

Periorbital animal bites

In the United States, approximately four million people are bitten by dogs annually, and about 800,000 of them (44% of whom are younger than 14 years) present for medical treatment¹⁻³. This accounts for more than 900 Americans visiting an emergency department on any given day after being bitten by a dog⁴. The majority of such injuries only cause minor trauma, therefore most published studies are significantly biased toward cases which are self-selected because of wound severity, fear of infection, actual infection, or potential legal considerations⁵.



Figure 1
Dog bite to right upper eyelid showing a combination of injuries.



Figure 2
Dog bite to right lower eyelid area.



Figure 3
Same patient as in Figure 2, one year after surgical repair of laceration.

Although domestic dogs are responsible for more than 80% of all bites, other animals, domestic or wild, can also inflict similar injuries⁶. Bites of other pets, such as gerbils and guinea pigs, are less common and far less serious because of their relatively small jaws and teeth. Wild animals also bite humans who intrude on their habitat. These may include squirrels, skunks, rabbits, bats, snakes, rats and mice. Exotic animals such as exotic felines (e.g., lions and panthers) or monkeys have also been reported to bite human handlers occasionally.

Almost one half of all reported cases of dog bites involve an animal owned by the victim's family or their neighbours³. Most victims are involved in normal, non-provoking activities before the dog attacks⁷. Sometimes what is perceived by humans to be non-provoking behaviour is actually threatening to the animal. Some such behaviour includes approaching, disturbing, petting, feeding, or even kissing the animal.

About 60-70% of animal-bite victims are children, with those between the ages of five and nine being the most vulnerable. Boys are bitten more often than girls and bites in children are more serious than those in adults⁷. Neonatal deaths resulting from a dog bite most often involve a sleeping baby^{1,2}. Children, who are often face-to-face with pets, and whose unpredictable behaviour intentionally or unintentionally may provoke an animal, are particularly susceptible to attacks to the head and neck⁸.

Individuals less than 15 years of age are most susceptible to sustain bites to the face, with most of these injuries occurring to the "central target area" of lips, nose, and cheeks and less than 10% involving the ocular adnexa.

History and examination

The exact history should be elicited and should include the circumstances of the injury (provoked or unprovoked). Any animal which was exhibiting truly odd and aggressive behaviour may be ill and carry the increased risk of having rabies. Ascertain whether the animal's vaccination status is known. Check also on the patient's vaccination status. The patient may need a tetanus booster.

Most animal bites in children are unwitnessed, and so details of the history may be difficult to elicit even if the cause of the trauma is readily apparent. For both medical and legal reasons, the attacking animal should be identified and isolated if possible⁹. The patient's overall medical status should be ascertained. Any patient with an immunosuppressive disease may be predisposed to a more rapidly spreading and severe infection³.

A thorough physical and ophthalmic examination of the involved area should be

done. Some children especially if they are agitated, distressed or uncooperative may need to be examined under sedation. Examine the wound for signs of infection such as swelling or pus.

Wounds seen before eight hours after the injury occurred and are not clinically infected need not be cultured⁹. A bite wound which is more than eight or 12 hours old will already be infected and needs antibiotic therapy, or it is not likely to become infected and will not require it. A patient with a more recent bite trauma may be a candidate for prophylactic antibiotics¹⁰. Wounds which are seen later than 24 hours after injury and show no signs of infection at presentation should be observed and not cultured⁹. X-rays could be required if the examination indicates the possibility of fracture or of a foreign body, such as an animal tooth imbedded in the tissue. A diagram or photograph of the wound should be kept for the medical record. Pertinent negative results should also be recorded since many injuries result in legal proceedings.

Animal bites can be categorised as avulsions, lacerations, puncture wounds, or crush injuries; most patients suffer a combination of these⁶ (**Figure 1**). True avulsion (loss of tissue) is not common, with most injuries being irregular lacerations. Puncture wounds and crush injuries are the most likely to become infected¹¹. Only 15-20% of dog bite wounds become infected¹².

In children, animal bites to the head may be further complicated by unsuspected intracranial penetration⁶. Even if there is no direct intracranial injury, the vascular supply to the face contains a myriad of channels with direct access to the cerebral and other systemic venous and arterial systems. A penetrating animal injury allows introduction of potentially life-threatening pathogens into these vascular systems¹³.

Wound care

Proper wound cleansing is the most important step in decreasing possible wound infection. The wound should be washed with soap and water and irrigated with normal saline. A copious, high-pressure jet flow can be obtained with a large syringe (20cc-35cc) and an 18-gauge to 20-gauge needle or plastic catheter^{7,10}. Each wound should be irrigated with a minimum of 100cc of saline. Such irrigation reduces bacterial inoculums and debrides the wound. Care should be taken not to inflict additional trauma or to inject fluid into the tissues³.

