

Bites & stings

Spider bite: A rational approach

G. M. Hawdon, K. D. Winkel

(Australian Family Physician, Vol 26, No 12, December 1997)

Background. Spider bite is one of the most common envenomation problems in Australia. Australia is home to two spiders of major medical importance: the Sydney funnel web spider and the redback spider.

Objective. This paper describes the features of envenomation and discusses treatment for bites by the Sydney funnel web spider and the redback spider. Bites by other spiders are also discussed, as is the problem of necrotising arachnidism.

Discussion. It is hoped that the information contained within this article will be of help to medical practitioners dealing with spiderbite throughout Australia. There is, as yet, a great deal to be learned about spiderbite, particularly necrotising arachnidism.

In terms of number of victims, spider bite is probably the most important envenomation in Australia. There are two Australian spiders of major medical importance, the Sydney funnel web and the redback spider. Several other Australian spiders, including relatives of the Sydney funnel web, have also been reported as dangerous to humans.

Sydney funnel web spider

The male funnel web spider (*Atrax robustus*) is Australia's most dangerous spider, and is capable of causing death in as little as 15 minutes. It is only found within a 160 km radius of Sydney, although related species have been described all along the east coast of Australia, and one of these, the northern or tree dwelling funnel web spider, *Hadronyche formidabilis* (*Figure 1*), has been shown to be dangerous to humans.

The Sydney funnel web is a large, black aggressive spider with large powerful fangs (*Figure 2*). The male appears to be more dangerous than the female. It lives in burrows or crevices in rocks or around house foundations, lining the burrows with silk. Colonies of more than 100 spiders may be found. The male spiders in particular tend to wander into houses in the summer, especially in wet weather. Interestingly their venom appears to have a particularly deleterious effect on primates, whereas other mammals are relatively unaffected. Before the introduction of antivenom in 1980, there had been 13 known fatalities associated with bites from this spider. Since the antivenom has been in use, no deaths have been recorded, and time spent by bite victims in hospital has been greatly reduced. Most bites occur in the warmer months, and are predominantly sustained on the extremities. The pressure immobilisation method of first aid should be employed for bites by any large black spider in the Sydney area, since the illness

caused by funnel web bites may be rapidly progressive and death may ensue within minutes to hours. Children are especially at risk, due to their lower body weight and the potential for multiple bites to occur if the spiders are handled.

Table 1. Symptoms and signs of funnel web spider envenomation

- Numbness around the mouth and spasms of the tongue.
- Nausea and vomiting, abdominal pain, acute gastric dilatation.
- Profuse sweating, salivation, lacrimation, pilo-erection.
- Localised and generalised muscle fasciculation and spasm, commencing in facial tongue or intercostal muscles, and including trismus, which may necessitate paralysing the patient with muscle relaxants in order to manage the airway.
- Dyspnea.
- Confusion, irrationality, coma that may persist in the presence of normalised ventilation, oxygenation and blood pressure, and may be related to raised intracranial pressure.
- Hypertension, vasoconstriction, tachycardia and cardiac arrhythmias.
- Widely dilated pupils, that may be fixed.
- Acute non-cardiogenic pulmonary oedema.

Symptoms and signs of envenomation

In most cases little venom is injected and no symptoms develop. None the less, first aid should be promptly applied and medical attention sought without delay. If envenomation has occurred, the bite site may be extremely painful, although tissue necrosis is not seen. There is some evidence that prolonged immobilisation of venom in the tissue may lead to inactivation. Systemic symptoms can develop within minutes if effective first aid is not employed. They are due to atraxotoxin's direct effect on somatic and autonomic nerves leading to the widespread release of neurotransmitter. Symptoms and signs of envenomation are listed in *Table 1*. Later, the severely envenomated patient may develop progressive hypotension and apnoea.

Hospital management

If first aid has not been applied before the patient reaches hospital, this should be put in place on arrival and should remain in situ until antivenom is available, monitoring is in place and

expertise and equipment for resuscitation and mechanical ventilation are assembled, preferably in an intensive care unit. Intravenous access should be secured as soon as possible, as the patient may become confused and difficult to manage. If no symptoms or signs have developed 4 hours after the bite, or after the removal of first aid measures, the patient may be discharged.

Administration of antivenom

Premedication with parenteral antihistamine plus or minus corticosteroid is recommended. The use of adrenaline as a premedication is not recommended due to the widespread catecholamine release caused by the venom. The initial dose of antivenom is two ampoules, which should be administered intravenously, initially very slowly while watching for an allergic reaction. If no reaction occurs, the rate of administration may be increased. Another ampoule should be given if no improvement is observed after 15 minutes, and further doses given at similar intervals until the patient's condition improves. No adverse reactions have been reported after treatment with funnel web spider antivenom, which consists of highly purified rabbit IgG.

