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Popular Article

# Parrot Fever: A Zoonotic Threat

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***Abstract***

Avian chlamydiosis is one of the important neglected diseases with critical zoonotic potential. Psittacosis, also known as parrot fever and ornithosis, is a bacterial infection of humans that can cause severe pneumonia and other serious health problems. It is caused by *Chlamydophila psittaci*, formerly known as *Chlamydia psittaci*. In birds, *C. psittaci* infection is referred to as Avian chlamydiosis (AC). Infected birds shed the bacteria through faeces and nasal discharges, and humans become infected from exposure to these materials. It is characterized by fever, prominent headache, and a non-productive cough. The mainstay of diagnostic testing is serologic, although molecular techniques increasingly are utilized. Prevalence of the disease in wild birds, pet birds, and poultry causes economic losses to the poultry industry and the pet bird trade. Doxycycline is the treatment of choice.

**Keywords-** Avian chlamydiosis, Psittacosis, *Chlamydophila psittaci*, Zoonosis

## Introduction

Avian chlamydiosis is one of the important neglected diseases with critical zoonotic potential (Ravichandran *et al.*, 2021). Psittacosis, also known as ornithosis and parrot fever, is a zoonotic disease caused by *Chlamydia psittaci*, an intracellular, Gram-negative a bacterium that infects both birds (avian chlamydiosis) and humans (psittacosis, parrot fever, or ornithosis). The term psittacosis is derived from the Greek word for parrot; nonetheless, the disease was first described in medical literature in 1879. The 1929 and 1930 psittacosis pandemic impacted around 800 persons worldwide. Psittacosis pandemics were attributed to imported psittacine birds from South America to Europe and North America in 1929. The Centre for Food Security and Public Health reports that, avian

chlamydiosis is a reportable disease in the United States and Canada (West, 2011).

It is spread from birds to humans and causes a variety of clinical presentations, including subclinical or self-limiting influenza-like disease, atypical pneumonia, and fulminant psittacosis with multi-organ failure. Transmission occurs by direct contact with vulnerable animals, avian nasal discharges, infectious avian faecal contents, and inhalation of feather dust (Balsamo *et al*., 2017).The organism attaches to the upper respiratory tract mucosal surface after inhaling microorganisms from secretions, faeces, or even feather dust. Although many people remain asymptomatic, atypical pneumonia is thought to be caused by an immunological reaction involving the outer membrane proteins (OMP). Poultry and domestic birds such as parrots, cockatiels, macaws, and parakeets are among the most common hosts of Chlamydia psittaci. Despite the fact that the organism contains non-avian species such as cattle, sheep, swine, and so on, none of these have transmitted disease to humans (Khadka *et al*., 2022).

*Chlamydophila psittaci* in birds can be diagnosed by detection of antigens, immunohistochemical staining, polymerase chain reaction assays, and serology. Diagnosis of Psittacosis in humans, is made through the use of a micro immunofluorescence test to detect antibodies against *C. psittaci* in paired sera. Birds infected with avian chlamydiosis should be treated with Antibiotic therapy preferably tetracyclines are used for the management of the patient and doxycycline for 45 days. A variety of treatment methods can be used, including doxycycline-medicated feeds, medicated water, oral medication, or injectable doxycycline. It is also important that the bird's caretaker follow appropriate standard hygiene practices to minimize the zoonotic potential associated with the disease (Khadka, *et al.*,2022). Currently, there are multiple reports of new and unexpected cases of chlamydia associated with community-acquired pneumonia (CAP) around the world which highlighted the importance of multi-disciplinary 'One Health' collaboration to tackle this pathogen. Around 1% of CAP worldwide is caused by *C. psittaci* (Hogerwerf *et al*., 2017)

**Etiology**

The family Chlamydiaceae (order Chlamydiales, phylum Chlamydiae) has more than 15 distinct species that are obligate intracellular, coccoid, gram-negative bacteria with a unique conserved biphasic life cycle in hosts. *C. psittaci* is the principal causal agent with a high zoonotic risk, however other species exist. Recent identifications of *C. avium, C. gallinacea, C. ibidis*



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(Candidatus taxon), and *C. buteonis* suggested a complex aetiology of avian chlamydiosis (Ravichandran *et al*., 2021).

