of snake bite cases**

Month	Russell's viper (n-57)	Echis Carinatus (n-19)
January	2	1
February	2	1
March	1	-
April	3	-
May	1	1
June	4	1
July	8	1
August	12	1
September	6	1
October	12	6
November	3	3
December	3	3

**Table 3: Site and time of bite**

	Russell's viper (%)	Echis carinatus (%)
Upper extremities	21 (37)	7 (37)
Lower extremities	36 (83)	12 (63)
Time of bite		
AM	35 (61)	11 (58)
PM	22 (40)	8 (42)

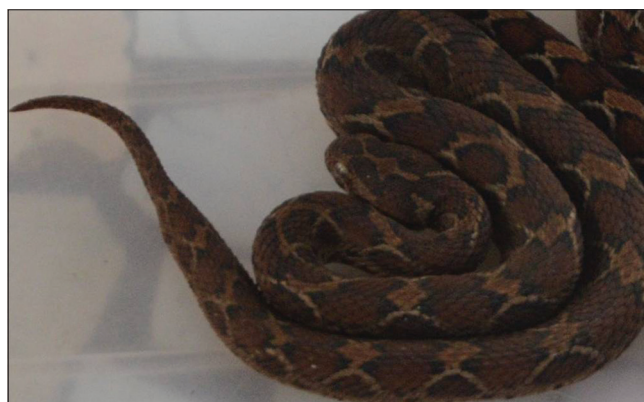
hospital preserved specimen of snakes.<sup>[5]</sup> Big four Krait, cobra, *Echis Carinatus* and *Russell's viper* are common venomous snake seen all over Maharashtra. We prepared the poster by actually taking photographs of snakes [Figure 1]. Because of the high literacy rate in Maharashtra, even villagers are more conscious regarding health. Repeated workshops regarding different snakes found in rural Maharashtra are held at *Panchayat* by snake rescuers. Victims are not encouraged to kill the snake. However, the villagers are aware that the treatment snake poisoning depends upon the species of snake and to avoid delay and confusion in the management at primary health center in present series 48% victim manage to killed and brought the specimen of snake.

In India polyvalent snake antivenom is available from Hakkine institute Mumbai, Serum institute Pune, and Bharat serum. 1 ml of reconstituted serum neutralizes 0.6 mg of dried *Russell's viper* and 0.45 mg dried *Echis Carinatus* venom. The average dry weight of venom injected at the time of bite is 63 mg by *Russell's* and 13 mg by *Echis carinatus viper*. Initial total dose of ASV to be administered 200 and 70 ML respectively.<sup>[10,13]</sup> In India *Russell's* and *Echis Carinatus* included in category 1 snake poisoning.<sup>[14]</sup> Snake bite is a disease of poverty.<sup>[15,16]</sup> moreover ASV is not free from severe reaction thus, it should be administered to only a case whom snake injected the venom and shows sign and symptoms of envenoming. ASV is always short supply. Medical officer who never treated case of snake bite before is unaware of this indication, total dose and possible specie involved resulted in un-necessary use as in dry bite<sup>[16]</sup> or avoidance of administration in indicated cases result in high morbidity and mortality.<sup>[17]</sup> In viper bite rapid diagnosis and early administration of ASV may prevent venom induced coagulopathy and subsequent vascular complication including disseminated intravascular coagulation and renal failure.<sup>[18-21]</sup>

*Russell's viper* fangs are long curved and more than 70% stored of venom in the gland is emptied during bite in the deep tissues. The venom is rich in procoagulant and glycoprotein which activates factor x. Venom and arginine esterhydrolase which activates factor V -induced consumption coagulopathy occurred due to



**Figure 1:** Photographs of BIG four venomous snake *Echis carinatus*, *Russell' viper*, Krait and cobra. Victim who saw the snake *Russell's viper* at the time of bite but did not kill snake but identified the culprit *Russell's viper*



