Biosecurity for Small Animal Practice: More Than Just an Isolation Ward
Marie E. Kerl DVM, MPH, DACVIM (SAIM), DACVECC
Department of Veterinary Medicine and Surgery, University of Missouri

According to a report published by the Centers for Disease Control in March 2009, healthcare acquired infections occur at a rate of 4.5 per 100 hospital admissions, and cost $6.65 billion in inflation-adjusted dollars for 2007 (around $25,000 per patient). In addition to monetary costs, healthcare-acquired infections produce a negative effect on hospital resources, and result in increased patient morbidity, mortality, and loss of quality of life. In review of the list of emerging and re-emerging infectious diseases published by the National Institute of Allergy and Infectious Diseases, over half are either shared by animals and people with a common environmental connection, or have direct zoonotic potential.

Infection threats exist for the veterinary intensive care unit as well as for human healthcare facilities. There are multiple sources to introduce and perpetuate infections, including pre-existing contagions with which animals are admitted, lag time between shed of infectious agents and onset of clinical signs, hospitalization of animals with severe illnesses that contribute to immunosuppression, prolonged hospital stays, extensive use of instrumentation and indwelling lines which serve as portals for nosocomial infections, and antimicrobial resistance which occurs with extensive use of antibiotic therapy. In addition, hospitalized animals soil themselves and the environment when immobile, presenting challenges for cleaning and disinfection. Compared to human healthcare facilities, there is a relative paucity of information about prevention of hospital-acquired infections, and few standardized plans are available to serve as guidelines to institute in existing intensive care units.

Nosocomial and Zoonotic Infections

A nosocomial infection is one that is not present or incubating at the time of admission to a healthcare facility. There are reports in the veterinary literature characterizing nosocomial outbreaks in small animal facilities; however the majority of reports have focused on *Salmonella enterica* outbreaks in large animal facilities. With regards to small animal facilities, causative organisms in literature reports of catheter-associated infections and antimicrobial resistance have included *Serratia marcescens*, *Salmonella spp.*, *Clostridium perfringens*, *Acinetobacter baumannii*, *Escherichia coli*, and *Clostridium difficile*. These infections are contracted either from the patient’s own normal bacterial flora or from organisms colonizing the hospital environment. Environmental contaminants are more likely to be controlled by changes in intensive care unit procedures; whereas infections resulting from endogenous flora typically occur in animals that are immunocompromised as a result of their illness or therapy.

Zoonotic pathogens are of particular concern since these present a risk for owners and hospital personnel as well as hospitalized pets. A zoonotic disease is one that is typically found in an animal that can be transmitted to a person, and an anthrozooponosis is a disease of humans that can be transmitted to animals. Although many types of organisms (e.g. bacteria, viruses, rickettsial organisms, fungi) have zoonotic potential, the bigger concern with hospitalized animals is colonization with those organisms commonly implicated in nosocomial infections. *Salmonella spp.*, *E. coli*, *Campylobacter*, and *C. difficile* all have recognized zoonotic potential. Methicillin-resistant *Staphylococcus aureus* (MRSA) and *C. difficile* are the two most common causes of nosocomial infections in human healthcare facilities. *C. difficile* is a normal enteric bacterium to which veterinary workers can become exposed in routine patient care. Animals may be contaminated, colonized, or infected with MRSA as a result of exposure in the veterinary hospital environment or by people carrying the organism, and are also able to transmit infection to people to perpetuate the cycle. Other important zoonoses that present a disproportionate risk to owners and veterinary workers with small animal patients and hospital settings include leptospirosis, salmonellosis, campylobacteriosis, dermatophytosis, and blastomycosis.

A 2007 report from the Ontario Veterinary College described an outbreak of MRSA in a small animal intensive care unit. In this report, a positive culture for MRSA was found in a Golden Retriever receiving mechanical ventilation for neuromuscular disease. Because of concerns regarding zoonosis and hospital-associated infection, barrier precautions were instituted and a screening program was implemented which consisted of performing cultures from nasal and rectal swabs in animals hospitalized in the ICU over time. On the first day of investigation, MRSA was identified in the index case and one other animal. Despite instituting barrier protection, MRSA was identified in 23% of ICU patients within the 13 days of initiating surveillance, and further colonization was not identified after discharge of the original group of colonized animals. Colonization was independent of age, species, service providing care, length of stay, and none of those colonized showed clinical evidence of their MRSA infection. In this study, had a surveillance protocol not been instituted to monitor progression of the outbreak, no other evidence would have existed. Colonization...
of MRSA has been documented in pets residing in households with people that have clinical MRSA. The type of MRSA identified between person-animal pairs was identical in most cases. For pets that are enrolled in pet-facilitated therapy programs, another study identified a 4-fold increase of MRSA and 2-fold increase of *C. difficile* colonization in those that participated in therapy programs at healthcare facilities compared to those that participated in therapy in a non-healthcare setting.12 Pets accepting treats or licking hands were more likely to be colonized. In a recent investigation evaluating prevalence of MRSA colonization in person-pet pairs from households with human healthcare workers, households with veterinary healthcare workers, and households with no healthcare workers, there was no difference found among the 3 populations, and less than 1% of isolates identified were identical.13

