STATE TOXINOLOGY SERVICES

Toxinology Dept., Women's & Children's Hospital, North Adelaide SA 5006 AUSTRALIA

SNAKEBITE MANAGEMENT OVERVIEW DOCUMENT

www.toxinology.com record number SN0430

Family

Viperidae

Scientific name combined

Crotalus durissus unicolor

Common name

Aruba Island Rattlesnake

Global region in which snake is found

South America

CLINICAL OVERVIEW

South American rattlesnake bite is quite different from North American experience. Crotalus durissus terrificus and related species cause relatively minor local effects, though pain and swelling can occur. It is the systemic effects that predominate and can kill. Neurotoxic flaccid paralysis, myolysis, secondary renal failure and coagulopathy can all occur, though it is the first two that are most common. Antivenom therapy is central in treatment.

There is only limited clinical data on bites by the Aruba Island rattlesnake, but bites certainly occur and appear to follow the neotropical rattlesnake pattern, with limited local effects, but systemic neurotoxicity. No cases so far reported have resulted in severe envenoming of major paralytic features, with no cases of respiratory paralysis, but such severe envenoming cannot be confidently excluded. Similarly, so far there are no cases of myolysis or coagulopathy documented. No specific antivenom is available, so non-specific antivenoms would need to be used in severe envenoming.

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Crotalus durissus unicolor

First aid

1. After ensuring the patient and onlookers have moved out of range of further strikes by the snake, the bitten person should be reassured and persuaded to lie down and remain still. Many will be terrified, fearing sudden death and, in this mood, they may behave irrationally or even hysterically. The basis for reassurance is the fact that many venomous bites do not result in envenoming, the relatively slow progression to severe envenoming (hours following elapid bites, days following viper bites) and the effectiveness of modern medical treatment.
2. The bite wound should not be tampered with in any way. Wiping it once with a damp cloth to remove surface venom is unlikely to do much harm (or good) but the wound must not be massaged.
3. All rings or other jewellery on the bitten limb, especially on fingers, should be removed, as they may act as tourniquets if oedema develops.
4. If the bite is on a limb, a broad bandage (even torn strips of clothing or pantyhose) should be applied over the bitten area at moderate pressure (as for a sprain; not so tight circulation is impaired), then extended to cover as much of the bitten limb as possible, including fingers or toes, going over the top of clothing rather than risking excessive limb movement by removing clothing. The bitten limb should then be immobilised as effectively as possible using an extemporised splint or sling.
5. If there is any impairment of vital functions, such as problems with respiration, airway, circulation, heart function, these must be supported as a priority. In particular, for bites causing flaccid paralysis, including respiratory paralysis, both airway and respiration may be impaired, requiring urgent and prolonged treatment, which may include the mouth to mask (mouth to mouth) technique of expired air transfer. Seek urgent medical attention.
6. Do not use Tourniquets, cut, suck or scarify the wound or apply chemicals or electric shock.
7. Avoid peroral intake, absolutely no alcohol. No sedatives outside hospital. If there will be considerable delay before reaching medical aid, measured in several hours to days, then give clear fluids by mouth to prevent dehydration.
8. If the offending snake has been killed it should be brought with the patient for identification (only relevant in areas where there are more than one naturally occurring venomous snake species), but be careful to avoid touching the head, as even a dead snake can envenom. No attempt should be made to pursue the snake into the undergrowth as this will risk further bites. In Australia and parts of New Guinea, Snake Venom Detection Kits are available to identify the snake from venom left on the skin.
9. The snakebite victim should be transported as quickly and as passively as possible to the nearest place where they can be seen by a medically-trained person (health station, dispensary, clinic or hospital). The bitten limb must not be exercised as muscular contraction will promote systemic absorption of venom. If no motor vehicle or boat is available, the patient can be carried on a stretcher or hurdle, on the pillion or crossbar of a bicycle or on someone's back.
10. Most traditional, and many of the more recently fashionable, first aid measures are useless and potentially dangerous. These include local cauterization, incision, excision, amputation, suction by mouth, vacuum pump or syringe, combined incision and suction ("venom-ex" apparatus), injection or instillation of compounds such as potassium permanganate, phenol (carbolic soap) and trypsin, application of electric shocks or ice (cryotherapy), use of traditional herbal, folk and other remedies including the ingestion of emetic plant products and parts of the snake, multiple incisions, tattooing and so on.

