

Snake bites

Snake bites can be life-threatening injuries that can require intensive care. [1] The majority of people who are bitten by snakes in the UK, and indeed in countries where venomous snakes are more common, will have been bitten by a non-venomous snake. However, unless the identity of the snake is known with certainty, it is advisable to administer first aid with the assumption that the snake may have been venomous.

Snake bites are uncommon in the UK. There is only one indigenous poisonous snake – the *Vipera berus*, or adder; however, other species of snakes may be found in private collections or zoos.

Pathophysiology

Snake venom is discharged through hollow fangs in the upper jaw from glands found below each eye. The volume of venom released may have been assessed by the snake before striking, to suit the size of the prey. It is also affected by the degree of threat and whether the snake has discharged venom recently. The venom is made up mostly of water but imparts venomous effect according to the properties of enzymatic proteins in the venom. The venomous effects vary between species but can be variously:

- Destructive to tissue:
 - Proteases, collagenases and hyaluronidases facilitate tissue destruction and spread of venom.
 - Local tissue necrosis can be dramatic and require skin grafting.
 - Haemolysis and muscle necrosis may follow snake bite.

- Neurotoxic:
 - Neuromuscular blockade may cause cardiac failure and respiratory failure.
 - The local wound from snakes such as the coral snake may be small but the consequences of the venom can be considerable (respiratory failure).
- Thrombogenic:
 - Enzymes may promote clot formation and plasmin activation.
 - Consumptive coagulopathy and haemorrhage may then result.

Epidemiology

- Internationally it is difficult to obtain accurate figures for the incidence of snake bites and deaths from snake bites. Many snake bites will, of course, go unreported, particularly in countries where venomous snakes are rare or resources are lacking.^[2] Case reports can be found from countries often when it is considered a rare event.^[3]
- The incidence of snake bites varies in national centres across the USA from 4 bites to 19 bites per 100,000 of the population.^[4]
- In Croatia the mean annual incidence of venomous snake bites is 5.2 per 100,000 of the population.^[5]
- In Australia there are 1,000 to 3,000 snake bites per year with an annual incidence of about 15 bites per 100,000 of the population. There are 2 to 4 deaths per year (similar to the USA but in a population about 10% of the size of the USA). There has been a lot of research on antivenoms from Australia.^{[6] [7] [8] [9] [10]}
- Sri Lanka is not a place for ophidiophobes, with a very high incidence of snake bites. The number of venomous snakes also makes deaths from snake bites more common, perhaps 10 times the rates in the USA and Australia.^[11]

- Deaths from snake bites are rare. In the USA there are about 4 deaths per year from snake bites, although reporting is sporadic and figures may be higher for deaths from snake bite. In Croatia only 2 people (0.4%) died after snake bite over a 21-year period.^[5]
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- UK:^[12]
 - There were 510 snake bite enquiries to the UK National Poisons Information Service (NPIS) from 2004 to 2010.
 - 69% of those bitten were male and 31% female. The average age of cases was 32 years.
 - British adder bites accounted for 52% of cases, an exotic species in 26%, unknown in 18% and another UK snake in 4%. 82% of cases occurred between the months of April and September, with a peak during August.
 - 85 cases were assessed as requiring antivenom, and 84 cases received treatment with antivenom.

Presentation^[13]

History

It is important to obtain an accurate history if possible. Ideally this should incorporate:

- Details of the snake. This may be known exactly in the case of captive snakes. Knowledge of wild, indigenous species will help identification.^[2]^[11] Identification is then according to accurate description of size, colour, patterning and other characteristics ('rattle', habitat).
- Timing of the snake bite:
 - Time of the bite.
 - Onset of pain in relation to the bite.

- Record local symptoms:
 - Pain.
 - Paraesthesia.
 - Swelling.
 - Intense pain implies more significant envenomation.
- Record systemic symptoms:
 - Nausea.
 - Vomiting.
 - Diarrhoea.
 - Abdominal pain.
 - Difficulty breathing.
 - Difficulty swallowing.
- Details of previous snake bites and treatments.
- Routine history of:
 - Other illnesses.
 - Medication.
 - Known allergies.

Examination

This should be thorough.

- Check vital signs according to the airway, breathing and circulation routine. Assess:
 - Angio-oedema and shock.
 - Confusion and/or drowsiness.
 - Loss of consciousness.
 - Pulse and blood pressure.
- Examine wound and look for:
 - Local tissue destruction.
 - Oedema.
 - Blisters.
 - Streaking/erythema or discoloration (of affected limb and trunk).
- Examine for systemic effects:
 - Changes in skin sensation or paraesthesia can signal release of neurotoxin (for example, from coral snakes).^[14]
 - Hypotension.
 - Bleeding (for example, epistaxis, petechial haemorrhages).
 - Lymphadenopathy.

- Other serious effects:
 - Coagulopathy.^[15]
 - Coma.
 - Seizures.
 - Pulmonary oedema, adult respiratory distress syndrome (ARDS).
 - Rhabdomyolysis.
 - Acute pancreatitis.
 - Acute kidney injury.^[3]

Differential diagnosis

- Allergic reactions and anaphylaxis.
- Wound infections.
- Other venomous bites (wasps, scorpions, spiders).
- Deep venous thrombosis.

Investigations

Bloods

- FBC.
- Clotting studies.
- Fibrinogen and fibrinogen degradation products.
- Creatine kinase (possible rhabdomyolysis).
- Blood cross-matching.
- Routine blood biochemistry.
- Urinalysis (myoglobinuria).
- Blood gases (where there are systemic symptoms or signs).

Other investigations

- Standard CXR if indicated.
- Wound X-ray for retained teeth/fangs.
- The enzyme-linked immunosorbent assay (ELISA)-based rapid Snake Venom Detection Kit (SVDK) is available in Australia.^[16] It can be used for clinically significant snake bites with a swab of the bite site or even urine to identify which antivenom is appropriate.

Management

Management of an adder bite

- Most will occur in the summer months in people walking through areas of long grass or heathland.
- Fatalities are rare but may cause significant morbidity.
- Following an adder bite, pain will immediately be felt at the bite site and local swelling will occur.
- First aid:
 - Treatment prior to transfer to hospital should consist ONLY of reassurance to the patient and immobilisation of the limb.
 - A bandage SHOULD NOT be applied in this instance as over-tightening of the bandage has led to complications.

- Once in hospital, management should consist of:
 - Observation of the patient for local swelling (at least two hours). Patients who are asymptomatic with no evidence of swelling after two hours may be discharged; all others must be admitted for observation.
 - Wound care:
 - Clean the bite site and splint the limb.
 - Give anti-tetanus prophylaxis as required.
 - General care:
 - Monitor pulse, blood pressure and respiration (every 15 minutes).
 - Apply cardiac monitor to look for arrhythmias.
 - Ensure adequate hydration.
 - Achieve intravenous access.
 - Investigation:
 - Perform ECG twice-daily - looking for nonspecific ECG changes such as T-wave inversion and ST depression.
 - Check U&Es, FBC, creatine kinase and clotting studies, and repeat daily during admission.
 - Drug therapy - supportive and symptomatic therapy should be provided as necessary:
 - **Hypotension:** treat with colloid infusion.
 - **Angioneurotic oedema:** use antihistamines, prednisolone, adrenaline (epinephrine), depending on severity.
 - **Nausea and vomiting:** use antiemetics.
 - **Pain:** give simple analgesia.
 - **In severe cases:** antivenom treatment may be required. In the UK contact the Public Health England (PHE) poisons helpline for further information.^[17]

First aid for snake bites

General principles

- Appropriate first aid has been shown to reduce mortality in patients who have been bitten by a venomous snake. Some traditionally recommended procedures may do more harm than good. For example, incising the wound, sucking the wound, applying a tourniquet, ice or chemicals should be avoided.
- Follow basic emergency life support principles.
- Reassure the patient.
- Keep the patient still and immobilised.
- Arrange immediate transfer for definitive care.

Non-venomous snake bites

- The majority of snake bites in the UK will be non-venomous such as those from pythons and constrictors.
- These snake bites should be treated in the same way as any other animal bite.
- Clean and dress the wound.
- Give anti-tetanus prophylaxis as required.
- If the precise identity of the snake is unknown, keep under observation for several hours.
If there are any systemic features (such as limb oedema, hypotension), assume that the bite is venomous and call the local poisons centre (the NPIS in the UK) for further advice.
- Local blistering and transient dizziness and nausea are not suggestive of systemic involvement.

Venomous snake bites

- Venomous snake bites are very rare in the UK and are most commonly the result of an adder bite.
- Venomous snakes, even when they bite, do not always inject venom or sufficient venom to cause envenomation.

- If the venom causes local damage and not neurotoxicity, like the adder bite, pressure immobilisation is not recommended. However, an affected limb should be immobilised.
- In Australia most of the venomous snakes are systemically neurotoxic.^[18] Where a venomous snake other than an adder is thought to have been involved (or snake not identified) the first aim is to prevent the snake venom from being systemically absorbed. In such cases a pressure immobilisation (PIM) bandage including a splint to reduce movement should be applied to the affected limb as soon as possible following the bite. The wound should not be cleaned prior to the application of the bandage, as traces of venom around the bite may help to identify appropriate antivenom if this is required.^[19] The following method is suggested for application of a PIM bandage:
 - Identify the site of the bite from the patient's account (there may be no visible evidence of a bite mark).
 - From the site of the bite, apply a compression bandage from the digits to the proximal end of the limb.
 - The bandage should not be constricting (tension approximates to that applied for a sprained ankle).
 - Mark the site of the bite on the outside of the bandage to allow a small window to be cut in the bandage for venom swabs to be taken.
 - Apply a splint to immobilise the limb; transport the patient to the nearest accident and emergency department. Keep movement to a minimum.
 - For bites to the head neck and torso, local pressure should be applied.

Hospital care

- In the UK, experience of treating snake bites is likely to be limited.
- Patients should be resuscitated and monitored appropriately in the normal way. Intravenous access should be achieved and oxygen readily available.

- Advice on specific management should be sought from the relevant poisons centre (the NPIS in the UK) whilst initial assessment and resuscitation are being carried out.
- It is important to have gathered information and history as above to aid the further management of patients who have suffered envenomation. In many parts of the world there is a shortage of antivenom and, in the literature, a shortage of evidence for best treatment, clinical features and epidemiology.^[19] More research on the efficacy of antivenoms is needed.^[20]

Complications

The complications depend on the specific envenomation. A variety of complications can occur:

- Local wound complications.
- [Compartment syndrome](#) (pit viper particularly).
- Cardiovascular complications.
- Haematological complications.^[15]
- Respiratory complications.
- Acute kidney injury.^[21]
- Neuromuscular blockade (for example, coral snake bite).^[22]
- Hypersensitivity reactions (type 1 and type 3).

Prognosis

Even in the USA where snake bites are more common and venomous snakes more numerous, full recovery is expected and death very rare (perhaps 1 death per 5,000 snake bites).

Mortality in patients with snake bites can be predicted by variables such as the presence of bleeding tendencies, respiratory failure and shock.^[23]

Further reading

- [Utkin YN](#); Animal venom studies: Current benefits and future developments. World J Biol Chem. 2015 May 26;6(2):28-33. doi: 10.4331/wjbc.v6.i2.28.
- [Gadwalkar SR, Kumar NS, Kushal DP, et al](#); Judicious use of antivenom in the present period of scarcity. Indian J Crit Care Med. 2014 Nov;18(11):722-7. doi: 10.4103/0972-5229.144014.
- [Silva A](#); Dangerous snakes, deadly snakes and medically important snakes. J Venom Anim Toxins Incl Trop Dis. 2013 Oct 7;19(1):26. doi: 10.1186/1678-9199-19-26.

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