STATE TOXINOLOGY SERVICES

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

SNAKEBITE MANAGEMENT OVERVIEW DOCUMENT

www.toxinology.com record number SN0326

Family

Viperidae

Scientific name combined

Agkistrodon bilineatus bilineatus

Common name

Common Cantil , Mocasina , Castellana , Gamarilla , Mexican Moccasin , Mexican Cantil

Global region in which snake is found

Central America

CLINICAL OVERVIEW

Limited published case experience, combined with experience with related species, indicates bites by these snakes is likely to cause mild to moderate, sometimes severe local swelling and pain, which may be accompanied by bleeding, blistering and necrosis. Non-specific systemic effects may occur, including secondary shock due to fluid shifts into the bitten limb. Coagulopathy occurs, at least in severe cases, with extensive bleeding possible. Renal failure can occur. Fatalities, even in adults, sometimes within a few hours of the bite, regularly occur. Neurotoxic paralysis and systemic myolysis are not likely to occur.

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

SNAKEBITE MANAGEMENT OVERVIEW DOCUMENT

SNAKEBITE MANAGEMENT OVERVIEW DOCUMENT (continued)

Agkistrodon bilineatus bilineatus

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. The bitten limb should be immobilised as effectively as possible using an extemporised splint or sling; if available, crepe bandaging of the splinted limb is an effective form of immobilisation.
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.
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.

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

SNAKEBITE MANAGEMENT OVERVIEW DOCUMENT

SNAKEBITE MANAGEMENT OVERVIEW DOCUMENT (continued)

Agkistrodon bilineatus bilineatus

Clinical summary

The cantils, *Agkistrodon bilineatus*, are a major cause of snakebite within their range and are considered highly dangerous. Death rates following bites are not well documented, but deaths regularly occur, sometimes within a few hours of the bite. Local necrosis may also be common, with amputation rates as high as 16% quoted. Locals consider this snake the most dangerous species within its range, ahead of *Bothrops* and Crotalus species. However, it appears that many bites are less severe.

Overall, bites are likely to leave visible fang marks, followed by rapid development of moderate to severe local pain, swelling that may be extensive, discolouration of skin in the bitten region, and in some cases, progression to severe swelling, fluid shifts into the bitten limb, with the potential for secondary hypovolaemic shock, blistering of skin, local haemorrhage and development of necrosis. Bites to digits are more likely to result in severe necrosis requiring amputation. Though not well reported for these snakes, given the extent of local tissue effects and damage, compartment syndrome would certainly be possible.

In addition to the severe local effects, these snakes can cause major systemic effects, especially coagulopathy, with oozing of blood from fang punctures and IV sites, bleeding gums, epistaxis, haematuria, generalised petechiae. Secondary renal failure can occur, as can shock.

Fatality is possible due to shock, renal failure, or septicaemia secondary to gangrene of the bitten limb.

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

SNAKEBITE MANAGEMENT OVERVIEW DOCUMENT

SNAKEBITE MANAGEMENT OVERVIEW DOCUMENT (continued)

Agkistrodon bilineatus bilineatus

Treatment summary

North American pit viper bites (rattlesnakes, copperheads, cottonmouths etc) are generally managed as a group, without specific differences between species, except for *Crotalus scutulatus* bites (potential for significant neurotoxicity). The following is based on standard guidelines for these snakes. Be aware that while North American *Agkistrodon* species bites are generally less severe than rattlesnake bites and copperhead bites, in particular, are often minor only, *Agkistrodon bilineatus* bites are often severe, even fatal, and should be managed as for major rattlesnake species.

Around 20% of all rattlesnake bites will be dry bites (percentage for *Agkistrodon* uncertain), without significant local or systemic effects. For most North American pit viper bites, if no local or systemic effects have developed by 12 hrs (some would suggest 6hrs as sufficient), then the bite is almost certainly a dry bite. Limited published data on *Agkistrodon bilineatus* suggests that local necrosis rates are high, with amputation required in up to 16% of cases.