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Crotalus durissus unicolor

Clinical summary

Substantial case data and venom data are available only for a few members of the South American rattlesnake group, particularly the most important member, *Crotalus durissus terrificus*, a major cause of bites throughout its range, though still less important than some key species of *Bothrops*. The following is based on experience with *Crotalus durissus terrificus*. It is possible, even likely, that more thorough clinical study may reveal clinical differences between each *Crotalus durissus* subspecies.

SOUTH AMERICAN RATTLESNAKE GROUP (*Crotalus durissus*)

Bites may cause minimal to significant local pain, often obvious bite marks, but swelling may be minimal, occasionally extensive, while blistering, bruising and necrosis do not occur. In more serious bites, major systemic envenoming can be apparent within an hour of the bite, but may be delayed several hours. There may be general symptoms, such as headache, nausea, vomiting or abdominal pain, but these may all be absent, despite major envenoming, which is characterised by flaccid paralysis and/or myolysis. The paralysis will usually first present as ptosis, then ophthalmoplegia, other cranial nerve weakness, sometimes pupil dilation, then progressive skeletal muscle weakness, culminating in respiratory paralysis. First paralytic signs may be evident within 1 hour of the bite. Speed of progression is variable. Myolysis may also develop early, presenting first as painful or tender muscles, often associated with red to black urine (myoglobinuria). Renal failure, usually anuric, secondary to the myolysis is common and may be associated with potentially lethal (cardiotoxicity) hyperkalaemia. Death is most often due to intractable cardiac or respiratory arrest. Muscle biopsies show clear evidence of widespread myolysis in such cases. In the past coagulopathy has not been considered a feature of envenoming by these snakes, but more recent case data from bites by *Crotalus durissus* subspecies from Brazil, clearly shows that mild to moderate coagulopathy can occur, including defibrination, though major pathologic bleeding is not a feature.

Limited case data on Aruba Island rattlesnake bites suggest that severe envenoming is uncommon to rare, if it can occur at all, with documented cases showing minimal local effects, and generally minor neurotoxic systemic effects, varying from burning pain or parasthesiae in the bitten limb, to more generalised minor muscle weakness, but major systemic paralysis, respiratory paralysis, myolysis and coagulopathy have so far not been reported after bites by this snake.

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Crotalus durissus unicolor

Treatment summary

Envenoming of the pattern seen with South American rattlesnake bites, with minimal to mild local effects, potentially severe, even lethal systemic effects, requires a rather different approach to that used for North American rattlesnake bites. The principal systemic effects are progressive flaccid paralysis, potentially respiratory paralysis, systemic myolysis with possibility of secondary renal failure, hyperkalaemia and hyperkalaemic cardiotoxicity, and a generally mild coagulopathy, with partial defibrination, rarely thrombocytopenia, and pathologic bleeding unlikely.

The rate of envenoming is uncertain but, at least for larger snakes and species, likely to be high. As the local effects of the bite can be trivial, despite major systemic envenoming, the local effects cannot be used to determine likely severity, unlike most North American rattlesnake bites and many other South American pit viper bites. Therefore, every case should be admitted and observed at least overnight. An IV line should be inserted and an initial IV fluid load given. It is important to maintain good renal flow early, to reduce the chance of renal damage secondary to myolysis and myoglobinuria. Fluid input and output should be strictly recorded. Laboratory tests should be performed early, particularly looking for myolysis (CK), renal damage (creatinine, urea, K+), and coagulopathy (PT/INR, aPTT, fibrinogen, FDP/d-dimer, platelet count, full blood picture). Careful clinical examination for evidence of developing systemic envenoming should be performed immediately and frequently thereafter, to ensure signs of paralysis (ptosis, ophthalmoplegia, dysarthria, dysphagia, poor tongue protrusion etc), myolysis (muscle pain, tenderness & weakness) and coagulopathy (spontaneous bleeding from bite site, venepuncture wounds, gums etc) are detected as soon as they become apparent, to allow early antivenom therapy. It is essential that both clinical examination and lab tests are repeated over a period of hours, to ensure early envenoming is detected and treated before it becomes severe. If initial lab tests are normal, consider repeating after another 2-3 hours and again another 2-4 hours later, or earlier if clinical signs develop. If the third set of lab tests are normal and the patient remains symptom & sign free, it is possible that it was a dry bite. Continue to observe overnight. If still well the following day, repeat lab tests and if still normal, discharge is reasonable.

For all cases developing systemic envenoming, particularly flaccid paralysis or myolysis, antivenom therapy is required, the sooner the better. Several antivenoms are available in South and Central America, targeting the most important species. It is assumed that there will be enough cross reactivity to cover less common species, but this may not always be the case. Where possible, it is preferable to use antivenom raised in the country or region of origin of the snake. However, there is no specific antivenom for the Aruba Island rattlesnake. The Venezuelan antivenom has been suggested as most appropriate, if available, otherwise consider some of the other South and Central American polyvalent snake antivenoms covering *Crotalus durissus* subspecies.

