# CASE 2

**SHORT CASE NUMBER: 3_9_2**
**CATEGORY: CHILDREN & YOUNG PEOPLE**
**DISCIPLINE: PAEDIATRICS_MEDICINE**
**SETTING: EMERGENCY DEPARTMENT**
**TOPIC: POISONING AND ENVENOMATION**

## Case

**Sven Tuk, aged 3 years, presents with an inflamed, swollen and painful hand. Her mother repeats that she was playing in the garden shed with her boys and had presented crying. The pain has not responded to Panadol, and is aggravated by movement. The pain and swelling are now extending up her arm. On examination, you note Sven is sweating and dry retching.**

## Questions

1. List your likely diagnosis and differential diagnosis
2. Outline your approach in terms of further history, examination and investigation.
3. If red back spider bite was suspected, what would make you consider administration of antivenom?
4. If Sven had been bitten by a tiger snake, and presented with headache, abdominal pain, vomiting and ascending paralysis, how would you manage her presentation?
5. Summarise the principles of pressure – immobilisation first aid.
6. Poisoning is common in children aged 1-5 years. Outline the principles of management in suspected poisoning in a 3 year old child.
7. List some common strategies to prevent childhood poisoning.

**Suggested reading:**

Tibballs, J., Oakley, E. & Winkel, K. (2012). Poisoning and envenomation. In: M. South & D.Isaacs (Eds.). *Practical Paediatrics* (7th Ed). (PP 208 – 220). Edinburgh: Churchill Livingston/Elsevier.

## ANSWERS

1. **List your likely diagnosis and differential diagnosis**

   The most likely diagnosis is a Red-back spider bite. Differential diagnosis would include a bee, or wasp sting, or other spider bite. Bee and wasp stings are not usually associated with sweating or vomiting. Other spider bites are unlikely. Funnel web spider spiders do not cause a local reaction. The white tailed spider is thought to cause only a local reaction. Since all Australian snakes do not cause a local reaction, snake bite is also highly unlikely.

2. **Outline your approach in terms of further history, examination and investigation.**

   **Further history:**
   Known presence of red-back or other spiders, bees or wasps, or snakes at or near their home, or whether any were noticed by her boys. Obtain precise time of incident.

   **Examination:**
   Take vital signs – temperature pulse and blood pressure (measure the blood pressure in the unaffected arm).
   Inspect the hand for evidence of a bee sting still present in the skin, and the rest of the skin for rashes.
   Observe whether sweating is generalised or localised to the affected arm.
   Inspect for muscle fasciculation at the site.
   Palpate the axilla for local lymphadenopathy.
   Ascertain whether there is generalised muscular weakness.

   **Investigations:** There are no venom detection tests for spider bites. To exclude a snake bite, a rapid venom detection test can be performed from a swab from the bite site, blood or urine.

3. **If red back spider bite was suspected, what would make you consider administration of antivenom?**

   If the reaction has spread beyond the local bite site, with systemic symptoms and signs or severe or recurrent pain, antivenom should be given.

