

CLINICAL PRACTICE GUIDELINES

Management of Snake Bites

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1. Introduction

There is extensive evidence that management, mainly treatment to target of diabetes improves immediate Snake bite is a common medical problem in Sri Lanka. Hospital admissions due to snakebite have increased over the years reflecting the acceptance of allopathic management and treatment of these bites, as a result of energetic health educational programmes.

However, the lack of consensus on management issues in a hospital setting has been a major concern. The feed back and discussions we had with doctors during our outreach seminars conducted across the length and breadth of this country over the few years have confirmed these impressions.

The need for practical guidelines to be used by hospital doctors who commonly encounter the problem of snakebite has been amply demonstrated.

Clinicians have been grappling with a major problem for decades - How best to use antivenom serum (AVS).

These guidelines contain a section on the selection of patients for AVS therapy. We hope this would prevent the injudicious and inappropriate over-use of AVS. The judicious use of AVS will not only result in enormous cost reduction of therapy but will also prevent exposing patients to the risks of AVS use. We have also highlighted simple practical steps designed to increase the safety of the currently available AVS that could be followed in any hospital setting.

We no longer advocate the killing of snakes.

Experienced physicians are capable of taking crucial management decisions, even when the offending snake is not brought to hospital. Their experience and knowledge is embodied in these guidelines for intelligent application: not having the offending snake at hand, whether dead or alive, is no longer a bar to rational management of snakebite.

2. Occupational categories more vulnerable to snake bites

- Farmers
- Plantation workers (Rubber, Coffee)
- Herdsmen
- Hunters
- Snake handlers (Snake charmers and snake restaurants and traditional Chinese pharmacies)
- Fishermen and fish farmers
- Sea snake catchers (for sea snake skins, leather)

3. Prevention of snakebites

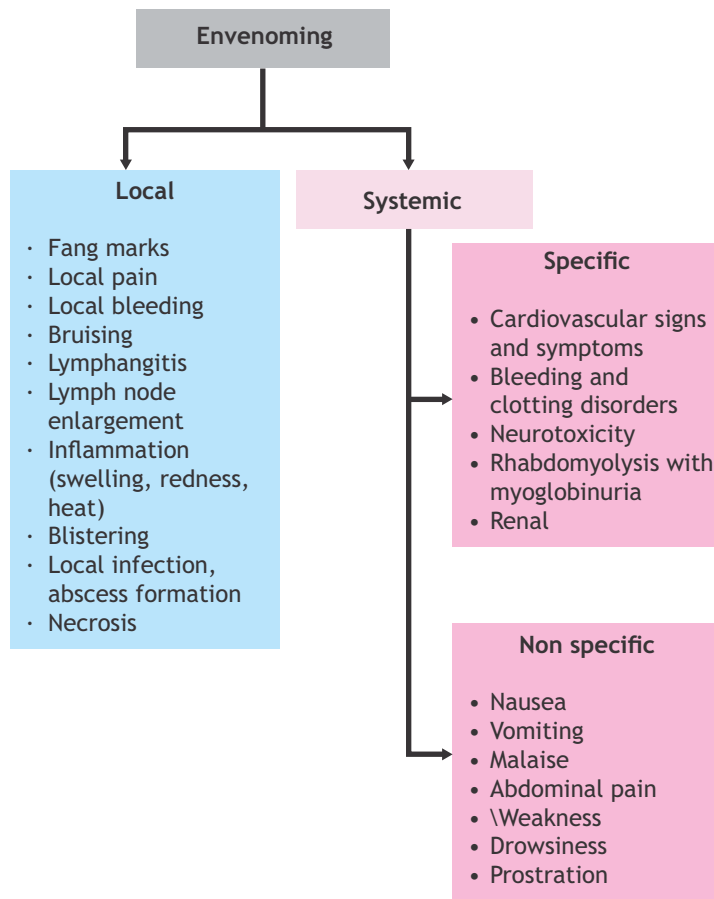
Snakebite is an occupational hazard that is very difficult to avoid completely. However, attention to the following recommendations might reduce the number of accidents.

Recommendations

- 3.1 Education! Know your local snakes, know the sort of places where they like to live and hide, know what time of the year, at what time of the day / night or in what kind of weather they are most likely to be active.
- 3.2 Be especially vigilant about snakebites after rains, during flooding, harvest time and night.
- 3.3 Try to wear proper shoes or boots and long trousers, especially when walking in the dark or in undergrowth.
- 3.4 Use a light (torch, flashlight or lamp) when walking at night
- 3.5 Avoid snakes as far as possible, including snakes performing for snake charmers. Never handle, threaten or attack a snake and never intentionally trap or corner a snake in an enclosed space.
- 3.6 If at all possible, try to avoid sleeping on the ground.
- 3.7 Keep young children away from areas known to be snake infested.
- 3.8 Avoid or take great care handling dead snakes, or snakes that appear to be dead.
- 3.9 Avoid having rubble, rubbish, termite mounds or domestic animals close to human dwellings, as all of these attract snakes.

- 3.10 Frequently check houses for snakes and, if possible, avoid types of house construction that will provide snakes with hiding places (e.g. thatched roofs with open eaves, mud and straw walls with large cracks and cavities, large unsealed spaces beneath floorboards.)
- 3.11 To prevent sea snake bites, fishermen should avoid touching sea snakes caught in nets and on lines. The head and tails are not easily distinguishable. There is a risk of bites to bathers and those washing clothes in muddy water of estuaries, river mouths and coastlines.

4. Signs of envenoming



5. Conditional identification of venomous snakes

5.1 On epidemiological features

5.1.1 Site of bite

- Fingers & hand, ankle & foot: Saw-scaled & hump-nosed vipers
- Elbow & below, knee & below: Cobra, Russell's viper
- Head to toe: Krait

5.1.2 Time of bite

- Most Krait bites happen between 10 pm and 6am while sleeping indoor

5.1.3 Season of bite

- Krait bites: Low incidence in December to April. High incidence in May to November

5.1.4 Circumstances of bite

- Paddy fields, roads, footpaths at dawn and dusk: Russell's viper
- Victims sleeping on the floor at night: Krait
- Near bodies of water or inside dwellings: Cobra

5.2 On clinical features

5.2.1 Russell's Viper

- Local swelling
- Neurotoxicity (ptosis, external ophthalmoplegia)
- Coagulopathy (dark urine, prolonged clotting time, incoagulable blood)
- Myotoxicity (myalgia, tender muscles, rhabdomyolysis)
- Acute renal failure

5.2.2 Cobra

- Local swelling, tissue necrosis
- Neurotoxicity (ptosis, external ophthalmoplegia, respiratory paralysis, limb paralysis, coma)
- No coagulopathy

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5.2.3 Krait

- Neurotoxicity (ptosis, external ophthalmoplegia, respiratory paralysis, limb paralysis, coma)
- No local effects
- No coagulopathy

5.2.4 Hump- nosed viper

- Local swelling, haemorrhagic blisters
- Coagulopathy (red urine, spontaneous bleeding, incoagulable blood on 20 WBCT)
- Acute renal failure

5.2.5 Saw - Scaled viper

- Local swelling
- Coagulopathy (incoagulable blood on 20WBCT)

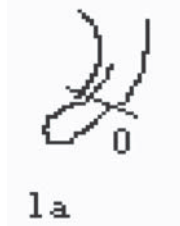
See the algorithm on Clinical Syndromic approach (annexure 1)

6. Identification of venomous snakes

Do not handle live snakes. Handle 'dead' snakes with care as they may not be dead and even if dead, they are capable of inflicting a reflex bite

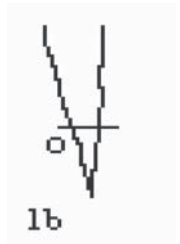
1a - Tail flattened, paddle-like, tip rounded

Sea snakes



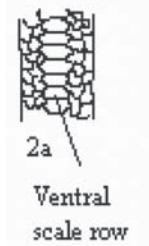
1b - Tail conical, round in section, tip pointed

Land Snakes



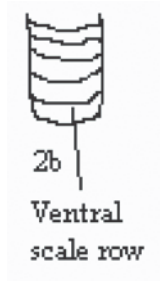
2a - Ventral scales do not extend the full width of the body

Non-venomous snakes



2b - Ventral scales extend the full width of the body

Venomous and non venomous snakes



3a - Head triangular, neck well defined..... Go to 4 below

Vipers (and cat snakes)



3b - Head ovate, neck not well defined Go to 7 below

Cobra, kraits (and others)



4a - Bright green with black markings, head scales small, similar to body

Scales, a pit present between the eye and the nostril (loreal pit)

