NEW ASPECTS FOR TREATMENT OF SNAKE BITE: A REVIEW
Abraham Jobin*, Rai Neeta
Department of Pharmaceutics, S.I.R.T College of Pharmacy, Bhopal, (M.P), India

Article Received on: 18/09/12 Revised on: 20/10/12 Approved for publication: 04/11/12

*Email: jobinabraham84@gmail.com

ABSTRACT
Recommendation of the effective dose to the medical facility and all the possible condition. Much of the first aid currently carried out is ineffective and dangerous. The right method will get the victim to the hospital quickly, without recourse to traditional medical approaches which can dangerously delay effective treatment and will supply the doctor with the best possible information on arrival. Different consideration of the inapplicable method like PIM different treatment of the snake bite like ASV. Management of Snake Bite and Administration of anti-venom Reassurance helps reduce anxiety related high blood pressure, palpitations etc. Because people who are bitten can't always positively identify a snake, they should seek prompt care for any bite, though they may think the snake is nonpoisonous. PASV contains antibodies against cobra, common krait and viper. 5 vials are given if signs are mild -primarily local manifestations, administration like i.m. i.v and management of the signs and symptoms of snake bite.

Keywords: Intramuscular (I.M), intravenous (I.V), Pressure Immobilization Method (PIM), Polyvalent anti-snake venom (PASV), anti snake venom (ASV)

INTRODUCTION
Primary importance is the need to recommend the most effective first aid for victims, to enable them to reach the nearest medical facility in the best possible condition. Much of the first aid currently carried out is ineffective and dangerous. ¹

Recommended Method for India
The first aid being currently recommended is based around the mnemonic:
“Do it R.I.G.H.T.”
It consists of the following:
R. = Reassure the patient. 70% of all snakebites are from non-venomous species. Only 50% of bites by venomous species actually envenomate the patient.
I. = Immobilize in the same way as a fractured limb. Use bandages or cloth to hold the splints, not to block the blood supply or apply pressure. Do not apply any compression in the form of tight ligatures, they don’t work and can be dangerous.²
G. H. = Get to Hospital Immediately. Traditional remedies have No Proven benefit in treating snakebite.
T = Tell the doctor of any systemic symptoms such as ptosis that manifest on the way to hospital.
This method will get the victim to the hospital quickly, without recourse to traditional medical approaches which can dangerously delay effective treatment and will supply the doctor with the best possible information on arrival. The snake, if killed should be carefully taken to the hospital for identification by the doctor. No time should be wasted in attempting to kill or capture the snake. This solely wastes time and can lead to other victims.³

Newer Methods Considered Inapplicable in the Indian Context
Pressure Immobilization Method (PIM)
Pressure Immobilization has gained some supporters on television and in the herpetology literature-:
- PIM was developed in Australia in 1974 by Sutherland (Sutherland 1981). His research involved tying monkeys to wooden frames and injecting venom, then seeing if a pressure bandage would slow the absorption. He achieved some good results but there were mixed findings. He only used 13 monkeys which is not an adequate sample. He argued that a crepe bandage AND an integral splint be applied over the wound to a pressure of 55mm of Mercury. The version used in India of a bandage alone, Sutherland argued would be ineffective.
- Further work done by Howarth (Howarth 1994) demonstrated that the pressure, to be effective, was different in the lower and upper limbs. The upper limb pressure was 40-70mm of Mercury; the lower limb was 55-70mm of mercury.
- Howarth’s work also showed that full immobilisation was crucial. If the victim walked for 10 minutes after application the PIM would be ineffective (Currie, 1993). He also stated that pressures above the ranges specified would INCREASE the flow of venom. (Gray 2003) argued that pressures under the recommended range may also increase venom flow.
- Further studies have demonstrated that improvised splints are ineffective (Davidson, 2001).⁴

Preventative Measures
- Walk at night with sturdy footwear and a torch and use the torch! When walking, walk with a heavy step as snakes can detect vibration and will move away!
- Carry a stick when grass cutting or picking fruit or vegetables or clearing the base of trees. Use the stick to move the grass or leaves first. Give the snake chance to move away. If collecting grass that has previously been cut and placed in a pile, disturb the grass with the stick before picking the grass up.
- Keep checking the ground ahead when cutting crops like Millet, which are often harvested at head height and concentration is fixed away from the ground.
- Pay close attention to the leaves and sticks on the ground when wood collecting.
- Keep animal feed and rubbish away from your house. They attract rats and snakes will follow.
- Try to avoid sleeping on the ground.
- Keep plants away from your doors and windows. Snakes like cover and plants help them climb up and into windows.