**Transmission Of Avian Psittacosis**

**Transmission in Birds**

*Chlamydophila psittaci* is spread between birds by contaminated airborne particles (e.g., feather dander, faecal dust) and ingestion of infected material (e.g., contaminated faeces). Close contact with respiratory or oral secretions can also expose birds to the C. psittaci pathogen. Some birds may be asymptomatic carriers of the disease and occasionally excrete the bacteria, particularly when immunocompromised (Smith, 2011).

**Transmission in Human being**

The occurrence of ornithosis in humans depends on multiple factors like the intensity of exposure, microbial factors, and route of transmission (Rybarczyk *et al*., 2020).Infected birds excrete the bacteria in their faeces and nasal secretions. When exposed to diseased birds, people become infected by inhaling aerosolized germs or by handling contaminated feather dander, faecal material, or bodily tissue. Beak-to-mouth contact is another method of exposure. People who are exposed to birds on a daily basis at aviaries, poultry farms, pet shops, veterinary clinics, and as pet bird owners are the most vulnerable to illness. However, even brief contact with diseased birds and/or a polluted environment can lead to human infection (Smith, 2011).

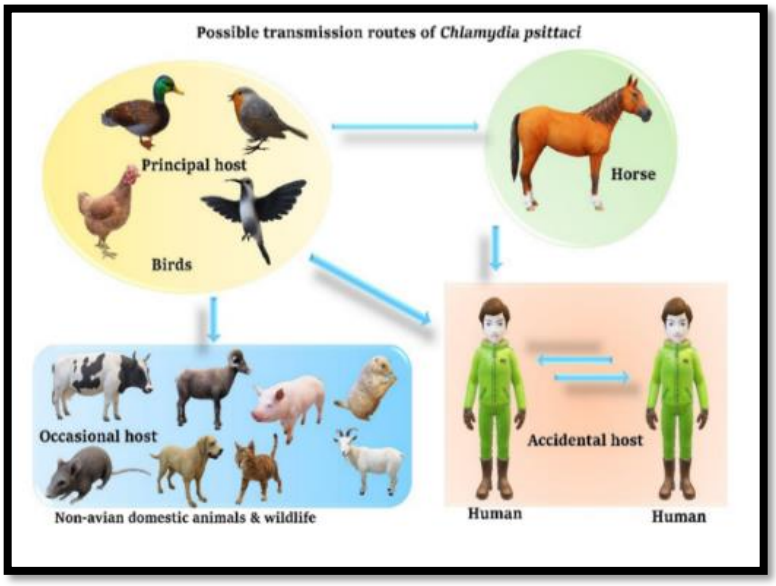


**Fig 1: Transmission routes of *Chlamydophila psittaci***

(Source-A comprehensive review on avian chlamydiosis: a neglected zoonotic disease)



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**Clinical Signs in Birds**

The incubation period for avian chlamydiosis has been reported to be between 3 days and several weeks. Lethargy, anorexia, ruffled feathers, discharge from the eyes or nose, diarrhea, and the expulsion of green to yellow-green urates are typical clinical signs of avian chlamydiosis. Severely affected birds can produce dark green faeces, are often emaciated and dehydrated, and may die. Some infected birds may be subclinical carriers and shed the bacterium during stressful events (e.g., immunosuppressed); therefore, periodic screening for *C. psittaci* may be important (Smith, 2011).

**Fig 2:- Lethargic & Ruffeled Feather, mucopurulent nasal discharge**

**Fig 3: showing greenish watery diarrhea in parrot**



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**Clinical Signs in Humans**

The incubation period of *C. psittaci* in humans is 5 to 14 days. Psittacosis is characterized by the sudden onset of fever, chills, headache, malaise, myalgia, nonproductive coughing, and dyspnea. The most common symptom is a nonproductive cough, which may also be accompanied by chest tightness or difficulties breathing. There may also be an enlarged spleen, an undefined rash, and a pulse-temperature dissociation (fever without an elevated heart rate). The level of pulmonary involvement may be understated by auscultatory observations. Lobar or interstitial infiltrates may be found on radiographs. Infections with *Coxiella burnetii*, *Histoplasma capsulatum*, *Mycoplasma pneumoniae*, *Legionella spp.*, *C.* pneumoniae, and respiratory viruses including influenza are included in the differential diagnosis of *C. psittaci* pneumonia. Other organ systems besides the respiratory tract can be affected by *C. psittaci*, leading to endocarditis, myocarditis, hepatitis, arthritis, and keratoconjunctivitis. Encephalitis, and more recently, ocular adnexa lymphoma. Severe illness with respiratory failure, thrombocytopenia, and hepatitis has also been reported (Smith, 2005).