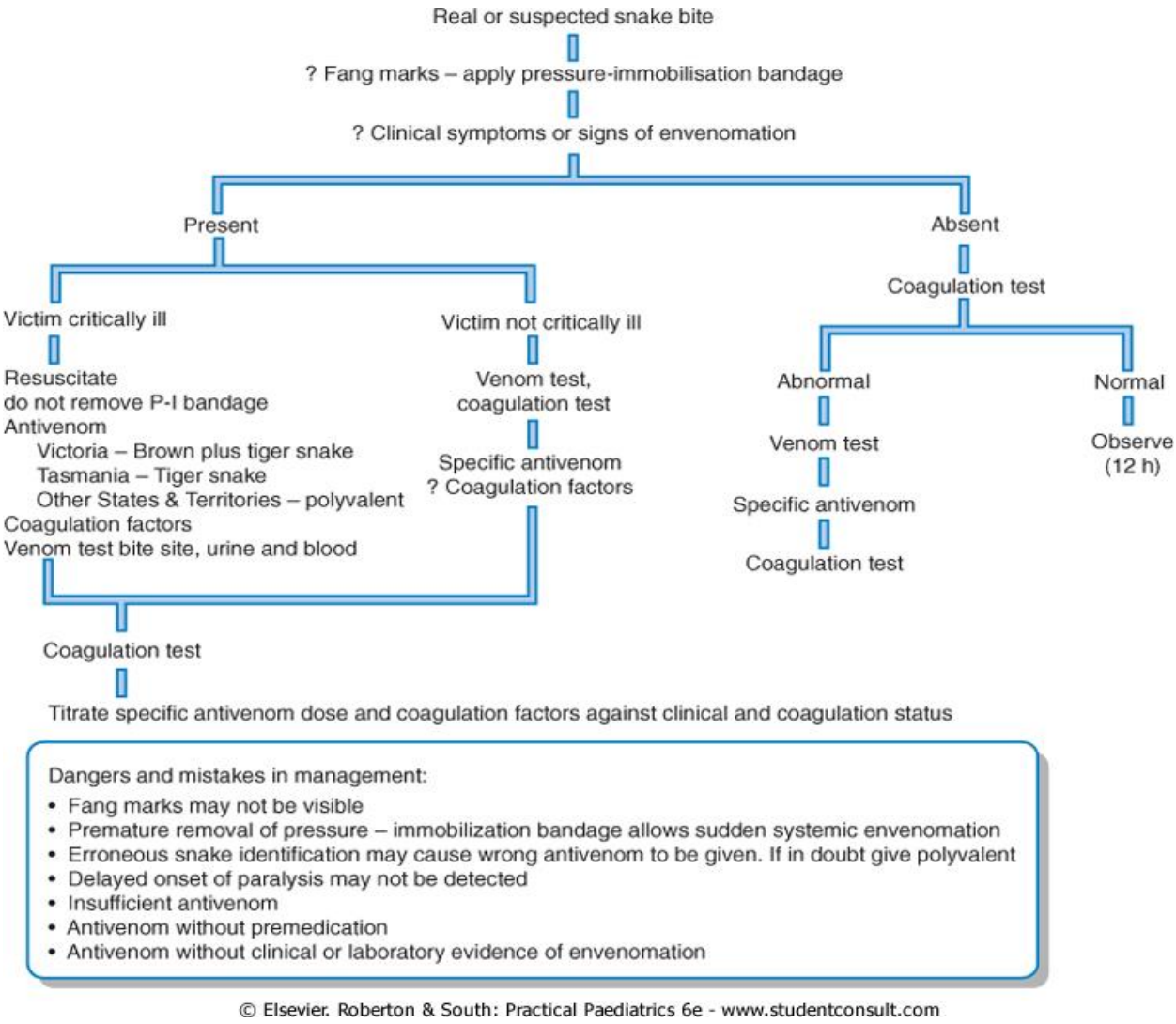
4. **If Sven had been bitten by a tiger snake, and presented with headache, abdominal pain, vomiting and ascending paralysis, how would you manage her presentation?**

   Tiger snakes and brown snakes account for most envenomations. All Australian snakes are elapids, which have relatively small fangs and whose venoms do not cause severe local effects. Different species have different effects but the two most common acute threats to life are neuromuscular paralysis with respiratory failure and coagulopathy causing bleeding with peripheral circulatory failure (shock).

   The main components of venoms are:
   - pre- and postsynaptic neurotoxins, which cause paralysis
   - prothrombin activators, which cause disseminated intravascular coagulation and haemorrhage
   - anticoagulants, which cause spontaneous haemorrhage
   - rhabdomyolysins, which may cause renal failure
   - haemolysins

**The principles of treatment for snake bite are:**

- to prevent rapid absorption of the venom from the subcutaneous tissue into the circulation by application of a pressure-immobilization bandage
- to neutralize the venom by the administration of antivenom
- to treat the effects of the venom, namely respiratory failure and bleeding.





**Antivenom**

Specific monovalent antivenoms (Commonwealth Serum Laboratories Ltd, Melbourne) are manufactured against tiger, brown, taipan, black, death adder and beaked sea snake (*Enhydrina schistosa*) venoms. These are effective against all known snakes in Australia and Papua New Guinea. A mixture of the five terrestrial antivenoms is available as a polyvalent preparation. The antivenoms are highly purified equine immunoglobulins. Cross-reactivity between species is limited, so that it is essential to administer the correct antivenom according to the identity of the snake.

If the identity of the snake is not known or uncertain, the type of antivenom to be administered is based on the known geographical snake distribution or according to the result of a venom detection kit test.

In Tasmania, where the snakes are (black) tiger snakes and copperheads, the appropriate antivenom is tiger snake antivenom.

In Victoria, where the dangerous species are tiger, brown, black and copperhead snakes, the appropriate antivenom therapy is tiger snake plus brown snake antivenom.

Everywhere else in Australia additional species exist and the polyvalent preparation should be chosen.

Although essential and life-saving, antivenoms are foreign proteins, which may cause a life-threatening anaphylactoid reaction. However, this may be prevented by premedication with subcutaneous (not intravenous or intramuscular) adrenaline (epin-ephrine) 0.005-0.01 mg/kg. Additional protective agents such as a steroid (hydrocortisone) and an antihistamine may be indicated if the patient has a known allergic history. Only one premedication dose of adrenaline is required. The antivenom should be administered intravenously, diluted with a crystalloid solution, over approximately 30 minutes. However, for severe envenomation it may be delivered rapidly. If polyvalent antivenom or multiple doses of monovalent antivenom are required, a course of steroid therapy (prednisolone 1-2 mg/kg/d for 5 days) should be given to prevent serum sickness.

The dose of antivenom is never certain at the beginning of treatment because the amount of venom injected is unknown. Each ampoule of antivenom contains enough to neutralize the average yield from 'milking' - a process whereby venom is collected by inducing a snake to bite a membrane stretched tautly over a receptacle. However, the venom injected on biting is highly variable and bites may be multiple. Children are more susceptible than adults because of the larger venom-to-body-mass ratio. The majority of envenomations are treated adequately with 1-3 ampoules but this dose should never be relied upon; many more ampoules are usually required in life-threatening envenomations.

Antivenom should not be withheld if indicated, as there is no other satisfactory treatment. Antivenom should be administered either if there are clinical signs or symptoms of envenomation after snake bite or if in their absence a substantial coagulopathy is present. Occasionally, venom can be detected in the urine but there is no clinical evidence or very mild coagulopathy. In this case antivenom may be withheld, but the patient's clinical and coagulation status should be checked regularly.

## 5. Summarise the principles of pressure – immobilisation first aid.

**Pressure-immobilization first aid**
Limbs sustain 95% of all bites. Snake venoms gain access from the subcutaneous tissue to the circulation via the lymphatics. These channels can be effectively occluded by the application of a firm crepe (or crepe-like) bandage applied over the bite site and whole of the limb. The application of a splint that includes joints on either side of the bite prevents the use of surrounding muscle groups and hence decreases lymph flow. Although the technique is a first aid measure that should be applied at the scene of the snake bite to prevent initial absorption of venom, it is also used in established envenomation in hospital to prevent additional absorption of venom while preparations are being made to administer antivenom.

The bandage can be left in place indefinitely as it should be no tighter than a bandage for a sprained ankle. However, the bandage does not allow substantial inactivation of venom in the tissues and should be removed after the asymptomatic patient reaches a hospital that has a stock of antivenom or after the envenomated patient has been given antivenom. It is dangerous to remove a bandage from an envenomated patient before administration of antivenom because its release allows a substantial additional quantity of venom to gain rapid access to the circulation. The splint and bandage should not be removed solely to allow inspection of the bite site of an envenomated patient; instead, the splint should be removed temporarily and a window should be cut in the bandage to allow a swab of the bite site to be taken for venom testing, then the bandage should be reinforced and the splint reapplied. Bites are usually visible as scratches or puncture wounds, but their presence and appearance, or absence, does not prove or disprove envenomation and does not allow identification of the snake involved.

**Life support**
In the severely envenomated patient, endotracheal intubation and mechanical ventilation may be required because of bulbar and respiratory muscle paralysis. If antivenom therapy is delayed, mechanical ventilation may be required for many days.