There have been two recent reports outlining current veterinary infection control and biosecurity practices in the United States.14,15 The first study reported on the findings from a survey performed from randomly selected veterinary practices in three major species areas (small animal, equine, food animal) to assess the precaution awareness for infectious disease prevention and veterinarians’ perception of zoonotic disease risks. Precaution awareness practices included such tasks as hand hygiene, sharps management, and barrier or isolation practices when performing a variety of common veterinary tasks. Findings indicated that in general, respondents did not engage in situation-appropriate protective behaviors to prevent zoonotic disease transmission. In assessing differences in engaging in protective behavior, small animal and equine veterinarians working in practices without written infection control plans were more likely to have less precaution awareness compared to those employed in facilities with written plans.14 This implies that providing effective information on infection control practices and establishing written protocols could be an effective means of increasing the use of appropriate protection. In the second study, hospital directors from AVMA-accredited veterinary teaching hospitals were contacted to participate in a telephone interview about infection control practices and nosocomial outbreaks in their hospitals. For the 38 hospitals that participated, 31 hospitals (82%) reported outbreaks of nosocomial infection in the 5 years prior to the interview, and 12 hospitals had completely closed sections of the hospital to limit spread. Nineteen hospitals (50%) reported occurrence of zoonotic infections in the 2 years prior to the interview. Only 16 facilities required personnel to complete a biosecurity training program.15 Based on these studies, nosocomial and zoonotic outbreaks occur in veterinary hospitals similarly to human hospitals, and there is an ongoing need to provide guidelines and teaching for infectious disease programs in all levels of the veterinary profession.

**Infection Prevention and Surveillance Plans**

Excellent quality resources for infection control plans in small animal practices are now widely available through the World Wide Web. The National Association of State Public Health Veterinarians published the Compendium of Veterinary Standard Precautions for Zoonotic Disease Prevention in Veterinary Personnel (CVSP) in August, 2008, and the Canadian Committee on Antibiotic Resistance produced Infection Prevention and Control Best Practices for Small Animal Veterinary Clinics (IPCP) in November 2008. The CVSP provides a stepwise review of the 3 facets of zoonotic disease transmission; source, host susceptibility, and routes of transmission. It then provides an overview of veterinary standard precautions which is subdivided into personal protective actions and equipment, protective actions during veterinary procedures, and environmental infection control. Additional sections include employee health with particular emphasis on vaccination protocols and documenting injury and exposure, and creating a written infection control plan. The appendices provide valuable information in a concise format, including a list of zoonotic diseases of importance in the United States, characteristics of selected disinfectants, and a model infection control plan for veterinary practices.

The IPCP is available at no cost online, and is written in a format that is easy to read and understand for all members of the veterinary healthcare team. Summary points of this publication are as follows:

1. Infection prevention and control strategies are designed to protect patients, owners, veterinary personnel, and the community. All veterinary personnel should play an active role in protecting every person and animal associated with the veterinary clinic.

2. Every veterinary clinic, regardless of size, should have a formal infection control program, a written infection control manual, and an infection control practitioner to coordinate the program.

3. Some form of surveillance should be practiced by all veterinary facilities. The keys to passive surveillance are to centralize the available data, and to have a designated ICP who compiles and evaluates the data on a regular basis.

4. Routine practices that are critical to infectious disease prevention and control include hand hygiene, risk reduction strategies, risk assessment of animals and personnel, and education.

5. All surgical procedures cause breaks in the normal defensive barriers of the skin or mucous membranes, and therefore carry an inherent risk of surgical site infection. Good general infection control practices are important for prevention of infection, but there are specific infection control measures pertaining to surgery that should be considered.
6. Every veterinary clinic should have an isolation area for caring for and housing animals with potentially contagious infectious diseases.

7. Proper wound care is critical to preventing transmission of bacteria, particularly multi-drug resistant pathogens, between animals, personnel, and the environment.

8. Animals from shelters and similar facilities should be considered high risk from an infectious disease standpoint and managed appropriately to prevent transmission if disease.