Green pit-viper



4b - Shades of brown, various patterns, head scales small or largeGo to 5

5a - Scales on head large, snout upturned, a loreal pit present

Hump-nosed viper



5b - Scales on head small, similar to body scales ...Go to 6

6a - Edges of body scales saw-toothed, light brown with white dagger mark on head and white wavy lines on sides of body

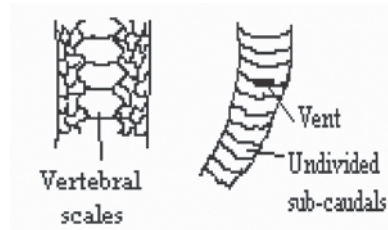
Saw-scaled viper

6b - Edges of body scales not saw-toothed, three longitudinal rows of chocolate-brown oval patches along the body, each outlined with black and yellow. Edges of body scales are not saw-toothed.

Russell's viper

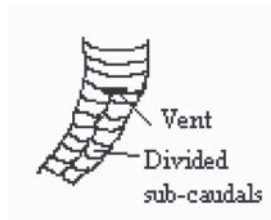
7a - Vertebral scale row (mid-back) enlarged and polygonal, sub-caudal scales are (those posterior to the vent) undivided; glossy black or brownish-black with white cross-bars

Kraits



7b - Vertebral scale row not enlarged, sub-caudals divided, golden-brown with white speckles, neck expansible in to a hood

Cobra



7. Management of snake bites

Management plan

- First aid
- Admit and Reassure
- Rapid clinical assessment and if necessary, resuscitate
- Assess for signs of envenoming and do detailed clinical assessment
- Investigations and laboratory tests
- Identify the snake. It will help with decisions regarding AVS administration and vigilance and preparedness regarding complications
- Commence tetanus prophylaxis.
- Commence Anti venom serum administration and monitor the response
- Management of special problems
- Treatment of the bitten part

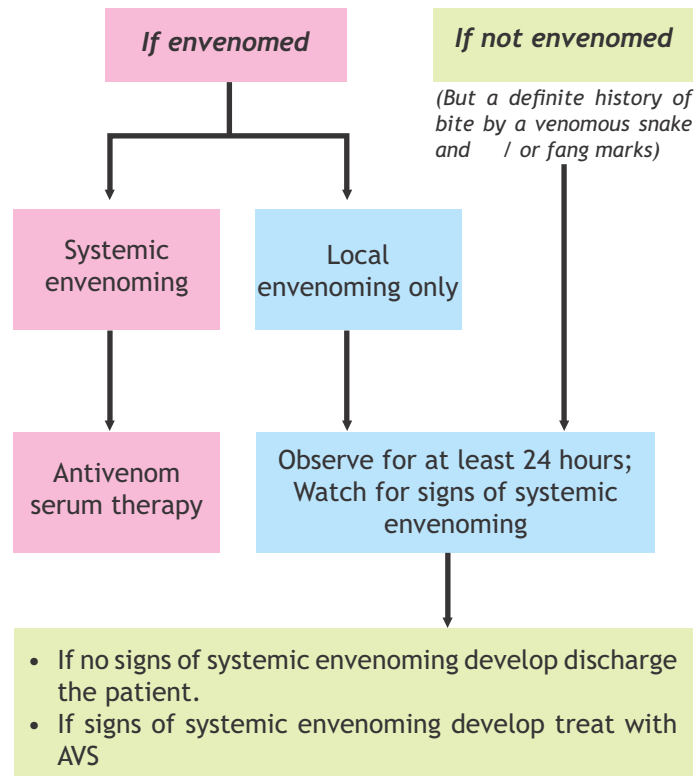
Monitoring

1. Level of consciousness
2. Pulse rate
3. Blood pressure
4. Respiratory rate & tidal volume
5. Temperature
6. Urine output and fluid balance

Avoid (Whenever possible)

- NSAIDs, including aspirin
- Intramuscular injections, including penicillin, tetanus booster on admission
- Concurrent administration of sera, other than anti-venom serum, that may produce anaphylaxis
- Narcotics and other respiratory depressants

Patient with a suspected snakebite



7.1 First aid

First aid is carried out immediately or very soon after the bite. It can be performed by the snake bite victim himself/herself or by anyone else who is present.