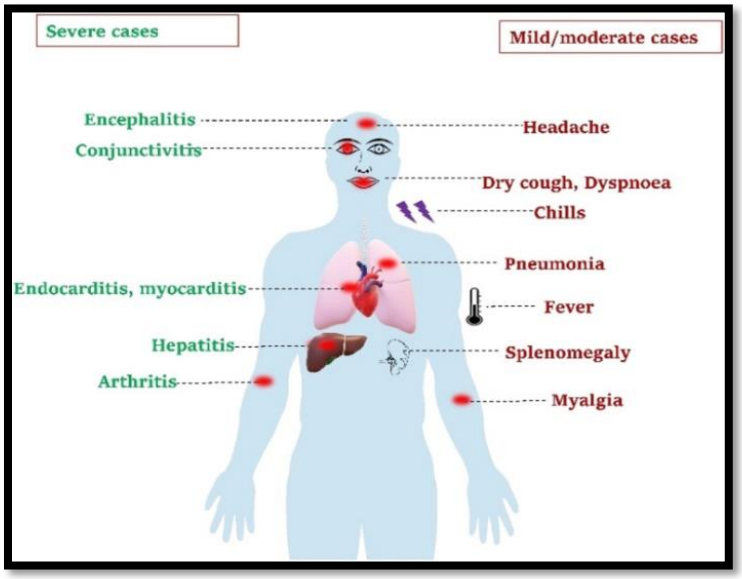


**Fig. 4: Clinical signs in human**

**Diagnosis In Birds**

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 one bird is tested



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(Ravichandran *et al*.,2021).

- **Histopathological examination:**

In birds with avian chlamydiosis, cloudy air sacs and enlargement of the liver and spleen may be 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 specimen.

- **Bacteriologic Culture:**

In live birds with suggestive clinical signs of chlamydiosis, a combined conjunctival, choanal and cloacal swab specimen, or liver biopsy specimen is recommended for testing. Chlamydophila species are obligate intracellular bacteria that must be isolated in tissue culture or embryonating chicken eggs. The proper handling of specimens is critical for maintaining the viability of organisms for culture, and a special transport medium is required. After 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.

1. **Elementary-body Agglutination** The elementary body is the infectious form of *C. psittaci*. Elementary body agglutination is commercially available and dtects IgM antibodies, an indication of early infection. Titers greater than 10 in budgerigars, cockatiels, and lovebirds and titers greater than 20 in larger birds are frequently detected in cases of recent infection. However, increased titers can persist after treatment is completed.
2. **Indirect Fluorescent Antibody Test** Polyclonal secondary antibody is used to detect host antibodies (primarily IgG). Sensitivity and specificity varies with the immunoreactivity of the polyclonal antibody to various avian species. Low titers may occur because of nonspecific reactivity.
3. **Complement Fixation** Direct CF is more sensitive than agglutination methods. False-negative results are possible in specimens from parakeets, young African gray parrots, and lovebirds. High titers can persist after treatment and complicate interpretation of subsequent tests. Modified direct CF is more sensitive than direct C.



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- **Tests for Antigen Tests for antigen detect the organism**.

These tests give rapid results and do not require live, viable organisms; however, false-positive results from cross-reacting antigens can occur. False-negative results can occur if there is insufficient antigen or if shedding is intermittent. As with all nonculture tests, results must be evaluated in conjunction with clinical findings.

