When your best friend bites: A note on dog and cat bites

H Dele Davies MD MSc FRCPC, Division of Infectious Diseases, Alberta Children Hospital, Calgary, Alberta

EPIDEMIOLOGY AND BURDEN OF PROBLEM

Dogs and cats are very important to millions of Canadians. In 1995, more than 100 million cats and dogs were owned as pets in Canada and the United States. Bites from these animals are very common, with between one million and two million dog bites reported annually in both countries (1). According to the *Canadian Hospitals Injury Reporting and Prevention Program* web site <www.hc-sc.gc.ca/hpb/lcdc/brch/injury/dog-bit_e.html>, injuries related to dog bites account for 1% of all visits to hospital emergency departments, and dogs are responsible for 85% of all bite wounds. Five- to nine-year-old males sustain dog bites most frequently. Dog and cat bites occur most often in the summer, and between 16:00 and 20:00. Up to 85% of dog and cat bites are caused by the victims' family pet or by a neighbour's pet. About half of these bites are considered to have been provoked.

In a survey of 455 families with 960 children who sustained injuries related to dog bites (2), 20% of the children were bitten at least once, and the majority of the children received bites before they were five years of age. Dog and cat bites are particularly more serious in children than in adults because children are more likely to be bitten on the face, neck and head in up to 70% of cases (1). Children account for the majority of the 10 to 20 deaths from animal bites that occur annually in the United States (3). As a result, physicians need to diagnose appropriately and treat bite-related injuries that are potentially life-threatening.

MICROBIOLOGY

Dog bites typically cause puncture wounds, lacerations and crush injuries. In a recent study involving 107 patients, Talan et al (4) documented the microbiology of 50 infected dog bites and 57 infected cat bites. *Pasteurella* species, streptococci and staphylococci were the most common aerobes, while *Fusobacterium* species, *Bacteroides* and *Porphyromonas* were the most common anaerobes. Dog bites contain *Pasteurella multocida* in about 25% of cases, other *Pasteurella* species in up to 25% of cases, as well as mixed anaerobes and *Staphylococcus aureus* (4). Cat bites also typically cause puncture wounds and

contain *Pasteurella multocida* in about 50% to 75% of cases, as well as other aerobes and anaerobes, including *S aureus* (4). Between 3% to 18% of dog bites become infected versus 28% to 80% of cat bites (2,4-13).

TREATMENT AND PROPHYLAXIS

The appropriate treatment for dog and cat bites consists of the following: inquiring about the status of tetanus immunization and providing booster doses, as needed; inquiring about the risk of rabies (see below) and arranging appropriate immunoprophylaxis; cleansing and debridement of the wound, and an assessment of the appropriateness of wound closure; an evaluation of the need for prophylactic antibiotics; and management of emotional trauma, which may occur as a result of the bite. Tetanus immunization guidelines should be administered according to the *Canadian Immunization Guide, 5th Edition* (Table 1) (14). The decision to begin rabies immunotherapy should be made in conjunction with the local medical officer of health based on the immunization status of the animal in question, its behaviour as evaluated by a veterinarian and whether the attack was provoked. Regardless of whether the animal is immunized, the local animal control agency should be notified so that they can quarantine the animal and keep it under observation for up to 10 days to see whether clinical symptoms develop.

If prophylaxis is indicated for a child, the *Canadian Immunization Guide, 5th Edition* schedule for administering rabies immunoprophylaxis should be followed (15). In situations where healthy animals are available for observation, the patient initially requires local wound treatment only. At the first sign of rabies in such animals, or starting immediately in the case of rabid, suspected rabid, unknown or escaped animals, immune globulin at a dose of 20 IU/kg should be given. An attempt should be made to infiltrate the full dose thoroughly into the wound and surrounding area. Any remaining volume should be injected intramuscularly at a site distant from the bite, such as the lateral thigh or gluteus muscle. In addition, a first dose of human diploid cell vaccine should be administered in the deltoid muscle as soon as possible, with additional doses

TABLE 1
Guide to tetanus prophylaxis in wound management adapted from *Canadian Immunization Guide, 5th Edition*

Tetanus immunization history	Clean, minor wound		Contaminated, complicated wound	
	DT*/Td	TIG	DT*/Td	TIG
Uncertain or less than four doses [†]	Yes	No	Yes	Yes
Four or more doses	Yes, if more than 10 years have passed since the last dose	No	Yes, if more than five years have passed since the last dose	No, unless the child has a significant immunodeficiency (eg, human immunodeficiency virus, agammaglobulinemia)

*Given as part of routine childhood immunization to children younger than seven years of age. [†]Four doses are the required primary immunization during infancy. For persons who completed primary immunization after age seven years, three doses are sufficient. DT/Td Diphtheria and tetanus toxoid/Adult type tetanus and diphtheria toxoid; TIG Tetanus immune globulin. Adapted with permission from Canadian Immunization Guide, 5th Edition, Health Canada, 1998. ©Minister of Public Works and Government Services Canada, 2000

