Introduction:

Snakebite cases are not unusual to ED visit across the globe. Snakebite is an acute life-threatening time limiting medical emergency. It is a preventable public health hazard often faced by rural population in tropical and subtropical countries with heavy rainfall and humid climate. Although death due to snakebite is disproportionately low to the number of total bites partly because of bite by a non-venomous breed or dry bite (bites not accompanied by the injection of venom). Over 3000 species of snakes have been identified worldwide, with nearly 800 species considered venomous. In Indian subcontinent there are more than two hundred species of snakes out of which only about one-third will be venomous.

The three major families of venomous snakes are the Elapidae, the Viperidae, and the Colubridae Hydrophidae (WHO 2010).

Elapidae (cobra, king cobra, krait, and coral snake): Neuroparalytic toxin.

Viperidae (vipers): Vasculotoxic – Hemotoxic – bleeding disorder

Hydrophidae (sea snake): Though venomous, they seldom bite. Neuroparalytic toxin.

Whatever be the venom status of the biting snake all cases of such bite should get treated in a health care facility.

First aid and Transport of the victim

It aims to retard systemic absorption of venom and to prevent systemic effect of venom. It should be initiated as soon as the victim realizes about the bite before shifting to nearest medical facility. It is not mandatory to look for a fan mark to establish authentication of a bite.

Reassurance of the victim is important as it will ease the patient's mental stress. Another important step in the pre-hospital setting is to immobilize the affected limb like in a case of a bone fracture. Any available rigid object can be used as a splint and to be tied with a roller bandage or a cloth. Nothing should be given orally. Traditional measures like tying a tourniquet or cutting and suctioning in an attempt to drain venom is to be discouraged. Patient should not be allowed to walk/run but should be passively transported as it will cause increased circulatory distribution of the venom. For every intervention adopted vital time should not be wasted.

Rapid clinical assessment and resuscitation

On arrival to the health care facility victim should be attended by a qualified physician with knowledge and experience to handle such cases. Many a times non-specific symptoms can lead to confusion because of anxious victim or bystanders. Definitive treatment with Anti-snake Venom (ASV) to be started as soon as signs of local/systemic envenomation begins. Hence knowledge of recognizing such signs and symptoms is necessary to efficiently treat such cases.

Symptomatic Patients

Neuroparalytic Venom mainly affects the neuro-muscular junction

Neuroparalytic snakebite patients present with typical symptoms within 30 min– 6 hours in case of Cobra bite and 6 – 24 hours for Krait bite. Although these time frame can vary significantly. These symptoms can be remembered as 5 Ds and 2 Ps.

5 Ds – Dyspnea, Dysphonia, Dysarthria, Diplopia, Dysphagia

2 Ps – Ptosis, Paralysis

Other signs are impending respiratory failure, diminished/lost tendon reflexes(DTR) and head lag.

Vasculotoxic toxidrome has both local and systemic manifestations. Locally there can be pain, swelling, blister formation or necrosis of the affected part. The swelling can be significant causing compartment syndrome. Hence surgical intervention is mandate early in the treatment as any delay can cause loss of the affected limb.

Systemic manifestation includes visible gingival bleed, epistaxis, ecchymosis, hematemesis, hemoptysis, hematochezia, sub-conjunctional bleed and bleeding from the bite mark per se. Acute abdominal pain can be attributed to gastro-intestinal or retro peritoneal bleed. Lateralizing neurological symptoms like asymmetrical pupils may point towards a Intra cranial bleed.

Life threatening complications are due to renal involvement. Patient presents with hematuria, hemoglobinuria, myoglobinuria followed by oliguria and anuria with acute kidney injury (AKI). Hypotension due to hypovolemia or vasodilatation or direct cardiotoxicity aggravates acute kidney injury. Long term sequelae e.g. pituitary insufficiency with Russell’s viper, Sheehan’s syndrome or amenorrhea in females.

Resuscitation and definitive urgent management should follow one the diagnosis is confirmed. The below mentioned are the red flag situations which require urgent resuscitation:

- Profound hypotension and shock resulting from direct cardiovascular effects of the venom or secondary effects such as hypovolemia, release of inflammatory vasoactive mediators, hemorrhagic shock or rarely primary anaphylaxis induced by the venom itself.
- Terminal respiratory failure from progressive neurotoxic envenoming that has led to paralysis of the respiratory muscles.
- Sudden deterioration or rapid development of severe systemic envenoming following the release of a tight tourniquet or compression bandage.
- Cardiac arrest precipitated by hyperkalemia resulting from skeletal muscle breakdown (rhabdomyolysis) after bites by sea snakes, certain kraits and Russell's vipers.
- If the patient arrives late: Late results of severe envenoming such as renal failure and septicemia complicating local necrosis.

A very simple diagnostic tool: 20 mins whole blood clotting test (20WBCT) can give clue of hemolytic nature of toxin and warrants initiation of Anti-Snake Venom.