1) **Enzyme-linked Immunosorbent Assay**- ELISA tests were originally developed for identification of Chlamydia trachomatis in humans. The exact sensitivity and specificity of these tests for identifying other Chlamydiaceae are not known. They are now occasionally used to identify suspected C. psittaci in birds. If a bird has a positive ELISA result but is healthy, the veterinarian should attempt to verify that the bird is shedding antigen via isolation of the organism. When a clinically ill bird has a negative ELISA result, a diagnosis of avian chlamydiosis cannot be excluded without further testing (e.g., culture, serologic testing, or PCR assay).
2) **Fluorescent Antibody Test**- Monoclonal or polyclonal antibodies, fluorescein staining techniques, and fluorescent microscopy are used to identify the organism in impression smears or other specimens. These tests have similar advantages and disadvantages to ELISA. This test is used by some state diagnostic laboratories.
3) **Tests for DNA**- Numerous laboratories offer diagnostic testing using PCR assay. PCR amplification can be sensitive and specific for detection of target DNA sequences in collected specimens (e.g., combined conjunctival, choanal and cloacal swab specimens, and blood). Results differ between laboratories because there are no standardized PCR primers, and laboratory techniques and sample handling may vary. Because of the sensitivity of the assay, samples for PCR must be collected with techniques that avoid contamination from the environment or other birds. PCR does not differentiate between viable and nonviable microorganisms. Test results must be interpreted in light of clinical presentation and other laboratory tests.



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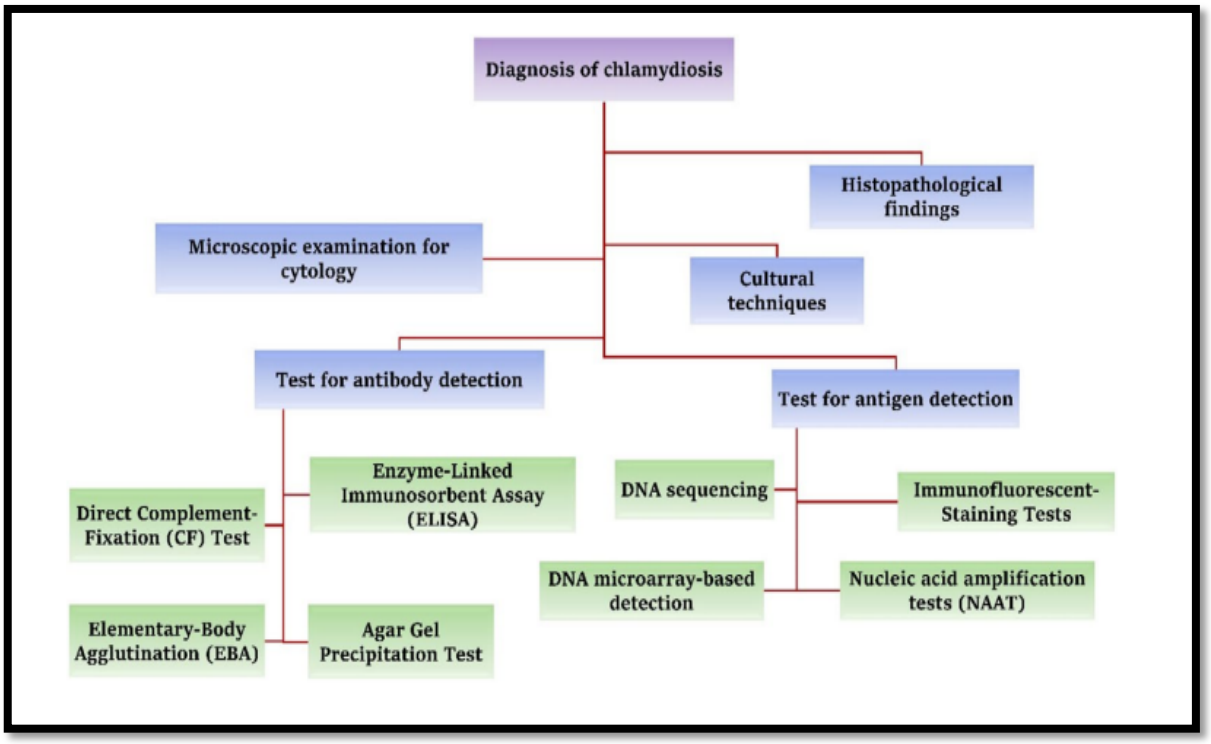


**Fig. 5: Diagnosis of avian chlamydiosis**

## Diagnosis In Human Beings

Usually, a chest X-Ray shows a ground-glass-like shadow in the involved lobes. Computed tomography (CT) is found to have higher sensitivity and may reveal nodular pulmonary infiltrates with surrounding ground-glass opacities (Haba and Naito, 2019).

