Occupational health and safety in small animal veterinary practice: Part I — Nonparasitic zoonotic diseases

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Abstract — Zoonotic diseases are an ever-present concern in small animal veterinary practice and are often overlooked. A variety of nonparasitic zoonotic diseases may be encountered in small animal practice, including cat scratch disease (bartonellosis), cat bite abscesses, rabies, leptospirosis, methicillin-resistant *Staphylococcus aureus*, *Clostridium difficile*-associated diarrhea, salmonellosis, avian chlamydiosis, campylobacteriosis, dermatophytosis, and blastomycosis. These may cause human disease ranging from mild and self-limiting to fatal. The risk of development of a zoonotic disease can be lessened by early recognition of infected animals, proper animal handling, basic biosecurity precautions, and, most importantly, personal hygiene.

Résumé — Santé et sécurité au travail dans les cliniques vétérinaires pour petits animaux: première partie — zoonoses non-parasitaires. Les zoonoses constituent une préoccupation constante dans les cliniques vétérinaires pour petits animaux mais sont souvent négligées. De nombreuses zoonoses non-parasitaires peuvent se rencontrer dans les cliniques pour petits animaux: maladie des griffes du chat (bartonellose), abcès de morsure du chat, rage, leptospirose, *Staphylococcus aureus* résistant à la méthicilline, diarrhée associée à *Clostridium difficile*, salmonellose, parriquettsiose aviaire, campylobactériose, dermatophytose, et blastomycose. Tous ces problèmes peuvent se répercuter sur la santé humaine causant des maladies dont l’ampleur varie de légère et circonscrite jusqu’à mortelle. Le risque de développer une zoonose peut être diminué par un dépistage hâtif des animaux infectés, par une manipulation sécuritaire des animaux, par des mesures de biosécurité de base et, le plus important, par l’hygiène personnelle.

Cat scratch disease (bartonellosis)
Cat scratch disease is typically a mild disease of humans caused by *Bartonella henselae* or *B. clarridgeiae* (4,5). Young kittens, feral cats, or former strays are more likely to harbor this bacterium (5). It is debatable...
whether cats develop clinical disease in response to *Bartonella* infection, as most infections are thought to be subclinical. If disease does occur, it is thought to be mild and self-limiting, characterized by fever, lethargy, gingivitis, uveitis, and nonspecific neurological signs (4). Most human infections are due to scratches or bites; however, fleas and ticks feeding on infected cats can also transmit infection (3). In the vast majority of human cases, infection is also mild and self-limiting.

Clinical signs in humans typically include development of a papule at the site of inoculation, followed by regional lymphadenopathy, mild fever, malaise, and generalized myalgia, which usually resolve spontaneously over a period of weeks to months (3,6,5). Encephalitis can develop in a small percentage of cases. Prevention of bartonellosis involves avoidance of inoculation with *Bartonella* spp. Realistically, cat scratches and bites are difficult to avoid in small animal practice; however, proper restraint, both manual and chemical, and adequate training of personnel can reduce the risk. If a cat scratch occurs, prompt cleansing of wounds is important.

Transmission is also possible via contact of abraded skin with infected saliva, so veterinary personnel should wear gloves whenever they have skin lesions. While of lower risk, flea infestations should be treated to decrease the likelihood of transmission to humans (3). Finally, it is important to remember that declawing is not an effective means of disease prevention.

Canine infection with *B. henselae* and transmission of infection from young, healthy dogs to humans has been reported (7,8). However, whether these cases resulted from direct transmission or were flea-borne is unclear, as it was not reported whether these animals were infested with fleas.