Aims of first aid

1. Attempt to retard systemic absorption of venom
2. Preserve life and prevent complications before the patient can receive medical care
3. Control distressing and dangerous early symptoms of envenoming
4. Arrange transport of the patient to a place where medical care is available

5. ABOVE ALL, DO NO HARM

Most traditional first aid methods should be discouraged; they do more harm than good.

Recommended first aid methods

- Reassure the victim who may be very anxious.
- Immobilize the bitten limb with a splint or sling as any movement or muscular contraction increases absorption of venom into the blood stream and lymphatic system.
- Consider pressure immobilization for some elapid bites.
- Avoid any interference with the bite wound as this may introduce infection, increase absorption of the venom and increase local bleeding.

Arterial tourniquets are not recommended

Transport to hospital

Patient must be transport to a place where they can receive medical care (dispensary or hospital) as quickly, but safely and comfortably as possible. Any movement, but especially movement of the bitten limb must be reduced to an absolute minimum to avoid increasing the systemic absorption of venom. Any muscular contraction will increase this spread of venom from the site of the bite.

7.2 Admit and reassure

Patient should be seen and assessed by doctors and nurses as soon as possible and patient should be reassured as most of the patients are frightened after a snake bite.

7.3 Rapid clinical assessment; if necessary, resuscitate the patient

Airway - Maintain and clear airway

Breathing - Assess and support:
Ventilate with Ambu bag and mask, or endotracheal tube

Circulation - Assess and support
Establish IV access
Infuse normal saline (20ml/kg body weight / IV bolus)
Check the BP. Repeat the same once

7.4 Assess for signs of envenoming and detailed clinical assessment

Early clues that a patient has severe envenoming;

- Snake identified as a very dangerous one
- Rapid early extension of local swelling from the site of bite
- Early tender enlargement of local lymph nodes,
 - indicating spread of venom in the lymphatic system
- Early systemic symptoms:
 - Collapse (hypotension, shock), nausea, vomiting
 - Diarrhoea, severe headache, 'heaviness' of eye lids, Inappropriate (pathological) drowsiness, Early ptosis / ophthalmoplegia
- Early spontaneous systemic bleeding
- Passage of dark brown urine

7.4.1 Examination of the bitten part

Extent of swelling, tenderness, local lymph node enlargement, blistering, etc should be noted

7.4.2 General examination

Pulse rate and blood pressure (look for postural drop)

Skin and mucous membranes for evidence of petechiae, purpura, ecchymoses

Abdominal tenderness may be due to abdominal and retroperitoneal bleeding

Loin pain and tenderness may be due to acute renal ischemia (Russell's viper bites)

7.4.3 Neurotoxic envenoming

Check eye movements: look for early external ophthalmoplegia

Pupil-size and reaction

Other motor cranial nerve examination: facial muscles, tongue, gag reflex

"Broken neck sign": muscles flexing the neck may be paralyzed

7.4.4 Bulbar and respiratory paralysis

Can the patient swallow?

Paradoxical respiration

Measurement of ventilatory capacity using Spirometer to measure ventilation TV/ VC

7.4.5 Generalized rhabdomyolysis

Occurs due to Russell's viper and sea snake bites. It is suspected by muscle tenderness. The tenderness is seen on active and passive movements and later the limb may become paralyzed

7.4.6 Examination of the pregnant women

There will be concern about fetal distress (revealed by fetal bradycardia), vaginal bleeding and threatened abortion. Monitoring of uterine contractions and fetal heart rate is useful. Lactating women who have been bitten by snakes should be encouraged to continue breast feeding.

7.5 Investigations and laboratory tests

7.5.1 20 minute whole blood clotting test (20WBCT)

This very useful and informative bedside test requires very little skill and one piece of apparatus - A new, clean, dry, glass vessel

20 minute whole blood clotting test (20WBCT)

- Place a few milliliters of freshly sampled venous blood in a small glass vessel
- Leave undisturbed for 20 minutes at ambient temperature
- Tip the vessel once
- If the blood is still liquid (unclotted) and runs out, the patient has hypofibrinogenaemia (“incoagulable blood”) as a result of venom induced consumption coagulopathy
- If there is any doubt, repeat the test in duplicate, including a “control” (blood from healthy person)
- Warning! If the vessel used for the test is not made of ordinary glass, or if it has been used before and cleaned with detergent, its wall may not stimulate clotting of the blood sample in the usual way and test will be invalid

7.5.2 Other tests

- Haemoglobin concentration and haematocrit
- Platelet count
- White blood cell count
- Blood film
- Biochemical tests (muscle enzymes, liver function, Serum creatinine, blood urea, serum potassium)
- Urine examination (red cells, proteinuria, etc)

7.6 Identify the snake

If the dead snake has been brought, it can be identified. Otherwise, the species responsible can be inferred indirectly from the patient's description of the snake and the clinical syndrome of signs and symptoms.