Coagulopathy may cause massive haemorrhage from mucosal surfaces and subsequent peripheral circulatory failure. Haemorrhage may occur into a vital organ, particularly the brain. It is essential to restore the circulatory volume with

blood transfusion and to normalize coagulation with antivenom and coagulation factors (fresh frozen plasma). Antivenom neutralizes venom but it does not, per se, restore coagulation. Repeated laboratory tests of coagulation (prothrombin time, activated partial thromboplastin time, serum fibrinogen and fibrin degradation products) or bedside tests of bleeding should be performed repeatedly to determine the need for more antivenom and coagulation factors. The coagulation status is the most sensitive guide to the need for additional antivenom after bite by coagulopathic species.

## 6. Poisoning is common in children aged 1-5 years. Outline the principles of management in suspected poisoning in a 3 year old child.

Poisoning occurs most frequently in this age group. Most instances are said to be accidental, in which the young child discovers a drug or a household cleaning or chemical agent. The majority of serious poisonings occur with prescribed drugs or with over-the-counter drugs. Parents are often unaware that drugs must be stored safely and they underestimate the capabilities of young children who, at this age, become increasingly mobile and curious. They eat substances that are not palatable to adults, and tablets and capsules that resemble lollies (sweets).

### Management

The immediate aim in the management of poisoning, whether serious or not, is to attend to the effects of the poison on the patient. Later, attention should be given to the circumstances with the aim of preventing a recurrence. There are innumerable poisons. All medicines and many household substances are poisonous if taken in sufficient quantity. Upon presentation, the action to be taken, if any, will be determined by the substance involved, its amount, the interval between ingestion and presentation, and the effect of the poison. The following principles of management may be applied universally:

**1.) Support vital functions**
It is imperative to maintain and support vital functions if these are depressed. Many poisons are excreted adequately or metabolized by the body if the vital functions are maintained. If the patient is unconscious, the airway, the depth and frequency of breathing and the circulation should be examined for adequacy.

**2.) Establish the diagnosis**
It is important to establish:

- what poisons are involved
- in what quantity
- when exposure occurred.

Often the diagnosis of poisoning is self-evident, but at times the diagnosis is not obvious. When a poison has been identified, it should never be assumed that other poisons could not be involved. The symptoms and signs of poisoning are diverse but dangerous drugs threaten vital functions. Seriously poisoned patients present commonly with:

- unconsciousness
- cardiorespiratory failure
- convulsions.

If any of these are present and the cause is otherwise not known, poisoning should be high on the list of differential diagnoses. A meticulous physical examination and history provides invaluable help in diagnosis and treatment. Laboratory investigations may be necessary to establish a diagnosis, determine the amount of poison in the body and help determine specific treatment for certain poisons.

**3,) Prevent absorption**

Some poisons contaminate the skin, conjunctivae and mucous membranes and other poisons are inhaled as gases. Surface contamination requires copious irrigation with water, while inhalational poisoning may require oxygen

therapy and mechanical ventilation. The great majority of poisons are ingested, for which the options for therapy include induced emesis, oral or gastric administration of activated charcoal, gastric lavage and whole bowel irrigation. If the poison has been absorbed already and has reached the vascular compartment, invasive techniques may be required such as:

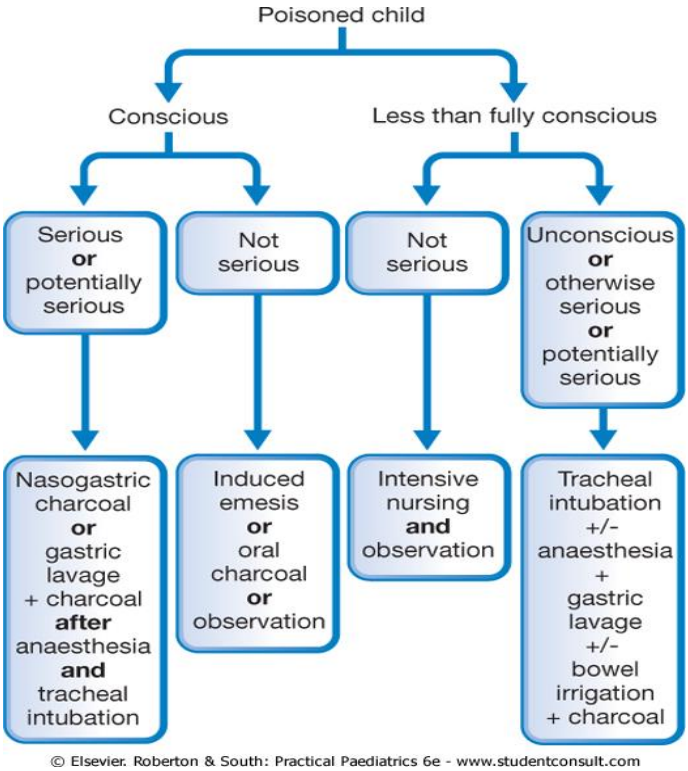
- plasmafiltration
- haemofiltration
- charcoal haemoperfusion
- haemodialysis
- peritoneal dialysis
- exchange transfusion