9. Safety of personnel and animal owners should always be a priority.

10. Education of personnel and clients about zoonotic and infectious disease risks and prevention is crucial.

Routine practices (hand hygiene, risk reduction strategies, risk assessment of animals and personnel, education) are straightforward methods of infection prevention that can be instituted immediately in any veterinary practice. Effective hand hygiene kills or removes microorganisms on the skin while maintaining the integrity of the skin. If the hands are visibly soiled, they should be washed to remove surface debris. This process will also remove most transient bacteria from the surface of the skin. Proper handwashing protocol includes removing all jewelry, wetting hands with warm water (hot water is more likely to damage skin), applying liquid or foam soaps, vigorously lathering all surfaces of the hands for 15 seconds, rinsing the soap from hands with warm water, drying thoroughly by blotting with paper towels, and turning off taps with the towels used for drying. Bar soaps should be avoided because they act as a medium. Effectiveness of handwashing will be reduced by skin that is chapped or damaged, fingernails more than 3-4 mm in length or artificial nails or nail enhancements, and jewelry. When hands are not visibly soiled, the use of alcohol based waterless hand sanitizers is the preferred method of cleaning. Sanitizers should contain 70-90% alcohol, and emollients to reduce skin damage that can occur with frequent use of these products. For proper use of sanitizers, hand and arm jewelry should be removed, a 2-3 cm diameter pool of product should be applied, and all surfaces of the hand should be rubbed until the product is completely dried. Drying takes 15-20 seconds, and hands must be completely dry before touching the patient. There is a rare risk of flammability in the presence of an oxygen-enriched environment. These products are more effective at killing microorganisms on the hands than handwashing with antibacterial soap, although they are not effective against bacterial spores and Cryptosporidium spp., as well as non-enveloped viruses (e.g. canine parvovirus, feline panleukopenia virus).

Risk reduction strategies include wearing clothing (lab coats, scrubs) that are dedicated for in-clinic use only and can be easily cleaned following each use. Gowns provide better barrier protection than do lab coats, and disposable gowns should not be re-used. Gloves should always be worn when contact with blood, body fluids, secretions, excretions, and mucous membranes is possible. Gloves should also be work for cleaning environmental surfaces, and while doing laundry if gross contamination is present. The use of gloves does not replace the practice of hand hygiene. Gloves must be disposed of and replaced following encountering a contaminated surface to prevent spread of contagions. Footwear should always be worn and should consist of closed-toe shoes to completely protect the feet. Shoe covers may be required for specific situations. Face and respiratory protection should be worn when appropriate.

Cleaning involves the removal of visible organic matter with soap or detergent, and disinfection involves the application of a chemical or other procedure to a cleaned surface to kill the remaining microbes that are not removed by cleaning. Cleaning must always be performed before a disinfectant is used. Resources are available to identify appropriate disinfectants to use for various pathogens. Normal machine washing with commercial detergent will reduce most pathogens; however laundry from animals with contagions should not be co-mingled with other clinic laundry. Forced-air tumbler dryers are an important step in disinfection since the temperatures reached and uniform application of heat throughout the items will reduce bacterial numbers. Waste should be segregated into biomedical hazard waste (used sharps and items heavily contaminated with blood), liquid waste, and household waste. Liquid waste should be carefully disposed of via a commercial sewer system.

Surveillance is a key to any infectious disease control program. Programs can be designed and implemented using active surveillance or passive surveillance. Active surveillance involves gathering data specifically for infection control purposes. This method provides high quality data but is expensive and requires a dedicated time commitment. Active surveillance is typically utilized to investigate a specific disease outbreak, or in an area with increased infectious disease threats. Passive surveillance involves utilizing data or information already being collected (e.g. bacterial culture and susceptibility results, results of other types of clinical disease testing, monitoring for specific signs of infectious disease). These results can be used to determine endemic disease rates, antimicrobial susceptibility patterns, and changes in disease patterns. Keys to maintaining a functional passive surveillance program include a method to centralize the available data, and to assign an infection control officer to compile and evaluate this data on a regular basis. This method will prevent missing the start of an outbreak in a large hospital that might otherwise be missed due to lack of communication.
Self-Assessment Questions:
1. Name 2 zoonotic diseases to which a small animal health provider is commonly exposed:
2. Name 2 nosocomial bacteria that are present in your hospital setting.
3. Describe the difference between a passive and an active surveillance program.
4. In the event of a positive culture for Methicillin-Resistant Staph. aureus from a patient in my ICU, I would institute the following steps:
5. List one example of each of the following types of infection control at your healthcare setting:
   Administrative control:
   Environmental control:
   Personal protective equipment:
6. Name the infection control officer at your facility.
7. Do you have a written infection control policy?
8. The single most important tool to prevent hospital-acquired infections is: