Sarkar et al. Egyptian Journal of Forensic Sciences (2018) 8:12
DOI 10.1186/s41935-018-0040-3

Egyptian Journal of Forensic Sciences

CASE REPORT Open Access

Nephrotoxicity in krait bite: a rare case series of three fatalities in consecutive bites by a single snake

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Abstract

Background: Death due to poisonous snakebite is a formidable health hazard. It is a matter of concern especially in agrarian countries. Clinically snakebite envenomation are neurotoxic and vasculotoxic. Krait (*Bungarus faciatus*) Venom is essentially neurotoxic.Nephrotoxicity in krait bite is an important issue that has been less studied and reported.

Case presentation: In the present series, we report three cases of deaths in consecutive bites by a single banded krait. Significant renal involvement was found at autopsy. The kidneys showed interstitial haemorrhage and inflammatory cell infiltration. The renal changes were similar in all the three cases bitten by the same snake.

Conclusions: From the findings of autopsy and histology of the present case series we can conclude that nephrotoxicity is an important effect of krait bite. Though less reported and researched kidney changes in krait bite is a significant issue in treatment as well as autopsy diagnosis. .
We can also infer that the immunogenicity of the snake venoms can be different from our expectation.

Keywords: Pathology, Single snake, Krait bite, Kidney, Interstitial nephritis

Background

High mortality due to poisonous snakebite is a formidable health hazard. It is a matter of concern for health care providers especially in agrarian countries of South East Asian region. (Mohapatra et al., 2011; Halesha et al., 2013; Chugh et al., 1983; Chugh, 1989; Mukhopadhyay et al., 2010a) Cases of snakebite envenomation comprise medical emergency. The outcome of therapy however, depends on how fast and prompt medical care is initiated. It also depends on how specific antidotes are administered and monitored clinically.

Given the socio-cultural scenario of developing countries, treatment is often delayed due to several inter related issues. Ignorance, superstition, lack of infrastructure and inadequate logistic support are some of the factors that contribute to the high mortality in the vulnerable population.

Clinically snakebite envenomation can be broadly classified into neurotoxic and vasculotoxic. Cobra and krait both belong to the neurotoxic variety while viper bites are vasculotoxic. Other organ involvement like myotoxicity and cadiotoxicity has also been reported in snakebite.

The composition of KRAIT (*Bungarus faciatus*) venom is essentially neurotoxic. Symptoms develop very rapidly and most often the bites are painless and marks are invisible in the body. Earlier works have reported significant clinical and autopsy changes in the Krait bite fatalities.

The venom of the banded krait (*Bungarus faciatus)* mainly contains neurotoxins (pre- and postsynaptic neurotoxins).These include acetylcholine (Ach) esterase, phospholipase B, and glycerophosphatase. Common Indian krait venom contains both presynaptic beta bungarotoxin and alpha bungarotoxin (Bawaskar & Bawaskar, 2015). LD_{50} values of 2.4 mg/kg—3.6 mg/k SC, 1.289 mg/kg IV and 1.55 mg/kg IP are reported. The average quantity of venom delivered per bite is 20–114 mg. Engelmann and Obst (1981) listed the venom yield at 114 mg (dry weight). (Engelmann, 1982).

The major clinical effects caused by the venom of this species include vomiting, abdominal pain, diarrhoea, and dizziness. Severe envenomation leads to rapid respiratory failure and death. A hospital based study revealed maximum mortality and severity in krait (60%) followed by

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cobra (13.33%) and viper (8.9%) envenomation (Saravu et al., 2012).

Another investigation by clinical toxicologists reported untreated mortality rate of 1—10%,. This may be because contact with humans is rare .the amount of injected venom in defensive bites is lower than aggressive ones. A polyvalent antivenom is currently available and widely used in India and several other south Asian countries. Regional variation in clinical presentation has been described in bite by some species of Cobra (Robed Amin et al., 2014; Chippaux et al., 1991).

