Management of common animal bites in the emergency centre

The most common animal bites to present in emergencies are dog and snake bites.

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In South Africa there are a variety of animals that have the potential to inflict injuries. However, such injuries are relatively rare compared with dog bites, which are by far the most frequently encountered animal bites managed in our emergency centres. Many of the principles in the management of dog bites also apply to bites from other animals. Snake bite victims may require specific medical interventions such as the administration of antivenoms. For these reasons the focus of this article will be on dog bites and snake bites.

Dog bites

Dog bites are a major public health concern and are responsible for approximately 1% of emergency centre visits in the United States.[1] The magnitude of the problem in South Africa is likely to be similar, and Dwyer *et al*. found that dog bites accounted for 1.5% of all trauma unit presentations at the Red Cross War Memorial Children's Hospital in Cape Town over a 13.5-year period.[2]

In 2006 more than 31 000 patients required reconstructive surgery in the USA as a consequence of dog bites. The estimated direct and indirect cost of dog bites amounts to around $250 million per year in the USA.[3]

South African and international studies have shown repeatedly that children are the highest risk group for attacks by dogs.[2,4] Children younger than 7 years are more likely to be bitten in the face, neck and scalp. This is probably because their height puts them at face level with dogs. Small children may also provoke dogs by taking their toys, kissing and petting them.

Severe psychological consequences are reported in children who were bitten by dogs, especially when the bites involved the head and neck areas.[4] Deaths from severe mauling are also an unfortunate reality.

Dog breeds associated with more aggressive behaviour are pit bull terriers, Rottweilers, German shepherds and Dobermans.[5] Several countries and states in the USA have 'dangerous breed' legislation that prohibits ownership of a variety of attack dogs, including pit bull terriers. There is no 'dangerous breed' legislation in South Africa.

Pathology and microbiology

Dogs are natural scavengers, capable of eating and biting through hard bones. As such they have powerful jaws and are able to exert biting power of between 30 kg and 70 kg per square centimetre.[1] When puncture wounds overlie bone an open fracture should always be suspected and radiological examination is mandatory. Common injuries caused by dog bites are abrasions, simple lacerations, deep puncture wounds, crush injuries and fractures. Injuries to deep structures such as nerves and blood vessels can occur.

The pathogens in dog bite injuries originate from the oral flora of the dog and the skin flora of the human. *Pasteurella multocida*, staphylococci, streptococci and anaerobes are most frequently involved in wound infections. Wound infection with *Pasteurella multocida* usually occurs early (within 12 hours) with significant erythema and pain and can cause sepsis if left untreated. Wound infection with *Capnocytophagia canimorsus*, a gram-negative bacillus, can cause a severe septic shock syndrome with fulminant purpura and gangrene to the limbs. This type of infection is not common in immune-competent individuals. Risk factors include immunosuppression, alcohol abuse, corticosteroid therapy and splenectomy. Devitalised tissue is a good breeding ground for *Clostridium tetani* and prophylaxis should be considered. The rabies virus can be transmitted from rabid dogs.

Management

Patients who have sustained severe injuries (Fig. 1) should be resuscitated first. Immediate direct pressure should be applied to bleeding wounds. Intravenous lines should be inserted and blood taken for cross-matching. Attention should be given to the airway and breathing

