— If in doubt, give glucose 2–5 mL/kg of 10% glucose IV if unable to drink or unconscious, otherwise give a sugary drink.

**Interpretation**

Peak blood levels of alcohol occur 30–60 minutes after ingestion.

**Iron**

Patients who have ingested iron should ideally have a plasma iron level estimated before desferrioxamine is given. Serum levels of over 300 micrograms/dL are associated with moderate toxicity, levels of over 500 micrograms/dL with serious toxicity, and levels over 1 mg/dL with death.

**Interpretation**

Patients with acute iron poisoning have significant increase in plasma iron levels within 2 hours of over-dosage. Initial serum levels of less than 90 micromol/litre are supportive but not absolute evidence of mild poisoning. Normal serum iron levels are in the region of 10–30 micromol/L (80–180 micrograms/dL).

**Paracetamol**

Take blood samples at least 4 hours after ingestion of paracetamol.

**Interpretation**

A plasma level that falls above the treatment line at different times indicated in the graph of paracetamol level against time (see Figure 7.4.1) indicates moderate to severe poisoning. Treat with N-acetylcysteine. Lower thresholds for treatment are indicated if the patient is on enzyme-inducing drugs or alcohol is taken habitually.

### 7.5 Envenomation

**Box 7.5.1 Minimum standards**

- Mono- and polyspecific antivenoms.
- Chlorphenamine.
- Anticholinesterase (only if appropriate for the region).
- Analgesia.
- Prazosin (only if appropriate for the region).
- Heart failure treatment.

#### Introduction

Envenoming by snakes, scorpions, spiders or marine venomous animals is common in many areas of the tropics. Children are particularly at risk; they may be attracted to venomous creatures and do not recognise the danger that they represent. Envenoming is often more severe and more rapid in children because the ratio of the amount of venom to body weight is much higher.

A clear-cut history of envenoming is often not present. Some bites are not recognised at the time of the event; other children will be too young to explain what has happened. Envenoming should always be considered in any child with an unexplained illness, particularly if there is severe pain, swelling or blistering of a limb, or if the child is bleeding or shows signs of neurotoxicity.

#### Prevention

Discourage children from handling snakes, scorpions or spiders or touching marine animals. They should be taught to avoid putting their hands down holes, and to carefully check their shoes and clothing before dressing. Keeping grass short around dwellings, use of sensible footwear, keeping dwellings insect-free, and taking care when swimming can all help to prevent injury by venomous animals.

#### Snakebite

There are a large number of species of venomous snakes throughout the world. These can be divided into three main categories: vipers, elapids and sea snakes. The pattern of envenoming depends upon the biting species. Therefore clinicians need to know about the snakes present in the region in which they work. Only 50–70% of patients who are bitten by venomous snakes develop signs of envenoming.

Major clinical effects following snakebite can be categorised as follows:

- **Local effects:** pain, swelling or blistering of the bitten limb. Necrosis at the site of the wound may sometimes develop.
- **Systemic effects:**
  - Non-specific symptoms: vomiting, headache, collapse.
  - Painful regional lymph node enlargement indicating absorption of venom.
  - Specific signs: non-clotting of blood; bleeding from gums, old wounds and sores.
  - Neurotoxicity: ptosis, bulbar palsy and respiratory paralysis.
  - Shock: hypotension.
  - Rhabdomyolysis: muscle pains and black urine.

**Vipers**

Most commonly cause local swelling, shock, bleeding and non-clotting blood.

**Elapids**

Cause neurotoxicity and usually minimal signs at the bite site (with the exception of some cobras which also cause necrosis).

Sea snakes cause myotoxicity and subsequent paresis.

Exceptions to this general rule do occur. For example, some vipers cause neurotoxicity and some Australian elapids also cause non-clotting blood and haemorrhage.
First aid outside hospital

- Reassure the patient. Many symptoms following snakebite are due to anxiety.
- Avoid harmful manoeuvres such as cutting, suction or the use of tourniquets.
- Immobilise and splint the limb. Moving the limb may increase systemic absorption of venom.
- Apply a pressure bandage if tissue necrosis is rare following snakebite in your region, particularly if rapid transport to hospital is not possible. This is especially important for snakes that cause neurotoxicity. Apply a crepe bandage over the bite site and wind it firmly up the limb. This can only be recommended on a geographical basis, not a clinical one, as necrosis is not apparent initially.
- Transport the patient to hospital as soon as possible.
- If the snake has been killed, take it with the patient to the hospital.

Diagnosis and initial assessment

- Carefully examine the bitten limb for local signs.
- Measure the pulse, respiration rate, blood pressure and urine output. Blood pressure and other signs of shock (see Section 5.5) must be watched for if children are unwell, are bleeding or have significant swelling; shock is common in viper bites.
- Look for non-clotting blood. This may be the only sign of envenoming in some viper bites. The 20-minute whole-blood clotting test (WBCT20) is an extremely easy and useful test. It should be performed on admission and repeated 6 hours later.

