# Public Veterinary Medicine: Public Health

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*Chlamydophila psittaci* (formerly known as *Chlamydia psittaci*) is a member of the family *Chlamydiaceae*.[1] It is a bacterium that can be transmitted from pet birds to humans. In humans, the resulting infection is referred to as psittacosis (also known as parrot fever and ornithosis). Psittacosis typically causes influenza-like symptoms and can lead to severe pneumonia and nonrespiratory health problems. With appropriate treatment, the disease is rarely fatal. From 1988 through 2003, the CDC received reports of 935 cases of psittacosis,[2] which is an underrepresentation of the actual number of cases. Most human cases were associated with exposure to pet birds. Other persons at risk include pigeon fanciers and persons in specific occupations (eg, employees in poultry slaughtering and processing plants, veterinarians, veterinary technicians, laboratory workers, workers in avian quarantine stations, farmers, wildlife rehabilitators, and zoo workers). Because human infection can result from brief, passing exposure to infected birds or their contaminated excretions or secretions, persons with no identified leisure time or occupational risk can become infected.

In this compendium, *C psittaci* infection in birds is referred to as avian chlamydiosis. Chlamydial organisms have been isolated from approximately 100 bird species but are most commonly identified in psittacine (parrot-type) birds, especially cockatiels and budgerigars, commonly known as parakeets or budgies. Among caged, nonpsittacine birds, infection with *Chlamydiaceae* organisms occurs most frequently in pigeons and doves. Avian chlamydiosis is less frequently diagnosed in canaries and finches. The recommendations in this compendium provide standardized procedures for controlling avian chlamydiosis in the pet bird population, an essential step in efforts to control psittacosis among humans. This compendium is intended to guide public health officials, physicians, veterinarians, the pet bird industry, and others concerned with the control of *C psittaci* infection and the protection of public health.

## Infection in Humans (Psittacosis)

**Transmission**—The disease resulting from *C psittaci* infection in humans is called psittacosis, and most infections are typically acquired from exposure to pet psittacine birds. However, transmission has been documented from poultry and free-ranging birds, including doves, pigeons, birds of prey, and shore birds. Infection with *C psittaci* usually occurs when a person inhales organisms that have been aerosolized from dried feces or respiratory tract secretions of infected birds. Other means of exposure include mouth-to-beak contact and handling infected birds' plumage and tissues. Even brief exposures can lead to symptomatic infection; therefore, certain patients with psittacosis might not recall or report having any contact with birds.

Mammals occasionally transmit *Chlamydiaceae* organisms to humans. Certain chlamydial species infect sheep, goats, and cattle, causing chronic infection of the reproductive tract, placental insufficiency,

and abortion. Those species are transmitted to humans when humans are exposed to the birth fluids and placentas of infected animals. Another chlamydial species, the feline keratoconjunctivitis agent, typically causes rhinitis and conjunctivitis in cats. Transmission of this species from cats to humans may be underreported.

Person-to-person transmission has been suggested but not proven.[3] Standard infection-control precautions are sufficient for humans with psittacosis, and specific isolation procedures (eg, private room, negative pressure air flow, and masks) are not indicated.

cies by different birds, cages should be thoroughly scrubbed with soap and water, disinfected, and rinsed in clean running water. Exhaust ventilation should be sufficient to prevent accumulation of aerosols and prevent cross-contamination of rooms.

- Control the spread of infection. Isolate birds requiring treatment. Rooms and cages where infected birds were housed should be cleaned immediately and disinfected thoroughly. When the cage is being cleaned, transfer the bird to a clean cage. Thoroughly scrub the soiled cage with a detergent to remove all fecal debris, rinse the cage, disinfect it (allowing at least 5 minutes of contact with the disinfectant), and rerinse the cage to remove the disinfectant. Discard all items that cannot be adequately disinfected (eg, wooden perches, ropes, nest material, and litter). Minimize the circulation of feathers and dust by wet-mopping the floor frequently with disinfectants and preventing air currents and drafts within the area. Reduce contamination from dust by spraying the floor with a disinfectant or water before sweeping it. Do not use a vacuum cleaner because it will aerosolize infectious particles. Frequently remove waste material from the cage (after moistening the material), and burn or double-bag the waste for disposal. Care for healthy birds before handling isolated or sick birds.
- Use disinfection measures. All surfaces should be cleaned thoroughly before disinfection. *Chlamydophila psittaci* is susceptible to most disinfectants and detergents as well as heat; however, it is resistant to acid and alkali. A 1:1,000 dilution of quaternary ammonium compounds (eg, Roccal or Zephiran) is effective, as are 70% isopropyl alcohol, 1% Lysol, 1:100 dilution of household bleach (ie, 2.5 tablespoons/gallon), and chlorophenols. Many disinfectants are respiratory irritants and should be used in a well-ventilated area. Avoid mixing disinfectants with any other product.

Treatment and care of infected birds—All birds with confirmed or probable avian chlamydiosis i 2hlamydio n213 Tentif..02589 Tcd(Ceol1 1misihcnd 14e aoimM Tă poa—8 .5d4 8 .5d4 8 nestcto0(oug4wastepr)20(c

5. Schaffner W. Birds of a feather—do they flock together? *Infect Control Hosp Epidemiol* 1997;18:162–164.

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From the National Association of State Public Health Veterinarians (NASPHV) Psittacosis Compendium Committee.

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## Appendix 1
Methods for diagnosing avian chlamydiosis.

