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# National Snakebite Management Protocol

**Directorate General of Health Services**
**Ministry of Health and Family Welfare**
**Government of India**
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## Acknowledgments

This National Protocol is the result of commitment of a number of experts towards addressing the various issues related to snakebite treatment in India. World Health Organisation, India Country Office and South East Asian Regional Office are specially acknowledged for their support in bringing out this protocol.

# Contents

# Acronyms

| | |
|---|---|
| ABG | Arterial blood Gas |
| APTT | Activated Partial Thromboplastin Time |
| ASV | Anti Snake Venom |
| AV | Anti Venom |
| BP | Blood Pressure |
| BT | Bleeding Time |
| CAT | Computerized Axial Tomography |
| CT | Clotting Time |
| DIC | Disseminated Intravascular Coagulation |
| ECG | Electro Cardio Graphy |
| ELISA | Enzyme Linked Immuno Sorbent Assay |
| FDP | Fibrin Degradation Products |
| FEV1 | Forced Expiratory Volume 1 |
| FFP | Fresh Frozen Plasma |
| FVC | Forced Vital Capacity |
| ICU | Intensive Care Unit |
| IV | Intra Venous |
| IM | Intra Muscular |
| NP | Naso Pharyngeal |
| NSAID | Non Steroidal Anti Inflammatory Drugs |
| PR | Pulse Rate |
| PHC | Primary Health Centre |
| PCV | Packed Cell Volume |
| PT | Prothrombin Time |
| PIM | Pressure Immobilization Method |
| RBC | Red Blood Cell |
| RR | Respiratory Rate |
| TT | Tetanus Toxoid |
| 20 WBCT | 20 minute Whole Blood Clotting Test |
| WHO | World Health Organization |

# National Snakebite Management Protocol

# Section-1

## Introduction

India is estimated to have the highest snakebite mortality in the world, with WHO estimates placing the number at 30,000 per annum. There are about 236 species of snakes in India. Most of them are non-poisonous and their bites, apart from causing panic reaction and local injury do not harm the patient. However, there are 15 varieties that are poisonous and four among them, namely the cobras, the Russell's viper, the saw- scaled vipers and the kraits are the most common.

Snakebite is a predominant problem of the rural and peri-urban areas. Most of the fatalities are due to the victim not reaching the hospital in time. Most of these fatalities are preventable. The community is not well informed about the occupational risks and simple measures that can prevent a bite. It continues to adopt harmful practices such as tourniquets, cutting & suction, herbal remedies, quackery etc. These are not only ineffective but also dangerous.

It is recognised that current medical education is reliant on western textbooks for snakebite management. The teaching and training at all levels addresses the problem in a generic way not suitable to Indian context. This has led to a situation where the doctors, nurses and community health workers at the Primary, Secondary and Tertiary levels are not able to manage snakebite cases.

Research has shown that primary health care doctors do not treat snakebite mainly due to lack of confidence. At the secondary and tertiary care level, multiple protocols are followed mainly from western textbooks, which are not appropriate for Indian settings. Anti snake venom (ASV) is administered when it is not required and/or in doses well in excess of the required amount.

The need for a protocol for managing snakebites in Indian context could not be over emphasized. The national snakebite management protocol recognizes the need to bring in behavioural change among the community regarding the occupational risks and its reduction. It also recognizes the fact that earlier an envenomed patient is treated with ASV, the better the outcome. It clearly delineates the management principles and protocols at all levels. The implementation of the protocol in a limited way in the states of Tamil Nadu, West Bengal, Puducherry and Rajasthan, Madhya Pradesh and Kerala, has shown improved outcomes in terms of lives saved and decrease in quantum of ASV used. In the forgoing sections, the Protocol is presented as a solution based approach.

## 2.1 Poisonous snakes in India

Substantial number of snakebites in India is due to non poisonous snakes. Even, many bites by poisonous snakes are dry bites implying that the snakes fail to inject the venom. However, the non-poisonous bites and the dry bites may cause panic reaction and local injury. There are 15 varieties that are highly venomous and four among them, namely cobra (*Naja naja)*, the Russell's viper (*Daboia russelii)*, the saw- scaled viper (*Echis carinatus)* and the krait (*Bungarus caeruleus)* commonly causes envenomation and are included in the ASV mix. Cobras and Kraits belong to Elapidae and the vipers belong to Viperidae family.

Most of the bites in Rajasthan and Maharashtra are from saw scaled viper. In Kerala, the bites are mainly due to the Russell's viper. In Tamil Nadu, the bites are reported from all four species. In West Bengal, the reported bites are caused by Russell's viper, krait and cobra except the saw scaled viper. In hilly terrains of the northern Himalayas krait bites are common. Bites from the Hump Nose Pit Viper (*Hypnale hypnale)* are being reported from the states of Kerala, Tamilnadu and Maharashtra. Rajasthan reports bites from Sochurek's saw scaled viper (*Echis sochureki*).

The four species namely, cobra (*Naja naja)*, the Russell's viper (*Daboia russelii)*, the saw- scaled viper (*Echis carinatus)* and the krait (*Bungarus caeruleus)* were believed to be causing all fatalities in India. However this concept has led to some serious problems:

- ASV Manufacturers only produce anti – venom against these species.
- The polyvalent snake venom used in India is found ineffective for bites from Hump nose viper and less effective against Sochurek's saw scaled viper.
- The assumption that only 'The 'Big 4' can cause serious symptoms and death have led to mis – identification of species.
- Other deadly snakes may be going un – noticed and causing death and disability! The recent discovery of the Hump – nosed Pit Viper as a species capable of causing life threatening symptoms has demonstrated this.

In order to determine the actual list of medically significant species in India, the old concept of 'The Big four' is to be abandoned for a newer more flexible model that enables better classification of species. Further research needs to be undertaken to establish a definitive list of medically significant snakes in India.

## 2.2 Snakes of Medical Significance based on W.H.O. classification

The W.H.O. classification developed in 1981 has been adopted as the Indian preferred method for categorising snakes of medical importance.

**Class I: Commonly cause death or serious disability**

Russell's viper / Cobra Spp. / Saw Scaled Viper Spp.

**Class II: Uncommonly cause bites but are recorded to cause serious effects (death or local necrosis)**

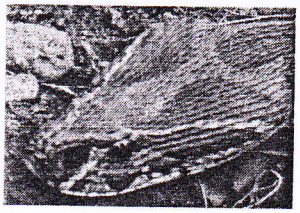
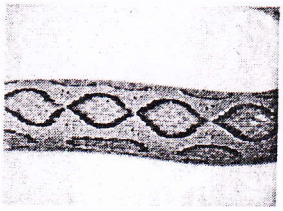
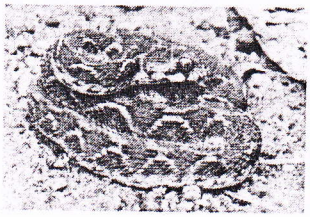
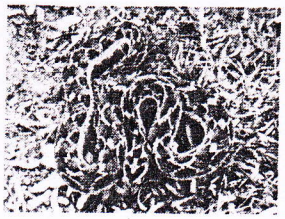
Common Krait and other krait Spp./Hump-Nosed Pit Viper /King Cobra / Levantine Viper

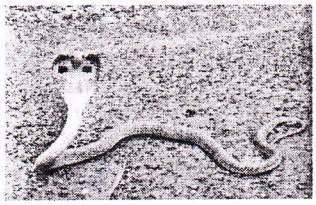
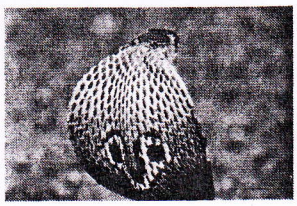
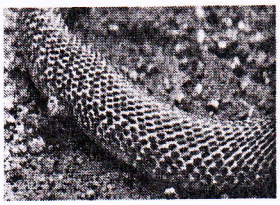
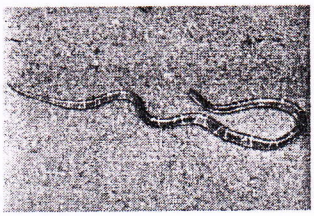
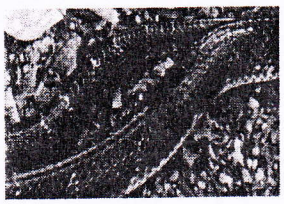
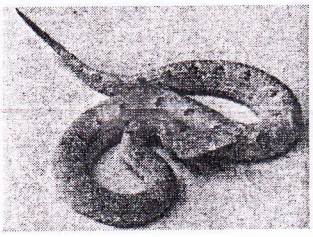
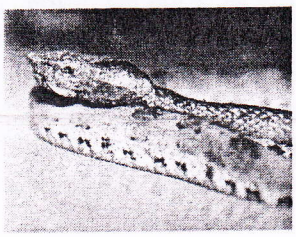
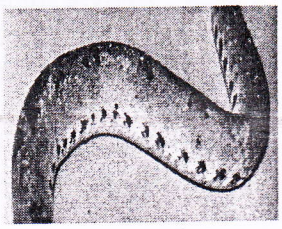
**Class III: Commonly cause bites but serious effects are very uncommon.**
Bamboo Pit Viper

## 2.3 Pictogram for identification of snakes of medical importance

Many a times the persons accompanying the victims bring the killed snake which is assumed to have bitten the patient. This necessitates that the health workers are knowledgeable in identifying at least the venomous ones in the area where they are providing the services. The advantage lies in the fact that if enough knowledge is imparted in identifying the species, the health worker can reassure the victim that the bite is due to a non-poisonous snake and alleviate the fear.

The table below gives pictorial view of lethal snakes common to Indian terrain and their identifying features:

| Common Name of the snake | Photograph | Head | Scales/ patterns |
|---|---|---|---|
| Russell Viper (*Daboia russelli)* |  |  |  |
| Saw Scaled Viper *(Echis carinatus)* |  |  |  |

| | | | |
|---|---|---|---|
| Cobra *(Naja naja)* |  |  |  |
| Common Krait (*Bungarus caeruleus)* |  |  |  |
| Hump Nose Pit Viper (*Hypnale hypnale)* |  |  |  |

The pictorial chart of common snakes (poisonous and non-poisonous snakes) is at **Annexure-I.**

## Clinical Features

Snake venom contains proteins that are predominantly neuro toxic or haemotoxic. Cobras and Kraits have neuro toxins and present with neurological manifestations. Haemostatic abnormalities are prima facie evidence of a Viper bite. Russell's viper can also manifest neurotoxic symptoms in a wide area of India. Saw Scaled Vipers do not cause renal failure whereas Russell's viper and Hump-nosed Pit Viper do.

In bites by poisonous and non-poisonous snakes, anxiety is a predominant manifestation. Non poisonous snakebites may also leave puncture marks and swelling at the site.

The table below summarizes the nature of toxin, the signs at the bite site and the systemic manifestations of envenomation.

| Common Name of the snake | Nature of Toxin | Local symptoms and signs at bite site | Systemic symptoms and signs |
|---|---|---|---|
| Russell's Viper (*Daboia russelii)* | Haemotoxic Neurotoxic | Pain at bite site (Not always) Ecchymoses and swelling **Blister formation at the site of bite and on the affected limb Necrosis of the limb** | Rise in CT/BT. Bleeding from the gingival sulci, epistaxis, GI bleeding, haematuria, melaena. Hemorrhage results in anemia, renal failure, coagulopathy, and hypotension. Can also cause initial neurotoxic symptoms i.e. ptosis etc. |
| Saw Scaled Viper *(Echis carinatus/sochureki)* | Haemotoxic | Local pain (not always) Ecchymoses and swelling Bleeding from the site **Rapid discolouration at the site** | Rise in CT/BT. Bleeding from the gingival sulci, epistaxis, GI bleeding, hematuria, melena. Hemorrhage results in anemia, coagulopathy, and hypotension |
| Cobra *(Naja naja/kaouthia/ oxiana)* | Neurotoxic ( post synaptic) | Local pain (not always) Swelling, ecchymoses and local necrosis | Sluggish pupillary response, diplopia Ptosis, dilated pupils, arrhythmia, difficulty |

| | | | |
|---|---|---|---|
| | | | in breathing, hypotension, unconscious state, cardiac arrest and respiratory arrest. |
| Common Krait (*Bungarus caeruleus/fasciatus/ sindanus Spp/niger)* | Neurotoxic (pre-synaptic) | Small puncture marks often not discernable **Minimal or absent local symptoms** | Sluggish pupillary response, ptosis, diplopia, difficulty in swallowing due to glossopharyngeal dysfunction, dilated pupils, difficulty in respiration, arrhythmia, hypotension, loss of conciousness, coma, respiratory arrest, and sudden cardiac arrest. |
| Hump Nosed Pit Viper (*Hypnale hypnale)* | Haemotoxic | Local pain<br>Ecchymoses and swelling<br>Bleeding from the site | Rise in CT/BT. Bleeding from the gingival sulci, epistaxis, GI bleeding, hematuria, melena.<br><br>Hemorrhage results in anemia, renal failure coagulopathy, and hypotension |

## 4. Community Interventions

Snakebite is a predominant problem of the rural and peri-urban areas. Often snakebites cluster around certain bio-mechanical activities, in certain geographic areas, at certain time of the day. This poses definite occupational risk to farmers. In fact, grass-cutting remains a major situational source of bites. This section looks at the occupational risk and the ecological factors for which simple interventions at community level are suggested to reduce the risk and prevent snakebites. The recommended first aid protocol, methods that need not be followed, the do's and dont's for the community are described.