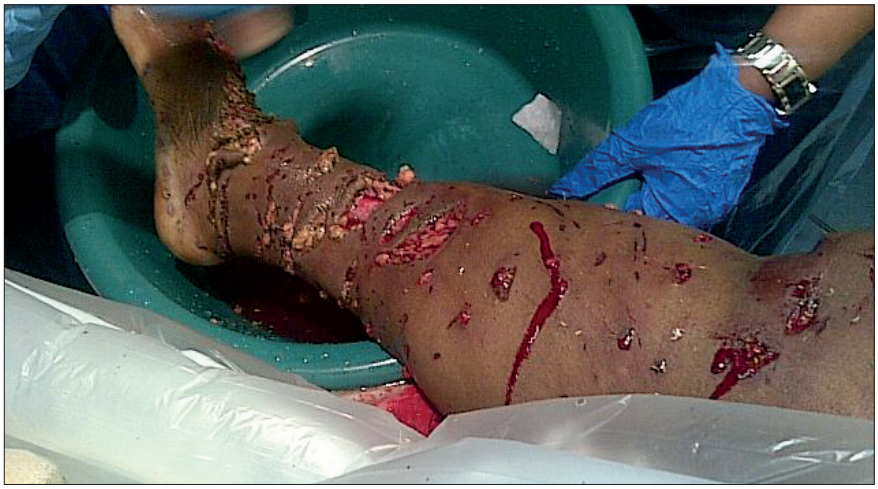

Fig. 1. This patient sustained severe injuries to all her limbs after an attack by multiple dogs. She required several units of blood, fresh frozen plasma and platelets as part of her resuscitation.

and supplemental oxygen can be administered to maintain saturation levels above 94%. Packed cells and fresh frozen plasma should be ordered if severe blood loss has occurred. Intravenous analgesia should be administered to patients in severe pain. Wound management for patients with extensive injuries, septic wounds, joint involvement and fractures should take place in theatre.

South African and international studies have shown repeatedly that children are the highest risk group for attacks by dogs.

Most patients with minor bite wounds can be treated as outpatients. Excellent local wound care is the key to prevent infection and promote good wound healing in these patients. Wounds should be cleaned and all foreign material removed. Devitalised tissue should be debrided. Irrigation with copious amounts of saline is indicated. Irrigation of puncture wounds can be achieved effectively with the use of a syringe and the plastic cannula of an 18 - 20 gauge IV needle. Stronger antiseptic solutions like povidone iodine and alcohol can cause damage to the wound surface that can impair wound healing and should only be used in cases of bites from suspected rabid dogs.[6]

Wound closure

Simple open lacerations less than 12 hours old can be closed primarily provided that the wounds were cleaned and irrigated properly.[7] Facial wounds can be sutured up to 24 hours after injury provided no sign of infection is present. Extensive and infected facial wounds should be managed by or in consultation with a reconstructive surgeon. Wounds that are a high risk for infection should not be sutured and should be left to heal by secondary intention (see Table 1).

Table 1. Wounds that are not recommended for suturing

- Puncture wounds
- Crush injuries
- Bite wounds on the hands
- Minor lacerations on the lower extremities
- Wounds that appear to be infected
- Wounds older than 12 - 24 hours
- If there is a danger of rabies

Prophylaxis

Routine antibiotic prophylaxis is not indicated for all bite wounds. It is indicated for high-risk patients, such as those with vascular compromise, depressed immunity, diabetes mellitus and asplenia. It is also indicated in high-risk wounds such as those described in Table 1. Amoxicillin-clavulanic acid is effective against most of the likely pathogens and is the antibiotic of choice. For patients with penicillin allergy a quinolone such as levofloxacin or co-trimoxazole and clindamycin can be used.

Tetanus prophylaxis (0.5 ml tetanus toxoid) should be given to all patients who have not received immunisations in the previous 5 years. The need for tetanus immunoglobulin should be considered in severe crush injuries.

The decision to initiate rabies prophylaxis should be determined by the following factors:

- What is known about the incident, e.g. was the dog sick? Did the dog salivate excessively? Did the dog behave out of character? Was the dog immunised against rabies? Is the dog known or is it a stray or unknown dog? Is it available for observation for 10 days?
- What is the epidemiology of rabies in the area where the incident took place, e.g. is there an outbreak of rabies among dogs or wild animals in the region? Have there been human fatalities? Up-to-date information on the epidemiology of rabies in South-Africa can be obtained from the National Institute of Communicable Diseases (website: www.nicd.ac.za/).

When puncture wounds are observed overlying bone an open fracture should always be suspected and radiological examination is mandatory.

Table 2 indicates the level of risk and immunisation schedules for bite wounds from potentially rabid dogs.