See above (6)

7.7 Commence Anti venom serum administration and monitor the response

Antivenom is the only specific antidote to snake venom. The most important decision in the management of a snake bite victim is whether or not to give antivenom.

IF SYSTEMIC ENVENOMING IS PRESENT

7.7.1 Commence anti-venom serum (AVS) therapy immediately for the bites of:

- Russell's viper
- Cobra
- Common Krait (Sri Lankan krait - cross reactivity)
- Saw-scaled viper

7.7.2 No AVS therapy for bites of:

- Hump nosed viper (even if severe local swelling is present)
- Green pit viper
- Sea snakes

It is never too late to give AVS provided the indications are present

Give it **only** if features of **systemic** envenoming are present for bites of

- Russell's viper
- Cobra
- Common Krait (Sri Lankan krait - cross reactivity)
- Saw-scaled viper

Do not give for local envenoming alone

Do not give for bites of

- Hump nosed viper (even if severe local swelling is present)
- Green pit viper
- Sea snakes

7.7.3 AVS THERAPY

- Commence AVS as soon as systemic envenoming has been detected
- Dose: 100 ml (10 ampoules) of Indian polyspecific AVS in 200 ml of normal saline infused intravenously over one hour
- In Viper bites - AVS may be repeated in 6 hours if coagulopathy persists or bleeding
- In Cobra & Krait bites - Usually one dose of AVS is sufficient unless there is clinical evidence of progression of neurological deficits or deteriorating neurotoxicity
- Local administration of antivenom at site of bite is not recommended.

7.7.4 Different routes of administration

Antivenom should never be given intramuscularly if it can be given intravenously

7.7.5 Observation of the response to antivenom

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

- General: the patient feels better. Nausea, headache and generalized aches and pains may disappear very quickly. This may be partly attributable to a placebo effect.
- Spontaneous systemic bleeding (e.g. from the gums) usually stops within 15-30 minutes.
- Blood coagulability (as measured by 20WBCT) is usually restored in 3-9 hours. Bleeding from new and partially healed wounds usually stops much sooner than this.
- In shocked patients, blood pressure may increase within the first 30-60 minutes and arrhythmias such as sinus bradycardia may resolve.
- Neurotoxic envenoming of the post-synaptic type (Cobra bites) may begin to improve as early as 30 minutes after antivenom, but usually take several hours. Envenoming with presynaptic toxins (Kraits and sea snakes) is unlikely to respond in this way.
- Active haemolysis and rhabdomyolysis may cease within a few hours and the urine returns to its normal colour.

In Viper bites, monitor the efficacy of AVS by repeatedly performing the 20 minute whole blood clotting test (20WBCT) at the bedside

- Initially at the start of AVS therapy
- Repeat in 6 hours if the blood does not clot in 20 minutes, repeat AVS infusion and perform 20WBCT 6 hours later
- Continue the cycle till the blood clots

7.7.6 Recurrence of systemic envenoming

In patients envenomed by Vipers, after an initial response to antivenom (cessation of bleeding, restoration of blood coagulability), signs of systemic envenoming may recur within 24-48 hours.

This is attributable to:

- Continuing absorption of venom from the “depot” at the site of the bite, perhaps assisted by improved blood supply following correction of shock, hypovolaemia etc, after elimination of antivenom (range of elimination half-lives: IgG 45 hours; F(ab)² 80-100 hours; Fab 12-18 hours);
- A redistribution of venom from the tissues into the vascular space, as a result of antivenom treatment.

Recurrent neurotoxic envenoming after treatment of Cobra bites has also been described

If the blood remains incoagulable, (as measured by 20WBCT) six hours after the initial dose of antivenom, the same dose should be repeated. This is based on the observation that, if a large dose of antivenom (more than enough to neutralize the venom procoagulant enzymes) is given initially, the time taken for the liver to restore coagulable levels of fibrinogen and other clotting factors is 3-9 hours.