### 4.1 Occupational Risk and other ecological factors

The normal perception is that rural agricultural workers are most at risk and the bites occur first thing in the morning and last thing at night. However, this is of very little practical use to rural workers in preventing snakebite since it ignores the fact that:-

- In rubber, coconut and areca nut plantations clearing the base of the tree to place manure causes significant numbers of bites.
- Harvesting high growing crops like Millet that require attention focused away from the ground.
- Rubber tapping in the early hours 03:00-06:00 AM.
- Vegetable harvesting / fruit picking.
- Tea and coffee plantation workers face the risk of arboreal and terrestrial vipers when picking or tending bushes.
- Workers deployed for clearing weeds are at equal risk as their grass-cutting colleagues.
- Walking at night without a torch, barefooted or wearing sandals accounts for a significant number of bites.
- Bathing in ponds, streams and rivers, in the evening. It should not be assumed that because the victim is bitten in water that the species is non-venomous. Cobras and other venomous species are good swimmers and may enter the water to hunt.
- Walking along the edge of waterways.

### 4.2 Preventative Measures

- ☑ Walk at night with sturdy footwear and use a 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 while 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.
- ☑ During trekking etc through forests or mountains, stay on clearly marked tracks. Do not step or reach into an area where you cannot see the ground. Wear boots, long-sleeved shirts and long pants.

## 4.3 First Aid Treatment Protocol

Of 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. The case management at the field level includes reassuring the victim, immobilising the bitten limb and transporting the victim to nearest treatment facility within the shortest possible time. Many of the deaths that take place due to delay in reporting to a health facility are preventable.

### 4.3.1 Do it R.I.G.H.T

The first aid that's currently recommended to be administered by self or the community volunteer is based around the mnemonic:

**"Do it R.I.G.H.T."**

The letters in the mnemonic stands for:

- ☑ **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 =** **Immobilise 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!**
- ☑ **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 further bites.

## 4.3.2 Traditional Methods to be discarded

### 4.3.2.1 Tourniquets

The use of tight tourniquets made of rope, belt, string or cloth have been traditionally used to stop venom flow into the body following snakebite. However, they have the following drawbacks and problems:

- Risk of Ischemia and loss of the limb.
- Increased risk of necrosis with 4/5 of the medically significant snakes of India.
- Increased risk of massive neurotoxic blockade when tourniquet is released.
- Risk of embolism if used in viper bites. Pro-coagulant enzymes will cause clotting in distal blood. In addition, the effect of the venom in causing vasodilation presents the danger of massive hypotension when the tourniquet is released.
- They do not work! Venom was not slowed by the tourniquet in several experimental studies, as well as in field conditions. Often this is because they are tied on the lower part of the limb or are incorrectly tied.
- They give patients a false sense of security, which encourages them to delay their journey to hospital.

**For the above reasons, Tourniquet use is contra-indicated.**

### 4.3.2.2 Cutting and Suction

- Cutting a victim with incoagulable blood increases the risk of severe bleeding as the clotting mechanism is no longer effective. Further, it increases the risk of infection. No venom is removed by this method.

- Suction devices have been conclusively proven not to reduce the amount of circulating venom. There has been some evidence that these devices increase envenomation as they inhibit natural oozing of venom from the wound. In addition, they have been shown to increase the local effects of necrosis.

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#### 4.3.2.3 Washing the Wound

Victims and bystanders often want to wash the wound to remove any venom on the surface. This should not be done as the action of washing increases the flow of venom into the system by stimulating the lymphatic system.

#### 4.3.2.4 Electrical Therapy and Cryo Therapy

Electric shock therapy for snakebite received a significant amount of press coverage in the 1980's. The theory behind it stated that applying an electric current to the wound denatures the venom. Research showed however that the venom is not denatured. In addition, it has been demonstrated that the electric shock has no beneficial effect. It has now been abandoned as a method of first aid.

Cryo-therapy involving the application of ice to the bite was practiced in the 1950's. It was subsequently shown that this method had no benefit and merely increased the necrotic effect of the venom.

### 4.3.3 Newer Methods Considered Inapplicable in the Indian Context

#### 4.3.3.1. Pressure Immobilisation Method (PIM)

Pressure Immobilisation finds mention in the herpetology literature. Some medical textbooks have also referred to it. However, PIM's applicability in the Indian context has not been studied!

- PIM was developed in Australia in 1974 by Sutherland. His research involved tying monkeys to wooden frames and injecting venom, then seeing if a pressure bandage would slow the absorption. 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 (1994) demonstrated that the pressure, to be effective, was different in the lower and upper limbs. The upper limb pressure was 40-70 mm of mercury; the lower limb was 55-70 mm 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). It was also stated that pressures above the ranges specified would INCREASE the flow of venom. Other researchers also argued that pressures under the recommended range may also increase venom flow (Gray 2003).
- Work carried out by Norris (2005) showed that only 5% of lay people and 13% of doctors were able to correctly apply the technique!
- Further studies have demonstrated that improvised splints are ineffective (Davidson, 2001).

- In addition, pressure bandages should not be used where there is a risk of local necrosis; that is in 4/5 of the medically significant snakes of India.

- Therefore, to use PIM, Indian Health Workers or Community volunteers would need:

    - To be in possession of crepe bandages and splints.
    - For the victim to immediately drop to the ground when bitten.
    - To have to be in pairs as the bystander must tie the bandage and splint, while the victim remains immobile.
    - To be able to tie the bandage to the correct level of pressure depending on whether an upper or lower limb was involved, when only 13% of emergency room doctors could achieve this.
    - And not to have to walk for more than 10 minutes.

**For the above reasons, the Pressure Immobilisation Method is not recommended for use in India.**

### 4.3.4 Further First Aid Research

There has been some initial research that has suggested that a 'Pressure Pad or Monash Technique' may have some benefit in the first aid treatment of snakebite. In this method, a hard pad of rubber or cloth is applied directly to the wound in an attempt to reduce venom entering the system.

This method should be subjected to further research in India to assess its efficacy. It may have particular relevance to the Indian Armed Forces who carry Shell Dressings as part of their normal equipment, and would thus be ideally equipped to apply effective first aid in difficult geographic settings where the need is great.

## 4.4 Creating Awareness among the community about Do's and Don'ts

Awareness should be created among the community about the **Do's and Don'ts** of the Snakebite.

### 4.4.1 Do's

- Reassure the victim that death is not imminent and that medical care is available. Reassure that most of the bites are non- venomous.

- Remain calm; make the victim comfortable. Control anxiety. Excitement may increase heart rate and blood circulation. This will help spread the venom through your body much faster.

- Lay down flat on the ground; Keep the bitten body part below heart level (do not lift the bitten part above the chest).

- Remove shoes, rings, watches, jewellery and tight clothing from bitten area. They may act as a tourniquet in the event swelling occurs.

- Immobilize the victim's bitten limb in the same way as for a fracture. Bandage it using a cotton bandage (or using any clean cloth material). Finally, apply a splint, and do not allow the limb or the muscles in the area of the bite to be moved much.

- **Be prepared** to treat for shock and possibly administer CPR.

- **Get the victim to the nearest** hospital as soon as possible using available transport.

**Don'ts**

- Do not apply a tourniquet or constriction band. You could cut off blood flow to the limb, causing more damage than the snakebite.

- Do not wash the bite site with soap and water or any other solution to remove venom from the bite site. Action of washing increases the flow of venom into the system by stimulating the lymphatic system.

- Do not make cuts or incisions on or near the bitten area. Viper bites cause uncontrollable bleeding with incoagulable blood. You could also cut nerves, tendons or blood vessels and cause infection.

- Do not use electrical shock.
- Do not freeze or apply extreme cold to the area of the bite.
- Do not apply any kind of potentially harmful herbal and folk remedies.
- Do not attempt to suck venom out with your mouth. It is ineffective and does not remove venom. You could have an ulcer or wound in your mouth, allowing venom to get into your bloodstream.

- Do not give the victim drink, alcohol or other drugs. This can cause complications in the successful treatment of the bite.

- Do not attempt to capture, handle or kill a venomous snake. More people are bitten during these activities than in any other situation.

- Do not go to traditional healers or quacks as there are no proven traditional remedies. Traditional remedies only appear to work in non-venomous bites.

# 5. Snake Bite Treatment Protocol: Diagnostic Phase

## 5.1 Patient Assessment Phase: On arrival.

- ❋ Deal with any life threatening symptoms on presentation. i.e. Airway, Breathing and Circulation.
- ❋ If there is evidence of a bite, where the skin has been broken, give Tetanus Toxoid.
- ❋ Routine use of anti-biotic is not necessary, although it should be considered if there is evidence of cellulitis or necrosis.

## 5.2 Diagnosis Phase: General Principles

- ☑ Wherever possible, identify the snake responsible for the bite. Colour and scaling are unreliable means of determining species. Have the victim carefully bring the snake to hospital if it has been killed.
- ☑ Bite marks are of no use in identifying whether 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.
- ☑ Determine if any traditional medicines have been used, they can sometimes cause confusing symptoms.
- ☑ Determine the exact time of the bite. This can give indications as to the progression of any symptoms.
- ☑ 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.

**All patients will be kept under observation for a minimum of 24 hours.**

## 5.3 Diagnosis Phase: Symptoms

### 5.3.1 General

Generic features have been dealt under section 3. The table below summarises the evidence based situation.

| Feature | Cobras | Kraits | Russell's Viper | Saw Scaled Viper | Hump Nosed Viper |
|---|---|---|---|---|---|
| **Local Pain/ Tissue Damage** | YES | NO | YES | YES | YES |
| **Ptosis/ Neurological Signs** | YES | YES | YES! | NO | NO |
| **Haemostatic abnormalities** | NO | NO! | YES | YES | YES |
| **Renal Complications** | NO | NO | YES | NO | YES |
| **Response to Neostigmine** | YES | NO? | NO? | NO | NO |
| **Response to ASV** | YES | YES | YES | YES | NO |

Haemostatic abnormalities are prima facie evidence of a Viper bite. Cobras and Kraits do not cause haemostatic disturbances. Saw Scaled Vipers do not cause renal failure whereas Russells Viper and Hump-nosed Pitviper do.

Russells Viper, in a wide area of India, also manifests neurotoxic symptoms. This can sometimes cause confusion and further work is necessary to establish how wide this area might be. The neurotoxic symptoms in Russell's viper are believed to be pre synaptic or Krait like in nature. It is for this reason that a doubt is expressed over the response of both species to Neostigmine (See below for use of neostigmine).

### 5.3.2 General signs and symptoms of Viperine envenomation

- Swelling and local pain.
- Tender enlargement of local lymph nodes as large molecular weight Viper venom molecules enter the system via the lymphatics.
- Bleeding from the gingival sulci and other orifices such as epistaxis.
- .The skin and mucous membranes may show evidence of petechiae, purpura ecchymoses.
- Vomiting.
- Acute abdominal tenderness which may suggest gastro-intestinal or retro peritoneal bleeding.
- Hypotension resulting from hypovolaemia or direct vasodilation.
- Low back pain, indicative of an early renal failure or retroperitoneal bleeding. This must be carefully investigated as many rural workers involved in picking activities complain of back pain generally.
- The passing of reddish or dark-brown urine or declining or no urine output.
- Lateralising neurological symptoms and asymmetrical pupils may be indicative of intra-cranial bleeding.
- Muscle pain indicating rhabdomyolysis.
- Parotid swelling, conjunctival oedema, sub-conjunctival haemorrhage.

### 5.3.3 General signs and symptoms of Elapid envenomation

- Swelling and local pain (Cobra).
- Local necrosis and/or blistering (Cobra).
- Descending paralysis, initially of muscles innervated by the cranial nerves, commencing with ptosis, diplopia, or opthalmoplegia. The patient complains of difficulty in focusing and the eyelids feel heavy. There may be some involvement of the senses of taste and smell but these need further research.
- Paralysis of jaw and tongue may lead to upper airway obstruction and aspiration of pooled secretions because of the patient's inability to swallow.
- Numbness around the lips and mouth, progressing to pooling of secretions, bulbar paralysis and respiratory failure.
- Hypoxia due to inadequate ventilation can cause cyanosis, altered sensorium and coma. This is a life threatening situation and needs urgent intervention.
- Paradoxical respiration, as a result of the inter-costal muscles becoming paralysed is a frequent sign.
- Stomach pain which may suggest submucosal haemorrhages in the stomach (Krait).
- Krait bites often present in the early morning with paralysis that can be mistaken for a stroke.

### 5.3.4 Late-onset envenoming

The patient should be kept under close observation for at least 24 hours. Many species, particularly the Krait and the Hump-nosed pit viper are known for the length of time it can take for symptoms to manifest. Often this can take between 6 to 12 hours. Late onset envenoming is a well documented occurrence.

This is also particularly pertinent at the start of the rainy season when snakes generally give birth to their young. Juvenile snakes, 8-10 inches long, tend to bite the victim lower down on the foot in the hard tissue area, and thus any signs of envenomation can take much longer to appear.