The rabies vaccine (human diploid cell vaccine) should be given on days 0, 3, 7, 14 and 28. The vaccine (1 ml) should be given in the deltoid muscle or anterolateral thigh. When it is given with the immunoglobulin (RIG) the last dose (day 28) can be omitted.[8]

The dose of RIG is 20 IU/kg. As much as is anatomically feasible should be administered around the wound. The remainder should be administered at an intramuscular site distant from that of vaccine inoculation. If RIG is unavailable on the first visit it can be delayed by a maximum of 7 days from the date of the first vaccine injection.

Snake bites

Snake bites are recognised by the WHO as a neglected tropical disease and are responsible

Table 2. Definition of categories of exposure

- Category III: Single or multiple transdermal bites or scratches, licks on broken skin, contamination of mucous membrane with saliva (licks) – use rabies immunoglobulin plus vaccine
- Category II: Minor scratches or abrasions without bleeding or nibbling of uncovered skin – use vaccine alone
- Category I: Touching, feeding of animals or licks on intact skin – no exposure therefore no prophylaxis if history reliable

Table 3. Equine antivenoms made by the South African Vaccine Producers (SAVP)

Polyvalent antivenom can be used against the venom of the following snakes:

- Puff adder *(Bitis arietans)*
- Gaboon adder *(Bitis gabonica)*
- Rinkhals *(Haemachatus haemachatus)*
- Green mamba *(Dendroapsis angusticeps)*
- Jameson's mamba *(Dendroapsis jamesoni)*
- Black mamba *(Denroapsis polyepsis)*
- Cape cobra *(Naja nivea)*
- Forest cobra *(Naja melanoleuca)*
- Snouted cobra, previously 'Egyptian cobra' *(Naja annulifera)*
- Mozambique spitting cobra *(Naja mossambica)*

Monovalent antivenom can be used against the venom of the boomslang *(Dispholidus typus)*

Contact details of SAVP:

- Website: www.savp.co.za
- Phone: +2711 3866063 or 6078

Fig. 2. This rinkhals is feigning death and should not be picked up (photo courtesy Arno Naude).

for up to 125 000 deaths around the world each year.[9] The majority of these deaths occur in the poor countries of Africa, Asia and Latin America. There are around 170 snake species in southern Africa, of which only a small percentage are highly venomous to humans. It is probably worthwhile for clinicians who are expected to manage snake bites to have knowledge of the snake species that can be treated with the polyvalent and monovalent antivenoms (Table 3) as well as a few other medically important snakes such as the vine snake, stiletto snake, berg adder and night adder. Although it can be useful, the identification of the snake species is not always possible or practical. A syndromic approach to the clinical manifestations and management of snakebite as proposed by Blaylock appears to be safe, logical and effective.[10]

Field management

The patient should be reassured, kept at rest and transported to the nearest appropriate medical facility as quickly as possible.

Alcohol and drugs that can confound the clinical picture should be withheld. A pressure bandage around the affected limb that is splinted or in a sling may be valuable in patients who were bitten by neurotoxic snakes. However, a pressure bandage may worsen cytotoxic envenomation due to increased local effects.

If the snake was killed by bystanders it should not be handled directly, since the bite reflex can remain intact in recently killed snakes. Some snakes such as the rinkhals can feign death very effectively (Fig. 2). The snake should be handled with a long stick, placed in a safe rigid container and brought along for identification. A digital photo can be taken of a live snake from a safe distance.

Patient assessment and management in the emergency centre

Many snake bites or suspected snake bites do not result in envenomation. In patients with no fang marks and no local or systemic signs of envenomation a period of close observation is indicated.[11] Vital signs and peak flow rates (FEV_1) should be measured half-hourly. Patients should be reassessed regularly to determine if any limb swelling or neurotoxic symptoms are emerging. Adult patients can be discharged if no symptoms develop within 6 - 12 hours. Children should be observed for longer (24 hours).

Devitalised tissue is a good breeding ground for *Clostridium tetani* and prophylaxis should be considered.

Patients with signs of envenomation will fall into one of three general syndromic categories, namely cytotoxic (painful progressive swelling), neurotoxic (progressive weakness) or haemotoxic (bleeding).

