DIAGNOSIS & MANAGEMENT OF *STREP ZOO* INFECTIONS IN SHELTERS

Cynda Crawford, DVM, PhD

Streptococcus zooepidemicus (*Strep zoo*) is a significant pathogen of concern for dogs and cats in shelters. This Lancefield Group C gram-positive bacterium causes fatal hemorrhagic pneumonia in dogs and fatal pneumonia and meningoencephalitis in cats. This presentation provides an overview of *Strep zoo* epidemiology, clinical disease, diagnosis, and infection management in the shelter setting.

Epidemiology

Similar to horses, pigs, and ruminants, *Strep zoo* is a commensal organism in the upper respiratory tract of healthy dogs and cats. Not all dogs and cats are colonized by *Strep zoo*; in fact, limited surveys have demonstrated a low prevalence in the population. Why some animals are normal carriers and others are not is unknown. Carriers shed the bacteria in oronasal secretions that spread the organisms to other animals and the environment. *Strep zoo* can be a deadly pathogen for newly colonized animals, and the factors promoting this are not completely understood.

Most documented reports of *Strep zoo* disease occur in crowded shelters and sanctuaries instead of dogs and cats in pet homes. Crowding coupled with endemic respiratory illnesses are likely the most important risk factors for *Strep zoo* transmission. Crowding increases opportunities for direct contact between animals, hampers effective sanitation to increase infectious doses in the environment, and decreases ventilation and air quality causing irritated airways susceptible to colonization by commensal organism. Primary respiratory viral infections damage airway epithelial barriers and paralyze the mucociliary apparatus, increasing access and invasion by opportunistic commensal bacteria. There is mounting evidence that dogs infected by canine distemper virus, canine pneumovirus, or canine influenza virus are at highest risk for co-infection with *Strep zoo* bacteria. For cats, *Strep zoo* infections occur most commonly in crowded unsanitary shelters, sanctuaries, and hoarding environments where respiratory disease due to endemic herpesvirus and calicivirus is rampant.

Clinical Disease

Dogs present initially with cough and nasal discharge most likely due to a primary viral infection. In dogs co-infected with *Strep zoo*, close inspection may reveal grimacing and drawn lips with exaggerated inspiratory effort, followed by rapid progression to respiratory distress, bleeding from the nose and mouth, collapse, and death within hours. Death is due to fulminant hemorrhagic pneumonia and hemothorax. In many cases, dogs with no tell-tale signs of respiratory disease are simply found dead in their run with blood oozing from the mouth and nose. This scenario is the waving red flag for possible *Strep zoo* infection. The possibility of *Strep zoo* transmission in a shelter must be recognized quickly as survival depends upon prompt therapy with appropriate antibiotics.

In addition to the upper and lower respiratory tract, *Strep zoo* bacteria infect the central nervous system in cats. Infected cats typically present with copious oculonasal discharge and dyspnea from pneumonia. They may also display neurological signs such as pain on palpation of the

neck, ataxia, recumbency, and seizures. Death is due to severe pneumonia and meningoencephalitis. Cats don't have hemorrhagic pneumonia like dogs, and dogs don't have meningoencephalitis like cats.

Diagnosis

Since all respiratory pathogens cause similar clinical signs, the pathogen causing the infection cannot be diagnosed based on clinical signs. Not every coughing dog or snotty cat needs diagnostic testing to determine the cause. However, there are certain triggers signaling the need for diagnostic testing to provide proper management of individual animals as well as the population. Triggers for testing for *Strep zoo* include sudden death of dogs with hemorrhage from the nose and mouth, dogs with dyspnea and rapid decompensation from pneumonia, dogs with subtle bleeding from the nose, and cats with severe respiratory signs with or without concomitant neurological signs. The best diagnostic test is PCR performed on swabs of the upper respiratory tract. Nasal and oropharyngeal swabs from dogs, and oropharyngeal swabs from cats, are submitted to diagnostic labs offering comprehensive PCR panels for canine or feline respiratory pathogens including *Strep zoo*. PCR is very sensitive and specific with relatively quick turnaround times for results. Some labs offer a "reflex" bacterial culture and antibiotic sensitivity test for samples that are PCR-positive for *Strep zoo*. This follow-up culture/antibiotic sensitivity testing is important for verification of infectious *Strep zoo* and identification of effective antibiotics for treatment.

The most valuable diagnostic test frequently overlooked by shelters is necropsy. Animals that die or are euthanized due to severe illness often yield the most clues for solving the diagnostic puzzle. If a complete necropsy is not feasible, lung tissue can be easily harvested from dogs and cats that die from pneumonia. Fresh lung pieces can be submitted for the comprehensive PCR panel and bacterial culture testing. This identifies both viral and bacterial infections. Formalin-fixed lung can be submitted for histopathology.

Management of *Strep zoo* Infections

Management of *Strep zoo* infections employs the same strategy used for containment and resolution of other contagious diseases: isolation of sick/infected animals, quarantine of asymptomatic exposed animals, and creation of a clean break to prevent further exposures. The twist for *Strep zoo* is inclusion of proper antibiotic treatment to eliminate the bacteria. This includes therapeutic treatment of sick animals and prophylactic treatment for exposed animals. The most effective antibiotics are penicillins and cephalosporins. *Strep zoo* is resistant to doxycycline and fluoroquinolones.

Sick animals should be housed in a physically enclosed isolation room to stop pathogen exposure in the general population. Following confirmation of *Strep zoo* infection in one or more symptomatic animals, antibiotic treatment of every dog or cat with respiratory illness is essential for saving lives. This does not mean that every sick animal must be tested first as time is of the essence and it is not good use of money. The operative assumption is that sick animals may have *Strep zoo* co-infection.

