Making the Difference-A Community based approach to Snakebite First Aid

Ingrid M. Jacobsen
Indian Snakebite Research Initiative, Kooran House, Nayathode, Kerala 683572
E-mail: Ingrid.jacobsen@gmail.com

Abstract

First Aid is a crucial element in ensuring the optimum outcome from a venomous snakebite and correct application is a significant determinant of the condition in which a child victim will present at hospital for treatment. Unfortunately the field is still dominated by traditional myths and unscientific and impractical modern ones. It is therefore vital that doctors both know and disseminate the correct first aid methods., The Indian National Snakebite Protocol outlines a modern approach based on the mnemonic Do it R.I.G.H.T., Reassure, Immobilise, Get to Hospital, Tell tale signs. These actions all support the prime objective of first aid in snakebite, to minimise both the speed at which venom will spread from the bite site and attach to receptor sites and any delay in getting the victim to a hospital. The use of tourniquets, cutting the wound and application or consumption of herbal remedies have been proven to be ineffective in treating the acute stage of snakebite and can also be intrinsically dangerous in such an emergency., Doctors are ideally placed to dispel myths, collect and disseminate accurate information about snakebite first aid and major risk activities in their area, supported by eye-catching posters for display in schools and hospitals.

Key Words. Snake Bites, Intensive Care Units, Pediatric, Pediatrics, Developing World, India, First Aid

Introduction

Most children have a perspective on snakes and snakebite that is alternatively learnt at their mother's knee or increasingly nowadays by sensational TV programmes on Animal Planet or National Geographic. Despite the availability of a wealth of scientific data, these tales still have a potency, perhaps because of their apparent authoritative origins, that serves to perpetuate untested myths about snakes and snakebite first aid across future generations and otherwise well informed groups (1,2). Snakebite first aid has at its objective, getting the victim to the doctor in the best shape to ensure a positive outcome. Despite the view expressed at a recent meeting of 'snakebite experts' that the prevention of snakebite mortality is "antivenom you know, its not first aid and its not other things its antivenom", poor snakebite first aid has an impact on outcome and needs to be addressed (3).

Reprints Requests: Dr. Ingrid M. Jacobsen
Indian Snakebite Research Initiative
Kooran House, Nayathode- 683 572, Kerala
E-mail: ingrid.jacobsen@gmail.com

The purpose of this review is to outline a modern approach to snakebite first aid based on current research (1,4). It proposes a series of action programmes that can easily be taught and publicised by doctors, teachers and other key opinion makers in the community and whose target audience is primarily children and their parents who together can be a powerful influence for change.

Snakebite First Aid

The purpose of First Aid is to ensure that a victim reaches a treatment centre in the best possible condition so as to minimise the risks of disability and mortality associated with snakebite (1). In practice this translates into minimising the spread of any venom that has been injected. Unfortunately instinctive and learnt methods of dealing with snakebite often involve actions completely at variance with this objective and indeed worsen the prospects for the victim of serious injury or even death (1,2,4). It has therefore been necessary to redraw the advice to

ensure that it is both easy to remember in a stressful situation like snakebite and practical in a developing world scenario and to present it in a compelling manner to ensure ease of promulgation and retention.

There are four main actions involved in sequence in the correct first aid and these can be expressed in the mnemonic, Do it **R.I.G.H.T.** (1)

R for Reassurance

The natural tendency of both the victim and bystanders is to panic and the physiological manifestation of this will only increase the speed of spread of any venom through the blood system. Victims should be told that on average only 75% of snakebites are from a venomous species and that even if it is a venomous snakebite, on average only 50% of such bites actually envenomate, the rest are called 'dry' bites (1,4).

Victims will not be reassured by cutting them in an attempt to release the venom. The technique, even with suction of any kind is ineffective and in viperine envenomations with incoagulable blood, bleeding will be uncontrollable and the victim's condition will worsen.

Victims can be reassured that the physician that will treat them at the hospital has the latest methods to effectively treat snakebite, particularly if that physician has availed themselves of the Indian National Snakebite Protocol, approved by the Government of India (1,5).