Snake Bite Treatment Protocol
Patient Assessment Phase: On arrival.
- Deal with any life threatening symptoms on presentation. i.e. Airway, Breathing and Circulation.
Diagnosis Phase: General Principles

1. Where possible identify the snake responsible. Snake coloration is a very unreliable means of determining species as is most of the advice given concerning pupil shape and scalation. Have the victim carefully bring the snake to hospital if it has been killed.

2. All patients will be kept under observation for a minimum of 24 hours. In some countries bite marks have limited use in determining species. However, in India bite marks are of no use in identifying if a species is venomous or not. Many non venomous species leave just two fang-like marks e.g. Wolf Snakes. Some species like the Krait may leave no bite mark at all. Many venomous species have more than two fangs, as they grow reserve fangs in case the main ones break off.

3. Determine if any traditional medicines have been used, they can sometimes cause confusing symptoms.

4. Determine the exact time of the bite. This can give indications as to the progression of any symptoms.

5. Ask questions as to what the victim was doing at the time of the bite. Some activities such as grass cutting or feeding stock animals in the evening can be suggestive of snakebite.

Pain

1. Snakebite can often cause severe pain at the bite site. This can be treated with painkillers such as paracetamol. Adult dose of 500-1000mg 4-6 hourly. Pediatric dose 10mg/kg every 4-6 hourly orally.

2. Aspirin should not be used due to its adverse impact on coagulation. Do not use non steroidal anti-inflammatory drugs (NSAIDs) as they can cause bleeding. This can be particularly dangerous in a patient already having coagulopathy.

3. If available, mild opiates such as Tramadol, 50 mg can be used orally for relief of severe pain. In cases of severe pain at a tertiary centre, Tramadol can be given IV

Handling Tourniquets

1. Care must be taken when removing tight tourniquets tied by the victim. Sudden removal can lead to a massive surge of venom leading to neurological paralysis, hypotension due to vasodilation etc.

2. Before removal of the tourniquet, test for the presence of a pulse distal to the tourniquet. If the pulse is absent ensure a doctor is present before removal.

3. Be prepared to handle the complications such as sudden respiratory distress or hypotension. If the tourniquet has occluded the distal pulse, then a blood pressure cuff can be applied to reduce the pressure slowly.

Diagnosis Phase: Investigations

20 Minute Whole Blood Clotting Test (20WBCT)

1. Considered the most reliable test of coagulation and can be carried out at the bedside without specialist training. It can also be carried out in the most basic settings. It is significantly superior to the ‘capillary tube’ method of establishing clotting capability and is the preferred method of choice in snakebite.

2. A few mls of fresh venous blood is placed in a new, clean and dry glass vessel and left at ambient temperature for 20 minutes. The vessel ideally should be a small glass test tube. It is important that the tube is clean, glass and dry as the mechanism under review is the contact clotting mechanism. The use of plastic bottles, tubes or syringes will give false readings and should not be used.

3. The glass vessel should be left undisturbed for 20 minutes and then gently tilted, not shaken. If the blood is still liquid then the patient has incoagulable blood. The vessel must not have been washed with detergent as this will inhibit the contact element of the clotting mechanism.

4. The test should be carried out every 30 minutes from admission for three hours and then hourly after that. If incoagulable blood is discovered, the 6 hourly cycle will then be adopted to test for the requirement for repeat doses of ASV.