Report from Thailand, Malaysia and Bangladesh showed rapid death due to Krait bite.Renal involvement in snake bite has been reported and discussed at length in earlier works (Chugh, 1989; Mukhopadhyay et al., 2010a; Bawaskar & Bawaskar, 2015; Engelmann, 1982; Robed Amin et al., 2014; Chippaux et al., 1991).

Case presentation

In the present series, we are reporting three cases of deaths in consecutive bites by a single banded krait. Significant renal involved was found at autopsy in all the three cases. This rare case series highlights the high degree of fatality and autopsy features of nephrotoxicity in krait bite. Histopathological corroboration was done to assess the degree and extent of renal damage in fatal krait bite.

Of the three victims, two were adults and one was a child of four years. They were bitten by a single snake (banded krait).All three of them were brought dead at the emergency of a tertiary level teaching hospital. People accompanying the deceased had brought alongwith the offending snake which they had killed when it was found hiding at the corner of the house. Brief history revealed that all the three deceased,residents of a rural outskirts of a district town,were sleeping together on the floor of their thatched mud hut using a mosquito net. The krait has somehow intruded into the mosquito net and bit the victims in successive attacks.

The first case was a 27 years old male subject brought to the mortuary from the hospital. The dead body was average built moderately nourished with rigor mortis present all over.During autopsy, two pin- point punctured wounds, subcutaneous deep, placed 08 mm apart were found over the dorsum of the hand along ulnar border. On dissection, there was extravasation of blood in the surroundings soft tissue. The injury showed evidence of vital reaction.

The second (26 years female) and third case (four years old girl child) had similar findings with bites over tip of the right shoulder and medical aspect of right foot respectively.

In all the three cases, dissection revealed congestion of vital structures, with specific changes in the kidneys. Cut section of Kidneys showed bilateral cortico-medullary haemorrhage and gross congestion [Fig. 1].

Histopathology of the kidney

Histology of the kidneys showed interstitial haemorrhage and inflammatory cell infiltration (Fig. 2).The kidney of the child showed swelling, increased cytoplasmic eosinophilia and occasional surface blebbing of the renal tubular epithelial cells suggestive of early ischemic injury (Figs. 3 and 4).Krait poison is essentially neurotoxic but in these three cases, there was evidence of gross pathology of kidney. The renal changes at autopsy were significant. Renal histology of the three cases showed presence of definite pathology namely (a) Interstitial haemorrhage and inflammatory cell infiltration (b) swelling, increased cytoplasmic eosinophilia and (c) occasional surface blebbing of the renal tubular epithelial cells suggestive of early ischemic injury. Renal changes in fatal snakebite have been reported earlier. Those were mainly cortical necrosis and interstitial nephritis in the viper bites (Indraprasit & Boonpucknavig, 1986; Mukhopadhayay et al., 2010; Pinho & Burdmann, 2001; JCM et al., 1977; Sitprija & Boonpucknavig, 1977; Sitprija et al., 1982; Soe et al., 1993; Yogesh & Satish, 2014) and less frequently in cobra (Mukhopadhyay et al., 2010b). Whereas, the present series involves fatalities due to krait envenomation.

In our case series the duration from bite to death was almost 6 h as the victims were initially taken to an exorcist for remedy. The exorcist resorted to some tricks and chants only but failed to deliver. Thereafter they were transferred to a hospital when conditions deteriorated.