**Cat bite abscesses**

While not a specific disease entity, abscesses or local infections secondary to cat bites are not uncommon in veterinary practice. Although the frequency of cat bites at veterinary clinics in Canada has not, to the best of the authors’ knowledge, been reported, it is probably quite high. Most problems resulting from bites are not due to the trauma, but to secondary infections. A recent study reported that 3% to 18% of dog and 28% to 80% of cat bite wounds in humans become infected (9). *Pasteurella* spp. are involved in approximately 75% of cat bite infections. However, a variety of other pathogens can be isolated (9). While uncommon, serious sequelae, such as meningitis, recurrent abscesses, endocarditis, septic arthritis, septic shock, and death can occur (9,10). These complications are more common in young children, but they can occur in healthy adults. Obviously, absolute prevention of cat bites is impossible. However, the availability of proper restraint equipment and adequately trained staff can minimize the incidence of bites. Furthermore, any bite, particularly from a cat, should be treated as a potential problem. Wounds should be promptly and thoroughly cleansed. Antimicrobial prophylaxis is controversial for fresh bites in healthy individuals. In contrast, treatment is recommended for puncture wounds; wounds in areas considered to be high risk, such as the head, face, and hands; or wounds suspected of involving tendons, nerves, or vascular structures (9). Prompt medical attention should be provided in such cases or when normal healing does not occur.

**Rabies**

Rabies is at the forefront when people think about zoonotic diseases acquired from domestic animals. This neurological disease, caused by *Lyssavirus*, is of significant concern because of the very high mortality rate and the ability of the agent to infect immunocompetent people. Human rabies is very rare in Canada, with only 22 cases reported over the last 56 y (11). However, despite the low incidence of the disease, veterinary personnel must remain vigilant due to the severity of infection.

Rabies can be highly variable in its presentation, and while cases are generally classified as showing either the “furious” or “paralytic” form, there is no standard clinical picture. A history of a bite wound or exposure to a rabid animal is not always present, so rabies should be considered in any animal that suddenly develops profound behavioral changes or lower motor neuron paralysis (13). Animals suspected of being rabid should be handled as little as possible, and only by experienced personnel. Heavy protective gloves must be worn and other instruments, such as catch poles or cages, should be used whenever possible. The appropriate authorities should be contacted, because rabies is a reportable disease.

Risk of transmission to humans follows inoculation of infected saliva or central nervous system (CNS) tissue via a scratch, bite, open wound, or mucous membranes (21). All tissues of infected animals are potentially infectious, with highest titers in the CNS, saliva, and salivary glands (13). Rabies virus is most commonly transmitted via contact of broken skin or mucous membranes with saliva (14), so strict barrier precautions should be used in all suspected cases. Regardless of vaccination status, possible exposure via bites, scratches, or other means should be addressed aggressively and immediately. Wounds should be washed thoroughly. Ethanol, while irritating, can be applied to open wounds. Large volumes of 20% aqueous soap solution or quaternary ammonium disinfectant should be applied under pressure to bites (12). All in-contact individuals should report immediately to a physician to determine whether postexposure prophylaxis is required. The attending veterinarian may play an important role in this decision by conveying the likelihood of rabies, and it would be wise for the veterinarian, public health personnel, or both, to be in contact with the physician.

The United States Centers for Disease Control and Prevention (CDC) recommend preexposure vaccination for those more likely to be exposed to rabies than is the general public (15). Obviously, veterinarians are included in this category. However, a survey of veterinary clinics in California reported that a large proportion of at-risk staff were not vaccinated, as per CDC recommendations (16). Cost of vaccination, particularly for short-term and part-time employees is likely a major factor. Concerns about vaccine reactions may also play
a role. However, it is important for personnel in supervisory roles in veterinary clinics to seriously consider their clinic’s vaccination policies. Veterinarians should carefully consider who among their staff are high-risk individuals. Clinics that treat wildlife or feral animals must consider themselves at additional risk. Anyone potentially handling clinical cases must also be included in this category (front office staff in some clinics). At a minimum, employees should be made aware of the risks associated with rabies and of the current CDC vaccination recommendations. Serologic evaluation of antibody titers should be performed every 2 y to ensure that adequate protection persists (17,15).

**Leptospirosis**

Leptospirosis is a zoonotic bacterial disease caused by serovars of *Leptospira interrogans*. Leptospirosis is considered by some to be the most widespread zoonotic disease in the world and can infect a wide range of animals (18).

Clinical signs of leptospirosis in dogs can be classified as peracute, acute, subacute, and chronic (19). Peracute infection often results in sudden death with few clinical signs. Dogs with acute leptospirosis are pyrexic, icteric, myalgic, have vomiting and diarrhea, and may experience peripheral vascular collapse. The subacute form is generally manifested as fever, anorexia, vomiting, dehydration, and polydipsia. Severe renal disease with oliguria or anuria can also develop. Chronic leptospirosis should be considered in cases of fever of unknown origin, unexplained renal failure, or hepatic disease and anterior uveitis. The majority of infections in dogs are chronic or subclinical. While cats will seroconvert after natural or experimental exposure to leptospires, clinical disease is infrequent (20).