I for Immobilise Without Compression

Movement, involving as it does muscle contraction and lymph stimulation must be avoided (6). Ideally, the victim should not walk any distance but should be carried to onward transportation.

The most effective form of immobilisation is to treat the limb in the same way as for a fracture (1). Bites on the upper limbs should be placed in a sling and strapped to the body (Fig 1). For bites

to the lower limbs, the limbs should be secured together and the victim carried wherever possible to the selected means of transport (Fig 2).

Venom can be slowed by immobilisation of the limb and ideally the person, but can it be stopped? The application of tight bandages and tourniquets i.e. those bandages that occlude oxygenated blood has traditionally been popular in snakebite first aid but should not be used as not only have they been proved to be ineffective but their use can have intrinsic dangers such as increasing necrosis (7-8).

More modern alternatives such as the Pressure Immobilisation Method (PIM) have been advocated and received much publicity. In this method a crepe bandage is applied 'as tightly as with sprain', together with a splint (9-11). The stated objective was to inhibit lymphatic flow of the venom. What is not made clear is the flimsy nature of the science that supports this method. The original study was based on an animal model of 25 monkey, only 3 of which had PIM applied, 8 had pressure applied in other ways and 14 were never reported on, despite including "failed first aid experiments" (9). Despite this fatal flaw, the research was hurriedly adopted in Australia and now constitutes a method supported by claims of 'evidence'! (12) In addition, recent work, including a trial in India has shown:

1. Emergency physicians cannot apply the technique correctly (13)

2. Lay people cannot apply the technique (13-15)

3. Lay people following extensive training cannot retain the technique for longer than 24 hours (14)

4. Victims who have the technique properly applied, can travel in an Australian ambulance on Australian roads for 5 minutes before the technique become ineffective (16)

5. The bandage, that the victim must be carrying, should not be crepe but an elasticised sports bandage, which presumably the Indian rural worker will carry in their Nike sports bag with their energy drink! (16)

GH for Get to Hospital Fast

There is ample evidence to suggest that those victims arriving many hours, or even days, after a bite have the worst outcomes (5). The resort to traditional remedies, such as washing, applying or drinking herbal potions which are, in themselves, ineffective and at worst, a dangerous complication, are to be avoided because they delay the victim getting to hospital (1,4).

To many lay people it will seem counter-intuitive not to wash the wound but in so doing, the lymph system is stimulated which will cause the venom to circulate more rapidly (1,6).

There is a long list of plants in which a paste or concoction of the leaves or roots, applied to the wound or taken internally are listed as an 'antidote' to snake venom, amongst other things. Examples include chillies, to be chewed and *neem, Azadirachta indica*, leaves applied to the wound (17). The Glory Lily, *Gloriosa* superba is believed to be 'an effective antidote to cobra venom, *Bauhinia tormentosa*, in the yellow flowered variety only, is similarly 'extensively used" in traditional medicine as an antidote for snakebite as is *Gymnema sylvestre, Baliospermum montanum, Tinospora cordifolia, Aristolochia bracheolata*, wild turmeric, common indigo, *Indigofera tinctoria and Serpentwood*,

Rauvolfia serpentia (17).

What most of these plants have in common is that their active principles are variously anodyne, antipyretic, anti-microbial, emetic, purgative, expectorant and anti-inflammatory (17). As such whilst some may certainly have a place in reducing infections there have been no scientific trials that prove that any have a role in treating the acute stage of snakebite, that is in neutralising the damage causing venom. Snakebite is an acute emergency situation, not a chronic condition, and as such it requires immediate treatment with antibodies specific to the venom injected by the snake, which can only be provided by ASV. Snake venom circulates rapidly via the blood and lymph system from where it binds to its target cells. It is the aim of first aid to minimise the circulation and binding of venom as once the attachment has been completed such damage as is going to be caused by the venom has occurred and cannot be reversed; the belief that emetic or purgative principles found in for example, *Tinospora cordifolia* root and *Baliospermum montanum* seeds and can be ingested and remove the venom is misguided. The digestive system has no role to play in the treatment of snakebite.