All exposed asymptomatic animals should be considered an infectious risk and treated with an antibiotic for potential subclinical infection and to stop *Strep zoo* transmission. Exposure includes dogs or cats in the same housing location as confirmed cases, but frequently all dogs or

cats in the shelter are considered directly or indirectly exposed due to animal and staff movement, comingling of dogs from different locations in playgroups, etc. While antibiotic prophylaxis is typically not recommended for disease exposure because of risk for promoting bacterial resistance, it is warranted for *Strep zoo* because of the rapid progression of disease to death.

A clean break must be established to prevent exposure and infection of new animals. Ideally, no new animals should be admitted to the shelter during the *Strep zoo* treatment period. While this is possible for private nonprofit shelters, municipal shelters must practice intake diversion tactics to limit the number of new admissions. Animals that must be admitted should be started on the prophylactic antibiotic treatment for protection.

Clavamox, amoxicillin, and cephalexin are good antibiotic choices for *Strep zoo*, but they are not user-friendly for shelters because they require twice daily dosing. Staff do not have the capacity to administer twice daily doses at the proper time interval to dozens or hundreds of sick and exposed animals. Shelter-friendly antibiotic choices include cefpodoxime (Simplicef®, Zoetis Petcare, Parsippany NJ) administered orally once daily or cefovicin injection (Convenia®, Zoetis Petcare, Parsippany NJ) given once. For dogs, cefpodoxime PO once daily for 7 days is effective and convenient for staff. Injectable cefovecin offers the advantage of a "one and done" treatment that eliminates staff reliability and animal handling for daily medications. This is especially important for cats where the stress of handling for daily oral medication can cause or exacerbate respiratory illness.

Strep zoo infections are eliminated by the antibiotic treatment within 7 days, after which they are safe to release from isolation and quarantine. However, they likely have respiratory viral co-infections that require longer stays for safe release.

Successful management of *Strep zoo* requires sanitation practices that effectively eliminate bacterial contamination of the environment. These bacteria are inactivated by commonly used disinfectants in shelters. However, bacteria sequestered in biofilms on environmental surfaces are protected from contact with disinfectants and can be a source of future exposures. Best practice for daily sanitation of animal housing units includes scrubbing surfaces with a degreaser such as Dawn detergent to remove organic matter and biofilms before applying disinfectant. Staff in shelters that are overcrowded skip the cleaning step to save time. Body oils and organic debris eventually form biofilms that accumulate on the surfaces and trap pathogens. The pathogens retain viability because they are shielded from contact with disinfectants. Several shelters that skipped the cleaning step have experienced recurrent *Strep zoo* infections. When daily cleaning with a detergent is not feasible, an acceptable alternative is adding in the cleaning step once weekly to remove biofilms.

Lastly, *Strep zoo* is a zoonotic pathogen. Most human infections are acquired by contact with infected horses, pigs, or ruminants, with very few reports of transmission from dogs or cats. While staff caring for animals in isolation and quarantine should always wear PPE, it is very important during management of *Strep zoo*.

Key Takeaways

- *Strep zoo* is a significant pathogen of concern for dogs and cats in shelters, causing fatal hemorrhagic pneumonia in dogs and fatal pneumonia and meningoencephalitis in cats.
- While *Strep zoo* is a commensal organism in healthy dogs and cats, it can be a deadly opportunistic pathogen for other dogs and cats
- Crowding coupled with endemic respiratory illnesses are likely the most important risk factors for *Strep zoo* transmission
- Dogs infected by canine distemper virus, canine pneumovirus, or canine influenza virus are at highest risk for co-infection with *Strep zoo* bacteria.
- For cats, *Strep zoo* infections occur most commonly in crowded unsanitary shelters, sanctuaries, and hoarding environments with endemic herpesvirus and calicivirus.
- Dogs with *Strep zoo* infection initially present with cough and nasal discharge followed by rapid progression to respiratory distress, bleeding from the nose and mouth, collapse, and death within hours. Death is due to fulminant hemorrhagic pneumonia and hemothorax.
- *Strep zoo* infects the respiratory tract and brain in cats. Infected cats typically present with copious oculonasal discharge, dyspnea from pneumonia, and possibly neurological signs. Death is due to severe pneumonia and meningoencephalitis. Cats don't have hemorrhagic pneumonia like dogs, and dogs don't have meningoencephalitis like cats.
- Triggers for testing for *Strep zoo* include sudden death of dogs with hemorrhage from the nose and mouth, dogs with dyspnea and rapid decompensation from pneumonia, dogs with subtle bleeding from the nose, and cats with severe respiratory signs with or without concomitant neurological signs. The best diagnostic test is PCR performed on swabs of the upper respiratory tract or lung tissue.
- Management of *Strep zoo* infections employs the same strategy used for containment and resolution of other contagious diseases: isolation of sick/infected animals, quarantine of asymptomatic exposed animals, and creation of a clean break to prevent further exposures.
- The twist for *Strep zoo* is inclusion of therapeutic antibiotic treatment of sick animals and prophylactic antibiotic treatment for exposed animals. The most effective antibiotics are penicillins and cephalosporins.
- Shelter-friendly antibiotic choices include cefpodoxime administered orally once daily for 7 days or cefovecin injection given once.
- Successful management of *Strep zoo* requires sanitation practices that effectively eliminate bacterial contamination of the environment, including biofilms that may be harboring the bacteria.
- *Strep zoo* is a zoonotic pathogen. While staff caring for animals in isolation and quarantine should always wear PPE, it is very important during management of *Strep zoo*.