Veterinary personnel can be infected via contact by the urine or tissues from an infected animal with mucous membranes or skin lesions (3). In humans, the clinical signs and severity of disease can be highly variable, ranging from asymptomatic infections to sepsis and death (21). Headache, myalgia, nausea, and vomiting are common complaints; however, neurologic, respiratory, cardiac, ocular, and gastrointestinal manifestations can occur (21,22). Gloves and barrier gowns should be worn when handling affected (or suspect) animals or urine-contaminated items. Cages or runs should be hose-cleaned without prior disinfection (19). Periodic cleaning with a 5% bleach solution would, therefore, help to decrease environmental contamination.

**Methicillin-resistant *Staphylococcus aureus***

Methicillin-resistant strains of *Staphylococcus aureus* (MRSA) are major nosocomial pathogens in human hospitals (23,24) and have been reported in veterinary hospitals (25). Eleven cases of MRSA infection in horses and dogs have been identified at the Ontario Veterinary College between 2000 and 2002. While MRSA are no more pathogenic than other strains of *S. aureus*, infection with MRSA is of significant importance due to the high level of antimicrobial resistance. In general, colonization of health care personnel is asymptomatic and the main concern is transmission of the organism to susceptible patients. However, clinical MRSA cases in human health care professionals have been reported (26).

Methicillin-resistant strains of *S. aureus* have been isolated from dogs (27). Furthermore, transmission of MRSA from dogs to humans has been described (28). To date, clinically significant zoonotic transmission of MRSA has not been reported, but it should not be dismissed. Personal hygiene and judicious antimicrobial use should help to decrease the likelihood of MRSA acquisition in veterinary clinics. Veterinarians should request that multidrug-resistant *S. aureus* isolates be screened to determine whether they are MRSA.

**Clostridium difficile**

*Clostridium difficile* is an anaerobic bacterium that is a recognized cause of diarrheic disease in humans. Sporadic cases of *C. difficile*-associated disease in humans are not common and most cases involve antimicrobial therapy or hospitalization. The role of *C. difficile* in small animal enteric disease still needs to be clarified; however, *C. difficile* has been associated with diarrheic disease in dogs and cats (29,30). *Clostridium difficile* has also been isolated from the environment in veterinary clinics (31,32). Zoonotic transmission of this pathogen has not been adequately studied; however, zoonotic infection with *C. difficile* may be possible, particularly in veterinary clinic personnel receiving treatment with antimicrobial or immunosuppressive agents. Prevention of zoonotic *C. difficile* infection, if it occurred, would involve proper environmental cleaning, personal hygiene, and isolation of diarrheic animals. The spore form of *C. difficile* is resistant to most commercial disinfectants; however, a 5% bleach solution should be effective. Periodic cleaning with a 5% bleach solution would, therefore, help to decrease environmental contamination with this pathogen.

**Salmonellosis**

Salmonellosis is a systemic or enteric disease caused by serotypes of *Salmonella enterica* subspecies *enterica*. Dogs and cats with salmonellosis typically present with fever and diarrhea; however, subclinical infections can occur (33). In general, dogs and cats are rarely the source of human infection (3). Thus, less than 1% of cats have been reported to shed *Salmonella* spp. (34). In contrast, it has been reported that 90% or more of reptiles carry *Salmonella* spp. (35,36). Of special concern to veterinary personnel is nosocomial transmission of highly drug-resistant strains such as *Salmonella Typhimurium* DT104. Multiresistant *S. Typhimurium* DT104 has been reported in cats and dogs (37,38), and outbreaks of disease have occurred in cats and humans at small animal veterinary clinics (39). Suboptimal sanitation and hygienic practices were implicated as the cause of transmission in one of these outbreaks (39).

Fatal cases of salmonellosis acquired from pets have been reported in infants (40). Veterinary clinic personnel...
should, therefore, be especially aware of the risks of transmitting a *Salmonella* sp. from a patient to their children.

Prevention of transmission involves identification and isolation of clinical cases, recognition of animals at higher risk for asymptomatic carriage, and proper personal hygiene. Hand-washing is important after handling any animal, particularly reptiles and diarrheic animals. All surfaces contaminated with feces should be cleaned and disinfected promptly. Food consumption should not be permitted in animal treatment or holding areas. Further protection can be obtained by wearing gloves whenever feces are handled.

### Psittacosis/chlamydiosis

Avian chlamydiosis is a bacterial disease of birds caused by *Chlamydia psittaci* (formerly *Chlamydia psittaci*) (41). Infection with *C. psittaci* is most common in psitticine birds, especially cockatiels and parakeets, and may be subclinical, particularly in budgerigars, lovebirds, and cockatiels (42). The clinical signs of acute chlamydiosis are highly variable and include anorexia, depression, weight loss, nasal or ocular discharge, conjunctivitis, blepharitis, dyspnea, decreased vocalization, diarrhea, regurgitation, poor feathering, lack of molt, and sudden death (42). Chlamydiosis should be considered in any lethargic bird with nonspecific signs, especially if it has been purchased recently. Carriage rate is relatively low among pet birds; however, carriage rates of 50% to 95% can occur in some breeding colonies of budgerigars, lovebirds, and cockatiels (42).

Infection with *C. psittaci* can be transmitted from pet birds to humans. The condition in humans is termed psittacosis or ornithosis, and, typically, causes influenza-like disease that can progress to severe pneumonia or nonrespiratory disease. Following a 5- to 14-day incubation period, fever, chills, headache, myalgia, and malaise may ensue, accompanied by a nonproductive cough (43). Psittacosis is rarely (< 1% of cases) fatal, if treated appropriately (42). From 1988 to 1998, 846 cases of human psittacosis in the United States were reported to the CDC (44). It is presumed that this is an underrepresentation of the actual number of human cases in the United States. The majority of cases were associated with exposure to pet birds. While bird owners and pet shop employees are considered the highest risk group, veterinarians are also at increased risk of exposure (43). While most common among bird owners, human infection can occur following brief exposure to infected birds or contaminated feces. Transmission usually occurs following inhalation of aerosolized *C. psittaci* from respiratory secretions or dried feces. The CDC recommends that veterinary personnel should wear protective clothing, gloves, a surgical cap, and a respirator with an N95 rating or higher when cleaning cages or handling infected birds. *Chlamydia psittaci* is susceptible to most disinfectants, detergents, and heat; however, it is resistant to acid and alkali. Soiled cage papers should be wetted with a quaternary ammonium disinfectant, prior to cage cleaning (42). Contaminated surfaces should be scrubbed to remove all debris; disinfectant should be applied and left for at least 5 min before the surface is rinsed (43). Vacuum cleaning should not be performed, as this may result in aerosolization of the organism.

Veterinarians should note that avian psittacosis is not uncommon in pet birds and they should include the disease as a differential diagnosis in any lethargic bird with nonspecific clinical signs, particularly if recently purchased. Veterinary personnel exposed to birds should ensure that their physician is aware of the risk of psittacosis, if they develop influenza-like symptoms or other respiratory disease.

### Campylobacteriosis

Infection with *Campylobacter jejuni* is regarded as one of the most commonly identified causes of bacterial gastroenteritis in humans worldwide. Most *C. jejuni* infections are foodborne (45); however, transmission from pets to humans can occur. *Campylobacter upsaliensis* has been associated with enteritis in humans and it has been suggested that dogs may be a major source of infection (46). *Campylobacter* spp. infection in dogs and cats is not uncommon. An Australian study reported that *C. upsaliensis* and *C. jejuni* were found in 11% and 4% of cats and 34% and 4% of dogs, respectively (47). Carriage of *Campylobacter* spp. was not significantly higher in diarrheic animals compared with nondiarrheic animals in this study. In contrast, other studies have reported a significantly higher isolation of *Campylobacter* spp. from diarrheic dogs (48,49). In general, it appears that dogs are often asymptomatic carriers; however, clinical disease can occur. Disease is more common in dogs less than 6 mo of age; in a high stress environment; and housed in poor hygienic conditions, shelters, or kennels (47,50).