Intravenous access should be established in these patients and blood samples should be taken for clotting profile, complete blood count and renal functions. ECG, blood pressure and oxygen saturation should be monitored and 0.5 ml anti-tetanus toxoid (ATT) should be administered.

Table 4 gives a summary of the snake species, clinical picture and management of the different syndromic categories. Figs 3

Table 4. Syndromic approach to snake bite

Syndrome	Painful progressive swelling	Progressive weakness	Bleeding
Important snakes	Puff adder, gaboon adder, night adder, spitting cobras, stilletto snake	Mamba species, non-spitting cobras, berg adder	Boomslang, vine snake
Clinical picture	Mild: slowly progressive painful swelling Severe: rapidly progressive swelling and severe pain, ecchymosis, blisters, severe tissue necrosis, abscess formation, pseudo- and true compartment syndrome, nausea and vomiting, hypotension, bleeding tendency, shock, rhabdomyolysis, renal failure	Ptosis (Figs 3 and 4), diplopia, dilated pupils, difficulties in swallowing, salivation, progressive difficulty breathing, hypoxia	Bleeding from puncture sites, minor lacerations; development of disseminated intravascular coagulopathy over time
Management	Establish IV access Give analgesia Position the limb at the level of the heart Give IV fluid for shock and renal failure Treat local complications appropriately Give polyvalent antivenom in bites from gaboon adder, puff adder and spitting cobras Consider polyvalent antivenom if snake is unknown but envenomation is severe	Establish IV access Monitor oxygenation and ventilation closely (high dependency environment) Intubation and mechanical ventilation may be necessary Give polyvalent antivenom in bites from mambas and non-spitting cobras Consider polyvalent antivenom if the snake is unknown but envenomation is severe Consider neostigmine 0.05 - 0.07 mg/kg IVI with atropine 0.5 mg IVI[12] – may be repeated if improvement occurs	Establish IV access Give blood or blood component therapy if indicated Give monovalent antivenom (boomslang antivenom) for confirmed boomslang bite

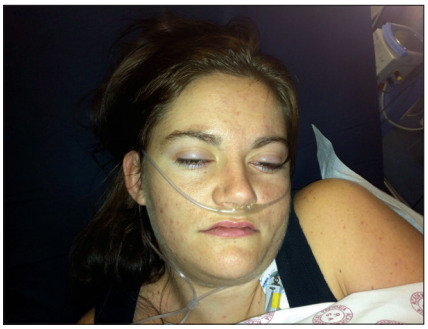

Fig. 3. This patient was bitten by a snouted cobra (Naja annulifera) *in a rural area of Gauteng. On presentation to the emergency centre she struggled to open her eyes on command (ptosis) due to the effect of neurotoxic envenomation.*

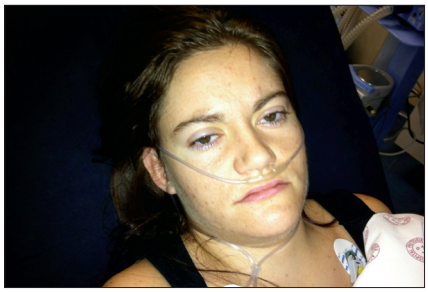

Fig. 4. Significant improvement was observed after administration of 10 units of polyvalent antivenom.

and 4 show a patient with ptosis after a bite by a snouted cobra.

Antivenom administration

A study conducted in Ngwelezana Hospital in KwaZulu-Natal found that anaphylactic and allergic reactions after the administration of antivenom were common, especially in children.[13] It is therefore important to have adrenaline and facilities for intubation and life support ready prior to administration of antivenom. Some authorities consider the administration of a single subcutaneous dose of 0.25 mg adrenaline prior to the administration of antivenom as a reasonable precaution.[14]

A dose of 50 - 80 ml polyvalent antivenom can be used for cytotoxic species and 80 - 200 ml for neurotoxic species. The dose should be placed in 200 - 500 ml saline and given over 30 minutes. Direct observation of the patient should occur during and immediately after antivenom administration. Close observation should

continue until the patient is stabilised over the ensuing 24 - 48 hours.