Anti-snake Venom (ASV)

Anti-snake venom is available is most of the health care facility where snake bite is prevalent. There is no absolute contradiction to ASV. Whenever indicated ASV should be started as soon as possible in indicated cases and has to be given in appropriate quantity. Commercially available ASV may be monovalent or polyvalent. In India polyvalent variant is only available which is effective against four common species; Russell's viper, Common Cobra, Common Krait and Saw Scaled viper

ASV come in two forms: lyophilized powder and liquid. Lyophilized ASV is simply liquid ASV freeze-dried. Both the forms are equally potent in neutralizing venom. Advantage of lyophilized form against liquid is that the former has a longer shelf life and does not require a cold chain.

Dose of ASV:

ASV should be given only by the IV route, and should be given slowly, under supervision during the initial period to intervene immediately at the first sign of any reaction. The rate of infusion can be increased gradually in the absence of a reaction until the full starting

dose has been administered. ASV must never be given by the IM route because of poor bioavailability by this route. Snakes inject the same dose of venom into children and adults. Children must therefore be given exactly the same dose of antivenom as adults. Epinephrine (adrenaline) should always be drawn up in readiness before ASV is administered.

Total ASV requirement ranges from 10 to 25 vials.

For neuroparalytic snakebite – ASV 10 vials stat as infusion over 30 minutes followed by 2nd dose of 10 vials after 1 hour if no improvement within 1st hour.

For vasculotoxic snakebite – Two regimens low dose infusion therapy and high dose intermittent bolus therapy can be used. Low dose infusion therapy is as effective as high dose intermittent bolus therapy and also saves scarce ASV doses.

Low Dose infusion therapy – 10 vials for Russel's viper or 6 vials for saw scaled viper as stat as infusion over 30 minutes followed by 2 vials every 6 hours as infusion in 100 ml of normal saline till clotting time normalizes or for 3 days whichever is earlier.

Or

High dose intermittent bolus therapy – 10 vials of polyvalent ASV stat over 30 minutes as infusion, followed by 6 vials 6 hourly as bolus therapy till clotting time normalizes and/or local swelling subsides.

No ASV for Sea snakebite or pit viper bite as available ASV does not contain antibodies against them.

Adverse Anti Snake Venom Reactions Anaphylactic reaction to ASV is not managed correctly it can be treated in

an uncommon occurrence. However, if even remote health care facility. Early anaphylactic reactions occur within 10–180 min of start of therapy and is characterized by itching, urticaria, dry cough, nausea and vomiting, abdominal colic, diarrhea, tachycardia, and fever. Some patients may develop severe life-threatening anaphylaxis characterized by hypotension, bronchospasm, and angioedema.

Pyrogenic reactions usually develop 1–2 h after treatment. Symptoms include chills and rigors, fever, and hypotension. These reactions are caused by contamination of the ASV with pyrogens during the manufacturing process.

Late (serum sickness–type) reactions develop 1–12 (mean 7) days after treatment. Clinical features include fever, nausea, vomiting, diarrhea, itching, recurrent urticaria, arthralgia, myalgia, lymphadenopathy, immune complex nephritis and, rarely, encephalopathy.

At the first sign of a reaction we have to stop the ASV immediately. Administer Epinephrine (adrenaline) (1 in 1,000 solution, 0.5 mg (i.e 0.5 ml) in adults intramuscular over deltoid or over thigh; In children 0.01 mg/kg body weight) for early anaphylactic and pyrogenic ASV reactions. Ideally 2 syringes should be drawn up ready if the ASV is known to cause frequent reactions. Administer chlorpheniramine maleate 10 mg intravenously.

Late Serum sickness reactions can be easily treated with an oral steroid such as prednisolone, adults 5mg 6 hourly, oral H_1 antihistamines provide additional symptomatic relief.

Neurotoxic Envenomation

Antivenom treatment alone cannot be relied upon to save the life of a patient with bulbar and respiratory paralysis**.** 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 Russell 's viper. However, it is worth trying in these cases. In all cases of neurotoxic envenomation, the **"AN challenge Test"** to be undertaken: Atropine 0.6mg followed by neostigmine (1.5mg) to be given IV stat and repeat dose of neostigmine 0.5 mg with atropine every 30 minutes for 5 doses. A fixed dose combination of Neostigmine and glycopyrrolate IV can also be used. Thereafter to be given as tapering dose at 1 hour, 2 hour, 6 hours and 12 hour. Majority of patients improve within first 5 doses. Patient need observation closely for 1 hour to determine if the neostigmine is effective. After 30 minutes, any improvement should be visible by an improvement in ptosis. Positive response to "AN" trial is measured as 50% or more recovery of the ptosis in one hour.

Renal Failure and ASV

Renal failure is a common complication of species such as Russell's Viper. The contributory factors are intravascular hemolysis, DIC, direct nephrotoxicity and hypotension and rhabdomyolysis. Such patient will require renal replacement therapy.

Antibiotics and Tetanus Prophylaxis

Broad spectrum antibiotic coverage along with post exposure tetanus prophylaxis.

Debridement of Necrotic Tissue

Cellulitis and Compartment syndrome needs urgent surgical intervention and require surgeon opinion.

Follow-up

A snakebite victim discharged from the hospital should continue to be follow 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 of 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.

Reference:

Management of Snake Bite- MOH Government of India

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