Traditional medicines appear to work because, as we have seen above, 85 out of 100 patients bitten by a snake have not been envenomed (1,4).

T for Tell the Doctor

When the victim reaches the hospital, the key decision for the doctor is whether the victim has been envenomed and therefore whether ASV is required. Victims and bystanders who accompany the victim can help with this process by telling the doctor any signs or symptoms they notice before arrival at the hospital (1).

An understanding and accurate description of the likely symptoms of a snakebite and the distinction between neurotoxic and haemotoxic are very helpful to the doctor in providing effective treatment as is the time that has elapsed since the bite and the time of onset of the various symptoms. This latter fact is perhaps the most crucial in helping the doctor correctly diagnose the condition and its treatment. Children can and should be given a rudimentary understanding of how snake venoms work so that they can understand what is likely to happen.

In particular they should understand the difference between neurotoxic and haemotoxic snakes and the symptoms of envenomation (1,4). Bystanders accompanying a snakebite victim to hospital should be alert to signs of drooping eyelids, double vision, dribbling and difficulty speaking, as these are the first signs of neurotoxic envenoming (1). Many of the deaths attributable to neurotoxic snakebites occur in transit to a hospital when paralysis reaches the diaphragm and respiratory arrest follows. Doctors in high neurotoxic snakebite areas can provide basic CPR courses for schools and teachers to ensure that breathing can be supported on the way to the hospital (1,4).

Any taste of blood in the victim's mouth or developing bruising at the bite site or elsewhere should be noted as this might indicate bleeding from the action of the venom. The limits of swelling every 10 minutes should be marked to indicate to the doctor the potential for envenomation (1).

Risk Avoidance

Doctors are ideally placed to contribute to a progressive reduction of snakebites in their community by an accurate understanding of the situations, which caused the victims that they have treated, to be bitten (1). Within any area, particularly rural communities most impacted by snakebite, bites tend to cluster around certain specific activities and times, generally related to the predominant types of crops and agricultural practices (1).

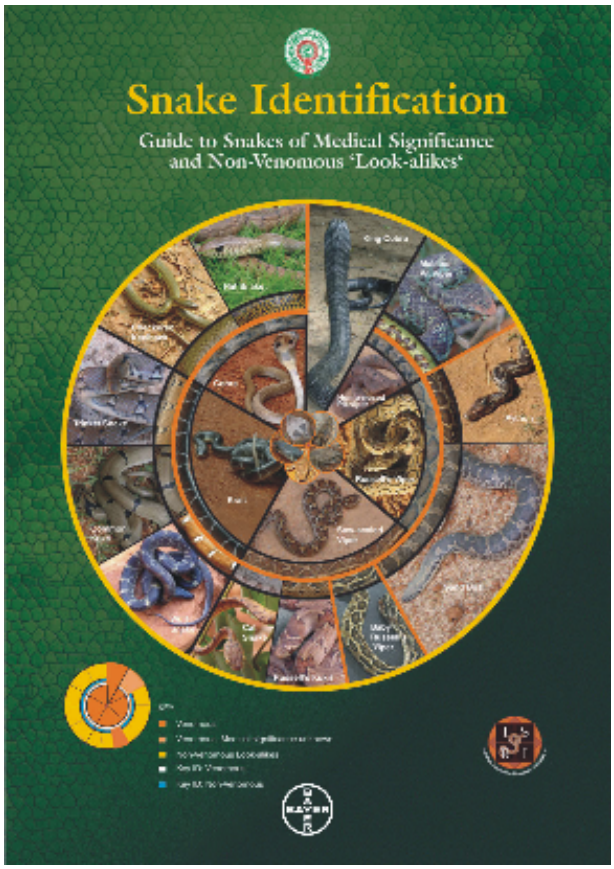
Additionally, it is children's' attitudes and activities that are most likely to lead to encounters with snakes and it is therefore important that they are schooled in;

1. Snake identification, particularly the distinction between venomous and non venomous snake species common within their locality

2. Risk analysis and avoidance –there are undoubtedly times of the year and specific places/activities that considerably increase the risk of snakebite.

