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Risk Factors Associated with Bites Due to Two Viperid Snakes: A Case Control Study

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Authors' contributions

This work was carried out in collaboration between all authors. Author SAMK and KGADW conceived the idea and designed the study. Authors SAMK, KGADW and AR did acquisition of data. Author PVRK analyzed data. Authors SAMK and KGADW drafted the article and critically revised for important intellectual content. All the authors read and approved the final version of the script to be published.

Case Study

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ABSTRACT

Aims: This study was to assess victim's environmental and behavioural risk factors that promote bites from two viperid snakes.

Study Design: A case control study.

Place and Duration of Study: Medical wards, General Hospital, Kurunegala, Sri Lanka, between June to December 2010.

Methodology: Cases were recruited prospectively from consecutive admissions to the General Hospital, Kurunegala, Sri Lanka with proven viperid bites. Age and gender matched control group was selected from relatives and neighbourhood of the cases in a ratio of 1 case: 2 controls.

Results: There were 56 cases and 112 controls with mean age 44 years and 45 years

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respectively. Of the 13 risk factors assessed, 7 risk factors showed a significant association with viperid bites. Those were (1) being in an ill lit place (OR, 95% CI= 6.6 (3.25-13.4), (2) being in outdoor places (OR, 95% CI= 148.8 (43.7-506), (3) working in a field (OR, 95% CI= 175 (31.4 – 976), (4) occupation as a field worker (OR, 95% CI= 5.3 (2.3-12), (5) low level of financial status (OR, 95% CI=9.9(2.75- 35.5), (6) lack of attached toilet (OR, 95% CI= 7.38 (2.15- 25.3), (7) presence of small rodents in the compounds (OR, 95% CI= 11 (4.88-24.9).

Conclusion: Identifying easily remediable risk factors would help in preventing viperid snake bites.

Keywords: Snake-bite; viperid snakes; Russell's viper; hump-nosed viper; risk factors; Sri Lanka.

1. INTRODUCTION

Snake bite is a major health problem common in the rural dry zone of Sri Lanka (Kularatne, 2001). The government of Sri Lanka has to bear heavy cost to import Indian polyvalent antivenom and to provide free health care to the victims of snake bite. Of the larger number of land snakes in Sri Lanka, only six are considered medically important (Kularatne, 2001). Of them, two viperid snakes Russell's viper (*Daboia russelii*) and hump-nosed pit viper (*Hypnale* species) are responsible for most of the venomous snake bites in Sri Lanka. Russell's viper (RV) causes the highest snake bite associated morbidity whilst hump-nosed pit viper (HNV) causes the highest number of venomous snake bites in Sri Lanka (Silva and Ranasinghe, 1983; Seneviratne et al., 2000; Kularatne and Ratnathunga, 1999; Ariaratnam et al., 2008). The commonest victim of snake bite is the rural dry zone paddy farmer (Kularatne, 2003). Ignorance and lack of knowledge about snakes among the rural folks promote snake bites and thus education on risk factors of snake bite would help them to prevent snake bite. Particularly, prevention of RV and HNV's bites certainly will reduce the hospital admissions and related morbidity and mortality.

To implement preventive strategies, there needs to be a clear understanding of the possible risk factors and their level of significant association with viper bites. There is a geographic variation in the distribution of hospital admissions due to bites of medically important snakes within the country (de Silva and Ranasinghe, 1983; de Silva and Aloysius, 1983; Ratnapala et al., 1983). This is most likely to be due to varying ecological conditions, human and snake behaviours. The distribution of an individual snake species is influenced by factors, such as, climate, rainfall, altitude, vegetation, and its preference for a particular prey. The above knowledge is needed to develop method to identify the risk factors of snake bite. The aim of this study was to study the environmental and behavioral risk factors of victims that influenced two viperid snake bites in Sri Lanka.

2. MATERIALS AND METHODS

The study was done as a case control study in Kurunegala district which spans part of the dry zone and the intermediate zone of Sri Lanka. Study was conducted during the period of June to December 2010. Cases were recruited prospectively from consecutive admissions to General Hospital, Kurunegala, Sri Lanka with RV and HNV bites presented with offending snake. General Hospital, Kurunegala is a tertiary care centre with facilities and trained personnel available to manage snake bites. Identification of the snakes was done by a

medical officer, by inspecting the dead specimens. Snake specimens were available in the unit to confirm the identification. Patients were interviewed and the data were collected in an interviewer administered questionnaire. Data recording was done in view of general details, demography, geographic location and related environmental factors. The age and gender matched control group was selected from relatives and neighbourhood of cases (i.e. similar socio-economic and cultural characteristics but without history of snake bites during their lifetime) in a ratio of 1 case: 2 controls (56 cases and 112 controls). From common knowledge and previous study findings (Dumavibhat, 1997; Morandi and Williams, 1997) 13 risk factors were studied for the study coming under two categories; eight general risk factors, and five risk factors at the time of bite. Occupation, level of education, financial status, placement of toilet facilities, surrounding environment, presence of small rodents in the surrounding, habit of alcohol consumption and attitudes towards snake were the general risk factors assessed. The five factors considered as risks at the time of bite were, place of bite, activity at the time of bite, use of protective wear, being in an ill lit place and being under influence of alcohol.