Supportive treatment may include oxygen, nasogastric aspiration, atropine (for excessive salivation), antihypertensives, sedation and muscle relaxants if necessary to facilitate ventilation, positive pressure (hyper)ventilation and invasive monitoring.

Northern tree dwelling funnel web spider

The northern tree dwelling funnel web spider (*Hadronyche formidabilis*) is found in the southeastern regions of Queensland. Although experience of envenomation by this spider is limited, it appears that the above treatment, including the use of *Atrax robustus* antivenom, is also effective for treating this spider's bite and probably for other funnel web spider bites.

Redback spider

Redback spider (*Latrodectus hasselti*) bite is the commonest envenomation requiring antivenom in Australia, with at least 250 cases per year receiving antivenom. Many times this number of cases are mild or unrecognised and do not receive antivenom. Redback spider bite is a frequent cause of presentation to emergency departments and general practitioners throughout Australia, and is particularly frequent over the summer months, although bites occur all year round. Men appear to be more frequently affected than women, probably in relation to occupational exposure. The spider is usually easily identified by the presence of a red, orange or brownish stripe on its abdomen (*Figure 3*). Only the female is considered dangerous, and it is generally shy, biting only defensively. The male is very small, only about 3 mm in diameter, with fangs that are unable to penetrate the skin. Bites are typically sustained when the spider is disturbed in the garden or shed, in clothing (especially footwear) or even when it is sat upon. Bites to the limbs comprise approximately 75% of cases.

Envenomation symptoms and signs

The time course and the actual symptoms are highly variable, but the progression of the illness is generally slow, and symptoms may persist for weeks after an untreated bite. The acute symptoms are listed in *Table 2*.

Table 2. Symptoms and signs of redback spider envenomation

- Immediate **pain at the bite site** plus erythema and swelling.
- Pain progressing over hours to involve the entire limb.
- Tender and swollen regional lymph nodes.
- **Sweating**, sometimes affecting only the bitten limb, and sometimes in **bizarre distributions** unrelated to the bite site.
- **Nausea, vomiting, abdominal pain.**
- **Headache.**
- Migratory arthralgia.
- Fever.
- Restlessness and **insomnia.**
- Hypertension and tachycardia.
- Neurological symptoms associated with the neuromuscular blockade and possibly catecholamine release caused by alpha-latrotoxin (eg, muscle weakness or twitching).

(The cardinal symptoms of envenomation by *Latrodectus hasselti* are in bold type.)

Management

First aid for redback spider bites consists of ice packs for local pain relief. Pressure immobilisation is not recommended due to the slow progression of symptoms. The exact mechanism(s) by which the toxins produce the observed clinical effects are poorly understood, as is the precise cause of death. No deaths have been reported since 1955, a year before the introduction of redback spider antivenom in Australia. At least 17 deaths had been reported before this.

Antivenom should be used in those cases that present with more than mild local pain or with systemic symptoms or signs of envenomation. The antivenom consists of a small volume (~0.5 mL) of 6% equine antibody solution, and is usually given by intramuscular injection, unless envenomation is severe, in which case the intravenous route should be used. The rate of reaction to the antivenom is low, observed in one series as 0.5%. Premedication is usually not given before the administration of redback spider antivenom. The dose should not be reduced for children, whose lower body weight renders them more susceptible to severe envenomation. Unlike most other envenomations, administration of redback spider antivenom may be effective even several weeks after the bite.

Mouse spiders

Mouse spiders, *Missulena spp* (Figure 4) are large and robust spiders found throughout Australia, except in Tasmania. They possess large powerful fangs and produce copious amounts of venom, which initial investigation has suggested may be quite toxic. Occasional case reports, mostly involving children, have implicated this spider as a cause of serious illness in humans. One such case report suggests that funnel web spider antivenom might be effective in the treatment of mouse spider bites, but information is scarce.

Other spiders

Thousands of species of spiders inhabit Australia. Most of these remain unknown to science and medicine and some may be dangerous to humans. A healthy respect should be maintained for all spiders.

Necrotising arachnidism

Necrotising arachnidism describes a syndrome of skin blistering, ulceration and necrosis after spider bite. Variations of this syndrome are described around the world, particularly in the Americas. Infrequently in Australia, severe illness develops, with ongoing pain and tissue destruction requiring extensive debridement and skin grafting. The chief Australian suspects are the white tailed spider, *Lampona cylindrata* (Figure 5) and the black widow or black house spider, *Badumna insignis* (Figure 6). Both are commonly found in houses throughout Australia.

Lampona cylindrata is readily identified by the distinctive white or grey spot on its cigar-shaped abdomen. The spot is present in both males and females, and the female is larger and more robust than the male. White tailed spiders are found in bedding, or in clothing that has been left on the floor, and are mainly active at night, when they hunt for their prey of spiders and insects. It is unknown whether the male and female are equally associated with skin necrosis. In most confirmed *L cylindrata* bites, only a mild to moderate localised reaction or blister ensues. However, significant tissue loss may sometimes occur. The proportion of bites that result in necrotic lesions is unknown.

