- Tender enlargement of the local lymph nodes usually indicates a systemic spread. (The apparent serum elimination half-lives of antivenoms in envenomed patients range from 26 to 95 hours. Envenomed patients should therefore be assessed for at least 3 or 4 days.)

Other Measures

- IV fluids, vasopressors, as indications arise.
- Whole blood or fresh frozen plasma, if there are clotting abnormalities and anomalous bleeding.
- Use cholinergics to reverse the neurotoxic features of elapid bites. Neostigmine (0.25–0.5 mg IV half hourly) needs to be given if there are signs of neuroparalysis. Give atropine 0.6 mg IV before every injection of neostigmine to block its muscarinic side effects.
- Renal failure to be tackled on appropriate lines, if need arises.
- Oxygen, assisted ventilation if there is respiratory failure.
- A fasciotomy may be required in very rare cases. Before performing fasciotomy, an objective assessment of impaired blood flow using Doppler ultrasound may be conducted.

POSTMORTEM APPEARANCES

Two bite marks about 1 cm deep in cases of elapid and 2 cm deep in cases of viper may be present. These should be searched and if need be, magnifying lens may be used. Sometimes, the bite marks may not be visible. **In case of viper bite,** there is swelling and cellulitis about the bitten part. Local appearances are more striking due to considerable oozing of blood from the site of puncture. The blood is generally fluid and haemolysed causing early staining of the blood vessels. As the venom is predominantly vasculotoxic, there may be haemorrhages in the lungs and also extravasation of blood in the serous membranes such as pleura and pericardium. Endocardial haemorrhages are characteristically found in the left ventricle, septum and papillary muscles. Haemorrhages may also be found in other organs. The regional lymph nodes are swollen and haemorrhagic. **In case of elapids,** where the venom is predominantly neurotoxic, there may not be definite local appearances and the cause of death may be difficult to approach except for the signs of asphyxia.

Snake specific venom antigens have been detected in wound swabs, aspirates or biopsies, serum, urine, CSF and other body fluids. Therefore, skin and underlying tissue surrounding the fang punctures, wound and blister aspirate, serum and urine should be collected and sent to the laboratory. Of the various techniques for the detection of snake specific venoms, radioimmunoassay (RIA) is probably the most sensitive and specific. However, enzyme immunoassay (EIA) has been most commonly used as it is cheap and simple. The RIA can detect venom levels as low as 0.4 µg/L, whereas EIA can detect venom levels as low as 5 µg/L.

MEDICOLEGAL ASPECTS

The vast majority of snake bites are accidental in nature. Homicide may rarely be committed (for instance by throwing a venomous snake on a sleeping victim or slipping it under the bathroom door or through a window). Suicides are virtually unreported (with the famous exception of Queen Cleopatra who is reputed to have committed suicide by getting herself bitten by a venomous snake, an asp which is an exotic variety of viper).

Pursuing and killing the snake is not recommended but if the snake has been killed, it may be taken to the hospital and may provide a clue towards treatment. However, the snake must not be handled negligently as even a severed head can inject venom. This may be possible up to an hour or so after death due to the reflex action.

Some nonvenomous snakes kill humans without injecting venom. They inflict death by squeezing the victim within their coiled body, e.g. python, boa constrictor, etc. Sometimes, killing by some other means may be disguised as death due to snake bite.

Sometimes, snake venom is used to kill cattle by a peculiar method for the sake of hides. For this purpose, a cobra is placed in an earthen vessel with a banana. The cobra is irritated by applying heat to the vessel. It bites the fruit, the pulp of which is then smeared on a rag and the rag thrust into the animal's rectum with the help of a bamboo stick. *Sui* poisoning of cattle resembles viperine snake bite.

Snake venom is poisonous only when injected and has no ill-effects when taken by mouth, as the venom is not absorbed from the gastric mucous membrane. The bodies of animals killed by snake poisoning may be eaten without ill-effects, but their blood is poisonous and is fatal if injected into the human body.

Arthropods

Phylum Arthropoda is the largest of the phyla in the animal kingdom and comprises six major groups (classes). However, class Insecta and Arachnida will be discussed here.

CLASS INSECTA

Bees

Of the various types of bees, the bumble bee (large in size and makes a buzzing sound) is the only harmless one. **Honey bees** can sting, but do so when threatened or harmed. They have a barbed stinger, which contains two lancets. When exercising sting, these lancets become firmly anchored to human skin resulting in disengagement of the whole apparatus from the abdomen. The eviscerated bee soon dies, but the reflex action of the attached muscles may continue to inject venom for some time.