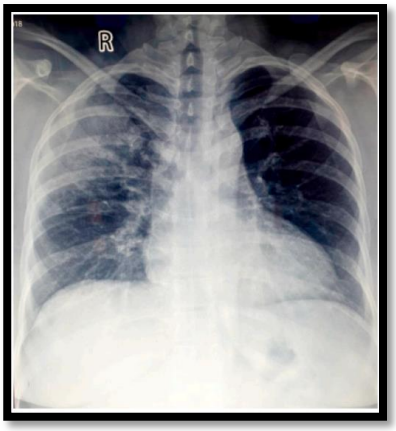


**Fig 6: Chest X-ray showed ill-defined consolidation involving the right upper and middle zones.**



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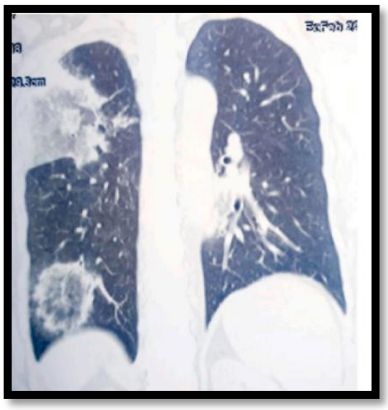

**Fig 7: Computed tomography (CT scan) Which showed patchy ground glass opacities in the apical and posterior segments of the right upper lobe as well as posterobasal segment of the right lower lobe with surrounding dense consolidation giving reverse halo sign.**

**Treatment**

Chlamydial organisms are susceptible to antibiotics such as quinolones, tetracyclines, and macrolides, although these drugs are not bactericidal (Rodolakis and Mohamad, 2010).Treatment for avian chlamydiosis in animals is usually done with tetracycline (e.g., Doxycycline) or fluoroquinolones (e.g., Enrofoxacin) either in oral (drinking water/feed) or parenteral (Intramuscular/ subcutaneous) routes (Bommana and Polkinghorne, 2019).The drug of choice for chlamydiosis treatment are chlortetracycline and doxycycline, to eliminate clinical disease and faecal shedding. Chlortetracycline and doxycycline are effective against actively multiplying organisms. Infected birds should receive antibiotics in the cooked mash or pelleted feed continuously for at least 45 days, except in budgerigars (budgies or parakeets), where 30 days of treatment can be efective, but it may lead to subtherapeutic plasma concentrations (Vanrompay *et al*.,2020).

**Dose**- Chlortetracycline @ 500–5000 ppm according to the species and food

Doxycycline @ 25 mg/kg, PO, BID

Enrofoxacin @25-20 mg/kg, PO, BID

Treatment in humans with tetracycline (preferably doxycycline, orally) should be continued for 10 to 14 days even after the control of fever. In children and pregnant women who are contraindicated to use tetracycline, a better alternative is macrolide antibiotics like erythromycin or azithromycin (dose: 250–500 mg, orally four times for 7 days) is used (Beeckman and Vanrompay, 2009).



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**Prevention and Control Recommendations**

To prevent transmission of *C. psittaci* to humans and birds, specific control measures are recommended:

1. **Educate persons at risk**- Inform all persons in contact with birds or bird-contaminated materials about potential health risks. By the time infection is recognized in a group of birds, a critical period for pathogen accumulation and possible dissemination to humans and other birds has already occurred. Bird caretakers with respiratory or influenza-like symptoms should seek prompt medical attention and inform their health care provider about bird contact.
2. **Protect persons at risk**- When cleaning cages or handling potentially infected birds, caretakers should wear protective clothing, which includes gloves, eyewear, a disposable surgical cap, and an appropriately fitted respirator13 with N95 or higher rating. Surgical masks might not be effective in preventing transmission of *C. psittaci*. In addition, necropsies of potentially infected birds should be performed in a biological safety cabinet. The carcass should be moistened with detergent and water to prevent aerosolization of infectious particles during the procedure. Maintain accurate records of all bird-related transactions for at least 1 year to aid in identifying sources of infected birds and potentially exposed persons. Records should include the date of purchase, species of birds purchased, individual bird identification, source of birds, and any identified illnesses or deaths among birds. In addition, the seller should record the name, address, and telephone number of the customer and individual bird identification (e.g., band or microchip number).
3. **Avoid purchasing or selling birds that have signs consistent with avian chlamydiosis**- Signs are nonspecific and may include lethargy, ocular or nasal discharge, diarrhoea, ruffled feathers, or low body weight.
4. **Avoid mixing birds from multiple sources**- To prevent disease outbreak in birds and pathogen transmission to humans, additional control and prevention methods (e.g., health screening, extended quarantine, and *C. psittaci* testing) may be required when birds from multiple sources are comingled.
5. **Quarantine newly acquired or exposed birds and isolate ill birds**- Isolation should include housing in a separate air space from other birds and non-caretakers.