For cases showing clear evidence of local effects, ± systemic symptoms (majority of cases), insert an IV line and give an initial IV fluid load. If there is evidence of major local swelling, with the potential for fluid shifts and shock, monitor BP closely and consider giving further IV fluids to maintain adequate BP and renal perfusion. In such cases, beware later resolution of the swelling resulting in circulatory overload and pulmonary oedema, especially in children.

Both local necrosis and compartment syndrome are a potential risk, with high rates of major local swelling and necrosis for *Agkistrodon bilineatus* bites, but compartment syndrome rates are not documented, may be uncommon to rare, and can be confused with direct venom-induced muscle necrosis, though this appears unlikely in *Agkistrodon* bites. If clinically it appears there may be a developing compartment syndrome, confirm this with pressure measurement before considering fasciotomy, otherwise unnecessary long term limb dysfunction and deformity may well result. Fasciotomy is rarely justified for snakebite. Unless the compartment syndrome is severe and well established, it is usually advisable to first try adequate antivenom therapy before proceeding to fasciotomy. Risks versus benefits must be carefully weighed for each individual case before deciding whether to first give antivenom, or proceed directly to fasciotomy.

In all cases with significant local or systemic effects, consider antivenom therapy. Given the severity of bites by *Agkistrodon bilineatus*, most cases will require antivenom therapy.

In North America it is common practice to grade the degree of envenoming and use this to determine the need for intervention (antivenom etc). While this process is not accepted by all, it does form a basis of common care guidelines and therefore its use should be considered, at least by those working in the USA. The grading is based on experience with rattlesnake (*Crotalus*) bites and any grading should be subject to reassessment, in a dynamic fashion, reflecting the dynamic nature of envenoming. It should be emphasised that this grading is for North American rattlesnake bites showing the classic features of envenoming, and therefore does not apply well to neurotoxic/myotoxic *Crotalus scutulatus* bites, where the local effects may be minor even with severe systemic envenoming.

Grade 0: Non-envenoming (a dry bite); there may be fang puncture marks, but no other local effects or systemic effects.

Grade 1: Mild envenoming; local effects (pain, swelling) limited to bite area, no systemic effects or blood test abnormalities.

Grade 2: Moderate envenoming; local effects extend beyond the bitten area, but not the whole bitten limb, systemic effects present (such as nausea, vomiting, abdominal pain, metallic taste in mouth, fasciculations of isolated muscle groups, especially the face), blood tests abnormal (may include thrombocytopenia, hypofibrinogenaemia, prolonged prothrombin time, elevated CK).

Grade 3: Severe envenoming; rapidly evolving swelling, blistering or ecchymosis or swelling extending to involve the whole bitten limb or beyond, potential for compartment syndrome, major systemic effects (including those seen in moderate envenoming, plus some or all of shock, widespread or severe bleeding, renal failure, respiratory problems, altered conscious state) and blood test abnormalities (severe thrombocytopenia, abnormal coagulation tests, myolysis with grossly elevated CK, myoglobinuria/anaemia, renal failure).

Antivenom would not be required or appropriate for Grade 0 cases, would not necessarily be required for Grade 1 cases, but if used would be at a low dose, while all Grade 2 & 3 cases require antivenom. Grade 3 cases will require a higher initial dose, and often require larger subsequent doses of infusions.