**Figure 2:** *Echis carinatus* or saw scaled or carpet viper



**Figure 3:** Bite fangs abrasion with clotted blood at the site of bite by *Echis carinatus* snake

**Table 4: Echis carinatus**

Group A (n-14)		
Clinical syndrome + killed specimen	14	73.68%
Correct identification of species on picture	9	68.28%
Incorrect or confused for identification on picture	5	37.76%
Correct identified the hospital preserved specimen	10	52.63%
Group B (n5)		
Clinical syndrome + snake seen only	5	26.31%
Correct identified on pictures	4	80%
Correct identified hospital preserved specimen	4	80%
<i>Russell's viper</i>		
Group A (n23)		
Clinical syndrome + killed specimen	23	40.35%
Correct identification on figures or photographs	18	78.26%
Confused or failure to identify	5	21.73%
Correct identification of preserved specimen	20	86.95%
Group B (n 28)		
Clinical syndrome+snake seen but not killed	28	49.12%
Correct identified on photographs or figures	20	71.42%
Failure of identification on photographs	8	28.57%
Correct identification preserved specimen	22	78.57%
Confused on specimen identification	6	21.62%
Syndrome but snake not seen	5	8.77%
Dry bite	1	1.75%

activation of the activators and factor x.<sup>[20]</sup> Soon after the bite victim experienced severe local pain and development of rapid swelling extending more than one segment of bitten part within few hours. Subsequently ecchymosed and blebs occur over the bitten part [Figures 4-6]. Because of rapid development of DIC

at the bite site, result in continuous oozing of blood from fangs abrasions and subsequently gum and systemic bleeding and if not treated victim developed hypotension, shock and renal failure.<sup>[9,10,21-24]</sup>

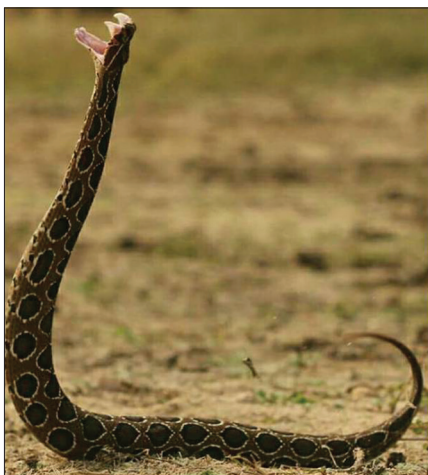


Figure 4: Russell's viper

*Echis carinatus* inject 10% of stored venom, venom is a big molecular size injected in subcutaneous tissue, and venom of *Echis carinatus* contains a zinc metalloprotein -ecarin which activates prothombin. Soon after envenoming by *Echis carinatus* species, within one 60-90 minutes there is progressive swelling over the bitten part. Fangs marks or abrasion with clotted blood seen at the site of bite [Figure 4]. Venom is big molecular size and being circulated through the lymphatic. Within 60-90 minutes victim experiences a painful lymphadenopathy at drainage area of the bitten part.<sup>[5,7,8,25]</sup>

In India most of practicing doctors at rural setting have to rely on the circumstances of the bite and the clinical features of envenoming to infer the biting process. Clinical syndrome is almost similar Russell's and *Echis carinatus* poisoning, but dose requirement of polyvalent snake antivenom significantly differ.<sup>[5,7,8]</sup>



Figure 5: Active oozing of blood from fangs abrasion of Russell's viper bite site

In absence of ELISA antigen detection test in India. By showing the pictures of common venomous snakes seen in particularly area, clinician can confirm the species by correlation with syndromic presentations. Rather than only depends upon the description of snake bitten by victim.<sup>[24,26]</sup> In the present series we found majority of victim could able to localize the bitten snake in photos. Posters of venomous snakes are available in all medical text books and also at primary health centers. However preserved species are rare. We trained all the peripheral doctors in *kokan* region regarding clinical syndromes evoked by venomous snakes and provided them a published literature along with pictures of venomous snakes helped to early administration of required quantity of antivenin in a indicated envenomed cases.<sup>[17,27,28]</sup>

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### Conflicts of interest

There are no conflicts of interest.

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Figure 6: Extensive blebs

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