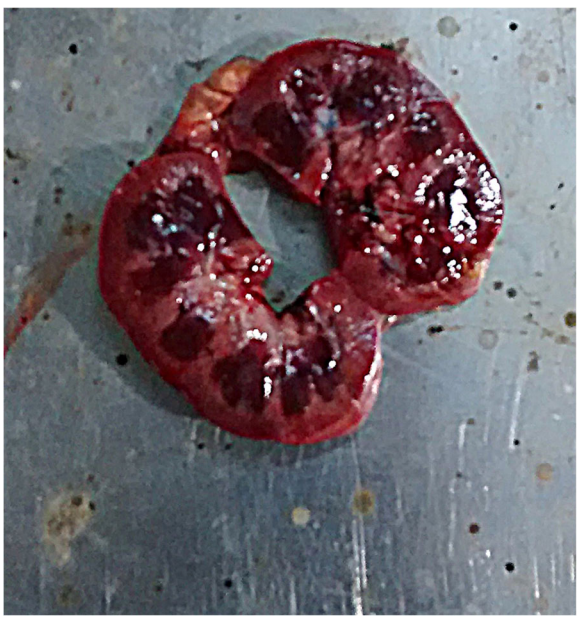

Fig. 1 Photograph of cut section of kidney showing severe cortico-medullary congestion and haemorrhage

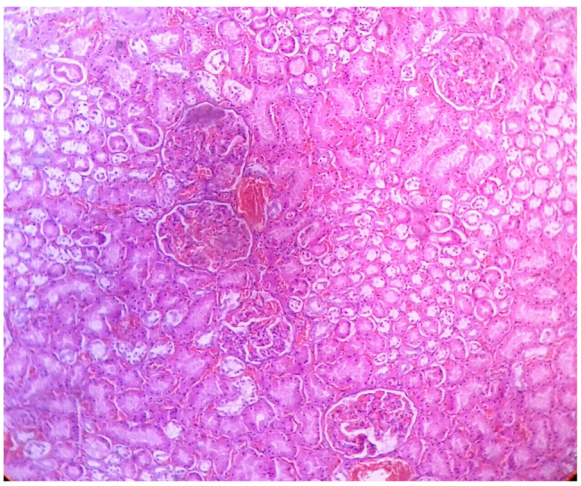

Fig. 2 Case 1 microphotograph showing interstitial haemorrhage and inflammatory cell infiltration. (H & E; 10×)

They were declared dead at the hospital emergency. As no treatment could be initiated, the changes in the kidneys can be attributed to the direct and exclusive effect of the venom. The inflammatory response noted in the kidneys supports our view that nephrotoxicity is a feature of krait bite. These features might have been masked by the overwhelming neurotoxicity and rapid death.

So we hypothesize that krait envenomation can be associated with rhabdomyolysis contributing towards renal damage. Possible ischemic effect causing tubular degeneration is also significant. This can be clearly inferred from the findings of histology. Plausible immunological mechanism is adequate in explaining the changes in the end organs in fatal krait bite.

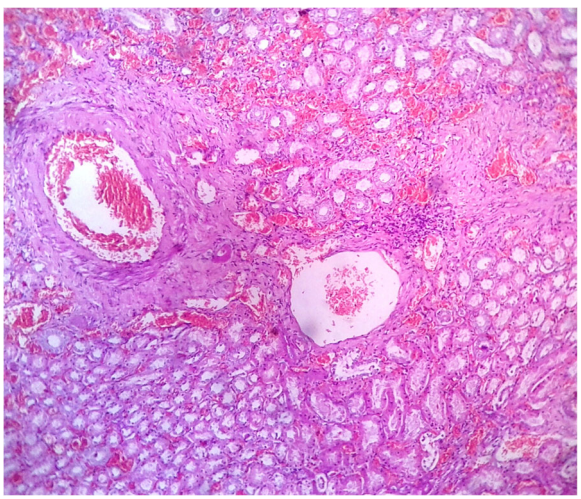

Fig. 3 Case 2 microphotograph showing interstitial haemorrhage and inflammatory cell infiltration. (H & E; 10×)

