Challenges in diagnosing and treating snakebites in a rural population of Tamil Nadu, India: the views of clinicians

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Abstract

Snakebites cause death, disability and economic devastation to their victims, people who live almost exclusively in rural areas. Annually an estimated two million venomous bites cause as many as 100,000 deaths worldwide as well as hundreds of thousands of deformities and amputations. Recent studies suggest that India has the highest incidence of snakebite and associated deaths worldwide. In this study, we interviewed 25 hospital-based clinicians who regularly treat snakebites in Tamil Nadu, India, in order to gauge their opinions and views on the diagnostic tools and treatment methods available at that time, the difficulties encountered in treating snakebites and improvements to snakebite management protocols they deem necessary. Clinicians identified the improvement of community education, training of medical personnel, development of standard treatment protocols and improved medication as priorities for the immediate future.

Keywords: snakebite, venom, anti-venom, ASV, big four

Introduction

Snakebites are one of the major neglected tropical medical challenges affecting rural populations worldwide with several million bites [1] and around 100,000 deaths each year [2]. India is one of the countries where snake envenomation is most prevalent, however snakebites in this country are poorly characterised [1-5]. The medically important snakes in India are considered to be the 'big four': the Russell's viper (*Daboia russelii*), saw-scaled viper (*Echis carinatus*), Indian cobra (*Naja naja*) and the common krait (*Bungarus caeruleus*), although other medically important snakes have also been reported [6-9].

The complexity of snake venoms and their combined action in victims pose considerable challenges to the treatment of bites. Currently, the only available treatment in rural India is polyvalent anti-snake venom (ASV) raised in either horses or sheep against the venoms of the big four. The efficacy of this ASV against the venom of snakes that are not one of the big four and big four

individuals from different geographical locations is unclear. Moreover, the administration of ASV from horses and sheep regularly leads to dangerous anaphylactic reactions and problems relating to hypersensitivity that can last for several days. In India, there are no specific diagnostic tools to confirm snakebite occurrence in victims or to identify the source snake species or family. There is therefore a need to improve diagnostic methods for snakebites, allowing the family of the offending snake to be known, appropriate quantities of ASV to be delivered and the dangers associated with the administration of ASV by inexperienced individuals to be minimised.

In order to better understand the available diagnostic techniques, treatment methods, difficulties encountered in treating snakebites and improvements required to current protocols, we conducted face to face interviews with clinicians who regularly treat snakebites and present their views in this article.

Methods

This study was conducted along with a population survey aimed at understanding snakebite incidence and its socio-economic impacts on the rural population of Tamil Nadu, India [5]. Interviews were conducted with 25 clinicians based in 20 private multi-specialty hospitals in the Indian state of Tamil Nadu. All the clinicians interviewed had been treating snakebites for at least six years and nine had more than 20 years of experience. A standard questionnaire was used to collect their views on snakebite incidence, diagnosis and treatment. The School of Biological Sciences Ethical Committee review panel at the University of Reading approved this study and the questionnaire. After obtaining written consent, the interviews were recorded either in the local language or in English and later translated by the authors. The appropriateness of translation was checked prior to the interviews. The authors performed the interviews and all data were anonymised prior to analysis.

Results and discussion

The clinicians in private hospitals were interviewed between 2010 and 2012 to gauge their opinions about current management and treatment of snakebites, the difficulties they have experienced and their views on how snakebite treatment could be improved in the future. On average, each clinician interviewed, evaluated and treated 50 snakebite victims per year with some of the referral hospital physicians seeing more than 100 victims each year (Table 1). Seventy-five percent of clinicians reported an increase in hospitalised snakebite cases during the rainy seasons, an observation that was stable over the years, while 25% observed no seasonal variations. In all cases, the clinical examination included analysing symptoms such as vomiting, nausea, bleeding gums, swelling/infection/bleeding at the bite site, and other physical symptoms. All the clinicians attempted to find out the time of bite, snake species and treatments received either from traditional healers or other medical professionals.

Following whole blood clotting time (WBCT) test and clinical observations, all clinicians used polyvalent ASV to treat the bites. Typically, treatment would start with ten vials of ASV, but as many as 200 vials were used in some cases (Table 1). The typical cost for a single vial was Rs400-550. Antibiotics and anti-histamine were the most common additional treatments reported, and the duration of a patients stay in hospital ranged from 2 days up to 35 days during this treatment (Table 1). The clinicians estimated the cost of treatment to range from Rs5,000 to Rs200,000. We found 67% of clinicians to consider identification of the offending snake important in order to determine whether it was likely to have more haemotoxic or neurotoxic effects. The remaining clinicians felt that identifying the snake was unimportant; mainly due to the lack of species-specific treatment.