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6. **Test birds before they are to be boarded or sold on consignment**- House them in a room separate from other birds pending test results.
7. **Screen birds with frequent public contact (e.g., bird encounters, long-term care facilities, schools)**- Such testing may be used to reduce potential human exposure from birds. Specific protocols should be established in consultation with a veterinarian, recognizing that some birds may demonstrate persistent IgG antibodies in the absence of active infection. A negative *C. psittaci* diagnostic test result does not guarantee that the bird is not infected.
8. **Practice preventive husbandry**- Position cages to prevent the transfer of faecal matter, feathers, food, and other materials from one cage to another. Do not stack cages and be sure to use solid-sided cages or barriers if cages are adjoining. Clean all cages, food bowls, and water bowls daily. Soiled bowls should be emptied, cleaned with soap and water, rinsed, placed in a disinfectant solution, and rinsed again before reuse.
9. **Control the spread of infection**- Care for healthy birds before handling isolated or sick birds. Isolate birds requiring treatment. Rooms and cages where infected birds were housed should be cleaned and disinfected thoroughly after removal of infected birds. Workers should wear appropriate protective clothing (see "Protect persons at risk" above). When the cage is being cleaned, transfer the bird to a clean cage. Thoroughly scrub the soiled cage with a detergent to remove all faecal debris, rinse the cage, disinfect it (most disinfectants require 5-10 minutes of contact time) and re-rinse the cage to remove the disinfectant. Reduce contamination from dust by spraying the floor with a disinfectant or water before sweeping it. Properly maintained ventilation systems are at low risk of harboring *C. psittaci*.
10. **Use disinfection measures**- All surfaces should be thoroughly cleaned of organic debris before disinfection. *Chlamydophila psittaci* is susceptible to many disinfectants and detergents as well as heat; however, it is resistant to acid and alkali. Examples of effective disinfectants include 1:1000 dilution of quaternary ammonium compounds, 1% Lysol, or freshly prepared 1:32 dilution of household bleach (1⁄2 cup/gallon). Many disinfectants are respiratory irritants for both humans and birds and should be used in a well-ventilated area. Avoid mixing disinfectants with any other product.



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**General Consideration**

- Protect birds from unnecessary stress (such as cooling or relocation), poor husbandry, and hunger. These issues impair treatment effectiveness and accelerate the development of secondary infections with other bacteria or yeast.
- Monitor the birds every day and weigh them every 3 to 7 days. If the birds are not gaining weight, have them re-evaluated by a veterinarian.
- Avoid high dietary calcium and other divalent cations because they limit tetracycline absorption. Remove the oyster shell, mineral blocks, and cuttlebone.
- Place birds to be treated in clean, uncrowded cages.
- Provide fresh water and essential vitamins on a daily basis. Continue medication for the full treatment period to avoid relapses. Birds can appear clinically improved and have reduced chlamydial shedding after 1 week.

**Conclusion**

Avian psittacosis is a potential zoonotic threat, particularly for individuals who work with or care for birds, such as pet store employees, bird owners, and poultry workers. It is important for these individuals to take proper precautions, such as wearing protective clothing and masks, washing their hands frequently, and maintaining good hygiene practices when working with birds.

Overall, while avian psittacosis is a serious disease, the risk of contracting it can be minimized by taking appropriate precautions. By being aware of the potential risks and taking steps to protect oneself, individuals who work with or care for birds can help to prevent the spread of avian psittacosis and other zoonotic diseases.

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