For boomslang bites, 10 - 20 ml monovalent antivenom should be administered in 100 ml saline over 15 minutes.

Fasciotomy and pseudo-compartment syndrome

Snake-bitten limbs may present with significant swelling and stiffness similar to compartment syndrome but may not have elevated intracompartmental pressures when measured with a Stryker needle.[10] There is some evidence that fasciotomy may increase myonecrosis in snake-bitten limbs.[15] Compartment syndrome of limbs may be successfully managed conservatively with elevation of the limb, mannitol admininistration, intravenous antivenom and close observation. Should conservative management fail, fasciotomy should be performed.

Venom ophthalmia

This is caused by the squirting of venom from the spitting cobras and rinkhals. The eyes should be washed out with copious amounts of water or Ringer's lactate.

A combination of lignocaine and fluorecin can be used to examine the eye for corneal erosions. If no erosions are present, instil an antibiotic eye ointment and cover the eye with a pad. Re-examine every 12 hours. Resolution should take place within 24 - 48 hours. If erosions are present, add a mydriatic and refer to an ophthalmologist for daily split-lamp examination until cured. It is not necessary to rinse the eyes with diluted antivenom.

References available at www.cmej.org.za

IN A NUTSHELL

- Children are the highest risk group for dog attacks and those younger than 7 years are frequently bitten in the face, neck and scalp.
- Puncture wounds overlying bone should always be examined by radiological imaging.
- Most patients with minor bite wounds can be treated as outpatients with excellent local wound care.
- Antibiotic prophylaxis is only indicated in high-risk patients and patients with high-risk wounds.
- The decision to initiate rabies prophylaxis is influenced by what is known about the incident and the epidemiology of rabies in the area.
- Snake bites are recognised by the WHO as a neglected tropical disease.
- When a patient is bitten by a snake it is very important that he or she should be taken immediately to the nearest appropriate medical facility.
- A syndromic approach to the manifestations and management of snake bites is logical and effective.
- There is a high incidence of serious allergic reactions to antivenom; adrenaline and facilities for intubation should be available prior to antivenom administration.
- Fasciotomy for compartment syndrome that is not confirmed by measurement of intra-compartmental pressure with a Stryker needle is controversial and some evidence exists that it may worsen myonecrosis.

SINGLE SUTURE

Cannabis anticonvulsant shakes up epilepsy treatment

The versatile cannabis plant may have a new use: it could be used to control epileptic seizures with fewer side-effects than currently prescribed anticonvulsants.

Ben Whalley at the University of Reading, UK, and colleagues worked with GW Pharmaceuticals in Wiltshire, UK, to investigate the anticonvulsant properties of cannabidivarin (CBDV), a little-studied chemical found in cannabis and some other plants. There is 'big, historical, anecdotal evidence' that cannabinoids can be used to control human seizures, says Whalley, but the 'side-effect baggage' means there have been relatively few studies of its pharmaceutical effect on this condition.

The team investigated the effectiveness of CBDV – one of around 100 non-psychoactive cannabinoids found in cannabis – as an anticonvulsant. They induced seizures in live rats and mice that had been given the drug. These animals experienced less severe seizures and lower mortality compared with animals given a placebo. The drug also had fewer side-effects and was better tolerated than three of the most widely prescribed anticonvulsants.

Epileptic seizures affect about 1% of the population. Left uncontrolled, they can lead to depression, cognitive decline and death. If you control the seizures, says Whalley, 'the chances of death drop away completely'. The decision about whether to test the drug in humans will be made next year.

'This is a very positive result,' says Ley Sander, an epilepsy specialist at University College London, UK, who was not involved in the study. 'We need new drugs,' he says. 'For 20 - 30% of people with epilepsy, nothing seems to work.' But he urges caution: 'The animals in the study are made epileptic,' he says, which is not how epilepsy is acquired in humans. He adds that what you see in animal models doesn't always translate directly into humans.

'Most compounds showing promise in preclinical studies never reach market,' warns Mark Richardson of the Epilepsy Research Group at King's College London. 'But I agree that these results justify progressing further down the drug development pipeline.'

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