## 5.4 Diagnosis Phase: Investigations

### 5.4.1 20 Minute Whole Blood Clotting Test (20WBCT)

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.

A few millilitres 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.

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.

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

### 5.4.2 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).
- ☑ ABG (if facilities available)

### 5.4.3 Immuno-diagnostics

An Indian medical college is currently working to develop Enzyme Linked Immuno Sorbent Assay (ELISA) testing for snake species and level of envenomation. It will take some years before a reliable and effective kit is available to doctors.

# 6. Snake Bite Treatment Protocol: Treatment Phase

## 6.1 Managing Pain

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. Paediatric dose 10mg/kg every 4-6 hourly orally.

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 through Intra Venous route.

**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.

## 6.2 Handling Tourniquets

Though not recommended, the current practice being followed would see many snakebite victims reaching the emergency with tightly tied tourniquets. Care must be taken when removing tight tourniquets. Sudden removal can lead to a massive surge of venom leading to neurological paralysis, hypotension due to vasodilation etc.

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

## 6.3 Anti Snake Venom (ASV)

Anti snake venom (ASV) is the mainstay of treatment. The ASV available in India is polyvalent i.e. it is effective against all the four common species; Russell's Viper (*Daboia russelii*), Common Cobra (*Naja naja*), Common Krait (*Bungarus caeruleus*) and Saw scaled Viper (*Echis carinatus*). There are no currently available monovalent ASVs primarily because there are no objective means of identifying the snake species, in the

absence of the dead snake. In such situations, it would not be possible for the treating physician to determine the monovalent ASV to treat the patient.

There are known species such as the Hump-nosed pit viper (*Hypnale hypnale*) where polyvalent ASV is known to be ineffective. In addition, there are regionally specific species such as Sochurek's Saw Scaled Viper (*Echis carinatus sochureki*) in Rajasthan, where the effectiveness of polyvalent ASV may be questionable. Further work is being carried out with ASV manufacturers to address this issue.

ASV is produced in both liquid and lyophilised forms. There is no evidence to suggest which form is more effective and many doctors prefer one or the other based purely on personal choice. Liquid ASV requires a reliable cold chain and refrigeration and has a two year shelf life. Lyophilised ASV, in powder form, has five year shelf life and requires only to be kept cool. This is a useful feature in remote areas where power supply is inconsistent.

### 6.3.1 ASV Administration Criteria

ASV is a scarce, costly commodity and should only be administered when there are definite signs of envenomation. Unbound, free flowing venom, can only be neutralised when it is in the bloodstream or tissue fluid. In addition, Anti-Snake Venom carries risk of anaphylactic reactions and should not therefore be used unnecessarily. The doctor should be prepared for such reactions.

If a patient has evidence to suggest systemic envenoming or severe current local envenoming, then **only** ASV will be administered.

#### 6.3.1.1. Evidence of systemic envenoming

- **Evidence of coagulopathy**: Primarily detected by 20WBCT or visible spontaneous systemic bleeding from gums etc. Further laboratory tests for thrombocytopenia, Haemoglobin abnormalities, PCV, peripheral smear etc provide confirmation, but 20WBCT is paramount.

- **Evidence of neurotoxicity**: Ptosis, external ophthalmoplegia, muscle paralysis, inability to lift the head etc.

The above two methods of establishing systemic envenomation are the primary determinants. They are simple to carry out, involving bedside tests or identification of visible neurological signs and symptoms. In the Indian context and in the vast majority of cases, one of these two categories will be the main determinants of whether ASV is administered to a patient.

Other determinants are:

- Cardiovascular abnormalities: hypotension, shock, cardiac arrhythmia, abnormal ECG.
- Persistent and severe vomiting or abdominal pain

#### 6.3.3.2. Severe Current Local envenoming

- Severe current, local swelling involving more than half of the bitten limb (in the absence of a tourniquet).

- In case of (i) severe swelling after bites on the digits (toes and especially fingers) (ii) after a bite from a known necrotic species, (iii) rapid extension of swelling (for example beyond the wrist or ankle within a few hours of bites on the hands or feet).

- If a tourniquet or tourniquets have been applied, these themselves can cause swelling. Once they have been removed for 1 hour and the swelling continues, then it is unlikely to be as a result of the tourniquet and ASV may be applicable.

**Purely local swelling, even if accompanied by a bite mark from an apparently venomous snake, is not ground for administering ASV. Swelling, a number of hours old is also not ground for giving ASV.**

### 6.3.2. Prevention of ASV Reactions – Prophylactic Regimes

There is no statistical, trial evidence of sufficient statistical power to show that prophylactic regimes are effective in the prevention of ASV reactions. Micro studies either show no benefit or modest benefit. These studies were underpowered to detect the true outcome effect. Well designed clinical trials are needed to conclude that the prophylactic treatment is beneficial.

Two regimens are normally recommended:

- 100 mg of Hydrocortisone and H1 antihistamine (10mg Chlorphenimarine Maleate; 22.5mg IV phenimarine maleate I.V. or 25mg Promethazine HCl I.M.) 5 minutes before ASV administration. The dose for children is 0.1 - 0.3mg/kg of antihistamine I.V. and 2mg/kg of Hydrocortisone I.V. Antihistamine should be used with caution in pediatric patients.

- 0.25 - 0.3mg adrenaline 1:1000 given subcutaneously

Since there is no evidence from good quality randomized clinical trials to support their routine use, decisions are grounded on criteria such as maximum safety policy, irrespective of the lack of definitive trial evidence. If the victim has a known sensitivity to ASV, pre-medication with adrenaline, hydrocortisone and anti-histamine may be advisable, in order to prevent severe reactions.

### 6.3.3 Test Dose of ASV

Test doses have been shown to have no predictive value in detecting anaphylactoid or late serum reactions and should not be used. These reactions are not IgE mediated but Complement activated. They may also pre-sensitise the patient and thereby create greater risk.

**NO ASV TEST DOSE MUST BE ADMINISTERED!**

### 6.3.4 ASV Administration: Dosage

Symptoms and signs being not a useful guide for deciding the degree of envenomation and having no diagnostic methods to determine the level of venom in blood or tissue, any ASV regimen adopted could only be an estimate. What is important is that a single protocol is established and adhered to, in order to enable results to be reliably reviewed.

There have been some studies to evolve low dose strategies. These studies have serious methodological flaws: the randomization is not proper, the allocation sequence was not concealed, the evaluators were not blinded to the outcome; there was no prior sample size estimation, and the studies were underpowered to detect the principle outcome. It could therefore be concluded that there is no evidence to show that low dose strategies have any validity in India. The same problem relates to high dosage regimens, often based on Harrison's textbook of medicine, which was written specifically for U.S. snakes and not intended for use in the developing world.

The recommended dosage level has been based on published research that Russell's Viper injects on average 63mg (Range 5mg – 147 mg; SD 7 mg) of venom. 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.

This suggests that the total required dose will be between 10 vials to 25 vials as each vial neutralises 6mg of Russells Viper venom. Not all victims will require 10 vials as some may be injected with less than 63mg. Not all victims will require 25 vials as very few are injected with a dose that is an outlier. However, starting with 10 vials ensures that there is sufficient neutralising power to neutralise the average amount of venom injected and during the next 12 hours to neutralise any remaining free flowing venom.

#### 6.3.4.1. Initial Dose

| ASV is recommended to be administered in the following initial dose: | |
|---|---|
| **Neurotoxic/ Anti Haemostatic** | **8-10 Vials** |

**N.B.** Children receive the same ASV dosage as adults. The ASV is targeted at neutralising the venom. Snakes inject the same amount of venom into adults and children.

#### 6.3.4.2 Mode of Administration

ASV can be administered in two ways:

1. Intravenous Injection: reconstituted or liquid ASV is administered by slow intravenous injection. (2ml/ minute). Each vial is 10ml of reconstituted ASV.
2. Infusion: liquid or reconstituted ASV is diluted in 5-10ml/kg body weight of isotonic saline or glucose.

**All ASV to be administered over 1 hour at constant speed.** The patient should be closely monitored for 2 hours.

**Local administration of ASV near or on to the bite site should not be done.** It has been proven to be ineffective, painful and raises the intra-compartmental pressure, particularly in the digits.

### 6.3.5. ASV Dosage in Victims Requiring Life Saving Surgery

In very rare cases, symptoms may develop which indicate that life saving surgery is required in order to save the victim. An example would be a patient who presents with signs of an intracranial bleed.

Before surgery can take place, coagulation must be restored in the victim in order to avoid catastrophic bleeding. In such cases a higher initial dose of ASV is justified (up to 25 vials) solely on the basis on guaranteeing a restoration of coagulation after 6 hours.

### 6.3.6 Snakebite in Pregnancy

There is very little definitive data published on the effects of snakebite during pregnancy. There have been cases reported when spontaneous abortion of the foetus has been reported although this is not the outcome in the majority of cases. It is not clear if venom can pass the placental barrier.

Pregnant women are treated in exactly the same way as other victims. The same dosage of ASV is given.

The victim should be referred to a gynaecologist for assessment of any impact on the foetus.

### 6.3.7. Victims Who Arrive Late

A frequent problem witnessed in our country is victims who arrive late after the bite, often after several days, usually with acute renal failure. The key determining factor to decide on ASV treatment is to look for signs of current venom activity. Venom can only be neutralised if it is unattached! Perform a 20WBCT and determine if any coagulopathy is present. If coagulopathy is present, administer ASV. If no coagulopathy is evident treat renal failure by reference to a nephrologist and dialysis.

In the case of neurotoxic envenoming where the victim is evidencing symptoms such as ptosis, respiratory failure etc, it is probably wise to administer one dose of 8-10 vials of ASV to ensure that no unbound venom is present. However, at this stage it is likely that all the venom is bound and respiratory support or normal recovery will be the outcome.

### 6.3.8. ASV Reactions

Anaphylaxis with ASV may be life-threatening. This is one of the factors contributing to reluctance on the part of PHC doctors in giving ASV. If the correct protocol is followed, it can be effectively treated and dealt with. Anaphylaxis can be of rapid onset and can deteriorate into a life-threatening emergency very rapidly. Adrenaline should always be immediately available.

The patient should be monitored closely for urticaria, itching, fever, shaking chills, nausea, vomiting, diarrhoea, abdominal cramps, tachycardia, hypotension, bronchospasm and angio-oedema. If anaphylaxis is evident, then:

- ASV will be discontinued.
- 0.5mg of 1:1000 Adrenaline will be given IM for adults. Children are given 0.01mg/kg body weight of adrenaline IM .
- In addition, to provide long term protection against anaphylactoid reaction, 100mg of hydrocortisone and an H1 antihistamine, such as Phenimarine maleate can be used at 22.5mg I.V. or Promethazine HCl can be used at 25mg IM, or 10mg Chlorphenirmarine Maleate if available, will be administered I.V.
- The dose for children is of Phenimarine maleate at 0.5mg/kg/ day I.V. or Promethazine HCl can be used at 0.3-0.5mg/kg IM or 0.2mg/kg of Chlorphenimarine Maleate I.V. and 2mg/kg of Hydrocortisone I.V.

| Antihistamine to be used in paediatric cases with caution. |
|---|

If after 10 to 15 minutes the patient's condition has not improved or is worsening, a second dose of 0.5 mg of adrenalin 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. If there is hypotension or hemodynamic instability, I.V. fluids should be given.

In extremely rare, severe life threatening situations, 0.5mg of 1:10,000 adrenaline can be given IV. This carries a risk of cardiac arrhythmias. However, it should only be used if IM adrenaline has been tried and the administration of I.V. adrenaline is in the presence of ventilatory equipment and ICU trained staff.

The IM route for the administration of adrenaline is the option selected, due to the rapidity of development of life threatening situation in anaphylaxis. Studies have shown that adrenaline reaches necessary blood plasma levels in 8 minutes in the IM route, but up to 34 minutes in the subcutaneous route. The early use of adrenaline has been selected as a result of study evidence suggesting better patient outcome if adrenaline is used early.

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.

Late Serum sickness reactions can be easily treated with an oral steroid such as Prednisolone, adults 5mg 6 hourly, paediatric dose 0.7mg/kg/day. Oral H1 Antihistamines provide additional symptomatic relief.

## 6.4 Neurotoxic Envenomation

Neostigmine is an anticholinesterase that prolongs the life of acetylcholine and can therefore reverse respiratory failure and neurotoxic symptoms. It is particularly effective for post synaptic neurotoxins such as those of the Cobra. There is some doubt over its usefulness against the pre-synaptic neurotoxin such as those of the Krait and the Russells Viper. However it is worth trying in these cases.

### 6.4.1 Neostigmine Test

In the case of neurotoxic envenomation the 'Neostigmine Test' will be administered. This test involves administration of 1.5-2.0 mg of neostigmine IM, together with 0.6mg of atropine I.V. The paediatric neostigmine dose is 0.04mg/kg IM and the dose of atropine in 0.05mg/kg.

The patient should be closely observed for 1 hour to determine if the neostigmine is effective. The following measures are useful objective methods to assess this:

- Single breath count.

- Millimeter of Iris uncovered (length covered by the descending eyelid).
- Inter-incisor distance (Measured distance between the upper and lower incisors).
- Length of time upward gaze can be maintained.
- FEV 1 or FVC (If available).