The clinicians reported a range of time intervals between the snakebite and the arrival of a victim at hospital. Forty percent of victims arrived within 30 minutes and a further 30% of victims arrived within a few hours of the bite (Table 1). Many also commented that some patients (approximately 30%) did not come to hospital until several days after the bite due to treatments sought from locally available traditional healers. Delays in arrival were considered to lead to increased envenomation effects and complications, particularly pulmonary bleeding, renal failure, necrosis, septicaemia, cerebral bleeding and respiratory failure. In some cases, the delay in obtaining correct treatments resulted in severe complications leading to surgery to remove or graft the affected areas. Despite this, less than five per cent of envenomed patients died in hospitals. Clinicians were frequently unable to save the lives of snakebite victims who had cerebral bleeding and pulmonary bleeding, and this was associated with 80% mortality due to increased complications. When clinicians were asked to report any unusual snakebite cases, two reported early morning neuroparalytic syndrome. The clinicians infused ASV assuming that this may have been due to a krait bite, and the victims recovered after 24 hours and confirmed that they had suffered from snakebite.

Clinicians were asked for their opinions on the treatments currently available and their views on how snakebite prevention and management could be improved in the future. Each, without exception, emphasized that current treatments lack efficacy since knowledge of the snakebite is normally limited, with nothing known about the species or dose of venom the victim is suffering from. They also suggested that diagnostic methods for snakebites should be improved to aid in the identification of snakebite, particularly in the case of krait bites. The clinicians recommended that tools must be developed to analyse the pharmacokinetics of venom activity in victims, and to monitor the rate of its release from the bite site into circulation. Developing appropriate diagnostic tools to identify specific snakebites would improve snakebite treatment.

Eighty percent of clinicians interviewed considered the use of polyvalent ASV to be a satisfactory approach, although considered improvements desirable, particularly to reduce side effects. We found 70% of clinicians to also recommend further ASV purification, which could reduce anaphylactic reactions in response to contaminants such as albumin and endotoxins. A few clinicians

also recommended the introduction of monovalent ASV, although confident identification of snake species would be necessary for this to be effective. Clinicians unanimously recommended that a standard protocol should be made available and followed. This has been recommended by others [10, 11] and there are recently updated (2016) WHO guidelines which can be found at apps.searo.who.int/PDS_DOCS/B5255.pdf and should be made available to all clinicians coming into regular contact with snakebite victims the world over, as there is a clear lack of knowledge in this area, as displayed by the delivery of up to 200 vials of ASV in some cases (table 1). Even in private hospitals, clinicians found there to be no snakebite protocols available. The production and circulation of protocols could at the very least prevent such dangerous over-doses and wastage of ASV.

Half of clinicians recommended that the government raise awareness of the dangers of snakebite among the general population, suggesting the use of advertisements in the local media and awareness camps in rural areas. Several clinicians wanted to see better training for those working in rural areas in order to avoid the unnecessary use of ASV for non-venomous bites and to enable local practitioners to treat the victims with confidence rather than referring them to distant hospitals. The clinicians also suggested that snakebite management should be introduced into the curriculum for medical students.

When asked what advice they had given to victims, clinicians reported to have given guidance about prevention of future bites by wearing protective clothing, particularly shoes, taking extra care when outside, and that patients should avoid home treatments and instead go straight to hospital. These preventive measures have also been suggested by other researchers [4, 10], and the WHO's latest guidelines for the management of snakebite in South East Asia recognise that community education is the best approach to prevent snakebites [12].

Conclusions

In summary, this study emphasizes the difficulties associated with the currently followed diagnostic and treatment methods from the clinicians' point of view. This highlights that there is a need to develop specific diagnostic tools for the confirmation of venomous snakebites and identification of the source snake family. Research should be initiated to develop monovalent ASV to specific snake species, or maybe bivalent ASV for the viper and elapid sides of the big four. We believe that this article could help the government officials in Tamil Nadu and India, as well as researchers working in this area to understand the complications associated with snakebites and to design strategies to improve the diagnosis and treatment of snakebites in India.

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Table

Table 1: Summary of clinicians' interview on complications associated with the diagnosis and treatment of snakebites.

Complications associated with the diagnosis and treatment of snakebites	
Number of years involved in treating snakebites	6 - >30 years
Number of patients seen in each hospital	20 - 150 cases/year
Seasonal variations in snakebites	Most of the bites occurred in rainy seasons
Preclinical diagnostic methods	Vomiting, nausea, bleeding, swelling, infections at the bite site and first aid received
Main treatment method	ASV
Number of vials used for treatment	Minimum 10 and maximum up to 200
Costs of ASV	Rs400 - Rs550/vial
Additional treatment options	Broad spectrum antibiotics, anti-histamines and blood or plasma transfusion
Hospital stay during treatment	Minimum 2 days and maximum 35 days
Treatment costs	Minimum Rs 5,000 to maximum Rs200,000 (went up to Rs1,000,000 when surgery was required)
Extreme complications seen with snakebites	Pulmonary bleeding, cerebral bleeding, acute renal failure and uncontrolled breathing
Percentage of victims that died in hospitals	0-<5%