**WBCT20 test**

- Place a few millilitres of freshly sampled blood in a new clean dry glass tube or bottle.
- Leave undisturbed for 20 minutes at ambient temperature.
- Tip the vessel once.
- If the blood is still liquid (i.e. unclotted) and runs out, the patient has hypofibrinogenaemia (‘incoagulable blood’) as a result of venom-induced consumption coagulopathy.

Look carefully for signs of bleeding which may be subtle (e.g. from gums, old wounds or sores). Bleeding internally (most often intracranial) may cause clinical signs.
- Look for early signs of neurotoxicity, such as ptosis (children may interpret this as feeling sleepy), limb weakness, or difficulties in talking, swallowing or breathing.
- Check for muscle tenderness and myoglobinuria in sea snake bites.
- Take blood for:
  - haemoglobin, white cell count and platelet count
  - prothrombin time, APTT and fibrinogen levels (if available)
  - serum urea and creatinine
  - creatine phosphokinase (CPK) (reflecting skeletal muscle damage) (if available)
- ECG (if available).

Hospital or health centre management

**General management**

- Observe the patient in hospital for at least 24 hours, even if there are no signs of envenoming initially. Review regularly, as envenoming may develop quite rapidly.
- Nurse the patient on their side with a slight head-down tilt to prevent aspiration of blood or secretions.
- Avoid IM injections and invasive procedures in patients with incoagulable blood.
- Give tetanus prophylaxis. Routine antibiotic prophylaxis is not required unless necrosis is present.

**Antivenom**

Antivenom is indicated for signs of systemic envenoming. Evidence for its efficacy in severe local envenoming is poor, but it is usually indicated if swelling extends over more than half of the bitten limb. Monospecific (monovalent) antivenom may be used for a single species of snake, and polyspecific (polyvalent) antivenom for a number of different species. The dose of antivenom depends upon the manufacturer’s recommendations and local experience.

Children require exactly the same dose as pregnant women (the dose is dependent upon the amount of venom injected, not body weight).
- Dilute the antivenom in two to three volumes of 5% glucose or Ringer-lactate or Hartmann’s or 0.9% saline and infuse over 45 minutes to an hour. The infusion rate should be slow initially and gradually increased. Note that doses of antivenom vary considerably; always follow the instructions enclosed with the antivenom.
- Draw up adrenaline in a syringe ready for use.
- Observe the patient closely during antivenom administration. Common early signs of an antivenom reaction include urticaria and itching, restlessness, fever, cough or a feeling of constriction in the throat.
- Patients with anaphylaxis should be treated with adrenaline (epinephrine). In a child give 10 micrograms/kg IM (see Section 5.1.B) and in pregnancy give 1 mL of 1 in 1000 adrenaline (1 mg) (see Section 5.1.B). An antihistamine, such as chlorphenamine, 200 micrograms/kg IM or IV, should also be given.
- Unless life-threatening anaphylaxis has occurred, antivenom can cautiously be restarted after this treatment.
- Routine adrenaline prophylaxis may reduce the incidence of antivenom anaphylaxis, but should not generally be used.
- Monitor the response to antivenom. In the presence of coagulopathy, restoration of clotting depends upon hepatic resynthesis of clotting factors. Repeat WBCT20 and other clotting studies if available, 6 hours after antivenom. If the blood is still non-clotting, further antivenom is indicated. After restoration of normal clotting, measure clotting at 6- to 12-hour intervals, as a coagulopathy may recur due to late absorption of venom from the bite site.

The response of neurotoxicity to antivenom is less predictable. In species with predominantly postsynaptically acting toxins, antivenom may reverse neurotoxicity, and failure to do so is an indication for further doses. However, the response to antivenom is poor in species with presynaptically acting toxins.
Other therapy
- Excise sloughs from necrotic wounds. Skin grafting may be necessary. Severe swelling may lead to suspicion of a compartment syndrome. Fasciotomy should not be performed unless there is definite evidence of raised intra-compartmental pressure (> 45 mmHg) (if measurable), and any coagulopathy has been corrected.
- Paralysis of intercostal muscles and diaphragm requires artificial ventilation. This can be performed by manual bagging with a bag-valve mask and may need to be maintained for days, using relays of relatives if ventilators and skills are not available.
- Anticholinesterases may reverse neurotoxicity following envenoming by some species.
- Maintain careful fluid balance to treat shock and prevent renal failure.
- Some cobras spit venom into the eyes of their victim. Rapid irrigation with water will prevent severe inflammation, and 0.5% adrenaline (epinephrine) drops may help to reduce pain and inflammation.

Scorpion stings
In some areas of the world, scorpion stings are more common than snakebites and cause significant mortality. The stinging scorpion is not often seen. A number of different species have broadly similar clinical effects. The major feature of envenoming is severe pain around the bite site, which may last for many hours or even days. Systemic envenoming is more common in children and may occur within minutes of a bite. The major clinical features are caused by activation of the autonomic nervous system (see Table 7.5.1).

Severe hypertension, myocardial failure and pulmonary oedema are particularly prominent in severe envenoming.