In patients who continue to bleed briskly, the dose of antivenom should be repeated within 1-2 hours.

In case of persistent cardiovascular signs, the initial dose of antivenom should be repeated after 1-2 hours, and full supportive treatment must be considered.

7.7.7 Conservative treatment when no antivenom is available

The following conservative measures are suggested:

Neurotoxic envenoming with respiratory paralysis: Assisted ventilation. This has proved effective, and has been followed by complete recovery, even after being maintained for periods of more than one month. Manual ventilation (anaesthetic bag) by relays of doctors, medical students, relatives and nurses has been effective where no mechanical ventilator was available.

Haemostatic abnormalities: Strict bed rest to avoid even minor trauma; transfusion of clotting factors and platelets; ideally, fresh frozen plasma and cryoprecipitate with platelet concentrates or, if these are not available, fresh whole blood should be given. Intramuscular injections should be avoided.

Shock, myocardial damage: Hypovolaemia should be corrected with colloid/crystalloids and controlled by observation of the central venous pressure. Ancillary pressor drugs (dopamine or epinephrine-adrenaline) may also be needed. Patients with hypotension associated with bradycardia should be treated with atropine.

Renal failure: conservative treatment or dialysis.

Dark brown urine (myoglobinuria or haemoglobinuria): correct hypovolaemia and acidosis and consider a single infusion of mannitol (Forced Alkaline diuresis)

Severe local envenoming: local necrosis, intracompartmental syndromes and even thrombosis of major vessels is more likely in patients who cannot be treated with antivenom. Surgical intervention may be needed but the risks of surgery in a patient with consumption coagulopathy, thrombocytopenia and enhanced fibrinolysis must be balanced against the life-threatening complications of local envenoming. Prophylactic broad spectrum antimicrobial treatment is justified.

7.7.8 Endpoint of AVS therapy

In Viper bites, the endpoint of AVS therapy is reversal of coagulopathy as determined by serial performance of 20WBCT.

Do not continue AVS administration for persistent neurotoxicity, provided the coagulopathy has been reversed

7.7.9 Contra indications to Anti venom therapy

There are no absolute contraindications, but those with atopic conditions and those who have reacted to horse or sheep serum in the past should be given antivenom only with signs of systemic envenoming

Snakes inject same amount of antivenom to both adults and children. Therefore children must be given the same dose as adults.

7.7.10 Antivenom reactions

This can be early (within a few hours) or late (5 days or more)

Early anaphylactic reactions:

Usually starts within 3 hours of starting treatment. The patient can develop urticaria, dry cough, fever, nausea, vomiting, abdominal colic, tachycardia and diarrhoea.

A minority can develop life threatening anaphylaxis with hypotension, angioedema and bronchospasm.

TREAT ANAPHYLAXIS IMMEDIATELY WITH

- Adrenaline: 0.5 ml of 1:1000 solution
 - If the patient is in shock and collapsed, give by injection intralingually through a 26 gauge needle (through the side or undersurface of the tongue)
 - If not in shock and collapsed, give by intramuscular injection
- Chlorpheniramine: 10 mg intravenously, If unavailable, give Promethazine 25 mg intravenously
- Hydrocortisone: 200 mg intravenously

Pyrogenic reactions:

Usually develop 1 to 2 hours after treatment. Fever with chills, vasodilatation and hypotension can be seen. Children may have febrile convulsions.

Treatment: Patient should be cooled physically and with antipyretics. Correct hypovolaemia with IV fluids

Late (Serum sickness type) reactions:

Develop 1 to 12 days after treatment. Clinical features include, fever, nausea, vomiting, diarrhoea, itching, recent urticaria, arthralgia, myalgia, lymphadenopathy, periarticular swellings, mononeuritis multiplex, proteinuria with immune complex nephritis and rarely encephalopathy.

Treatment: Serum sickness usually responds to a five day course of oral antihistamines. Those who are not responding in 48 hours should be given a 5 day course of prednisolone

7.8 Tetanus prophylaxis should be given before discharging the patient

7.9 Management of special problems

7.9.1 Acute Renal Failure

It is a major problem following Russell's Viper bites

Can be prevented

- by early use of AVS
- by ensuring good urine output in the first 24-48 hours
 - give adequate intravenous fluids
 - use intravenous furosemide and mannitol if necessary

Avoid king coconut water and fruit juices and Maintain accurate fluid balance charts

Treat with peritoneal dialysis or haemodialysis if acute renal failure sets in

7.9.2 Respiratory Failure

A major problem following krait bites. Consider,

- Ambu bag and mask ventilation
- IPPV via an endotracheal tube in an intensive care unit

Use bag and mask ventilation as an emergency measure. Transfer to a hospital with intensive care facilities.