For example, if single breath count or inter-incisor distance is selected the breath count or distance between the upper and lower incisors are measured and recorded. Every 10 minutes the measurement is repeated. The average blood plasma time for neostigmine is 20 minutes, so by T+30 minutes any improvement should be visible by an improvement in the measure.

If the victim responds to the neostigmine test then continue with 0.5mg of neostigmine IM half hourly plus 0.6mg of Atropine I.V. over an 8 hour period by continuous infusion. If there is no improvement in symptoms after one hour, the neostigmine should be stopped.

Some authors have suggested that it may be possible to treat patients with anticholinesterase drugs solely, in the case of elapid bites. However this approach ignores the value of neutralising the free flowing venom before it can attach and carry out its task.

## 6.5 Recovery Signs

If an adequate dose of appropriate antivenom has been administered, the following responses may be seen:

- Spontaneous systemic bleeding such as gum bleeding usually stops within 15 - 30 minutes.
- Blood coagulability is usually restored in 6 hours. Principal test is 20WBCT.
- Post synaptic neurotoxic envenoming such as in Cobra bites, may begin to improve as early as 30 minutes after antivenom, but can take several hours.
- Presynaptic neurotoxic envenoming such as in Krait bites, usually takes a considerable time to improve, reflecting the need for the body to generate new acetylcholine emitters.
- Active haemolysis and rhabdomyolysis may cease within a few hours and the urine returns to its normal colour.
- In patients with Shock, blood pressure may increase after 30 minutes.

## 6.6 Repeat Doses of ASV

### 6.6.1 Haemotoxic envenomation

In the case of haemotoxic envenomation, the ASV strategy will be based around a six hour time period. When the initial blood test reveals a coagulation abnormality, the initial ASV amount will be given over 1 hour.

No additional ASV will be given until the next Clotting Test is carried out. This is due to the inability of the liver to replace clotting factors before 6 hrs.

After 6 hours a further coagulation test should be performed and a further dose should be administered in the event of continued coagulation disturbance. This dose should also be given over 1 hour. CT tests and repeat doses of ASV should continue on a 6 hourly pattern until coagulation is restored, unless a species is identified as one against which Polyvalent ASV is not effective.

The repeat dose should be 5 - 10 vials of ASV i.e. half to one full dose of the original amount. The most logical approach is to administer the same dose again, as was administered initially. Some Indian doctors however, argue that since the amount of unbound venom is declining due to its continued binding to tissue, and with the objective to conserve scarce supplies of ASV, there may be a case for administering a smaller second dose. In the absence of good trial evidence to determine the objective position, a range of vials in the second dose has been adopted.

### 6.6.2 Neurotoxic

The ASV regime relating to neurotoxic envenomation has caused considerable confusion. If the initial dose has been unsuccessful in reducing the symptoms or if the symptoms have worsened or if the patient has gone into respiratory failure then a further dose should be administered, after 1-2 hours. At this point the patient should be re-assessed. If the symptoms have worsened or have not improved, a second dose of ASV should be given.

This dose should be the same as the initial dose, i.e. if 10 vials were given initially then 10 vials should be repeated for a second dose and then ASV is discontinued. 20 vials is the maximum dose of ASV that should be given to a neurotoxically envenomed patient.

Once the patient is in respiratory failure, has received 20 vials of ASV and is supported on a ventilator, ASV therapy should be stopped. This recommendation is due to the assumption that all circulating venom would have been neutralised by this point. Therefore further ASV serves no useful purpose.

Evidence suggests that 'reversibility' of post synaptic neurotoxic envenoming is only possible in the first few hours. After that the body recovers by using its own mechanisms. Large doses of ASV, over long periods, have no benefit in reversing envenomation.

Confusion has arisen due to some medical textbooks suggesting that 'massive doses' of ASV can be administered, and that there need not necessarily be a clear-cut upper limit to ASV'. These texts are talking about snakes which inject massive amounts of venom, such as the King Cobra or Australian Elapids. There is no justification for massive doses of 50+ vials in India, which usually result from the continued use of ASV whilst the victim is on a ventilator.

No further doses of ASV are required; unless a proven recurrence of envenomation is established, additional vials to prevent recurrence is not necessary.

## 6.7 Recurrent Envenomation

When coagulation has been restored no further ASV should be administered, unless a proven recurrence of a coagulation abnormality is established. **Indian ASV** is a $F(ab)_2$ product and has a half-life of over 90 hours and therefore **is not required in a prophylactic dose to prevent re-envenomation.**

## 6.8 Anti Haemostatic Maximum ASV Dosage Guidance

The normal guidelines are to administer ASV every 6 hours until coagulation has been restored. However, what should the clinician do after say, 30 vials have been administered and the coagulation abnormality persists?

There are a number of questions that should be considered. Firstly, is the envenoming species one for which polyvalent ASV is effective? For example, it has been established that envenomation by the Hump-nosed pit viper (*Hypnale hypnale*) does not respond to normal ASV. This may be seen in the case of *Hypnale*, where coagulopathy can continue for up to 3 weeks!

The next point to consider is whether the coagulopathy is resulting from the action of the venom. Published evidence suggests that the maximum venom yield from say a Russells Viper is 147 mg, which will reduce the moment the venom enters the system and starts binding to tissues. If 30 vials of ASV have been administered that represents 180 mg of neutralising capacity. This should certainly be enough to neutralise free flowing venom. At this point the clinician should consider whether the continued administration of ASV is serving any purpose, particularly in the absence of proven systemic bleeding.

At this stage the use of Fresh Frozen Plasma (FFP) or factors can be considered, if available.

## 6.9 Drugs not to be used in viper bites : Heparin and Botropase

Heparin has been proposed as a means of reducing fibrin deposits in DIC (Paul et al, 2003). However, heparin is contraindicated in Viper bites. Venom induced thrombin is resistant to Heparin, the effects of heparin on antithrombin III are negated due to the elimination of ATIII by the time Heparin is administered and heparin can cause bleeding by its own action. Trial evidence has shown it has no beneficial effect .

Botropase is a coagulant compound derived from the venom of one of two South American pit vipers. It should not be used as a coagulant in viper bites as it simply

prolongs the coagulation abnormality by causing consumption coagulopathy in the same way as the Indian viper venom currently affecting the victim.

## 6.10. Follow Up

A snakebite victim discharged from the hospital should continue to be followed up. At the time of discharge patient should be advised to return to the emergency if there is worsening of symptoms or signs such as evidence of bleeding, worsening pain and swelling at the site of bite, difficulty in breathing, altered sensorium etc. The patients should also be explained about the signs and symptoms of Serum Sickness (fever, joint pain, joint swelling) which may manifest after 5-10 days.

# 7. Snakebite Treatment Protocol: Treating Complications

As like every disease, snakebite cases may also develop complications. In our settings, a number of snakebite reports to the health facility with these complications. Complications may also develop during or after treatment as per protocol. Like any other diseases, complications are to be managed according to the merit of the situation. The complications need early recognition by the treating team to affect referral to the appropriate centre. Complications like compartment syndrome, renal complications, neurological sequelae, sepsis, multi organ failure etc. requires treatment at Secondary or Tertiary Care Centre. Complications such as infected wounds, ulceration, necrosis etc can be managed at PHC, CHC, Taluk Hospitals, District Hospitals.

The clinical practice guidelines for renal / surgical / neurological complications following snakebite are standard ones followed by the respective specialists depending on the stage and extent of the complications at the stage of referral. Some important clinical issues are dealt in the following paragraphs:

## 7.1 Hypotension

Hypotension can have a number of causes, particularly loss of circulating volume due to haemorrhage, vasodilation due to the action of the venom or direct effects on the heart. Test for hypovolaemia by examining the blood pressure lying down and sitting up, to establish a postural drop.

Usually crystalloids are used for volume expansion. There is no conclusive trial evidence to support a preference for colloids or crystalloids. In cases where increased generalised capillary permeability has been established a vasoconstrictor such as dopamine can be used, dose being is 5- 10μ /kg/minute in normal saline or glucose solutions as I.V. drip. The flow rate may be adjusted to maintain blood pressure adequately.

Rarely Russell's viper bites are known to cause acute pituitary and / or adrenal insufficiency. This condition may also contribute to shock. Hence, this entity has to be remembered while dealing with hypotension in snakebite. Follow-up checks on known Russell's viper victims need to ensure that no long term pituitary sequelae are evident.

## 7.2 Persistent or severe bleeding

In the majority of cases the timely use of ASV will stop systemic bleeding. However in some cases the bleeding may continue to a point when further appropriate treatment should be considered. The major point to note is that clotting must be re-established before additional measures are taken. Adding clotting factors, fresh frozen plasma (FFP),

cryoprecipitate or whole blood in the presence of un-neutralised venom will increase the amount of degradation products with the accompanying risk to the renal function.

## 7.3 Renal Failure

Renal failure is a common complication of Russell's viper and Hump-nosed pit viper bites. The contributory factors are intravascular haemolysis, DIC, direct nephrotoxicity, and hypotension and rhabdomyolysis. Renal damage can develop very early in cases of Russells viper bite and even when the patient arrives at hospital soon after the bite, the damage may already have been done. Studies have shown that even when ASV is administered within 1-2 hours after the bite, it is incapable of preventing ARF.

The following are indications of renal failure:

- Declining or no urine output although not all cases of renal failure exhibits oliguria
- Blood Bio-Chemistry
    - Serum Creatinine > 5mg/dl or rise of > 1mg / day.
    - Urea > 200mg/dl
    - Potassium > 5.6 mmol/l Confirm hyperkalaemia with ECG.
- Evidence of Uraemia or metabolic acidosis.

Declining renal parameters require referral to a nephrologist with access to dialysis equipment. Peritoneal dialysis could be performed in secondary care centres. Haemodialysis is preferable in cases of hypotension or hyperkalaemia.

## 7.4 Cardiac complications

Studies reveal rare manifestations of cardiac toxicity. These are rhythm abnormalities which include, bradycardia, tachycardia, sinus arrhythmia, gallop rhythm and rarely pulmonary oedema and cardiomegaly. Apart from showing the rhythm abnormalities, ECG may also rarely show tall T waves, pattern suggesting myocardial ischemia and atrio-ventricular block. Bradycardia and tachycardia may be a feature of disturbed autonomic nervous system and most often due to anxiety rather than direct injury to the cell membrane. A cardiologist needs to be consulted if the rhythm abnormalities or other ECG findings persist.

## 7.5 Surgical issues

The surgical issues observed in snake bite cases are:

- Ulcer following snakebite

- Necrosis of the skin and underlying tissues
- Gangrene of the toes and fingers
- Debridement of necrotic tissues
- Compartment syndrome and others

The details and approach to some of the surgical issues are given below:

**Table: Surgical issues: Assessment and action required.**

| Assessment | Action required |
|---|---|
| ❖ Assess for internal and external surgical issues related to envenomation carefully and observe for the same while the victim is at hospital and / or during follow up care.<br><br>❖ Wound status : Wound following snake bite may show bite marks with or without laceration. Sometimes venom may penetrate deep and hence deeper tissues may be damaged which may not be visible during initial examination.<br><br>❖ At the site of bite bleb or vesicle may develop and end in the form of an ulcer which is a non specific one. (Non-specific ulcers are defined as ulcers due to infection of wounds, physical or chemical agents or due to local irritation).<br><br>❖ Use of topical agents / traditional medicine | ❖ Care of the wound<br>Consider the following while managing the wound /ulcer.<br>- Minimize unnecessary blood loss.<br>- Avoid the formation of a hematoma.<br>- Initiate adequate cleaning with normal saline or tap water AND debridement.<br>- Remove debris and necrotic tissue, irrigate gently with water / normal saline.<br>- Expose viable tissues, excise eschar after controlling hemotoxic complications.<br>- Use topical antibacterial agents.<br>- Apply dressings after complete debridement. Maintain proper wound environment and prevent ischemia.<br>- Facilitate healing of acute wound by applying non adherent dressing to ensure adequate epithelialisation and to prevent contamination of the wound.<br>- Keep wounds clean and dry. Avoid soaking or scrubbing the wound.<br>- Teach & explain the care of wound to the patients. Educate on good personal hygiene and nutrition.<br>- Control diabetes if identified.<br>- Prepare and proceed to skin grafting later (if required) |

| | |
|---|---|
| ❖ **Compartment Syndrome**<br><br>Less common. There is little objective evidence that the intracompartmental pressure due to snakebite in India, ever reaches the prescribed limit for a fasciotomy.<br><br>Consider compartment Syndrome of the limb if any of the following 6 Ps. or a combination of them appear.<br><br>· Pain on passive stretching<br>· Pain out of proportion<br>· Pulselessness<br>· Pallor<br>· Parasthesia<br>· Paralysis<br><br>The limb can be raised in the initial stages to see if swelling is reduced. However, this is controversial as there is no trial evidence to support its effectiveness.<br><br>Tissue injury after compartment syndrome may be disproportionate to the clinical status. | ❖ Measure intra compartmental pressure (ICP) in suspected cases by Intra compartmental monitoring machine(Stryker pressure monitor) or by use of a saline monitor(normal <20mmof Hg) . Visual impression is a highly unreliable guide to estimating intra-compartmental pressure.<br><br>❖ Monitor ICP every 30 to 120 minutes if required<br><br>❖ Proceed with fasciotomy if the ICP exceeds greater than 30 to 40 mm of Hg.<br><br>❖ Restore coagulation time before commencing the procedures.<br><br>❖ Fasciotomy does not remove or reduce any envenomation. |

## 7.6 Neurological Sequele:

- Early recognition by observing closely for ptosis.
- Assess the neuroparalysis is neostigmine responsive or not.
- Early referral to well equipped centre for management of respiratory failure with Mechanical Ventilation.
- Elective Endotracheal Intubation and Ventilation while transferring the patient to higher centre.