Dead skin and scabs in and around the wound can be removed and the tissue irrigated a second time. Excessive debridement in the facial area is not advised since the defect may be enlarged resulting in difficulty in wound closure and a poor cosmetic outcome. The debridement of puncture wounds is unnecessary.

Surgical repair of animal bites which do not result in wound infection is well recognised. Puncture wounds are cleaned and not sutured.

Lacerations are repaired by standard wound closure techniques for that injured area (**Figures 2 and 3**). Canalicular lacerations should be repaired in a multilayered fashion with silicone tubing intubation and tubing removal in five or six months¹³.

Infected wounds and those seen after the first 24 hours should be left open⁵. However, cosmetic results will be better if facial and eyelid wounds are sutured¹⁰.

Factors enhancing the cosmetic result in wounds of the face may include the excellent blood supply in the area, copious irrigation, the use of prophylactic antibiotics and the rarity of oedema since the head is rarely a dependent part of the body⁵.

Wound infections

The purpose of antibiotic prophylaxis in animal bite wounds is two-fold: (a) to prevent contamination of the wound site by indigenous microbial flora (e.g., normal skin flora) and (b) to prevent infection in a wound site which has become contaminated by non-indigenous micro-organisms (e.g., canine or feline oral flora)¹³. Wound infections are much more common after cat bites than after dog bites. Fewer than 20% of dog bites become infected, but infections have been reported with 28-80% of cat bites¹⁴.

The decision to treat the patient with systemic antibiotics depends upon the nature and extent of the injuries. Treatment with prophylactic antibiotics for three to seven days is appropriate for dog bite wounds, unless the risk of infection is low or the wound is superficial^{5,12,15}.

The most frequent manifestations of infection are cellulitis, abscess, and, to a lesser extent, lymphangitis. Bone infection can spread to osteomyelitis. If any of these are present, a 10 to 14 day course of treatment is appropriate¹¹.

Most infected dog and cat bite wounds yield mixed polymicrobial organisms¹⁴. *Pasteurella multocida* is found in half of all dog bites and three quarters of all cat bites¹⁴. *Pasteurella multocida* infections commonly occur within 48 hours of inoculation and are characterised by prominent wound inflammation and drainage⁶. Other common aerobes in both cat and dog bite wounds include staphylococci, streptococci, and *Moraxella* species¹⁴.

When the features of wound infection become manifest more than a day following the animal bite, gram-positive bacteria such as *Staphylococcus aureus* or *Streptococcus viridans* are the most common causative microorganisms⁶. The most common anaerobes are *Fusobacterium*, *Bacteroides*, and *Porphyromonas* organisms¹⁴.

Amoxicillin-clavulanate potassium (Augmentin) is the antibiotic of choice for most animal bites¹². The clavulanic acid inhibits beta-lactamase and increases the effectiveness of the amoxicillin. This medication should be administered in oral dosages of 500mg every eight hours for adults, or 40mg/kg/day in

divided doses every eight hours for children of up to 40kg of weight⁶. For patients who are allergic to penicillin, doxycycline (Vibramycin) is an acceptable alternative, except for children younger than eight years and pregnant women¹². Erythromycin can also be used, but the risk of treatment failure is greater because of antimicrobial resistance¹⁴.

If a patient has an infection and is on oral antibiotics but is not showing signs of improvement within 24 hours, (oedema and cellulitis is not resolving), then the patient may need to be hospitalised for intravenous antibiotic therapy¹⁰.

Other treatment considerations

Animal bites should be considered tetanus prone wounds. The risk factors for these wounds include any one of the following clinical features: Wound age greater than six hours, a configuration of stellate shape, avulsion or abrasion, a depth of greater than one centimeter, mechanics of injury due to crush or puncture, the presence of any signs of infection, devitalised tissue, contaminants (dirt, faeces, soil, saliva), or denervated or ischaemic tissue¹⁶.

Prophylaxis against tetanus is indicated if the patient has had fewer than three doses of tetanus toxoid, if it has been more than five years since the patient's last dose, or if the patient's active immunisation status is unknown¹⁷.

Perhaps the most serious animal bite complication is infection with rabies, an acute encephalomyelitis caused by a neurotropic RNA virus from the rhabdovirus family⁷. The incubation period for rabies averages 30 to 50 days, with a range of 10 days to more than a year⁶. Although less than 20% of untreated persons have a chance of contracting rabies from the bite of a rabid animal, the disease has an essentially uniform mortality, making it a grave illness⁷. This makes it imperative to document with a thorough history the conditions surrounding the animal attack.

As a result of widespread vaccination of dogs against rabies in the United States, the most common source of the rabies virus is now wild animals, specifically raccoons, skunks and bats¹⁸. There are presently four formulations of three inactivated rabies vaccine available in the United States¹⁹. Rabies immunisation should begin within 48 hours after the bite, but it can be subsequently discontinued if the animal is shown to be free of rabies virus.

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