Other Useful Tests depending on availability

- Haemoglobin/ PCV/ Platelet Count/ PT/ APTT/ FDP/ D-Dimer Peripheral Smear
- Urine Tests for Proteinuria/ RBC/ Haemoglobinuria/ Myoglobinuria
- Biochemistry for Serum Creatinine/ Urea/ Potassium
- Oxygen Saturation/ PR/ BP/ RR/ Postural Blood Pressure +ECG/ X-Ray/ CT/ Ultrasound (The use of X-Ray and ultrasound are of unproven benefit, apart from identification of bleeding in Viperine bites).

Management of Snake Bite

- Allay anxiety and fright.
- Deaths have been reported from shock due to fright even when the bites were by non-poisonous snakes. Hence, it is vital to reassure patients.
- Not all snakes are poisonous.
- Not all poisonous snakes are fully charged with venom.
- Even those that are fully charged do not always inject a lethal dose.
- Reassurance helps reduce anxiety related high blood pressure, palpitations, tremors, sweating and rapid breathing. Check if the bite is due to a poisonous or a non-poisonous snake. Because people who are bitten can't always positively identify a snake, they should seek prompt care for any bite, though they may think the snake is nonpoisonous. Even a bite from a so-called "harmless" snake can cause an infection or allergic reaction in some individuals. In cases where the snake is killed and brought to the clinic, examination of the snake helps differentiate whether it is poisonous or non-poisonous. In the absence of the snake, the bite mark should be examined using a magnifying lens.
- If possible, try and keep bitten extremity at body level, when the person is lying. Raising it can cause venom to travel into the body. Holding it down, can increase swelling.
- Go to nearest hospital or medical facility as soon as possible
Under Medical Supervision

Administration of anti-venom

- Polyvalent anti-snake venom contains antibodies against cobra, common krait and viper.
- 5 vials are given if signs are mild - primarily local manifestations.
- 10 vials if signs are moderate - bleeding from gums, ptosis.
- 15 vials if signs are severe - vascular collapse, progressive paralysis.
- 1/3 of the dose should be given subcutaneously (near bite but not in fingers or toes).
- 1/3 intramuscularly.
- 1/3 intravenously.

The intravenous dose can be repeated every 6 hours till the symptoms disappear. For sea-snake bites, special anti venoms are available.

Manage toxic signs/symptoms

- Anti-venom acts only against circulating toxin, not toxin fixed to tissue. Therefore, specific measures have to be taken.
- In case of neuro toxic signs and symptoms, atropine (0.6 mg) subcutaneously should be followed by 5 injections of neostigmine (0.5 mg) intravenously (repeated 2 hourly depending on response) to reverse muscle paralysis.
- In case of vasculotoxic signs and symptoms, fibrinogen along with heparin may be given, but with extreme caution and constant monitoring, as heparin can intensify bleeding.

Take supportive measures

- These include blood or plasma transfusion to combat shock, mechanical respiration to combat respiratory distress, antibiotics to prevent secondary infection. Neuromuscular paralysis is the most dreadful complication of snake bite. It may occur within 15 minutes but may be delayed for several hours. To tackle hypersensitivity reactions to antivenom, steroids, adrenaline and antihistamines may be given.
- Reconstituted antivenin polyvalent may be administered intravenously in a 1:1 to 1:10 dilution in 0.9% sodium chloride injection or 5% dextrose injection. Decisions concerning the dilution of antivenin to be used, and the rate of intravenous delivery of the diluted antivenin should take into account the age, weight, and cardiac status of the patient; the severity of the envenomation; and the interval between the bite and the initiation of specific therapy.
- The entire initial dose of antivenin should be administered as soon as possible, preferably within 4 hours after the bite. Antivenin is less effective when given 8 hours or more after envenomation and may be of questionable value when given after 12 hours. However, in severe poisonings, it is recommended that antivenin therapy be given even if 24 hours have elapsed since the bite.
- The initial 5 to 10 mL of the diluted antivenin should be infused over a 3- to 5-minute period, with careful observation of the patient for evidence of an untoward reaction. If no symptoms or signs of an immediate systemic reaction appear, infusion of the diluted antivenin may be continued at the maximum rate considered safe for intravenous fluid administration.

The decision to use additional antivenin should be based on the clinical response to the initial dose and on continuing assessment of the severity of poisoning. If swelling continues to progress, if systemic symptoms or signs of envenomation increase in severity, or if new manifestations appear (for example, fall in hematocrit or hypotension), intravenous administration of an additional 10 to 50 mL (contents of 1 to 5 vials) or more may be necessary.

- Pit viper bites on toes or fingers may require as much as 50% more antivenin due to difficulties in achieving adequate antivenin concentrations in the affected area. However, antivenin should never be injected into a finger or toe.
- Polyvalent anti-snake venom contains antibodies against cobra, common krait and viper.
- The intravenous dose can be repeated every 6 hours till the symptoms disappear. For sea-snake bites, special antivenins are available.

Repeat doses of ASV

- In anti-hemostatic bites, once the initial dose has been administered over one hour, no further ASV is given for 6 hours. Twenty WBCT test every 6 hours, will determine if additional ASV is required. This reflects the period the liver requires to restore clotting factors.
- In the case of neurotoxic bites, once the first dose has been administered, and a Neostigmine test given, the victim is closely monitored. If after 1-2 hours the victim has not improved or has worsened then a second and final dose should be given. At this point the victim will have received sufficient neutralising capacity from the ASV, and will either recover or require mechanical ventilation; in either event further ASV will achieve nothing.

Following the correct snakebite protocol when treating a snakebite victim is extremely important. There are countless myths and fallacies concerning the first aid treatment of a snakebite. Incorrect procedure more often than not increases the damage already done by the venom, and could lead to further complications.

Before discussing the correct snakebite protocol, it is important to dispel some of the myths regarding the treatment of snakebite.

**WHAT NOT TO DO**

- Do not try to suck out the venom. This is ineffective and a total waste of valuable time. This kind of treatment only works in Hollywood. So, unless your name is John Wayne or Wyatt Earp, refrain from using this technique.
- Do not attempt to cut open the area around the bite. By doing this, you are only aggravating the situation, doing more damage by exposing more tissue.
- Do not apply ice to the bite area.
- Do not rub any substances into the bite. Remember the venom has entered the bloodstream, so any substance applied superficially to the bite area is completely fruitless.
- Do not apply a tourniquet without knowing the effect or type of venom that has been injected. For example, by restricting the blood flow with a cytotoxic (tissue destroying) venom, you will only succeed in creating further tissue damage to the affected area.
- Do not inject anything, including antivenom unless you are qualified to do so. Anyone prone to allergies and asthma may go into anaphylactic shock as a result of the antivenom entering the bloodstream which results in a sudden drop in blood pressure and may prove just as fatal.
as the venom itself. Hospitals and medical staff are equipped to deal with such an eventuality.
* Do not give anything orally to the victim.
* Do not kill the snake for later identification. This is unnecessary as the venom can be correctly identified symptomatically. By trying to kill the snake you are risking another bite and adding fuel to the fire.
* Do not use traditional remedies. Any treatments offered by traditional healers, witchdoctors, and shamans are ineffective.

All of the above methods are ineffective and should not be used as snakebite protocol

Now that we have put aside all the "mumbo jumbo", old wives tales, and Hollywood remedies for a snakebite. Here is the correct snakebite protocol to follow.

What to do in the event of a snakebite
* If the snake is still visible (or within striking distance), move away to minimise the risk of a second bite.
* If at all possible try to identify the snake if it is still visible as this will help the medical staff in providing the best medical care. If the snake has moved away and is no longer visible do not go looking for it. You are increasing the risk of another bite. Remember, identifying the snake is helpful, but not paramount in treating the victim.  
  
* Reassure the victim. Keep the patient calm.
* Restrict movement. Excessive movement speeds up blood circulation and thus distributes the venom through the body at a faster rate.
* In the case of a suspected cytotoxic bite allow for limited movement. This will spread the venom away from the bite site and thus reduce the tissue damage to the area.
* Remove all restrictive jewelry. Remove watches, rings, bracelets etc.
* Cut away restrictive clothing. This exposes the bite area, and in the case of a cytotoxic bite allows the venom to spread away from the bite site and reduces the tissue damage.
* In some instances a crepe pressure bandage is advised, however there are many instances where this is not applicable and this site does not have the scope to discuss all the inclusions and exclusions. For example a crepe pressure bandage is advised for a snouted cobra bite, but not for a black mamba bite yet both possess neurotoxic venom. If in doubt, seek medical advice.
* Keep the patient warm. This reduces the risk of shock.
* Be prepared for CPR. Maintain airways and ensure proper ventilation and maintain cardiovascular integrity.
* Immobilize the affected limb with a splint or sling to reduce the venom distribution.
* Monitor the vital signs until you reach a medical facility.
* Contact the hospital informing them of the patient's arrival. This will save valuable time.  

PRESSURE IMMOBILIZATION TECHNIQUE
- Apply a broad pressure bandage from below upwards and over the bite site as soon as possible. Do not remove trousers, as this will help the venom to enter into the bloodstream. Keep the bitten limb still. (You can splint the limb)
- The bandage should be as tight as you would apply to a sprained ankle. The patient should avoid any unnecessary movements
- Extend the bandages as high as possible (ideally up to the groin or in the case of arm, up to the armpit).
- Apply a splint to leg, immobilizing joints on either side of the bite
- Bind it firmly to as much of the leg as possible. Walking should be restricted
- Bites on the hand and forearm: bind to the axilla, use a splint to the elbow and use a sling.  

Snakebite Prevention
* As always, prevention is better than cure.
* Take care when clearing vegetation, raking dry leaves in your garden.
* Pressure immobilization Supervise kids in the outdoors, especially in a green neighborhood.
* Use torch/flashlight at night and keep wearing those shoes.
* Check shoes before wearing them.
* Watch your step and see before you sit!
* Keep your backyard free of junk and make sure your solid waste is managed properly.
* If you see a snake, do nothing. Let it go.
* Do not try to pick it up or kill it.
* If a snake has entered your premises, call professional snake rescuers.  

SUPPORTIVE THERAPY
The patient should be moved in appropriate area of hospital. The ICU will be required for the patients with signs of severe envenomation (coma, respiratory paralysis, hypotension, pulmonary edema, and history of syncope) Supportive therapy is required to buy time while the damaged organs recover. The types of supportive care that may be needed is summarized below.

Coagulopathy with bleeding
Coagulopathy usually reverses after ASV treatment. In exceptional cases, when there is severe bleeding or when urgent surgery is necessary, restoration of coagulability can be accelerated by giving fresh frozen plasma, cryoprecipitate (fibrinogen, factor VIII), fresh whole blood, or platelet concentrates.

Neurotoxic symptoms
Antivenom treatment alone cannot be relied upon to save the life of a patient with bulbar and respiratory paralysis. Once there is loss of the gag reflex, failure to cough, or respiratory distress, endotracheal intubation and initiation of mechanical ventilation is indicated.  

Care of bitten part
The appearance of an immobile, tensely-swollen, cold, and apparently pulseless snake-bitten limb may suggest to surgeons the possibility of increased intracompartmental pressure, especially if the digital pulp spaces or the anterior tibial compartment are involved.

As most snakes harbor aerobic as well as anaerobic bacteria in their mouths, a prophylactic course of penicillin (or erythromycin for penicillin-hypersensitive patients) and a single dose of broad spectrum antibiotic course which will cover anaerobes together with a booster dose of tetanus toxoid is recommended.  

Snakebite Prevention
* As always, prevention is better than cure.
* Take care when clearing vegetation, raking dry leaves in your garden.
* Pressure immobilization Supervise kids in the outdoors, especially in a green neighborhood.
* Use torch/flashlight at night and keep wearing those shoes.
* Check shoes before wearing them.
* Watch your step and see before you sit!
* Keep your backyard free of junk and make sure your solid waste is managed properly.
* If you see a snake, do nothing. Let it go.
* Do not try to pick it up or kill it.
* If a snake has entered your premises, call professional snake rescuers.  

SUPPORTIVE THERAPY
The patient should be moved in appropriate area of hospital. The ICU will be required for the patients with signs of severe envenomation (coma, respiratory paralysis, hypotension, pulmonary edema, and history of syncope) Supportive therapy is required to buy time while the damaged organs recover. The types of supportive care that may be needed is summarized below.