Fascination with snakes ensures that reliable snake identification booklets and posters, prepared or authenticated by a qualified

Such material (See Fig 3 & 4) must be tailored



herpetologist that are visually exciting and informative attract considerable interest when they are displayed in doctors waiting rooms, on school notice boards and other public places. Such material (See Fig 3 & 4) must be tailored for use in the locality and ideally should concentrate on the identification of key points by which the venomous snakes in a locality may be distinguished from the most commonly encountered non venomous snakes in that area. It is not relevant to everyday practice to rely on identification methods, which presuppose an intimate knowledge of snake taxonomy (18).

It is also important to note that colour is not a good indicator of a snake species as there can be wide variations in colour range within the same species. Distinctive behaviour needs to be explained such as the likelihood that most snakes will avoid contact with humans if at all possible. Children also need to understand that juvenile venomous snakes, even if tiny, are equally as dangerous as adults (19).

Risk places are any that are concealed and

undisturbed, particularly those that have been undisturbed for a long time and are dry and cool with little temperature variance. Similarly locations providing a prolific and easy source of food, such as rubbish heaps with a large rat population are likely to have a snake in attendance (1).

Risk times are periods when snakes are moving about searching for mates and when the juvenile snakes are emerging. Similarly, encounters are very likely when snakes are moving about searching for food or returning from such activity e.g. early morning or evening.

Risk activities are generally those which involve the above mentioned conditions coupled with a routine and therefore unthinking activity-playing ball games, cutting grass, cropping fruit and vegetables, fetching fodder/feeding animals in the early morning/ late evening when it is less easy to see a snake hidden under foliage (1).

Conclusion/ Action Plan

First Aid is, by definition, the first action that can be taken to mitigate the deleterious effects of snakebite and correct application is crucial in ensuring that a victim arrives in hospital in the best possible condition. Incorrect actions at this early stage can mean that there is delay in getting the victim appropriate treatment when rapid treatment with ASV is known to be key. It may also result in damaging complications, such as ischaemia and symptoms such as vomiting, which can obscure the diagnosis.

In the course of treating snakebites, Doctors have access both to information and members of the public and are ideally placed therefore to positively impact the number of snakebites in their community (1). For each snakebite successfully treated there is an opportunity to send the victim and bystanders back to their village relieved of traditional myths, with the correct first aid methods and with a good understanding of which activities need to be approached with care to avoid further bites. Even where a patient has died as a result of arriving late at hospital, for example, there is an opportunity for bystanders to learn from this unfortunate experience. Such is the fascination with all things relating to snakes that relatives will listen, learn and act differently in the future if doctors take the initiative.

1. Doctors should promulgate the correct Do it Right First Aid advice, ideally by arranging to display First Aid posters in their hospital emergency rooms, treatment rooms and emergency wards. This campaign is incorporated in the approved Indian National Protocol (1).

2. Doctors treating snakebite should keep identification material available in casualty as a guide to helping victims identify the relevant snake. This not only aids treatment but also builds an important database as to the biting species within a locality.

3. Doctors are ideally placed to build up a clear picture of the most likely times, places and activities that result in a snakebite in their communities. There is a wealth of information that can be gained from victims, collated, analysed and then passed on to the community. The time, place and precise activity at the time of the bite are all key questions that should be asked of any bite victim as well as identification of the snake species where this is possible (1,4).

4. Doctors can also hold workshops for the head teachers of local schools, so that they may act as trainers in their schools. It is imperative that future generations of Indians are equipped with the most effective means of dealing with snakebite. Despite Indian snakebite mortality statistics being consistently overstated, the actual level of 11,000 is too high and good first aid is an initial step in reducing it. (20-22).

