

The Pediatric Management of Snakebite: The National Protocol

Pediatric snakebite mortality and morbidity remains a significant contributor to the national statistics. Medical education, concerning snakebite management in India, is mostly derived from overseas textbooks, whose authors never intended their guidelines to be used in India(1). As a result many techniques, such as the use of anti snake venom (ASV) for purely local swelling, have been inapplicable incorporated into the Indian approach. In 2004, WHO established a Snakebite Treatment Group, to identify problem areas that could be resolved in order to reduce the current level of snakebite mortality reported as the highest in the world in absolute terms. As a result of this initiative a National Snakebite Conference was convened in July 2006 which developed national protocols for first aid and treatment, currently under consideration by the Government of India. This article contains some of the highlights of the new protocols.

First aid treatment

Despite the weight of research showing that tourniquets expose the victim to the risk of ischemic damage(2), potentially increase the necrotic action of the venom(3), present dangers of neurotoxic blockage(4) and clotting when the tourniquet is released and are ineffective in retarding venom flow(5), they remain the main first aid method adopted by victims.

In light of these problems the Pressure Immobilisation Method (PIM) was developed in Australia in the late 1970's and was advocated as a reliable technique to inhibit venom flow into the system(6). It recommends tying an elasticated or crepe bandage around the limb including an integral splint, in the same way as for a sprain. Despite the lack of trial evidence, and its reliance on selected clinical anecdote(7) this method received some support. However further research, demonstrated

that the required bandage pressure varied between the upper and lower limbs(8), that lay people and emergency room doctors were unable to apply the technique correctly in a simulated environment(9) and that the requirement for complete immobilisation was key. Walking for more than 10 minutes, even if the bandage was applied to the correct range of pressure, invalidated the effect of the bandage(8). In view of these limitations both tourniquets and PIM are rejected for use in India.

Incision, suction electric shocks, cryotherapy and washing the wound are contraindicated.

The first aid recommended is based around the mnemonic:

“Do it R.I.G.H.T.”

It consists of:

- R.** = **Reassure** the patient. Seventy per cent of all snakebites are from non venomous species. Only 50% of bites by venomous species actually envenomate the patient
- I** = **Immobilise** in the same way as a fractured limb. Children can be carried. 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 donot work and can be dangerous!
- 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.

Diagnosis and testing

Bite marks to determine whether the biting species was venomous or non venomous are of no use. Many venomous species are in possession of

more than one set of fangs and non venomous species can leave just two punctures from enlarged teeth, which can appear to be fang-like.

The 20 Minute Whole Blood Clotting Test (20 WBCT)(10) was adopted as the standard test for coagulopathy. It is simple to carry out but crucially requires a clean, new and dry test tube. A few mL of fresh venous blood is left undisturbed for 20 minutes, and then gently tilted. If the blood is still liquid this is evidence of coagulopathy and confirms that the biting species is Viperine. Cobras or Kraits do not cause anti-hemostatic symptoms.

ASV administration criteria

ASV should not be used without evidence of systemic envenomation or severe local swelling. Essentially systemic envenomation will be evident from the 20WBCT, signs of spontaneous bleeding or by visual recognition of neurological impairment such as ptosis. Severe local symptoms are defined as swelling rapidly crossing a joint or involving half the bitten limb, in the absence of a tourniquet. Once the tourniquet has been removed for more than one hour, if the swelling rapidly continues, this should be viewed as venom generated and not due to the continuing effect of the tourniquet. Purely local swelling is not grounds for administering ASV.

Anti-snake venom doses and administration

The initial dose of ASV to be given to a patient has been the subject of much debate. Symptomology is no help as a means of determining severity of envenomation as it is too dynamic and constantly evolving. How then do we derive dosage?

Published research has indicated that Russells Viper injects on average 63 mg (SD 7 mg) of venom in the first bite to both adults and children(11). Logic suggests that our initial dose should be calculated to neutralise the average dose of venom injected. This ensures that the majority of victims should be covered by the initial dose and keeps the cost of ASV to acceptable levels.

As each vial of polyvalent ASV neutralises 6 mg of Russells viper venom, the initial dose is 8-10 vials for both adults and children.

The range of venom injected was shown to be

5 mg- 147 mg. This would imply a maximum ASV dose of around 25 vials. Some victims will probably require less than 8-10 vials but it is likely that these will be small in number and it is sensible to set the initial dose at the average amount injected. Those envenomated with more than 60 mg will be addressed in repeat doses at the appropriate time.

There is no good evidence to suggest children should receive either more ASV because of body mass or less in order to avoid adverse reactions.

ASV should be administered over one hour. There is no benefit in administering each dose over longer periods and indeed lengthening the period before the ASV is able to neutralise the venom is counter intuitive.

Adverse reactions to anti-snake venom

Adverse reactions, either anaphylactoid or pyrogenic, have often been identified as reasons not to administer ASV in smaller local hospitals. The fear of these potentially life threatening reactions has caused reluctance amongst some doctors to treat snakebite. However, if handled early and with the primary drug of choice, these reactions are easily surmountable and should not restrict doctors from treating snakebite. Early intervention against these kind of reactions has been shown to have more positive outcomes(12). Patients should be monitored closely as there is evidence that many anaphylactoid reactions go unnoticed(13).

At the first sign of **any** of the following: Urticaria, itching, fever, shaking chills, nausea, vomiting, diarrhea, abdominal cramps, tachycardia, hypotension, bronchospasm and angio-oedema

1. **ASV will be discontinued**
2. **0.5 mg. of 1:1000 adrenaline should be given IM**

The pediatric dose is 0.01 mg/kg body weight of adrenaline IM.

In addition, to provide longer term protection against anaphylactoid reactions, 100 mg of hydrocortisone and 10 mg of H1 antihistamine will be administered IV. The dose for children is 0.2 mg/kg of antihistamine IV and 2 mg/kg of

Key Messages

- First aid treatment must avoid compression and emphasise immobilisation and rapid transport to hospital.
- Criteria for giving ASV are (i) Spontaneous bleeding and/or incoagulable blood measured by 20 WBCT; and (ii) visible neurological signs or severe local swelling.
- 8-10 vials of ASV is the initial starting dose for both adults and children.
- Deal with anaphylaxis early and with IM adrenaline as drug of choice.

hydrocortisone IV.

If after 10 to 15 minutes the patient's condition has not improved or is worsening, a second dose of 0.5 mg of adrenaline 1:1000 IM is given. This can be repeated for a third and final occasion but in the vast majority of reactions, 2 doses of adrenaline will be sufficient.

Once the patient has recovered, the ASV can be restarted slowly for 10-15 minutes, keeping the patient under close observation. Then the normal drip rate should be resumed.

The debate between intramuscular or subcutaneous adrenaline is decided by the need to rapidly reverse the reaction and restart the ASV. Evidence has shown that adrenaline reaches necessary blood plasma levels in 8 minutes via the IM route, but up to 34 minutes in the subcutaneous route(14).

ASV test doses have been abandoned. They have no predictive value in anaphylactoid or late serum reactions and may pre-sensitise the patient to the protein(3).

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(2).

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.

Conclusion

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 we all seek. Good evidence based research will further refine and develop both protocols in the future.

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