Coagulopathy with bleeding
Coagulopathy usually reverses after ASV treatment. In exceptional cases, when there is severe bleeding or when urgent surgery is necessary, restoration of coagulability can be accelerated by giving fresh frozen plasma, cryoprecipitate (fibrinogen, factor VIII), fresh whole blood, or platelet concentrates.

Neurotoxic symptoms
Antivenom treatment alone cannot be relied upon to save the life of a patient with bulbar and respiratory paralysis. Once there is loss of the gag reflex, failure to cough, or respiratory distress, endotracheal intubation and initiation of mechanical ventilation is indicated.  

Care of bitten part
The appearance of an immobile, tensely-swollen, cold, and apparently pulseless snake-bitten limb may suggest to surgeons the possibility of increased intracompartmental pressure, especially if the digital pulp spaces or the anterior tibial compartment are involved.

As most snakes harbor aerobic as well as anaerobic bacteria in their mouths, a prophylactic course of penicillin (or erythromycin for penicillin-hypersensitive patients) and a single dose of broad spectrum antibiotic course which will cover anaerobes together with a booster dose of tetanus toxoid is recommended.  

Snakebite Prevention
* As always, prevention is better than cure.
* Take care when clearing vegetation, raking dry leaves in your garden.
* Pressure immobilization Supervise kids in the outdoors, especially in a green neighborhood.
* Use torch/flashlight at night and keep wearing those shoes.
* Check shoes before wearing them.
* Watch your step and see before you sit!
* Keep your backyard free of junk and make sure your solid waste is managed properly.
* If you see a snake, do nothing. Let it go.
* Do not try to pick it up or kill it.
* If a snake has entered your premises, call professional snake rescuers.  

SUPPORTIVE THERAPY
The patient should be moved in appropriate area of hospital. The ICU will be required for the patients with signs of severe envenomation (coma, respiratory paralysis, hypotension, pulmonary edema, and history of syncope) Supportive therapy is required to buy time while the damaged organs recover. The types of supportive care that may be needed is summarized below.

Coagulopathy with bleeding
Coagulopathy usually reverses after ASV treatment. In exceptional cases, when there is severe bleeding or when urgent surgery is necessary, restoration of coagulability can be accelerated by giving fresh frozen plasma, cryoprecipitate (fibrinogen, factor VIII), fresh whole blood, or platelet concentrates.

Neurotoxic symptoms
Antivenom treatment alone cannot be relied upon to save the life of a patient with bulbar and respiratory paralysis. Once there is loss of the gag reflex, failure to cough, or respiratory distress, endotracheal intubation and initiation of mechanical ventilation is indicated.  

Care of bitten part
The appearance of an immobile, tensely-swollen, cold, and apparently pulseless snake-bitten limb may suggest to surgeons the possibility of increased intracompartmental pressure, especially if the digital pulp spaces or the anterior tibial compartment are involved.

As most snakes harbor aerobic as well as anaerobic bacteria in their mouths, a prophylactic course of penicillin (or erythromycin for penicillin-hypersensitive patients) and a single dose of broad spectrum antibiotic course which will cover anaerobes together with a booster dose of tetanus toxoid is recommended.
CONCLUSION
Snakes do not generally attack human beings unless provoked. Delayed medical management and lack of public awareness results in prolonged hospital and ICU stay of the patients. The new protocols are intended to encourage doctors, particularly in the Primary Health Centers, to treat snakebite at the periphery with confidence and enable the reduction in mortality. This can be decreased if regular public programmes regarding prevention, prehospital management (first aid), and the importance of early transfer to hospital are conducted. Most of the traditional methods for first aid treatment of snakebite, both western and “traditional/herbal,” have been found to result in more harm than good. Identification of the species of snake responsible for the bite is important for optimal clinical management. Antivenom is the only effective antidote for snake venom. However, it is expensive and usually in short supply and its use carries the risk of potentially dangerous reaction.

REFERENCES

Source of support: Nil, Conflict of interest: None Declared