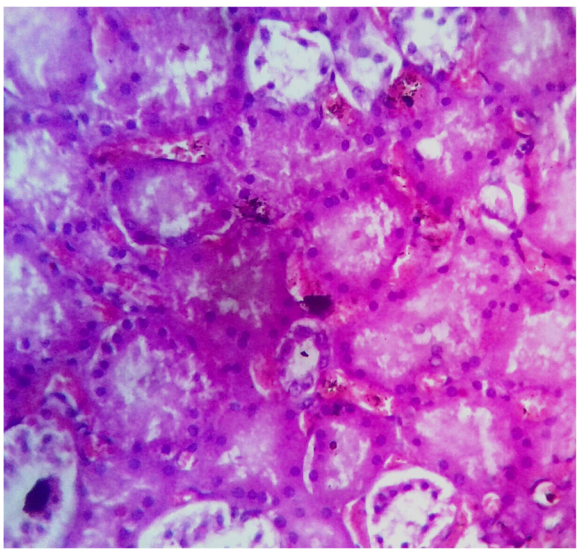

Fig. 4 Case 3. Microphotograph showing swelling increased cytoplasmic eosinophilia and occasional surface blebbing of the renal tubular epithelial cells. (H & E; 40×)

Conclusions

From our findings, we can infer that the immunogenicity of the snake venoms can be different from our current knowledge. There might be regional variations in the immunogenicity of snake venom depending on the species involved. This can serve as an indication for further research in elucidating the pathology of krait bite induced nephrotoxicity. Regarding the management of krait bite, polyvalent serum still remains the mainstay of therapy (Bawaskar & Bawaskar, 2015; Saravu et al., 2012; Robed Amin et al., 2014; Warrel, 2010).There may be need for organ specific system support for better results. Clinicians should be aware of these conditions while treating cases of krait bite.

The amount of toxin that is injected by the bite of a single snake is also a significant factor. This must be borne in mind while planning the management. This is clearly illustrated by the present case series of three fatalities from consecutive bites by the same snake. Victims should be taken to hospital first where anti venom is available. There should be positive activism and change in the mindset at community level.

Role of ventilator support and dialysis (Soe et al., 1993; Yogesh & Satish, 2014) should be explored in cases of krait (*Bungarus faciatus*) bites. We hypothesize that fatalities in Krait bites can be reduced by use of organ support along with early and timely monitored anti-venom therapy. Also further interdisciplinary research is needed in elucidating the immunogenicity of snake toxins.

Acknowledgements
The authors would like to acknowledge the contribution of Dr. Kaushik Roy MD post graduate trainee, forensic medicine Burdwan medical college Burdwan WB India. We would like to thank the anonymous reviewers for their constructive advice and valuable inputs.

Funding
Not applicable. No funding for the present cases from any sources. All are done as part of routine medico legal work.

Availability of data and materials
Not applicable.

Authors' contributions
Dr.Naren Sarkar and Dr. Soumeek Choudhury assisted the autopsy with Dr.Souvik Basu under the supervision and guidance of H.O.D Professor (Dr.) Partha Pratim Mukhopadhayay of Forensic Medicine, Burdwan Medical College. Dr.Naren Sarkar was assigned for dissection, tissue collection and documentation. Dr. Preeti Chandra prepared the tissue for histo-pathology with reports. Review of literature was done by Dr.Naren Sarkar. The manuscript was written by Professor (Dr.) P.P. Mukhopadhayay and Dr.Naren Sarkar. Review and correction were done by all the authors. The entire work was planned, conceptualized, and analysed by Professor (Dr.) P.P. Mukhopadhayay. All authors read and approved the final manuscript.

Ethics approval and consent to participate
Full ethics approval and clearance is waived for case reports. This is as per our IEC protocol. Only information for publishing report has be given to the author. Such permission was taken for the present case. Consent is not required for medico legal autopsy of unnatural death in our Institute as per statutory Law.

Consent for publication
Consent to publish was obtained from the next of kin.

Competing interests
The authors declare that they have no competing interests.

Publisher's Note

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Received: 4 May 2017 Accepted: 12 January 2018
Published online: 29 January 2018

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