TABLE 2
Situations for which prophylactic antibiotics* are recommended within 8 to 12 h of dog and cat bites

- Bites with a high risk of infection, such as deep punctures from cats that may have penetrated joint spaces, bones or tendons
- Wounds requiring surgical repair
- Attacks involving immunocompromised or asplenic hosts
- Bites involving hands and feet
- Facial bites
- Bites involving genitalia

* See Table 3 for suggested antibiotic choices

given on days 3, 7, 14 and 28. Care should be taken to ensure that appropriate psychological counselling is provided to children, particularly after savage attacks.

MANAGEMENT OF WOUNDS

All wounds should be examined carefully. Some wounds may need deeper exploration because injuries that appear to be superficial may overlie fractures; involve lacerated tendons, vessels or nerves; extend into body cavities; penetrate joint spaces; or damage structures such as the eye. In general, bite-related wounds should be treated and left open if they are punctures rather than lacerations, if they are not potentially disfiguring, if they involve the legs and arms (particularly the hands) as opposed to the face, or if the attack occurred more than 6 to 12 h earlier in the case of bites to the arms and legs, and 12 to 24 h earlier in the case of bites to the face (3). Facial lacerations from dog or cat bites are usually closed. Foreign material increases the risk of infection, and sutures, particularly subcutaneous sutures, should be used sparingly. Adequate sedation must be given to children to allow proper wound exploration, decontamination and repair, when indicated. In many cases, analgesia or anesthesia is needed for minor surgical procedures or proper debridement. Immediate and generous irrigation with soap and water, detergent or water alone at high pressures markedly decreases the concentration of bacteria in contaminated wounds and, most likely, will substantially reduce the risk of rabies.

Debridement of devitalized tissue further decreases the likelihood of infection. Debridement must be performed cautiously on the face, particularly near landmarks, such as the

vermillion border of the lip and the eyebrows. Debridement or suturing that may agitate a child or that involves particularly large wounds, or wounds with uneven or jagged edges may require a plastic surgery consultation. Cultures obtained at the time of injury are of little value because they cannot be used to predict whether an infection will develop or to identify the causative pathogens if infection occurs (3). However, when a bite shows evidence of infection, cultures should be taken to establish the etiological agent. *P. multocida* infection typically develops within the first 24 h. Infected bites on hands and feet, in particular, may have bony involvement, and consideration should be given to the possibility of underlying osteomyelitis or infection of tendon sheaths.

ANTIBIOTIC PROPHYLAXIS AND THERAPY

Eight randomized trials involving prophylactic antibiotics for dog and cat bites have been published (7). Only one of these trials, which used amoxicillin-clavulanate, demonstrated a statistically significant reduction in infections (7). However, a trend to reduced infections was noted in four of the remaining seven studies, and a meta-analysis by Cummins (7) demonstrated a reduction in the risk of infection after prophylactic antibiotics (relative risk 0.56, 95% CI 0.38 to 0.82). There is no current economic evaluation of a strategy of universal prophylaxis versus no prophylaxis or prophylaxis only for special situations.

Most experts currently recommend prophylactic antibiotics for the following situations only: bites with a high risk of infection, such as deep punctures caused by cats; wounds that require surgical repair; attacks involving immunocompromised hosts; and bites involving the hands or face (Table 2) (3,16,17). The study by Talan et al (4) supported the use of an antibiotic, such as amoxicillin-clavulanate as the drug of choice, if needed, for prophylaxis before infection or for treatment once infection has become clinically apparent (as noted by increasing swelling and erythema, which may be associated with streaking, warmth and tenderness). Based on the bacteriology noted in the study, alternative oral agents for the treatment of infections caused by dog and cat bites are suggested in Table 3. Penicillin, ampicillin or first-generation cephalosporins alone will not cover the full spectrum of organisms identified in dog or cat bites. *P. multocida* is sensitive to penicillin, and to second- and third-generation

TABLE 3
Prophylaxis (duration of 48 to 72 h) or empirical oral therapy for established infections caused by dog and cat bites*