The poison, its amount and the seriousness of its effects determine the treatment of the poisoned patient. These must be weighed against the hazards of removal. Unconscious or drowsy patients or patients who cannot protect their own airway should not undergo induced emesis or gastric lavage or be given activated charcoal or colonic washout solutions. The consequences of aspirating gastric contents during vomiting or regurgitation in a less than fully conscious state far outweigh the dangers of many untreated poisons, as the mortality from severe pneumonitis is approximately 50%. However, it is appropriate to remove a wide variety of ingested poisons with either:

- activated charcoal
- whole bowel irrigation
- gastric lavage, or
- a combination of these techniques.

Circumstances of presentation and ingestion dictate the choice of technique. Induced emesis, using ipecacuanha, was a commonly applied form of therapy but has now been largely abandoned because of limited effectiveness, the development of more effective techniques (e.g. activated charcoal) and risk of aspiration of gastric contents.

Activated charcoal is probably the most appropriate therapy in the emergency or casualty department, although whole bowel irrigation may be preferable for some agents. Gastric lavage should be reserved for a recent (within 1 hour) serious life-threatening ingestion in a conscious patient or for serious poisoning in a less than fully conscious patient who has airway protection. The circumstances for the employment of each technique are summarised in the following algorithm.



**4.) Administer an antidote**

Only relatively few poisons have antidotes but knowledge and use of these can be life-saving. The appropriate dose of each is determined by the amount of poison and its effects.

## 7. List some common strategies to prevent childhood poisoning.

The nature of poisoning varies for different age groups in children. Although poisoning in childhood is usually unintentional, the possibility of deliberate poisoning in the younger child as part of child abuse should not be forgotten. Pharmaceutical substances are involved in 70% of poisonings. In hospitals, errors in drug administration are frequent causes of poisoning.

The following is a list of common prevention strategies:

**Safe storage**

Store medicines, chemicals and household products safely out of reach and out of sight of children, up high (at least 1.5 metres) in a locked or child-resistant cupboard.
Separate medicines from chemicals and household products.
Do not store medicines in the refrigerator unless advised to do so by your pharmacist.
Visitors' bags may contain medicines. Keep them well out of reach of children.

**Safe containers**

Do not transfer medicines, chemicals or household products from their original containers. Keep everything in their original, labelled containers, never in cups or soft drink bottles.
Use medicines, chemicals and household products that are in child-resistant packaging (blister or strip packs or special 'push and turn' lids). However, remember that child-resistant packaging is not child-proof.

**Safe labels**

Be sure that all medicines, chemicals and household products are properly labelled.
Read the label carefully before use.

**Safe use**

Use medicines, chemicals and household products safely. Read directions for use carefully. Do not leave them unattended while in use.
Children tend to imitate adults, so avoid taking medicines in their presence.
Refer to medicines by their proper names. They are not lollies.
Use appropriate protection when painting, spraying chemicals or cleaning the oven. Follow the directions for use. Protect skin and eyes. Ensure there is adequate ventilation, with air circulating continuously. If there is a spill, remove any contaminated clothing immediately.

**Safe disposal**

Empty containers of liquid medications, chemicals and household products should be rinsed with water before they are thrown out.
Clean out your medicine cupboard regularly. Taken unwanted or out of date medicines to a chemist for disposal.