If in need of prolonged ventilation:

- Intubate
- Ventilate with Ambu bag
- Accompany the patient

7.9.3 Bacterial infections

Infection at the time of the bite with organisms from the snake's venom and buccal cavity is a problem with some species. In this case, a prophylactic course of penicillin (or erythromycin for penicillin-hypersensitive patients) and a single dose of gentamicin or a course of chloramphenicol, together with a booster dose of tetanus toxoid is recommended. Interference with the wound (incisions made with an unsterilised razor blade/ knife etc) creates a risk of secondary bacterial infection and justifies the use of broad spectrum antibiotics (e.g. amoxycillin or a cephalosporin plus a single dose of gentamicin plus metronidazole).

7.9.4 Compartment syndrome and fasciotomy

The appearance of an immobile, tensely-swollen, cold and apparently pulseless snake-bitten limb may suggest to surgeons the possibility of increased intracompartmental pressure, especially if the digital pulp spaces or the anterior tibial compartment are involved. Swelling of envenomed muscle within such tight fascial compartments could result in an increase in tissue pressure above the venous pressure, resulting in ischaemia. However, the classical signs of an intracompartmental pressure syndrome may be difficult to assess in snake bite victims.

Criteria for fasciotomy in snake-bitten limbs

- Haemostatic abnormalities have been corrected (antivenom with or without clotting factors)
- Clinical evidence of an intracompartmental syndrome
- Intracompartmental pressure >40 mmHg (in adults)

7.10 Rehabilitation

Restoration of normal function in the bitten part after the patient has been discharged from hospital is not usually supervised. Conventional physiotherapy may well accelerate this process. In patients with severe local envenoming, the limb should be maintained in a functional position. For example, in the leg, equinus deformity of the ankle should be prevented by application of a back slab.

8. Sea snakes

8.1 Identification

The head is often small in comparison to the body, with a slender neck and forebody. The hindbody is heavy, deep and laterally compressed. The belly is V-shaped and belly scales vestigial or absent. Tail is short, laterally compressed and paddle-shaped with a rounded tip. Most are silvery in colour with dark bands and the back darker than the belly. The notable exception is the yellow bellied sea snake which is chocolate brown or black on the back with a bright yellow belly; the tail is patterned in the same colours.

They may be confused with Water snakes washed out to sea from rivers. In fresh water snakes the belly is rounded and belly scales large (except *Acrochordus*). Tail is not paddle-shaped but usually conical tapering to a point. They are non-venomous and come in various colours usually none silvery with black bands.

Marine eels are types of fish possessing two pairs of nostrils, one pair being tubular. A gill opens on each side of the neck. Most have paired pectoral fins. Some have a dorsal fin and an anal fin confluent with the caudal (tail) fin. They don't have any scales. Some are silvery with black bands, resembling sea snakes.

Bites of sea snakes are painless with no local inflammation. Puncture marks with rapid onset of pain and inflammation could be due to a fish or sea urchin sting.

8.2 Signs of envenoming

- Stiffness
- Aching and pain on movement of the jaw, neck, trunk and limbs.

In serious envenoming, pain increases rapidly with muscle movement. Reluctance to move because of pain is followed by true paresis. Myoglobinuria turns the urine red-brown or black in colour.

8.3 Treatment

Specific therapy with sea snake antivenom is very effective and is indicated in serious envenoming.

This is **NOT AVAILABLE** in Sri Lanka.

Antivenom for land snakes should NOT be used for sea snake envenoming

Trivial envenoming: 10% of bite victims,

Presents with aching, stiffness and mild pain on muscle movement in the neck, trunk and limbs.

No treatment needed, resolution expected within 3 days.

Serious envenoming: 20% of bite victims.

Supportive treatment for:

Respiratory failure
Electrolyte disturbances, especially hyperkalaemia
Renal failure

Annexure

Patient presents with a Hx of snake bite BUT no dead snake and little / no description of the