<table>
<thead>
<tr>
<th>Clinical features of scorpion stings</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tachypnoea</td>
<td>Take patient to hospital immediately; delay is a frequent cause of death.</td>
</tr>
<tr>
<td>Excess salivation</td>
<td>Control the pain with infiltration of 1% lignocaine around the wound or give systemic opiates (with care) (see Section 1.15).</td>
</tr>
<tr>
<td>Nausea and vomiting</td>
<td>Scorpion antivenom is available for some species. Give intravenously in systemic envenoming, but IM injection has been used with good effect if there is no alternative.</td>
</tr>
<tr>
<td>Lacrimation</td>
<td>Prazosin is effective for treating hypertension and cardiac failure (orally 10–15 micrograms/kg two to four times a day increasing to control blood pressure to a maximum of 500 micrograms/kg/day for under 12 years and 20 mg/day over 12 years). The patient should be lying down for the first 4–6 hours of treatment in case there is a sudden fall in blood pressure.</td>
</tr>
<tr>
<td>Sweating</td>
<td>Severe pulmonary oedema requires aggressive treatment with diuretics and vasodilators (see Section 5.4.B).</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td></td>
</tr>
</tbody>
</table>

Marine envenoming
Venomous fish
Many different venomous fish may sting children if they stand on or touch the fish. Systemic envenoming is rare. Excruciating pain at the site of the sting is the major effect.
- Regional nerve blocks and local infiltration of 1% lignocaine may be effective (see Section 1.24). |
- Most marine venoms are heat-labile. Immersing the stung part in hot water is extremely effective for relieving the pain. Care should be taken to avoid scalding, as the envenomed limb may have abnormal sensation. The clinician should check the water temperature with their own hand. Asking the patient to immerse their non-bitten limb may help to avoid scalding.
Jellyfish
Venomous jellyfish have large numbers of stinging capsules (nematocysts) on their tentacles which inject venom when the tentacles contact skin. Pain and wheals are the usual effects but, rarely, systemic envenoming can be life-threatening. Many of the nematocysts will remain undischarged on tentacles that adhere to the victim. Therefore rubbing the area of the sting will cause further discharge and worsen envenoming.

- In box jellyfish stings, pouring vinegar over the sting will prevent discharge of nematocysts. For most other jellyfish, seawater should be poured over the stings and the adherent tentacles gently removed. Ice is useful for pain relief.
- Box jellyfish stings may occasionally be rapidly life-threatening. Antivenom is available and can be administered intramuscularly.

Further reading

Children’s rights
Article 19 of the United Nations Convention on the Rights of the Child states that children (people less than 18 years of age) have a right to be protected from being hurt and maltreated physically and mentally. It goes on to state that governments should ensure that children are properly cared for and should protect them from violence, abuse and neglect by their parents or anyone who looks after them.

Child abuse results in actual or potential harm to the child’s health, survival, development or dignity in the context of a relationship of responsibility, trust or power with the abuser.

Healthcare workers have a major responsibility in contributing to the prevention and recognition of childhood ill treatment. This poses particular challenges for healthcare workers when they work with children and families from different belief systems and cultural backgrounds. They may find that they have to care for street children, child soldiers, and children separated from their parents by civil strife and unrest, and find themselves making difficult judgements about how a child can be best protected when they have few if any points of reference, and only limited contact with other agencies.

7.6 The child who has been ill treated, abused or exploited

<table>
<thead>
<tr>
<th>BOX 7.6.1 Minimum standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of the in-country legal framework for child protection.</td>
</tr>
<tr>
<td>Understanding of cross-cultural child-rearing practices.</td>
</tr>
<tr>
<td>Links between health services, police child protection teams and/or social services in place.</td>
</tr>
<tr>
<td>Access to X-rays and blood clotting measurements.</td>
</tr>
<tr>
<td>Access to forensic advice.</td>
</tr>
<tr>
<td>Access to photography services, with secure storage of images.</td>
</tr>
<tr>
<td>Healthcare workers trained to recognise signs of physical and sexual abuse.</td>
</tr>
</tbody>
</table>

The basic principles of the investigation of child maltreatment are that:

- The welfare of the child is paramount
- Multi-agency/multi-sectored collaboration is needed
- Agencies must work together within the legal framework of the country (where this is in place).

Child maltreatment or abuse involves acts of omission and commission which result in harm to a child. It can occur in the family, in the community or in institutions (e.g. schools, hospitals, churches, mosques, temples, clubs, orphanages or other institutions). It encompasses:

- Exploitation through trafficking for sexual or other forms of slavery
- Exploitation through enforced prostitution
- Physical abuse
- Emotional abuse
- Neglect
- Sexual abuse
- Fabricated induced illness (FII)
- Conscription as child soldiers.

Features of presentation of a child to hospital which suggest possible ill treatment or abuse

- Delay in seeking medical help for an injury or serious clinical symptoms or signs (e.g. bleeding).
- A history that is vague or rehearsed, with inconsistencies and significant changes on re-telling or following questioning.
- No explanation of the cause of the injury.
- Repeated attendance at healthcare facilities (this may suggest fabricated or induced illness, FII; see below).
- Parents or carers being evasive or hostile.
- A history of injury that is inconsistent with the child’s age and/or developmental skills.