Data analysis: Data were entered in to a spread sheet and double checked for analysis and the data analysis was done using SPSS version 12, with results given in odds ratios, percentages, standard deviations and averages. The odds ratios presented are obtained from univariate analysis.

3. RESULTS

There were 56 cases and 112 controls with mean ages being 44 years (SD-15) and 45 years (SD- 22) respectively ($P = 0.704$). Age range of the cases was 15 to 70 years and of them, 57% was between the ages of 20 to 50 years. There were 34 (61%) males and 22 (39%) females among the cases. Sixty eight (61%) of the controls were males and 44 (39%) were females ($P = 0.9$). Hence the cases and controls were age and sex matched. Number of HNV bites was 39 (70%) and RV bites were 17 (30%). Thirty five (62%) bites had occurred during 2.00 pm to 10.00 pm. Of the 13 risk factors assessed, 7 risk factors showed a significant association with viperid bites.

The significant risk factors at the time of bite were (1) being in an ill lit place (64%), (OR, 95% CI= 6.6 (3.25-13.4), (2) being in outdoor places (93%), (OR, 95% CI= 148.8 (43.7-506) and (3) working in an outdoor field (96%), (OR, 95% CI= 175 (31.4 – 976). The general risk factors reached significant association were (1) Occupation as a field worker (55%), (OR, 95% CI= 5.3(2.3-12), (2) low level of financial status (93%), (OR, 95% CI=9.9 (2.75- 35.5), (3) lack of attached toilet (95%), (OR, 95% CI= 7.38 (2.15- 25.3), (4) presence of small rodents in the compounds (84%), (OR, 95% CI= 11 (4.88-24.9), (Table 1). The rest of the risk factors; not using protective wear, being under influence of alcohol, level of education, surrounding environment, habit of alcohol consumption and attitudes towards snakes were not significant.

Table 1. Risk factors of viperid snake bites

Risk factors	Cases number (%)	Controls number (%)	OR (95% CI)
Risks at the time of bite			
being in an ill lit place	36 (64)	25 (22)	6.6 (3.25-13.4)
being in outdoor places,	52 (93)	10 (09)	148.8 (43.7-506)
working in an outdoor field	54 (96)	10 (09)	175 (31.4 – 976)
General risk factors			
occupation as a field worker	31 (55)	23 (21)	5.3(2.3-12)
low level of financial status	52 (93)	87 (78)	9.9 (2.75- 35.5)
lack of attached toilet	53 (95)	80 (71)	7.38 (2.15- 25.3)
presence of small rodents in the compounds	47 (84)	37 (33)	11 (4.88-24.9)

4. DISCUSSION

This study identified some important risk factors which are remediable to prevent viperid snake bites in Sri Lanka. The HNV and RV snakes were considered in this study because they share common ecological characteristics (Kasturiratne et al., 2005). Majority of the patients were middle aged males and belonged to a lower income group. Similar observation had been reported in previous studies in Sri Lanka and in some other South Asian countries (Kularatne, 2003; Silva, 1981; Ariaratnam et al., 2008; Bawaskar and Bawaskar, 2003; Sharma et al., 2004).

We found that most viperid bites had occurred in outdoor places whilst victims were involved in field works. Occupation was an important risk factor as the field workers had a significant risk of getting snake bites. Studies in developing countries had shown that about half of the victims are farmers (Kularatne, 2003; de Silva, 1981; Pandey, 2007; Kularatne et al., 2009) as opposed to the studies in the developed nations like the US where the incidence is low among farmers but more among snake handlers (Morandi and Williams, 1997).

Moreover, the majority of bites were reported in the evening and at early hours of night. The time of snake bite usually depends on the relative abundance of diurnal and nocturnal snakes in the regions and their behaviors. Krait bites generally occur at night, whereas viperid and cobra bites mostly occur during daytime, dawn and dusk (de Silva, 1981; Hansdak et al., 1998; Kularatne, 2002). Being in an ill lit place was a significant risk factor. This implies the importance of the visibility at night to avoid snake bite. Presence of small rodents in the home garden might have lead to the attraction of snakes closer to human habitats promoting snake bites. Absence of an attached toilet at home prompts people go out in dark to outdoor toilet or the garden to void excreta make them susceptible to snake bite. None of the victims of this group were intentionally handling the snakes when they were being bitten.

The limitation of the study is the sample size. If the study had a larger sample the results would have been more precise, with narrow SD values. Also this fact limited application of multivariate analysis. However, study of this nature will pave the way for future studies.

5. CONCLUSION

This study found some important risk factors of viperid snake bites in Sri Lanka. In essence the significant risk factors were, being in ill lit places, being in outdoor places, working in outdoor fields, occupation as field workers, low level of financial status, lack of attached toilets and presence of small rodents in the compounds. These risk factors are easily remediable and would be useful in health education and in developing strategies in preventing snake bites.

ETHICAL APPROVAL

Informed written consent was obtained from all the cases and controls before recruitment to the study. We have obtained ethical clearance from the ethics committee, Faculty of Medicine, University of Peradeniya, Sri Lanka for epidemiological studies in snake bite.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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