Table 3. Differential diagnosis of possible necrotising arachnidism lesions

- Vascular ulcers (arterial or venous insufficiency).
- Diabetic ulcer.
- Infection.
 - Bacterial, eg, streptococcus, staphylococcus, anthrax
 - Mycobacterial, eg, *M ulcerans*
 - Fungal
 - ? Viral.
- Foreign body.
- Focal vasculitis.
- Injection of toxin (accidental or deliberate).
- Drug reaction.
- Physical/mechanical trauma (may be deliberate).
- Burns (especially chemical burns).
- Pyoderma gangrenosum.
- Neoplasm.
- Immunosuppression.
- Alpha1 antitrypsin deficiency.
- Fat herniation with infarction.

Badumna insignis is also commonly encountered in Australian homes, where it builds its lacy, untidy looking webs in the corners of windows or around houses. It too, has been

implicated in at least one case of extensive tissue necrosis and systemic illness. Again, it is unknown whether the male and female are equally dangerous.

One well described case of suspected necrotising arachnidism is thought to have involved a wolf spider, *Lycosa spp* (Figure 7).

Necrotising arachnidism is at present poorly understood in Australia, although it probably has some parallels with loxoscelism, a syndrome of tissue necrosis sometimes accompanied by systemic illness and occasional deaths in the USA. This syndrome is caused by the brown recluse spider (*Loxosceles reclusa*). Most cases of loxoscelism heal without aggressive medical treatment. A single case of skin necrosis associated with *Loxosceles rufescens* has been reported in Adelaide. The potential for other *Loxosceles* species in Australia to cause necrosis is unknown. A major difficulty is the lack, in most clinically suspected cases, of a definitive history of spider bite and/or a positive identification of the spider involved. In addition, there is as yet no test or assay for spider bite or spider venom, so retrospective diagnosis is also impossible at this time. Thus, the true incidence of necrotising arachnidism in Australia is unknown. The usual presentation is of an area of blistering or necrosis, often on the limb, in a patient who has been outside, often in the garden, but usually without a definite bite history or with no identification of the offending creature if a bite has been felt (Figure 8). The diagnosis of necrotising arachnidism, therefore, is one of exclusion and other treatable causes of necrotic lesions must be considered (Table 3).

Mycobacterium ulcerans, first described in Gippsland in Victoria in relation to so-called 'Bairnsdale ulcers' has been recognised as a cause of non-healing ulcers in other parts of Australia. This pathogen should be considered and excluded in the treatment of any chronic ulcer of uncertain aetiology. It requires special culture media and conditions, and may be overlooked unless a specific culture is done. It has been suggested that the lesions of necrotising arachnidism may be explained by *M ulcerans* infection, but this is probably rare.

Treatment of necrotising arachnidism

There is as yet no definitive treatment for necrotising arachnidism. Those that have been tried include:

- antibiotics
- corticosteroids
- hyperbaric oxygen therapy
- surgical debridement sometimes with skin grafting (early or late)
- and (for loxoscelism) cytotoxics such as colchicine and cyclophosphamide.

Antibiotics that have been used include dapsone (particularly in the USA), erythromycin and doxycyclines, as well as the more conventional penicillin, flucloxacillin and cephalosporins. Recent data from different experimental animal models of loxoscelism support the early use of hyperbaric therapy or dapsone. However, none of these treatments have been satisfactorily shown to be of clinical benefit, and no systematic human trials or even case control studies have been conducted. The availability of an antivenom for *Loxosceles reclusus* in the USA has not been as helpful as one might at first suppose. The lack of diagnostic and treatment options in Australia makes it impossible to quantify the cost to the community of this chronic, progressive condition, but considerable resources are expended in terms of multiple consultations with physicians and other health practitioners, drugs (including antibiotics), hyperbaric therapy, dressings and occasionally surgery. The Australian Venom Research Unit is currently involved in research aimed at the development of a diagnostic test and ultimately a treatment for this chronic and debilitating condition.

Summary of Important Points

➤ Sydney funnel web spider bites may cause a rapidly progressive, life threatening illness. Pressure immobilisation first aid should be used and immediate hospital treatment sought. Antivenom is available and effective.

➤ Redback spider bite is the commonest cause of antivenom use in Australia. The illness is slowly progressive and includes pain extending up the limb, headache, nausea and abdominal pain and sweating in sometimes bizarre distributions. Antivenom may be effective up to several weeks after the bite.

➤ Necrotising arachnidism is poorly understood in Australia, and the spider(s) responsible have not been positively identified. There is no treatment known to be effective. Exclude other causes of non-healing ulcers.