Dog bites	Cat bites
Amoxicillin-clavulanate 40 mg/kg/day by mouth divided tid (antibiotic of choice)	Amoxicillin-clavulanate 40 mg/kg/day by mouth divided tid (antibiotic of choice)
Alternative oral agents include:	Alternative oral agents include:
<ul style="list-style-type: none"> • A combination of penicillin V (25 to 50 mg/kg/day divided tid to qid) with a first-generation cephalosporin • A combination of clindamycin (20 to 40 mg/kg/day divided tid) with TMP/SMX (8 to 12 mg TMP/40 to 60 mg SMX/kg/day divided bid) • A combination of clindamycin (20 to 40 mg/kg/day divided tid) with a fluoroquinolone[†] • Azithromycin (limited data on efficacy) 	<ul style="list-style-type: none"> • A combination of penicillin V (25 to 50mg/kg/day divided tid to qid) with a first-generation cephalosporin • A combination of clindamycin (20 to 40 mg/kg/day divided tid) with TMP/SMX (8 to 12 mg TMP/40 to 60 mg SMX/kg/day divided bid) • An extended spectrum second-generation cephalosporin (eg, cefuroxime axetil) • A combination of clindamycin (20 to 40 mg/kg/day divided tid) with a fluoroquinolone[†] • Azithromycin (limited data on efficacy)

*See Table 2 for indications. [†]Fluoroquinolones are not routinely recommended for children younger than 18 years of age because of concerns about damage to developing cartilage. TMP/SMX Trimethoprim-sulphamethoxazole

cephalosporins, but it is resistant to cloxacillin, cephalixin, clindamycin and erythromycin. By contrast, *S aureus* usually is resistant to penicillin. Although azithromycin has not been studied, it displays in vitro activity against the common aerobic and anaerobic isolates from bite wounds when used as a single agent, and it may be useful for treatment (4,18).

PREVENTION

Municipal authorities should be encouraged to educate dog owners about their responsibilities with regard to training their pets; emphasis should be placed on discouraging aggressive behaviour when animals are young. Whether this approach alone is sufficient or whether there also is a need to certify certain breeds of dogs as being dangerous is debatable.

REFERENCES

1. Weiss HB, Friedman DI, Coben JH. Incidence of dog bite injuries treated in emergency departments. *JAMA* 1998;279:51-3.
2. Lauer EA, White WC, Lauer BA. Dog bites. A neglected problem in accident prevention. *Am J Dis Child* 1982;136:202-4.
3. Fleisher GR. The management of bite wounds. *N Engl J Med* 1999;340:138-40.
4. Talan DA, Citron DM, Abrahamian FM, Moran GJ, Goldstein EJ. Bacteriologic analysis of infected dog and cat bites. Emergency Medicine Animal Bite Infection Study Group. *N Engl J Med* 1999;340:85-92.
5. Aghababian RV, Conte JE Jr. Mammalian bite wounds. *Ann Emerg Med* 1980;9:79-83.
6. Callahan M. Prophylactic antibiotics in common dog bite wounds: A controlled study. *Ann Emerg Med* 1980;9:410-4.
7. Cummings P. Antibiotics to prevent infection in patients with dog bite wounds: A meta-analysis of randomized trials. *Ann Emerg Med* 1994;23:535-40.
8. Elenbaas RM, McNabney WK, Robinson WA. Evaluation of prophylactic oxacillin in cat bite wounds. *Ann Emerg Med* 1984;13:155-7.
9. Elliot DL, Tolle SW, Goldberg L, Miller JB. Pet-associated illnesses. *N Engl J Med* 1985;313:985-95.
10. Feder HM Jr, Shanley JD, Barbera JA. Review of 59 patients hospitalized with animal bites. *Pediatr Infect Dis J* 1987;6:24-8.
11. Jones DA, Stanbridge TV. A clinical trial using co-trimoxazole in an attempt to reduce infection rates in dog bite wounds. *Postgrad Med J* 1985;61:593-4.
12. Skurka J, Willert C, Yogeve R. Wound infection following dog bite despite prophylactic penicillin. *Infection* 1986;14:134-5.
13. Thomas PR, Buntine JA. Man's best friend?: A review of the Austin Hospital's experience in dog bites. *Med J Aust* 1987;147:536-40.
14. National Advisory Committee on Immunization. Tetanus toxoid. In: Health Canada, ed. Canadian Immunization Guide, 5th edn. Ottawa: Canadian Medical Association, 1998:164-7.
15. National Advisory Committee on Immunization. Rabies vaccine. In: Health Canada, ed. Canadian Immunization Guide, 5th edn. Ottawa: Canadian Medical Association, 1998:149-56.
16. Committee on Infectious Diseases. Bite wounds. In: Peter G, ed. Report of the Committee on Infectious Diseases. Elk Grove Village: American Academy of Pediatrics, 1997:122-6.
17. Brook I. Microbiology of human and animal bite wounds in children. *Pediatr Infect Dis J* 1987;6:29-32.
18. Goldstein E, Nesbit C, Citron D. Comparative in vitro activities of azithromycin, bay y 3118, levofloxacin, sparfloxacin, and 11 other oral antimicrobial agents against 194 aerobic and anaerobic bite wound isolates. *Antimicrob Agents Chemother* 1995;39:1097-100.

This article also appears in *Paediatr Child Health* 2000;5(7):381-383.