Antivenom should always be given IV, diluted if possible, but beware fluid overload in small children, causing pulmonary oedema. Always have adrenaline and resuscitation equipment ready prior to commencing antivenom, in case of an adverse reaction. Adrenaline is the most important treatment for severe early adverse reactions ("anaphylaxis"). Do not perform skin sensitivity testing prior to giving antivenom; this procedure is unreliable, dangerous and inappropriate. The initial dose of antivenom will be determined by the particular antivenom used and the degree of envenoming, not by the patient's size or weight. Children require "adult" doses. For the Venezuelan Suero Antiofidico polyvalente antivenom, the producer recommends an initial dose of at least 5 vials. An initial dose of at least 5 vials is also recommended for the Costa Rican and Butantan Brazilian products. The Mexican Antivipmyn requires a higher initial dose, at least 10-12 vials. It must be emphasised that none of these venoms use Aruba Island rattlesnake venom in their immunising mix, so none can be guaranteed to be effective.

After the initial antivenom is given, it is reasonable to wait at least 3 hours before deciding if a further dose is needed. The criteria for further doses, both when and if to give, and amount, are not well developed. In general, if there has been no improvement after the first dose, or worsening of envenoming, then a further dose should be strongly considered. Antivenom may not be effective at reversing paralysis, so if paralysis is the only feature worsening, there is probably little point in giving more and more antivenom, without effect. However, myolysis may respond to further or late antivenom therapy, as will coagulopathy. Antivenom is not likely to reverse secondary renal failure or hyperkalaemia.

In addition to antivenom therapy, it is important to maintain adequate hydration, particularly using IV fluids (if available) and ensure good renal flow. If anuric/oliguric renal failure has already developed, then fluid input must be carefully managed, as for any other cause of renal failure. The coagulopathy seen with some South American rattlesnake bites is rarely severe and antivenom should be adequate treatment. Replacement therapy with FFP, cryoprecipitate/platelets are unlikely to be required. Heparin has no place in treatment of venom induced coagulopathy. If there is progressive paralysis, it is important to check for adequate airway protection, because if this is lost, intubation may be needed, even though respiration is not fully paralysed. If there is significant respiratory paralysis, support respiration with intubation and external ventilation. Monitor effectiveness with a saturation monitor, if available, but avoid arterial blood gas measurements if there is any degree of coagulopathy.

All cases with envenoming, requiring antivenom therapy, should be carefully followed up after initial recovery, particularly

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looking for serum sickness due to the antivenom. Though unproven, some experts suggest a short course of oral steroids prophylacticaly to reduce the likelihood of serum sickness. It is best to advise patients/relatives from the outset that snakebite is a potentially severe injury, with a potential for adverse outcomes beyond the control of modern medical practice. Honest early discussion of the potential short and long term risks of both the bite and its treatment (ie anaphylactoid or serum sickness reactions to antivenom) are in the interests of both the patient and those offering treatment and may reduce the chance of later dissatisfaction or litigation.

Few doctors see snakebite cases frequently. Unless the treating doctors see many cases and feel justifiably confident in treating envenoming, they should consider early discussion with colleagues expert in this area of medicine. Such expert advice may be available through the regional poisons centres or specialist hospitals such as Instituto Butantan in Brazil, who will likely have a list of on-call experts. Early consultation may well avoid unpleasant problems developing later.

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Crotalus durissus unicolor

Available antivenoms

Suero Antiofidico polyvalente
Centro de Biotecnologia
Faculta de Farmacia,
Universidad Central de Venezuela
Av. Principal de Los Llustres
Los Caguaramos
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Venezuela
Phone: ++58-212-605-2704
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Email:
Website: www.caibco.ucv.ve

Antivipmyn
Instituto Bioclon
Calzada de Tlalpan No. 4687
Toriello Guerra
C.P. 14050
Mexico, D.F.,
Mexico
Phone: ++525-488-3716
Fax: ++525-688-2074
Email:
Website:

Polyvalent Antivenom
Instituto Clodomiro Picado T.
Facultad de Microbiolgia
Universidad de Costa Rica
San Pedro, San Jose
Central America
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Phone: ++506-229-0344; ++506-229-3135
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Website: www.icp.urc.ac.cr/comentar.htm

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Crotalus durissus unicolor

Management Flowchart