At least in North America (USA) the only approved antivenom for *Agkistrodon* species envenoming is the new ovine F(ab)' "Crofab", as the Wyeth Polyvalent Crotalidae antivenom is now either unavailable for restocking or out of production. It is unclear if this older product will again become available. Crofab is a safe, expensive, but effective antivenom which has only a short half life, owing to the small molecular size, compared to IgG antivenoms (eg Wyeth), so repeat doses or infusions are often required. The initial dose is usually suggested as 4-6 vials, followed by a further 6+ vials, either stat or, preferably, as an

infusion. The common regime suggested is 4-6 vials (each vial is reconstituted with 10mls sterile water) diluted in normal saline (250mls), given IV, initially at a slow rate (20-60ml/min) until it is clear no adverse reaction is occurring, then increase the rate to around 250ml/hr, until the whole initial dose is given. A slower rate or less volume might be required in small children, but still the same dose of antivenom. On completion, reassess to determine if antivenom has been effective. If there is still significant envenoming (eg advancing swelling, major systemic symptoms etc), consider further antivenom, at a similar dose and rate. Thereafter, it is often advisable to maintain antivenom levels by a continuous infusion, at a rate of 2 vials every 6hrs, up to 18+hrs, longer if major envenoming present. Higher doses may be justified in severe cases. Always have epinephrine & resuscitation equipment readily available prior to commencing antivenom therapy, in case of adverse reactions. In the past in the USA it was common practice to perform a skin sensitivity test prior to starting antivenom. This dangerous and ineffective procedure is not appropriate and is not advocated by the producer of Crofab; DO NOT USE SKIN SENSITIVITY TESTING!

The Mexican antivenom, Antivipmyn, is F(ab)2, not Fab', so is expected to have a longer half life and will not require such frequent doses to maintain levels. However, a higher initial dose is likely to be required, at least 10-12 vials (producer, Bioclon, suggests 5-16 vials initially in adults, depending on severity, with double this dose in children), and further doses may be needed to neutralise all circulating venom. The indication for further doses is unclear, but consider worsening local swelling or effects, or worsening or developing systemic effects, especially coagulopathy or thrombocytopenia (uncertain if this antivenom will affect the latter). Note that while this antivenom has been recommended for use in North American snakebite, it has only rarely been used in this role and does not yet have US FDA approval; the immunising snake species are central-south American, not North American.

In general, if there is a major coagulopathy or bleeding, antivenom will be the most effective treatment and should always be tried first, before considering blood product replacement therapy, except if there is life-threatening bleeding. If antivenom in adequate amounts fails to reverse coagulopathy sufficiently, over a reasonable period of time (allow several hours for such an effect, not minutes), then replacement therapy may be considered. Depending on the nature of the clinical problem or lab test abnormality, FFP, cryoprecipitate, platelet concentrate or whole blood might all be considered.

It is also unclear if antivenom will reduce the extent of systemic myolysis, should this occur (unlikely for *Agkistrodon* bites), but limited experience elsewhere suggests it may be effective. As severe myolysis is potentially lethal and debilitating, it is appropriate to trial antivenom therapy to reduce myolysis. Substantial doses might be required, but exact amounts are not currently determined.

All patients receiving antivenom or suffering any significant local or systemic effects should be followed up after discharge, particularly looking for delayed reactions to the antivenom (serum sickness) and functional problems affecting the bitten limb, as a result of venom-induced tissue injury. It should be stressed that even with the best treatment possible, full pre-injury function and appearance of the bitten limb cannot be guaranteed. Therefore, any such defect is not automatically an indication of malpractice, nor should it occasion legal action by the patient. 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 centre, who will likely have a list of on-call experts. Early consultation may well avoid unpleasant problems developing later.

SNAKEBITE MANAGEMENT OVERVIEW DOCUMENT

SNAKEBITE MANAGEMENT OVERVIEW DOCUMENT (continued)

Agkistrodon bilineatus bilineatus

Available antivenoms

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 crotalid antivenom (CroFab), Ovine, Fab
Protherics Inc. (US)
1207 17th Avenue South
Suite 103, Nashville
Tennessee 37212
U.S.A.
Phone: ++1-615-327-1027
Fax: ++1-615-320-1212
Email: info@prothetics.com
Website: www.protherics.com

SNAKEBITE MANAGEMENT OVERVIEW DOCUMENT

SNAKEBITE MANAGEMENT OVERVIEW DOCUMENT (continued)

Agkistrodon bilineatus bilineatus

Management Flowchart