References

1. Government of India. National snakebite protocol. New Delhi: Health & Family Welfare Department:2007
2. Simpson ID. A study of the current knowledge base in treating snakebite amongst doctors in the high risk countries of India and Pakistan – does snakebite treatment training reflect the local requirement? Trans Roy Soc Trop Med Hyg 2008,102:1108-14
3. Global Snakebite Initiative. Open discussion of the global snakebite initiative concept., Melbourne, (2008) Available at: http://www.snakebiteinitiative.org/files/GICT%20Conference%202008/Audio/Session%2016%20audio/Session%2016%20Open%20Discussion.mp3 [Accessed 11th April 2009]

4. Simpson ID. Snakebite management in In dia, the first few hours: a guide for primary care physicians. J. Indian Med Assoc, 2007;105:324-335.
5. Ghosh S, Maisnam I, Murmu BK, Mitra PK, Roy A, Simpson ID. A locally developed snakebite management protocol significantly reduces overall anti snake venom utilization in West Bengal, India. *Wilderness Environ Med*; 2008;**19**;267-74.
6. Gray S, Pressure Immobilization of Snakebite. Wilderness and Environmental Medicine 2003;14: 73–73.
7. Amaral CF, Campolina D, Dias MB, Bueno CM, Rezende NA. Tourniquet ineffectiveness to reduce the severity of envenoming after Crotalus durissus snake bite in Belo Horizonte, Minas Gerais, Brazil. 1998 Toxicon. May;36(5):805-8.
8. Tun Pe, Tin-Nu-Swe, Myint-Lwin, Warrell DA, Than-Win, The efficacy of tourniquets as a first aid measure for Russells Viper bites in Burma Trans. R Soc Trop Med Hyg 1987; 81:403-405
9. Sutherland, Coulter AR, Harris RD, Rationalisation of first aid methods for elapid snakebite Lancet 1979; i :183-186
10. Sutherland SK, Coulter AR. Early management of bites by the eastern diamondback rattlesnake (Crotalus adamanteus): studies in monkeys (Macaca fascicularis). Am J Trop Med Hyg. 1981;30(2):497-500.
11. Sutherland SK, Harris RD, Coulter AR, Lovering KE, First aid for Cobra (Naja naja) bites. Indian Journal of Medical Research 1981;73: 266-268
12. Edmondson, KW. Treatment of Snakebite. MJA 1979;9:257
13. Norris RL, Ngo J, Nolan K, Hooker G, Physicians and lay people are unable to apply Pressure Immobilisation properly in a simulated snakebite scenario. Wilderness and Environmental Medicine 2005;16:16-21
14. Simpson, ID, Tanwar, PD, Andrade, C, Kochar, DK, Norris, RL. The Ebbinghaus retention curve: training does not increase the ability to apply pressure immobilization in simulated snake bite—–implications for snake bite first aid in the developing world. Trans. R Soc Trop Med Hyg 2008;102:451-459
15. Maiden, M.J., White, J., 2006. Severe rapid-onset paralysis in a parttime soldier. Crit. Care Resusc. 8, 120—122.
16. Global Snakebite Initiative. Investigating pressure bandaging for snakebite in a simulated setting; bandage type, training and the effect of transport. Melbourne, (2008) Available at: http://www.snakebiteinitiative.org/files/GICT%20Conference%202008/Session%2021/Ms.%20Elizabeth%20Canale.ppt [Accessed 11th April 2009]
17. Joy PP, Thomas J, Mathew S, Skaria BP. Medicinal plants. In; Tropical Horticulture Volume 2. Calcutta, Naya Prokash;2001:449-632
18. Pillay VV. Irritants of animal origin. In: Pillay VV. Modern Medical Toxicology. New Delhi: Jaypee Brothers Medical Publishers; 2005:120–153.
19. Tun P, Khin Aung Cho. Amount of venom injected by Russells Viper (Vipera russelli) Toxicon 1986; 24(7): 730-733
20. waroop S, Grabb B. Snakebite mortality in the world. Bull WHO 1954;10:35–76.
21. Chippaux JP. Snakebites: appraisal of the global situation. Bull. World Health Org. 1998;76:515-24
22. Kasturiratne A, Wickremasinghe AR, de Silva N, Gunawardena NK, Pathmeswaran A, Premaratna, R et al. Estimating the global burden of snakebite: A literature analysis and modelling based on regional estimates of envenoming and deaths. PLoS Med 2008, 5: e218. doi:10.1371/journal.pmed.0050218