**Anticipate complications keenly by** examining the victims at regular intervals for alterations in symptoms and signs. Observe for anti snake venom related systemic changes and drug toxicity and manage them as described vide infra under treatment for ASV reactions.

# 8. Snakebite Management in Primary/Community/Dispensary Health Care Centres

A key objective of this protocol is to enable doctors in Primary Care Institutions to treat snakebite with confidence. Evidence suggests that even when equipped with anti snake venom, Primary Health Care doctors lack the confidence to treat snakebite due to the absence of a protocol tailored to their needs and outlining how they should proceed within their context and setting. The following summarizes a sequence of activities to be carried out in these settings for optimal response.

## 8.1 Patient Arrival & Assessment

- Patient should be placed under observation for 24 hours
- The snake, if brought, should be carefully examined and compared to the snake identification material.
- Pain management should be considered.
- 20WBCT in clean, new, dry, glass test tubes should be carried out every 30 minutes for the first 3 hours and then hourly after that.
- Attention should be paid for any visible neurological symptoms.
- Severe, current, local swelling should be identified
- If no symptoms develop after 24 hours the patient can be discharged with a T.T injection.

## 8.2 Envenomation; Haemotoxic

If the patient has evidence of haemotoxic envenomation, determined by 20WBCT, then 8-10 vials of ASV are administered over 1 hour. Adrenaline is made ready in two syringes of 0.5mg 1:1000 for IM administration if symptoms of any adverse reaction appear. If symptoms do appear, ASV is temporarily suspended while the reaction is dealt with and then recommenced.

### 8.2.1. Referral Criteria

Once the ASV administration is finished and the adverse reaction dealt with, the patient should be automatically referred to a higher centre with facilities for blood analysis to determine any systemic bleeding or renal impairment.

The 6 hour rule ensures that a six hour window is now available during which the patient can be transported.

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### 8.3 Envenomation; Neurotoxic

If the patient shows signs of neurotoxic envenomation 8-10 vials are administered over 1 hour.

Adrenaline is made ready in two syringes of 0.5mg 1:1000 for IM administration if symptoms of any adverse reaction appear. If symptoms do appear, ASV is temporarily suspended while the reaction is dealt with and then recommenced.

A neostigmine test is administered using 1.5-2.0mg of neostigmine IM plus 0.6mg of atropine IV. An objective measure such as single breath count is used to assess the improvement or lack of improvement given by the neostigmine over 1 hour. If there is no improvement in the objective measure the neostigmine is stopped. If there is improvement 0.5mg neostigmine is given IM every 30 minutes with atropine until recovery. Usually this recovery is very rapid.

If after 1 hour from the end of the first dose of ASV, the patient's symptoms have worsened i.e. paralysis has descended further, a second full dose of ASV is given over 1 hour. ASV is then completed for this patient.

If after 2 hours the patient has not shown worsening symptoms, but has not improved, a second dose of ASV is given over 1 hour. ASV administration is now complete for this patient.

#### 8.3.1. Referral Criteria

The primary consideration, in the case of neurotoxic bites, is respiratory failure requiring long term mechanical ventilation. Whilst it is entirely possible to maintain a neurotoxic victim by simply using a resuscitation bag, and this should always be used in a last resort, the best means of support is a mechanical ventilator operated by qualified staff.

Primary Care and even most Secondary care hospitals are not equipped with mechanical ventilators. The most important factor therefore is when to refer a patient to a hospital with a ventilator and under what conditions.

The key criteria to determine whether respiratory failure, requiring mechanical ventilation is likely, is the 'neck lift'. Neurotoxic patients should be frequently checked on their ability to perform a neck lift. If they are able to carry out the action then treatment should continue until recovery in the Primary care institution.

If the patient reaches the stage when a neck lift cannot be carried out then the patient should be immediately referred to a hospital with a mechanical ventilator.

**Conditions and Equipment Accompanying Neurotoxic Referral**

The primary consideration is to be provide respiratory support to the victim if respiratory failure develops before or during transit to the referral centre.

The key priority is to transfer the patient with a face mask, resuscitation bag and a person, other than the driver of the vehicle, who is trained on how to use these devices. If respiration fails then the victim must be given ventilatory support until arrival at the referral centre.

Greater success can be achieved with two additional approaches, prior to referral:

In the conscious patient, two Nasopharyngeal Tubes (NP) should be inserted before referral. These will enable effective resuscitation with the resuscitation bag by not allowing the tongue to fall back and block the airway, without triggering the gagging reflex. Improvised Nasopharyngeal tubes can be made by cutting down size 5 endotracheal tubes to the required length i.e. from the tragus to the nostril. NP tubes should be prepared and kept with the snakebite kit in the PHC. This is preferable as the patient may well be unable to perform a neck lift but still remain conscious and breathing. The danger will be that respiratory failure will occur after the patient has left the PHC and before arriving at the eventual institution. In that case the patient will be pre-prepared for the use of a resuscitation bag by the use of NP tubes.

In the unconscious patient, a Laryngeal Mask Airway or preferably a Laryngeal Tube Airway should be inserted before referral which will enable more effective ventilatory support to be provided with a resuscitation bag until the patient reaches an institution with the facility of mechanical ventilation.

The flow chart for managing snakebite at Primary Care Centre is at **Annexure-II.** Basic Minimal & Essential Drug and Equipment Profile for a Primary Health Centre are at **Annexure-III.**

Flow Chart for managing a victim at the referral Centre **is at Annexure-IV.**

## 9. Natural Calamities and Snakebites

Hydrological and Geological disasters disturb the eco system and displace the snakes from their natural habitats.

India has heavy concentration of rainfall spread over a period of three months (June to August). Forty million hectares of its landmass is vulnerable to floods. The Gangetic and Brahmaputra basins are prone to annual floods. Eight thousand Km of coast line is prone to cyclones/ tsunami's. Further the unstable tectonic plates of Indian sub continent makes it vulnerable to frequent earthquakes (54% seismic Zones III & IV). Some of these disaster prone areas are otherwise also reporting a large number of snakebites (Andhra Pradesh, Bihar, Kerala, Maharashtra, Orissa, Tamil Nadu, West Bengal). A vulnerability mapping of India is at **Annexure-V**.

Hydrological disasters namely floods, cyclones, tsunamis causes the burrows to be filled up with water displacing the snakes to higher grounds. The water current also drifts them to human habitations. They take shelter on tree tops and dwelling units in flooded areas. Seismic activities also tend to obliterate the burrows. Both the snakes and their pray have a tendency to move to human habitats far from their natural habitats.

For these reasons, increased number of snakebites is reported after natural calamities. The communities and primary health care institutions in such area should be prepared to attend to increased number of snakebites. The preparedness is also important from the perspective that the health institutions and services itself may have been affected or stressed by the disaster. Preparedness measures should include:

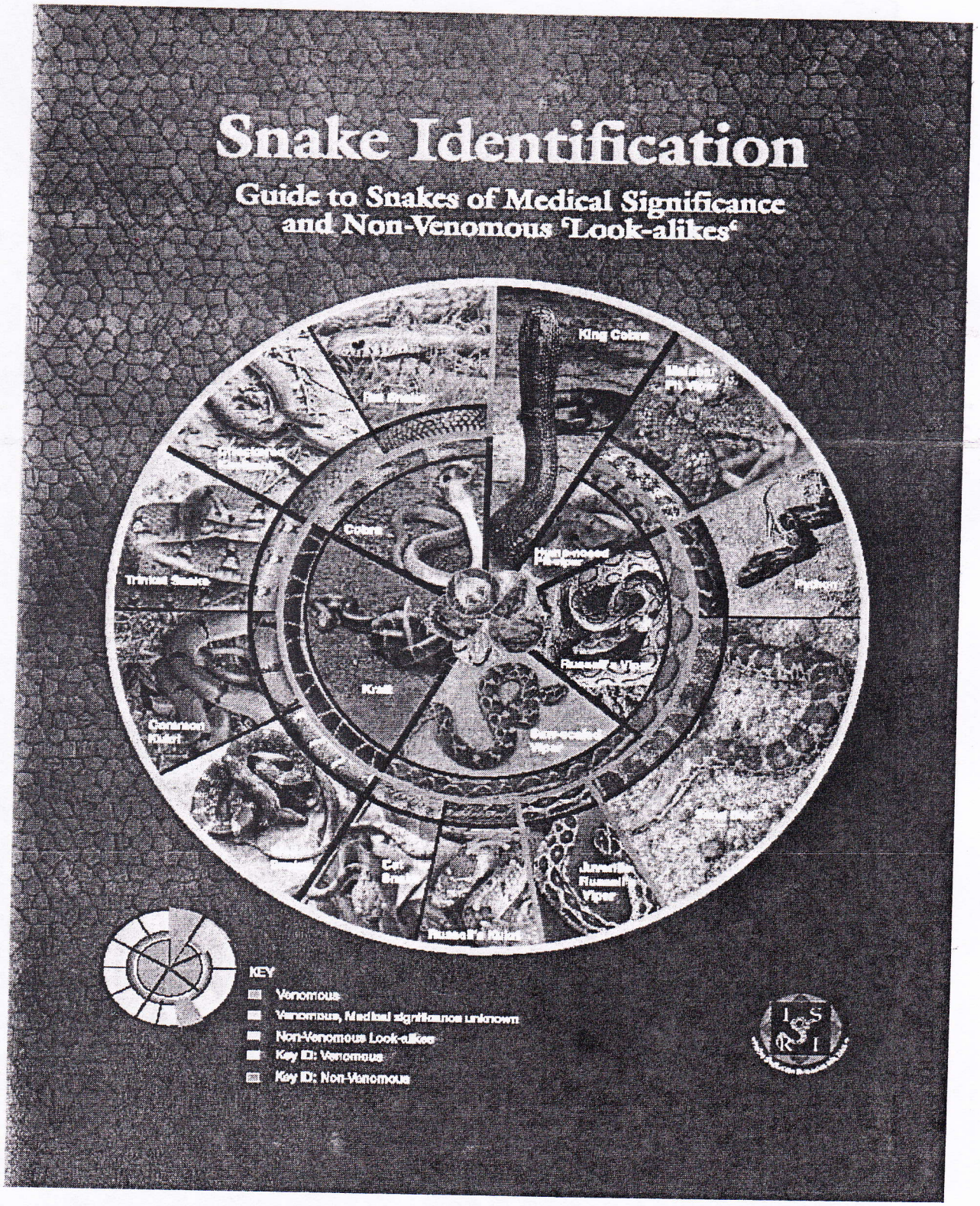
(i) Educating the communities on Do's and Don'ts.
(ii) Informing the community that vegetations and dwelling units above water level (during floods, cyclones, tsunamis) may have snakes also taking shelter in them.
(iii) Ensuring that the PHC doctors in the affected areas are trained in new protocol.
(iv) Capacity to mobilise additional trained personnel (in managing Snakebites using new Protocols) to the affected areas.
(v) Stocking of ASV and other logistics or modalities to procure them at short notice (Annexure-III).
(vi) Identifying and preparing the referral centre to manage complications.