Clinical signs can be variable with soft feces to watery, bloody diarrhea; anorexia; fever; and, occasionally, vomiting (50). Feline disease caused by *C. jejuni* alone appears to be rare; however, cats, particularly kittens, can occasionally shed the organism (34). One study reported that 6% of sporadic *C. jejuni* infections in humans were associated with exposure to diarrheic kittens (51). In humans, campylobacteriosis causes abdominal discomfort, fever, and diarrhea, which is sometimes bloody. Spontaneous recovery usually occurs in human cases, but antibiotic therapy aids in shortening the duration of *C. jejuni* shedding. While *C. jejuni* infection in humans is typically mild, it can, in rare cases (< 1/1000 cases), trigger Guillain-Barre syndrome, an uncommon but serious demyelinating disease (45). Regardless of the relatively low prevalence of zoonotic infection, veterinary clinic personnel should be aware of the risks of fecal-oral transmission. Prevention of *C. jejuni* acquisition in veterinary clinics involves recognition of carriers, personal hygiene, and disposal of contaminated feces.

### Dermatophytosis (ringworm)

Dermatophytosis (ringworm) is a fungal dermatologic disease of a variety of animals caused by *Microsporum* or *Trichophyton* spp. Disease in animals can be quite variable from mild or subclinical to severe lesions.
mimicking pemphigus foliaceus (52). Anecdotally, the prevalence of ringworm in small animals seems to be increasing, especially in high-density catteries, in shelters, and among stray animals. Humans can be infected and develop lesions following direct contact with clinically or asymptomatically affected animals, particularly cats (52). Indirect transmission via contaminated hair or scale in the environment or on fomites may also occur. Following a 1- to 3-week incubation period, skin lesions can develop. It has been estimated that 2 000 000 cases of zoonotic ringworm occur in the United States annually (53). Furthermore, ringworm infection was reported to be the most commonly acquired zoonotic disease among British veterinarians (54).

Animals can readily transmit *M. canis* infection while remaining asymptomatic (55). It would, therefore, be prudent to test all stray animals, particularly cats, and animals obtained from animal shelters for the presence of ringworm. Likewise, all animals with dermatologic disease should be screened. Evaluation of fluorescence by using a Wood’s lamp is an easy, cost effective test for *M. canis* and can be a valuable screening tool in the hands of an experienced clinician. It must be remembered, however, that no fluorescence under Wood’s lamp cannot rule out dermatophytosis, as not all infections exhibit fluorescence (52). Prevention of zoonotic dermatophytosis involves recognition and quarantine of infected animals, personal hygiene, and environmental disinfection. Contaminated areas should be vacuumed to remove all hair, and then triple cleaned with stabilized chlorine dioxide disinfectants or a 10% bleach solution (52). Infected animals should be handled with barrier protection, including gloves and gowns.

**Blastomycosis**

Blastomycosis is a fungal disease caused by *Blastomyces dermatitidis*. Most cases of canine blastomycosis are pulmonary and are associated with inhalation of spores from the environment. Clinical blastomycosis may be relatively nonspecific and include anorexia, weight loss, cough, dyspnea, ocular disease, lameness, or skin lesions (56). Zoonotic transmission of *B. dermatitidis* is considered to be uncommon; however, transmission to veterinarians via accidental injection of a contaminated pulmonary aspirate, accidental laceration during necropsy, and following a bite from an infected dog has been reported (57–59). Suspected infection of a veterinary technician from a culture specimen has also been reported (60). There is no risk of aerosol transmission of the yeast phase of the organism from infected animals to humans (56). Barrier precautions should be used when handling potentially infected specimens and culture should only be performed by laboratories equipped with Level 3 containment facilities. If inoculation with contaminated materials occurs, the affected site should be immediately and thoroughly cleansed, and a physician should be contacted.

**Conclusion**

Occupational exposure to zoonotic diseases is an inherent risk in veterinary medicine. It is not a realistic goal to completely eliminate the potential of contracting a zoonotic disease; rather, the focus should be on greatly decreasing the risk. The chance of developing a zoonotic disease can be reduced through early recognition and appropriate management of infected (or potentially infected) animals, adequate training of support personnel, proper animal handling and housing, and, most importantly, personal hygiene.

**References**


51. Anonymous. Surveillance of the flow of *Salmonella* and *Campylobacter* in a community. Seattle: Seattle-King County Dept of Public Health, CDC Control Section, 1984.