Wasps

Of the various types of wasps, the yellow jackets are most ill-tempered and may sting without provocation. The wasps and hornets are usually nonaggressive unless their hive is disturbed. The stinger of the wasp does not have barbs and hence can easily be withdrawn and reinserted. (Wasps and hornets, unlike bees, are scavenging insects and can transmit infection during a sting.)

Venom Composition

- Direct toxic effects are mediated by mixtures of low-molecular weight compounds such as serotonin, histamine, acetylcholine and several kinins.
- Polypeptide toxins in honey bee venom include mellitin, which damages cell membranes; mast cell-degranulating protein, which causes histamine release; apamin (a neurotoxin) and adolapin, which has anti-inflammatory action.
- Enzymes in venom include hyaluronidase, which allows the spread of other venom components and phospholipases.

Symptoms and Signs

- Uncomplicated stings cause immediate pain, a wheal and flare reaction, and local oedema and swelling that subside in a few hours.
- Multiple stings can lead to vomiting, diarrhoea, generalised oedema, dyspnoea, hypotension and collapse. Rhabdomyolysis and intravascular haemolysis may cause renal failure.

Diagnosis of Venom Hypersensitivity

Type I hypersensitivity is confirmed by detecting venom specific IgE in the serum using radioimmunosorbent testing (RAST). Intradermal skin tests using dialysed freeze dried pure specific venoms are also diagnostic. The RAST test has been used for postmortem diagnosis of Hymenoptera sting anaphylaxis. [Insects that sting to defend their colonies or subdue their prey belong to the order Hymenoptera, which includes aphids (bees and bumble bees), vespids (wasps, hornets and yellow jackets), and ants.]

Treatment

In case of bee stings, stingers embedded in the skin should be scraped or brushed off with a blade or a fingernail but not removed with forceps, which may squeeze more venom out of the venom sac. The site should be cleansed and disinfected, and cold compresses may be applied to slow down the spread of venom.

- Anaphylactic reaction necessitates immediate administration of epinephrine hydrochloride (0.3–0.5 ml of 1:1000 solution subcutaneously, repeated if necessary).
- Intravenous epinephrine (2–5 ml of a 1:10,000 solution) may be administered by slow push in profound shock.
- Antihistaminics are beneficial. Large local reactions may require a short course of oral therapy with glucocorticoids.
- Fluid resuscitation, oxygen, intubation and vasopressors may be required. The patient should be observed for 24 hours for recurrent anaphylaxis.

Spanish Fly (Cantharis vesicatoria or Blister Beetle)

A special type of insect-related poisoning is associated with this creature. The active principle is a highly irritant substance called **cantharidin**. The active principle is insoluble in water and soluble in alcohol, fats, ether and chloroform. Cantharis may be administered in the form of powdered beetles, or the tincture, or the active principle. The powder cannot be easily administered as it floats for sometime in any liquid with which it is mixed and attracts attention due to shining green particles.

On external application, it causes a blister or vesicle. Therefore, the Spanish fly is also known as blister beetle or cantharis vesicatoria. **On internal administration,** it causes severe inflammation of the gastrointestinal and genito-urinary tract. There is burning sensation in the throat and stomach, difficulty in swallowing, nausea, abdominal pain, vomiting of blood stained material and diarrhoea with blood and mucus. As time passes, nephrotoxic effects become evident. There occurs a dull heavy pain in the loins and constant desire to micturate but only small amount of blood stained urine is passed **(strangury)**. In the male, persistent and painful erection of the penis (priapism) may occur and there may be frequent seminal emissions. In females, there may be engorgement of the vulva and abortion may occur. In fatal cases, coma with convulsions usually precedes death.

Fatal Dose and Fatal Period

Cantharidin is readily absorbed from all surfaces including the skin, and it is possible that 10 mg of active principle (cantharidin) may cause death. Ordinarily, 1.5 gm of powdered cantharides is regarded as a fatal dose. Death usually occurs within 24 hours.

Treatment

Stomach wash may be carried out with warm water. Demulcents may be given in any quantity. Renal damage should be treated on appropriate lines. Alkalies need to be given to allay the irritation of the genito-urinary tract.

Postmortem Appearances

The whole alimentary tract may show intense inflammation. Parts of the powdered beetle may be found as shining elytra. The shining wings of the beetle resist putrefaction and may provide a valuable clue as to the identity of the poison. The kidneys may show acute nephritis and the genito-urinary tract, severe inflammation.

Medicolegal Aspects

Most of the cases of poisoning result from accidental overdose, arising out of the mistaken belief in its aphrodisiac properties. Contact with skin or eyes can result in intense irritation with blister formation.

It is said that infamous Marquis de Sade (the perversion 'sadism' is named after him), poisoned a number of prostitutes in a brothel with cantharidin in an attempt to arouse them. However, many of them died.

CLASS ARACHNIDA

Scorpion and spider are important representatives of this class.