# SECTION-10

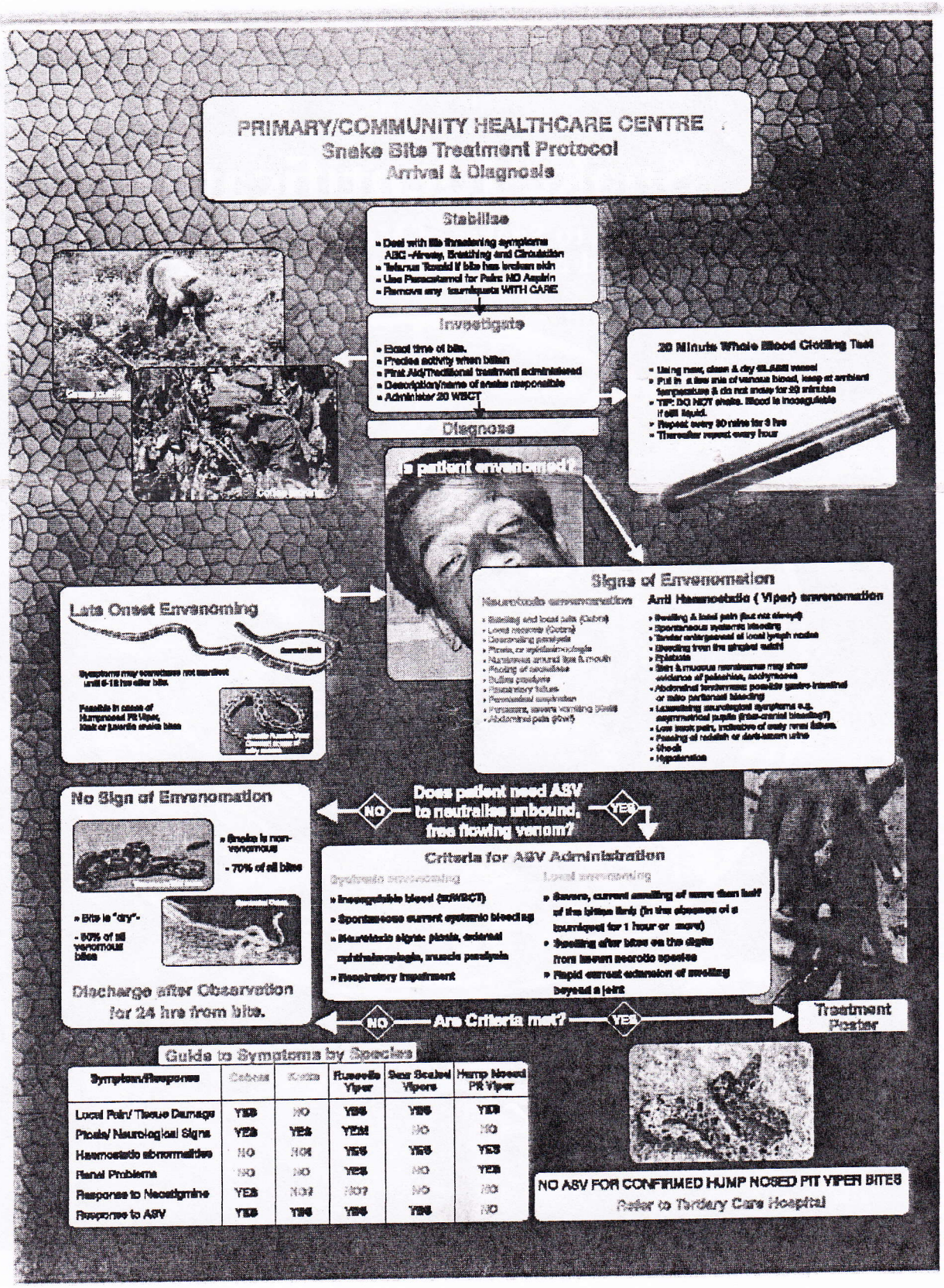
# ANNEXURES

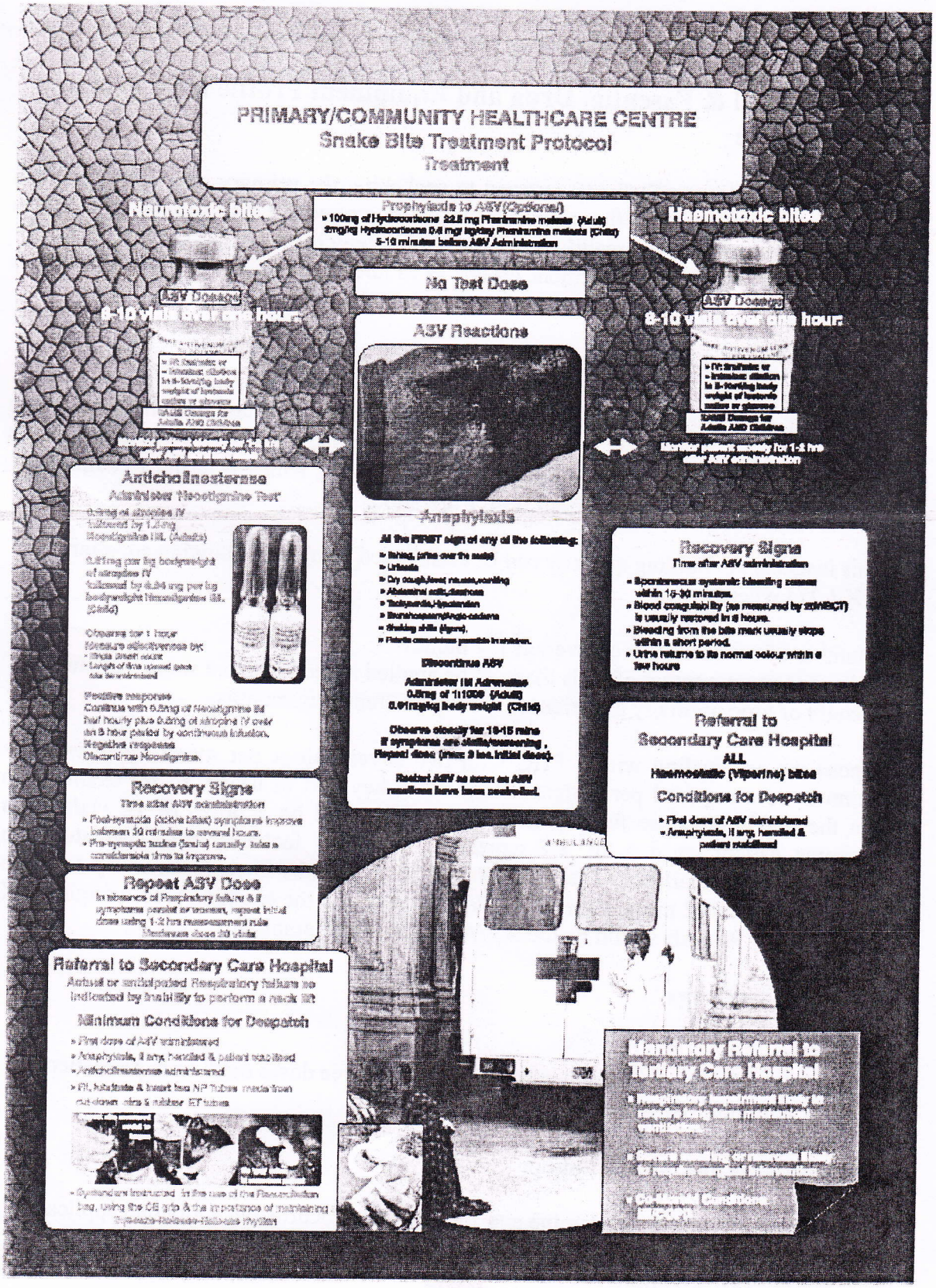
(23)

**Annexure-I**



## Annexure-II


PRIMARY/COMMUNITY HEALTHCARE CENTRE
Snake Bite Treatment Protocol
Arrival & Diagnosis
Stabilise
• Deal with life threatening symptoms ABC -Airway, Breathing and Circulation
• Tetanus Toxoid if bite has broken skin
• Use Paracetamol for Pain: NO Aspirin
• Remove any tourniquets WITH CARE
Investigate
• Exact time of bite.
• Precise activity when bitten
• First Aid/Traditional treatment administered
• Description/name of snake responsible
• Administer 20 WBCT
Diagnosis
20 Minute Whole Blood Clotting Test
• Using new, clean & dry GLASS vessel
• Put in a few mls of venous blood, keep at ambient temperature & do not move for 20 minutes
• TIP: DO NOT shake. Blood is incoagulable if still liquid.
• Repeat every 30 mins for 3 hrs
• Thereafter repeat every hour
Is patient envenomed?
Late Onset Envenoming
Symptoms may sometimes not manifest until 6-12 hrs after bite.
Feasible in cases of Humpnosed Pit Viper, Krait or juvenile snake bites
Signs of Envenomation
Neurotoxic envenomation
Anti Haemostatic ( Viper) envenomation
No Sign of Envenomation
» Snake is non-venomous
- 70% of all bites
» Bite is "dry"-
- 90% of all venomous bites
Discharge after Observation for 24 hrs from bite.
NO
Does patient need ASV to neutralise unbound, free flowing venom?
YES
Criteria for ASV Administration
Systemic envenoming
» Incoagulable blood (20WBCT)
» Spontaneous current systemic bleeding
» Neurotoxic signs: ptosis, external ophthalmoplegia, muscle paralysis
» Respiratory impairment
Local envenoming
» Severe, current swelling of more than half of the bitten limb (in the absence of a tourniquet for 1 hour or more)
» Spelling after bites on the digits from severe necrotic species
» Rapid current extension of swelling beyond a joint
NO
Are Criteria met?
YES
Treatment Poster
Guide to Symptoms by Species
Symptom/Response | Cobras | Kraits | Russells Viper | Saw Scaled Vipers | Hump Nosed Pit Viper
Local Pain/ Tissue Damage | YES | NO | YES | YES | YES
Ptosis/ Neurological Signs | YES | YES | YES | NO | NO
Haemostatic abnormalities | NO | NO | YES | YES | YES
Renal Problems | NO | NO | YES | NO | YES
Response to Neostigmine | YES | NO? | NO? | NO | NO
Response to ASV | YES | YES | YES | YES | NO
NO ASV FOR CONFIRMED HUMP NOSED PIT VIPER BITES
Refer to Tertiary Care Hospital


PRIMARY/COMMUNITY HEALTHCARE CENTRE
Snake Bite Treatment Protocol
Treatment
Prophylaxis to ASV (Optional)
Haematotoxic bites
Haematotoxic bites
No Test Dose
ASV Reactions
Anaphylaxis
Anticholinesterase
Recovery Signs
Time after ASV administration
Recovery Signs
Time after ASV administration
Repeat ASV Dose
Referral to Secondary Care Hospital
ALL
Haemostatic (Viperine) bites
Conditions for Despatch
Referral to Secondary Care Hospital
Minimum Conditions for Despatch
Mandatory Referral to Tertiary Care Hospital

Annexure-III

## Basic Minimal & Essential Drug and Equipment Profile for a Primary Health Centre

In order to be able to effectively respond to snakebite, the primary care centre needs a drug and equipment profile that supports snakebite treatment. Often the level of skill to design such a profile is not readily available. Good guidelines are therefore required for doctors and government procurement groups as to how to equip a primary centre for its role.

### Antivenom / Anti Snake Venom

The type of ASV used will be determined by availability, cost and effectiveness of the cold chain. Lyophilised ASV, in powdered form has a shelf life of 5 years and requires merely to be kept out of direct sunlight. Liquid AV/ASV, which is easier to administer, has a shelf life of two years and requires refrigeration.

In this instance the holding quantity can be established using the following equation: **(xd X 1.2) t** where:

x =number of envenomings on average per month
d = the maximum number of vials likely to be applied at the PHC to a single patient
t = length of time normally experienced for replenishment in months.

Suppose we are dealing with a PHC with two envenomings per month then x=2 The maximum dose required per patient determines a key part of usage, so for example, in India the maximum dose for a patient at a PHC would be 2 doses of 10 vials for a neurotoxic patient, so d = 20. 1.2 represents the safety factor to ensure greater than minimal stock is available. The restocking time in months is represented by t. If the restocking period is 2 months for AV/ASV to be replaced the equation would require 2 X 20 X 1.2 X 2 = 96 vials would be the AV/ASV base stock amount.

### Other Support Drugs

**Adrenaline**
Adult dosage of 0.5mg of 1:1000 with a potential of three doses maximum per patient. (Stock of Minimum 10 vials)

**Hydrocortisone and Antihistamine**

Adult dosage of 10mg antihistamine and 100mg of hydrocortisone. Only one application per patient is normally required before referral (stock of 10 vials)
**Neostigmine and Atropine**

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Adult dosage of 1.5mg for neostigmine and 0.6mg atropine for the test phase of treatment. Ongoing support if test shows positive response is 0.5mg neostigmine every 30 minutes. Victims who are responsive usually recover quite rapidly so assume a dosage requirement of 12 hours i.e. 24 x 0.5mg ampoules. Further atropine may also be required @ 1 ampoule of 0.6mg atropine for every 5-6 ampoules of 0.5mg neostigmine.

Dose required per neurotoxic bite would be about 30 ampoules (0.5 mg) of neostigmine and five ampoules of atropine.