Bacteria are classified as *Chlamydophila psittaci* on the basis of shared biochemical characteristics and genome composition. The individual chlamydial organisms that meet these classification criteria are not identical and represent life forms that have evolved, and continue to evolve, through infection of both ancient and naïve hosts. Diversity in the organism, the level of exposure, and the host response may cause aberrant test results in some individual animals.

Diagnosis of avian chlamydiosis can be difficult, especially in the absence of clinical signs. A single testing method might not be adequate. Therefore, use of a combination of culture, antibody-detection, and antigen-detection methods is recommended, particularly when only 1 bird is tested. Although there is no epidemiologic evidence of increased risk to young, elderly, or immunocompromised humans, more rigorous testing should be considered for birds in contact with these individuals. Consultation with an experienced avian veterinarian may help when selecting tests and interpreting results. Proper sample collection techniques and handling are critical for obtaining accurate test results.

**Pathologic diagnosis**—In birds that have avian chlamydiosis, cloudy air sacs and enlargement of the liver and spleen usually are observed but no specific gross lesion is pathognomonic. Chromatic or immunologic staining of tissue or impression smears can be used to identify organisms in necropsy and biopsy specimens.

**Bacteriologic culture**—Use of culture is recommended to avoid limitations associated with other tests. Tissue specimens from the liver and spleen are the preferred necropsy specimens. In live birds, combined choanal and cloacal swab specimens or liver biopsy specimens are ideal for diagnosis. Live birds being screened for *C psittaci* might not shed the microorganism daily. Therefore, to optimize recovery, serial specimens should be collected for 3 to 5 consecutive days and pooled before bacteriologic culture.

*Chlamydophila* spp are obligate intracellular bacteria that must be isolated in tissue culture or chick embryos. Specialized laboratory facilities and training are necessary for reliable identification of chlamydial isolates and adequate protection of microbiologists. The diagnostic laboratory should be contacted for specific procedures required for collection and submission of specimens. The proper handling of specimens is critical for maintaining the viability of organisms for culture, and a special transport medium is required. Following collection, specimens should be refrigerated and sent to the laboratory packed in ice but not frozen.

**Tests for antibodies**—A positive serologic test result is evidence that the bird was infected by *Chlamydiaceae* at some point, but it might not indicate that the bird has an active infection. False-negative results can occur in birds that have acute infection when samples are collected before seroconversion. Treatment with an antimicrobial agent can diminish the antibody response.

When samples are obtained from a single bird, serologic testing is most useful when signs of disease and the history of the flock or aviary are considered and serologic results are compared with WBC counts and serum activities of liver enzymes. A greater than 4-fold

## Appendix 2

Treatment options for pet birds with avian chlamydiosis.

Treatment of avian chlamydiosis can be difficult, and fatalities may occur. Although treatment protocols are usually successful, knowledge is evolving and no protocol ensures safe treatment or complete elimination of infection. Therefore, treatment for avian chlamydiosis should be supervised by a licensed veterinarian after consultation with an experienced avian veterinarian. During treatment, suggestions in the section "Treatment and care for infected birds" should be followed. All birds with avian chlamydiosis should be treated for 45 days, except as noted in the following sections. Sources of dietary calcium (eg, cuttle bone, mineral block, oyster shell, and highly supplemented pellets) should be reduced if tetracycline drugs are orally administered. In hand-fed neonates in which dietary calcium is required, the calcium and tetracycline should be given at least 4 to 6 hours apart.

### Treatment Using Doxycycline

Doxycycline is presently the drug of choice for treating birds with avian chlamydiosis. It is better absorbed and more slowly eliminated than other tetracyclines. This allows doxycycline to be effective with lower drug doses (improving palatability with food or water-based administration) or administered less frequently (improving ease of treatment). Treated birds should be monitored for signs of doxycycline toxicosis. Toxicosis can cause general signs of illness (signs of depression, inactivity, and decreased appetite), green- or yellow-stained urine, and altered results of hepatic tests (high serum activities of aspartate aminotransferase and lactate dehydrogenase and high serum concentration of bile acids). If toxicosis occurs, administration should be stopped and supportive care provided until the bird recovers. Treatment with a different regimen or lower doxycycline dose can be started at a later date.

• **Doxycycline medicated feed for budgerigars**—The following medicated diet[8] can be used to treat budgerigars with avian chlamydiosis:

• Mix 1 part cracked steel oats with 3 parts hulled millet (measured by volume). Add 5 to 6 mL of sunflower oil/kg of the oat-seed mixture, and mix thoroughly to coat all seeds. Add 300 mg of doxycycline hyclate (from capsules)/kg of oat-seed-oil, and mix thoroughly to ensure that oats and seeds are evenly coated. Mix fresh medicated oat-seed mix daily. Feed as the sole diet for 30 days. The oats and hulled millet seed are available at health food stores. Small-sized millet should be selected. Sunflower oil is available in grocery stores. Doxycycline hyclate capsules are available in 50- and 100-mg sizes.

• **Doxycycline medicated water**—Results of pharmacologic studies indicate that doses of 200 to 400 mg of doxycycline hyclate/L of water for cockatiels, 400 to 600 mg/L for Goffin's cockatoos, and 800 mg/L for African gray parrots will maintain therapeutic concentrations.[9,10] Research data are lacking for other species, but empiric use of 400 mg/L of water has been successful for many psittacine birds. Medicated water failed to maintain therapeutic concentrations in budgerigars.[8]

• **Orally administered doxycycline**—Doxycycline is the drug of choice for oral administration; either the monohydrate or calcium-syrup for-