Scorpion

It carries a cephalothorax, an abdomen and a six-segmented tail, which terminates in a bulbous enlargement called telson. The telson contains the stinger and venom apparatus. In addition, the scorpion also has two claws, which help to grasp its prey. The scorpions feed at night and remain hidden during the day in crevices or burrows or under wood, loose bark or rocks. Scorpions sting human beings only when disturbed.

The venom usually carries haemotoxic and neurotoxic actions. (It is predominantly neurotoxic.) It is a potent autonomic stimulator resulting in the release of massive amounts of catecholamines from the adrenal glands and nerve endings into the circulation. It also has some direct effect on the myocardium. Both these actions result in cardiac arrhythmias, hypertension and systolic dysfunction. Later, due to depletion of catecholamines, hypotension, bradycardia, etc. occur.

Symptoms and Signs

Local irritation is characterised by redness and burning pain radiating from the site. In most cases, the pain grows within a few hours of being stung. The victim may not be able to localise the pain due to its radiation along the dermatomes involved. However, the presence of local swelling and a punctated haemorrhagic spot may help in localising the site of the sting. There may be headache, giddiness, nausea, profuse perspiration, chest discomfort, paraesthesias, hypersalivation, cold extremities and sometimes, priapism. Hypertension may occur within 6 hours of sting, while pulmonary oedema takes longer time. Later, features suggestive of myocarditis may develop. Neurologic manifestations may persist for up to a week or so. While the mortality in adults is negligible, children may succumb from pulmonary oedema.

Treatment

Stings of nonlethal species require at most ice packs, analgesics or antihistamines. Antivenin therapy can reduce or eliminate mortality from more severe envenomations. Keeping the patient calm and applying pressure dressings and cold packs to the sting site decreases the absorption of venom. Intravenous infusion of midazolam controls the agitation, flailing and involuntary muscle movements produced by scorpion stings. Hypertension and pulmonary oedema respond to nifedipine, nitroprusside, hydralazine or prazosin, and bradyarrhythmias can be controlled with atropine. Currently, treatment of accelerated hypertension with prazosin (post-synaptic alpha-blocker) and nifedipine (calcium channel blocker) has been advocated. Simultaneously, correction of fluid loss due to sweating and vomiting needs to be taken care of by administering intravenous fluids.

Spider

The vast majority of spiders are harmless in the sense that they do not attack unless provoked. Two varieties are capable of producing severe toxicity.

Latrodectus mactans (Black Widow or Hourglass Spider)

This is found all over the world. The female of the species is larger and more vicious. There is usually a red hourglass spot on the dorsal surface of its shiny black body. **The venom is predominantly neurotoxic** and therefore does not produce much local necrosis and some persons experience no other symptoms except a sharp pinprick. However, α-latrotoxin, the most active component of the venom, binds irreversibly to nerves and causes release and eventual depletion of acetylcholine, norepinephrine and other neurotransmitters from presynaptic terminals. Within an hour or so, painful cramps spread from the bite site to large muscles of the extremities and the trunk. Other features may include salivation, diaphoresis, vomiting, hypertension, tachycardia, laboured breathing, anxiety, headache, fasciculations, paraesthesia, hyper-reflexia, urinary retention, uterine contractions and premature labour. Rhabdomyolysis and renal failure have been reported.

Loxosceles reclusa (Violin Spider or Brown Recluse)

It has a violin-shaped mark on its brown coloured back, and the female (as in case of black widow) is more dangerous. **The venom is mainly cytotoxic.** It contains an esterase, alkaline phosphatase, protease and other enzymes that produce tissue necrosis and haemolysis. Sphingomyelinase B, the most important dermonecrotic factor binds cell membranes and promotes chemotaxis of neutrophils, leading to vascular thrombosis. **Initially,** the bite is painless or produces a stinging sensation. Within the next few hours, the site becomes painful and pruritic, with central induration surrounded by a pale zone of ischaemia and a zone of erythema. **In severe cases,** the erythema spreads and centre of the lesion becomes haemorrhagic and necrotic. A black eschar forms and sloughs several weeks later, leaving an ulcer.

Treatment

Initial management includes local cleansing, application of sterile dressings and cold compresses. Elevation of the effected limb is helpful in preventing the spread of venom. Analgesics, antihistamines and antibiotics may be administered, if indicated. Within 48–72 hours, administration of dapsone (a leucocyte inhibitor) may halt the progression of lesions that are becoming necrotic. Usually, the dose is 50–100 mg twice daily after glucose-6-phosphate dehydrogenase deficiency has been ruled out.

Debridement and later skin grafting may be necessary after signs of acute inflammation have subsided. The victims should be monitored closely for signs of haemolysis, renal failure and other systemic complications.