**Paracetamol:**

500mg tablets (as per generic indent of the PHC)

**IV fluids**

Normal Saline, Ringer Lactate and 5 % Dextrose (As per generic indent requirement of PHC)

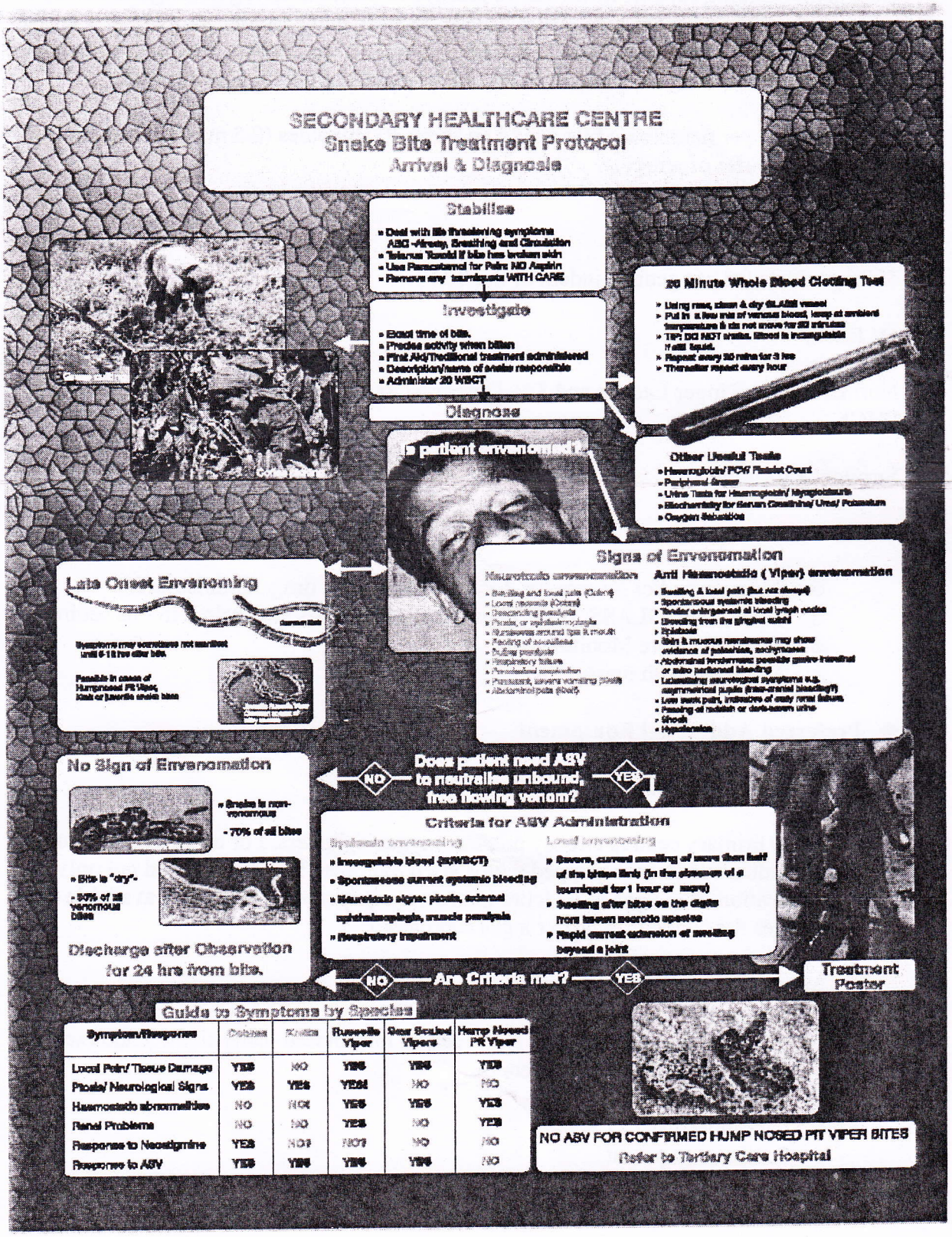
**Support Equipment**

- **Routine**
  - Syringes and/or IV sets for AV/ASV usage and drug administration
  - Clean, New GLASS Test Tubes (plastic test tubes are useless in this setting)
  - Blood Pressure Monitor
  - Ambubag with mask
- **Preferred Additional Equipment**
  - **Oxygen Cylinder**

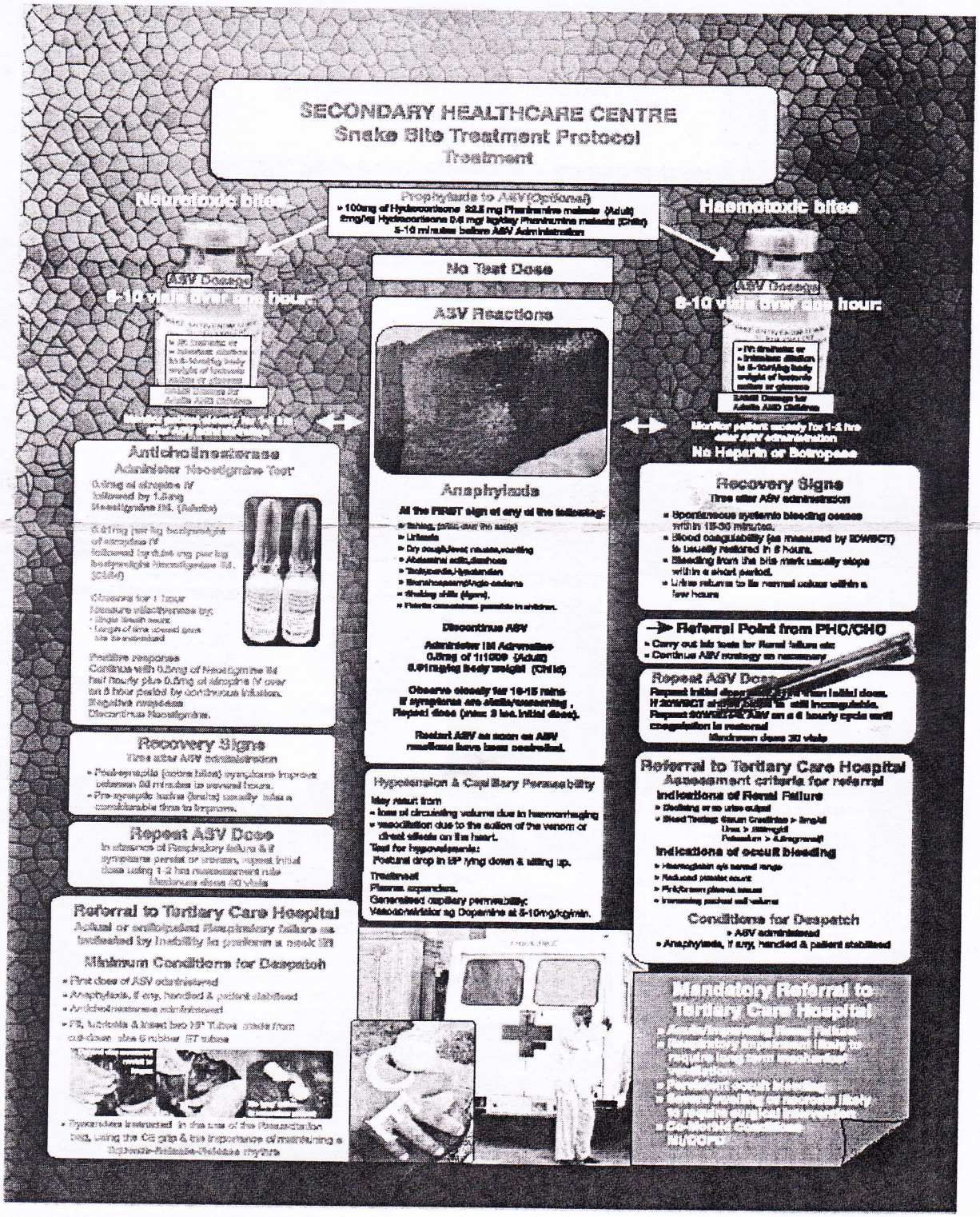
    Some primary centres already possess oxygen cylinders. For example, many of the Indian PHCs are equipped with a 40cft cylinder. This can be used not only for application of oxygen to a victim but newer equipment is becoming available that enables the cylinder to power a gas ventilator.

  - **Airway Support Equipment**
    - Laryngeal tube / LMA
    - Nasopharyngeal Airways (These can be improvised using size 5 Endotracheal Tubes cut to the required length
    - Endo Tracheal tubes
    - Laryngoscope
    - Suction equipment
  - **Stryker Intra-compartmental Pressure Monitoring Equipment.**

## Annexure-IV




| Symptom/Response | Cobras | Kraits | Russells Viper | Saw Scaled Vipers | Hump Nosed Pit Viper |
|---|---|---|---|---|---|
| Local Pain/ Tissue Damage | YES | NO | YES | YES | YES |
| Ptosis/ Neurological Signs | YES | YES | YES! | NO | NO |
| Haemostatic abnormalities | NO | NO! | YES | YES | YES |
| Renal Problems | NO | NO | YES | NO | YES |
| Response to Neostigmine | YES | NO! | NO! | NO | NO |
| Response to ASV | YES | YES | YES | YES | NO |


SECONDARY HEALTHCARE CENTRE
Snake Bite Treatment Protocol
Treatment
Prophylaxis to ASV(Optional)
Neurotoxic bites
Haematotoxic bites
No Test Dose
ASV Reactions
Anaphylaxis
Discontinue ASV
Anticholinesterase
Recovery Signs
Repeat ASV Dose
Hypotension & Capillary Permeability
Referral Point from PHC/CHC
Referral to Tertiary Care Hospital
Assessment criteria for referral
Indications of Renal Failure
Indications of occult bleeding
Conditions for Despatch
Minimum Conditions for Despatch
Mandatory Referral to Tertiary Care Hospital

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# TERTIARY HEALTHCARE CENTRE
## Snake Bite Treatment Protocol
### Arrival & Diagnosis

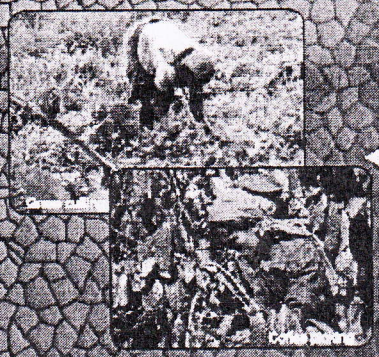
**Stabilise**

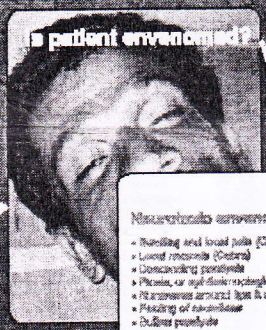
- Deal with life threatening symptoms ABC -Airway, Breathing and Circulation
- Tetanus Toxoid if bite has broken skin
- Use Paracetamol for Pain: NO Aspirin
- Remove any tourniquets WITH CARE

**Investigate**

- Exact time of bite.
- Precise activity when bitten
- First Aid/Traditional treatment administered
- Description/name of snake responsible
- Administer 20 WBCT

**Diagnose**

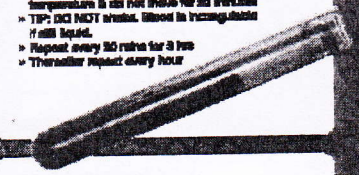




**Is patient envenomated?**

**20 Minute Whole Blood Clotting Test**

- Using new, clean & dry 5-10ml vessel
- Put in a few mls of venous blood, keep at ambient temperature & do not move for 20 minutes
- TIP: DO NOT shake. Blood is incoagulable if still liquid.
- Repeat every 30 mins for 3 hrs
- Thereafter repeat every hour



**Other Useful Tests**

- Haemoglobin/ PCV/ Platelet Count
- Peripheral Smear
- Urine Tests for Haemoglobin/ Myoglobinuria
- Biochemistry for Serum Creatinine/ Urea/ Potassium
- Oxygen Saturation

**Signs of Envenomation**

**Neurotoxic envenomation**

- Swelling and local pain (Cobra)
- Local necrosis (Cobra)
- Descending paralysis
- Ptosis, or eye movement palsy
- Numbness around lips & mouth
- Feeling of heaviness
- Diffuse myalgia
- Respiratory failure
- Paralytical aspiration
- Fasciculations, severe vomiting (rare)
- Abdominal pain (rare)

**Anti Haemostatic ( Viper) envenomation**

- Swelling & local pain (but not always)
- Spontaneous systemic bleeding
- Tender enlargement of local lymph nodes
- Bleeding from the gingival cuticle
- Epistaxis
- Skin & mucous membranes may show evidence of petechiae, ecchymoses
- Abdominal tenderness: possible gastro-intestinal or retro peritoneal bleeding
- Lateralising neurological symptoms e.g. asymmetrical pupils (intra-cranial bleeding?)
- Loin pain, indicative of early renal failure.
- Passing of reddish or dark-brown urine
- Shock
- Hypotension

**Late Onset Envenoming**

Symptoms may sometimes not manifest until 6-12 hrs after bite.

Possible in cases of Humpnosed Pit Viper, Mamba or Juvenile snake bites

**Does patient need ASV to neutralise unbound, free flowing venom?**

NO

YES

**No Sign of Envenomation**

- Snake is non-venomous
- 70% of all bites

- Bite is "dry"-
- 50% of all venomous bites

**Discharge after Observation for 24 hrs from bite.**

**Criteria for ASV Administration**

**Systemic envenoming**

- Incoagulable blood (20WBCT)
- Spontaneous current systemic bleeding
- Neurotoxic signs: ptosis, external ophthalmoplegia, muscle paralysis
- Respiratory impairment

**Local envenoming**

- Severe, current swelling of more than half of the bitten limb (in the absence of a tourniquet for 1 hour or more)
- Swelling after bites on the digits from known necrotic species
- Rapid current extension of swelling beyond a joint

NO

**Are Criteria met?**

YES

**Treatment Poster**

**Guide to Symptoms by Species**

| Symptom/Response | Cobras | Mambas | Russell's Viper | Saw Scaled Vipers | Hump Nosed Pit Viper |
|---|---|---|---|---|---|
| Local Pain/ Tissue Damage | YES | NO | YES | YES | YES |
| Ptosis/ Neurological Signs | YES | YES | YES! | NO | NO |
| Haemostatic abnormalities | NO | NO! | YES | YES | YES |
| Renal Problems | NO | NO | YES | NO | YES |
| Response to Neostigmine | YES | NO? | NO? | NO | NO |
| Response to ASV | YES | YES | YES | YES | NO |

**NO ASV FOR CONFIRMED HUMP NOSED PIT VIPER BITES**

Refer to Tertiary Care Hospital

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# TERTIARY HEALTHCARE CENTRE
## Snake Bite Treatment Protocol
### Treatment

**Prophylaxis to ASV(Optional)**
» 100mg of Hydrocortisone 22.5 mg Pheniramine maleate (Adult)
5mg/kg Hydrocortisone 0.6 mg/kg/day Pheniramine maleate (Child)
5-10 minutes before ASV Administration

**Neurotoxic bites**

ASV Dosage

8-10 vials over one hour

» IV: Undiluted or
» Intravenous dilution in 5-10ml/kg body weight of isotonic saline or glucose

Equal Dosage for Adults AND Children

Monitor patient closely for 1-2 hrs after ASV administration

**Haemotoxic bites**

ASV Dosage

8-10 vials over one hour

» IV: Undiluted or
» Intravenous dilution in 5-10ml/kg body weight of isotonic saline or glucose

Equal Dosage for Adults AND Children

Monitor patient closely for 1-2 hrs after ASV administration

**No Heparin or Botropase**

**No Test Dose**

## Anticholinesterase
### Administer Neostigmine Test

0.6mg of atropine IV
followed by 1.5mg
Neostigmine IM. (Adults)

0.01mg per kg bodyweight of atropine IV
followed by 0.04 mg per kg bodyweight Neostigmine IM. (Child)

Observe for 1 hour
Measure effectiveness by:
- Single breath count
- Length of time unaided gaze can be maintained

Positive response
Continue with 0.6mg of Neostigmine IM half hourly plus 0.6mg of atropine IV over an 8 hour period by continuous infusion.
Negative response
Discontinue Neostigmine.

## Recovery Signs
Time after ASV administration

- Post-systemic (bodily bites) symptoms improve between 30 minutes to several hours.
- Pre-synaptic (cobra bites) symptoms usually take a considerable time to improve.

## Repeat ASV Dose

In absence of Respiratory failure & if symptoms persist or worsen, repeat initial dose using 1-2 hrs commencement rule

Maximum dose 20 vials

## Referral Point from PHC/CHC & Secondary Care Hospital

» Check no. of ASV doses administered
» Maximum 20 Vials ASV per patient
» Ventilate & ventilate on Respiratory Support until Recovery

## ASV Reactions

## Anaphylaxis

**At the FIRST sign of any of the following:**
» Itching, rashes over the body
» Urticaria
» Dry cough,chest nausea,vomiting
» Abdominal colic,diarrhoea
» Tachycardia,Hypotension
» Bronchospasm/Angio-oedema
» Shaking chills (rigors),
» Febrile convulsions possible in children.

**Discontinue ASV**

**Administer IM Adrenaline**
**0.3mg of 1:1000 (Adult)**
**0.01mg/kg body weight (Child)**

**Observe closely for 10-15 mins**
**If symptoms are stable/worsening ,**
**Repeat dose (once 2 hrs. initial dose).**

**Restart ASV as soon as ASV reactions have been controlled.**

## Hypotension & Capillary Permeability

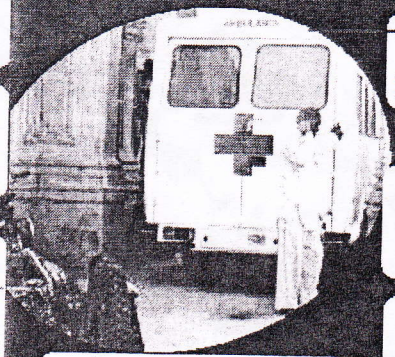
May result from
» loss of circulating volume due to haemorrhaging
» vasodilation due to the action of the venom or direct effects on the heart.

Test for hypotensionin:
Postural drop in BP lying down & sitting up.

Treatment
Plasma expanders.
Generalised capillary permeability:
Vasoconstrictor eg Dopamine at 5-10mg/kg/min.

## Recovery Signs
Time after ASV administration

- Spontaneous systemic bleeding ceases within 15-30 minutes.
- Blood coagulability (as measured by 20WBCT) is usually restored in 6 hours.
- Bleeding from the bite mark usually stops within a short period.
- Urine returns to its normal colour within a few hours



**Referral Point from PHC/CHC & Secondary Care Hospital**
» Carry out lab tests for Renal failure etc
» Continue ASV strategy as necessary

## Repeat ASV Dose

**Repeat initial dose after 6 hrs from initial dose. If 20WBCT shows blood is still incoagulable. Repeat 20WBCT & ASV on a 6 hourly cycle until coagulation is restored**

Maximum dose 20 vials

## Surgical Intervention

» Debridement of necrotic tissue
» Fasciotomy:
Pain on passive stretching, or out of proportion, Pulselessness, Pallor, Paraesthesia, Paralysis with significant swelling in the limb
AND Intracompartmental pressure above 40 mm of mercury

With Fasciotomy shock and recovery or reduce may never occur.

## Assessment Criteria

### Indications of Renal Failure
» Declining or no urine output
» Blood Testing: Serum Creatinine > 3mg/dl
Urea > 200mg/dl
Potassium > 6.5mg/mmol

### Indications of occult bleeding
» Haemoglobin are normal range
» Reduced platelet count
» Prothrombin plasma values
» Increasing packed cell volume

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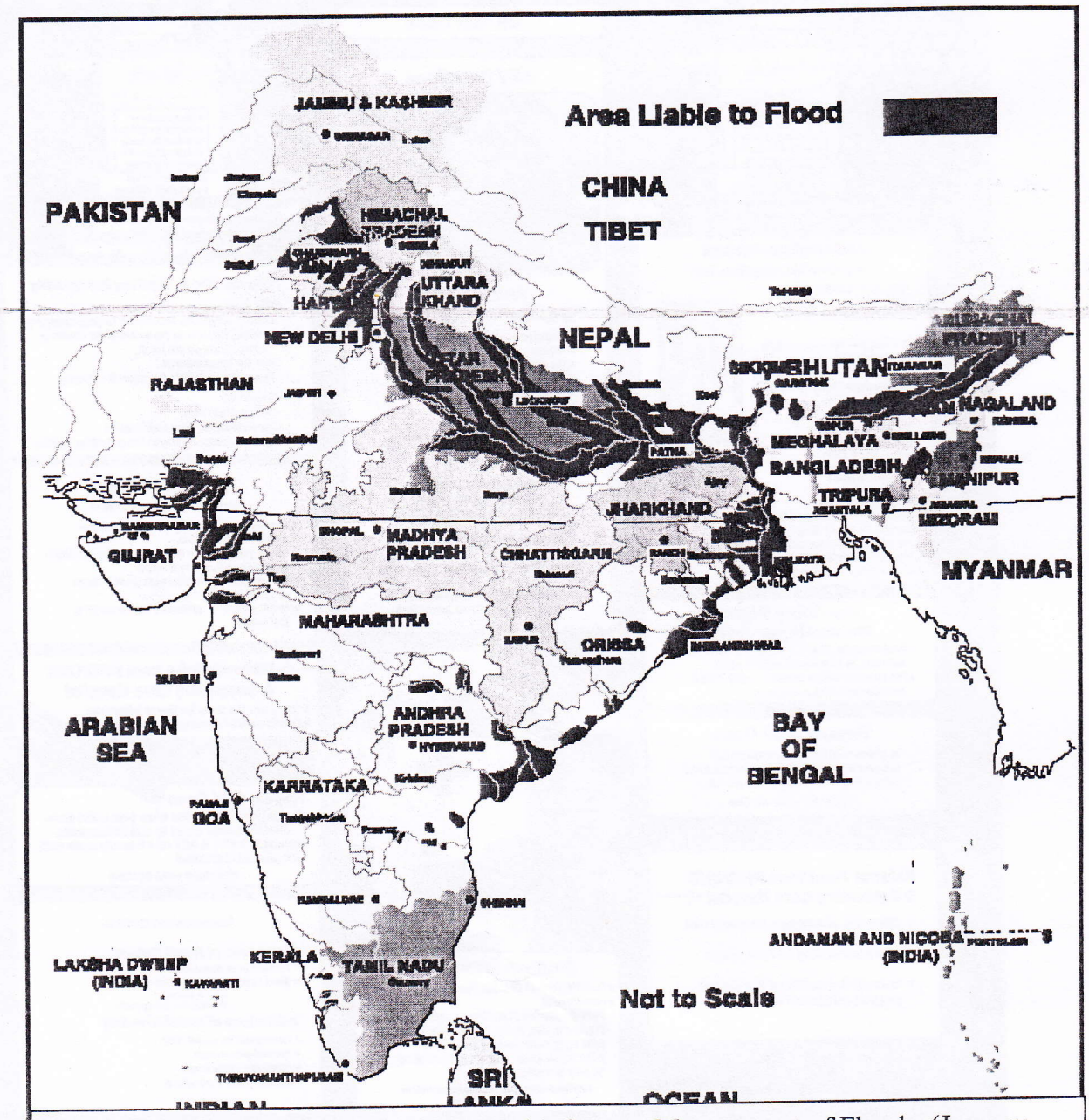
Annexure-V

## Vulnerability mapping of India

# AREA LIABLE TO FLOODS




Source: National disaster Management Guidelines on Management of Floods, (January 2008), National Disaster Management Authority, Government of India

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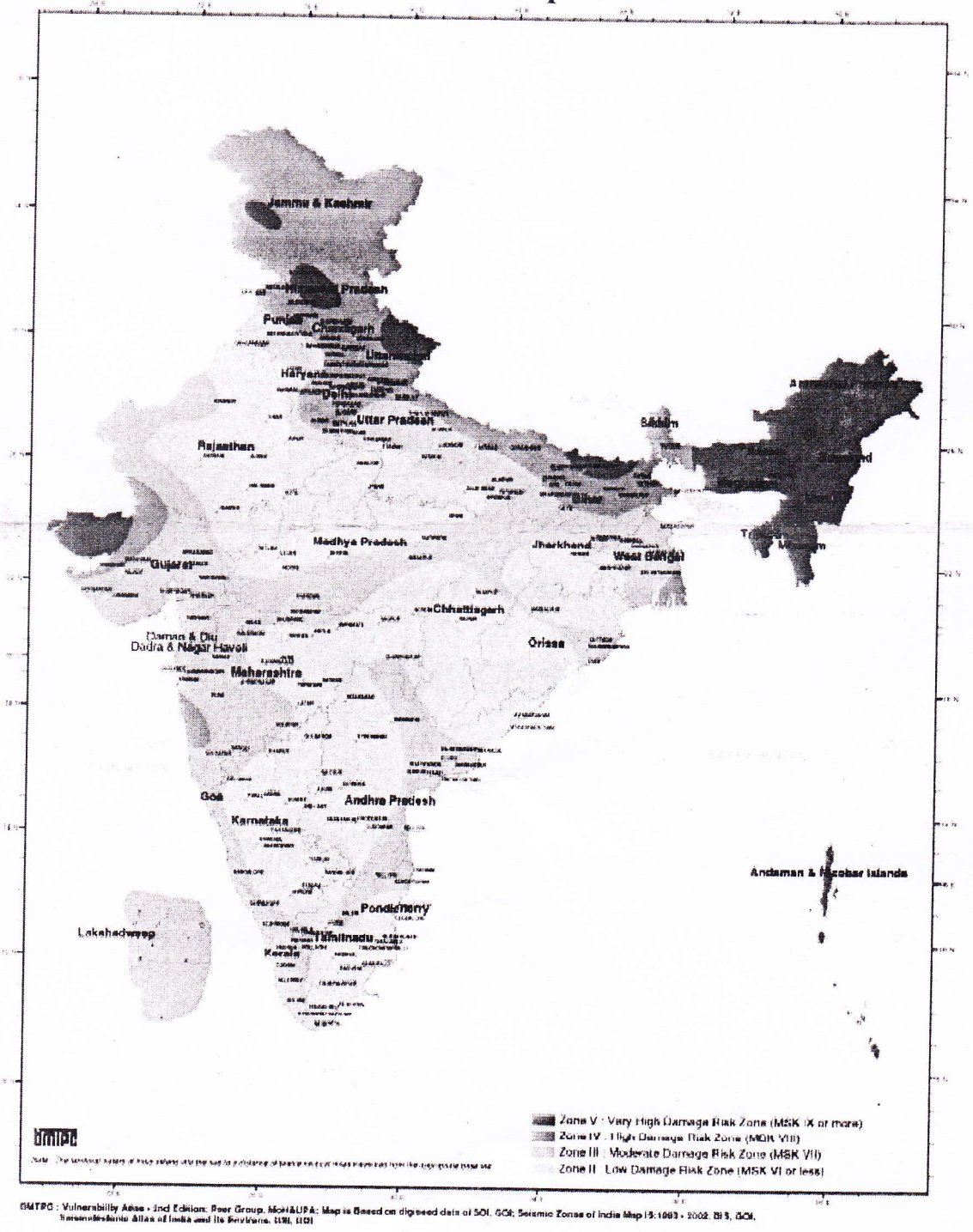
# Seismic Zone Map of India




Source: National disaster Management Guidelines on Management of Earthquakes, (April, 2007), National Disaster Management Authority, Government of India

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## SECTION-11

# APPENDICES

# Appendix 1

## First Aid References

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