BMJ Best Practice

# Psittacosis

Straight to the point of care

Last updated: Apr 29, 2021

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# Summary

Psittacosis is a notifiable condition. Patient isolation is usually not required as human-to-human transmission is rare.

Pneumonia due to *Chlamydia psittaci* cannot be clinically differentiated from other community-acquired, atypical pneumonias. Molecular testing and/or serology is required to confirm the diagnosis.

Tetracycline antibiotics are the preferred treatment; however, other antibiotics may be used as an alternative in select patients.

Patients generally respond well to antibiotics, with resolution of symptoms within 24 to 48 hours, although there is the potential for relapse from persistent infection.

# Definition

Infection caused by the obligate, intracellular, gram-negative bacterium *Chlamydia psittaci* (formerly known as *Chlamydophila psittaci*), which causes community-acquired, atypical pneumonia or conjunctivitis.[1] [2] It is predominantly a pathogen of birds and mammals; humans are an accidental host.[1] Exposure to infected birds is a common cause. Also known as parrot fever or ornithosis.

# Epidemiology

Infection occurs sporadically or as outbreaks. Outbreaks are more common among workers on duck or poultry farms, and in abattoirs and processing plants.[5] [6]

Between 25 and 50 cases are confirmed in England and Wales each year.[7] There have typically been fewer than 10 confirmed cases reported in the US each year since 2010, with 5 cases reported in 2017.[8] An outbreak was reported among workers at two poultry slaughter plants in Virginia and Georgia during August to October 2018 (13 confirmed cases).[9]

One meta-analysis found that approximately 1% of cases of community-acquired pneumonia were due to *Chlamydia psittaci*, with a range between 0% and 6.7%.[10] A Dutch study identified *C psittaci* by polymerase chain reaction of sputum as a cause of community-acquired pneumonia in 4.8% of cases.[11]Reporting may be limited by the fact that clinical differentiation of illness caused by *C psittaci* and illness caused by other organisms, especially *Chlamydophila pneumoniae*, can be difficult.

Approximately 5% to 8% of birds are infected with *C psittaci*, and 465 avian species are susceptible to this organism, most commonly psittacine (parrot-type) birds, especially budgerigars and cockatiels.[1] [12] *C psittaci* strains that infect psittacine birds and poultry are more virulent and can infect humans of all age groups through aerosolised particles or direct contact with infected nasal secretions, faeces, or tissue.[1] [6]

# Aetiology

Infection is caused by *Chlamydia psittaci*, an obligate, intracellular, gram-negative bacterium.[1] Contact with birds, for example among pet bird owners, people who work in zoos or pet shops, veterinarians, poultry and wildlife workers, and diagnostic laboratorians, appears to be the primary risk factor for infection.[13] Human infection can also result from indirect environmental exposure.[13]

The association of *C psittaci* infection in humans exposed to birds and mammals has been known since the 1870s.[14] However, approximately 25% of affected patients deny exposure, which points to a lack of recognition of contact with an asymptomatic, but infected, bird or mammal.[13]

Most infections are acquired from exposure to psittacine (parrot-type) birds, especially budgerigars and cockatiels. However, transmission has also been documented from nonpsittacine birds, most commonly pigeons and doves, as well as poultry, free-range birds, birds of prey, ducks, and shore birds.[13] [15]

Occupational exposure to commercially bred turkeys, other fowl, and mammals, or to infected tissue, can precipitate outbreaks of psittacosis.[6] Outbreaks have been observed on duck, turkey, and other poultry farms, among abattoir workers, and from exposure to feral pigeons.[1] [5] [6] [16] [17] [18] [19] [20] [21] [22] There have also been reports of outbreaks associated with bird shows and in veterinary teaching hospitals.[23] [24] [25] Certain strains that infect poultry and psittacine birds tend to be more virulent.[1] [6]

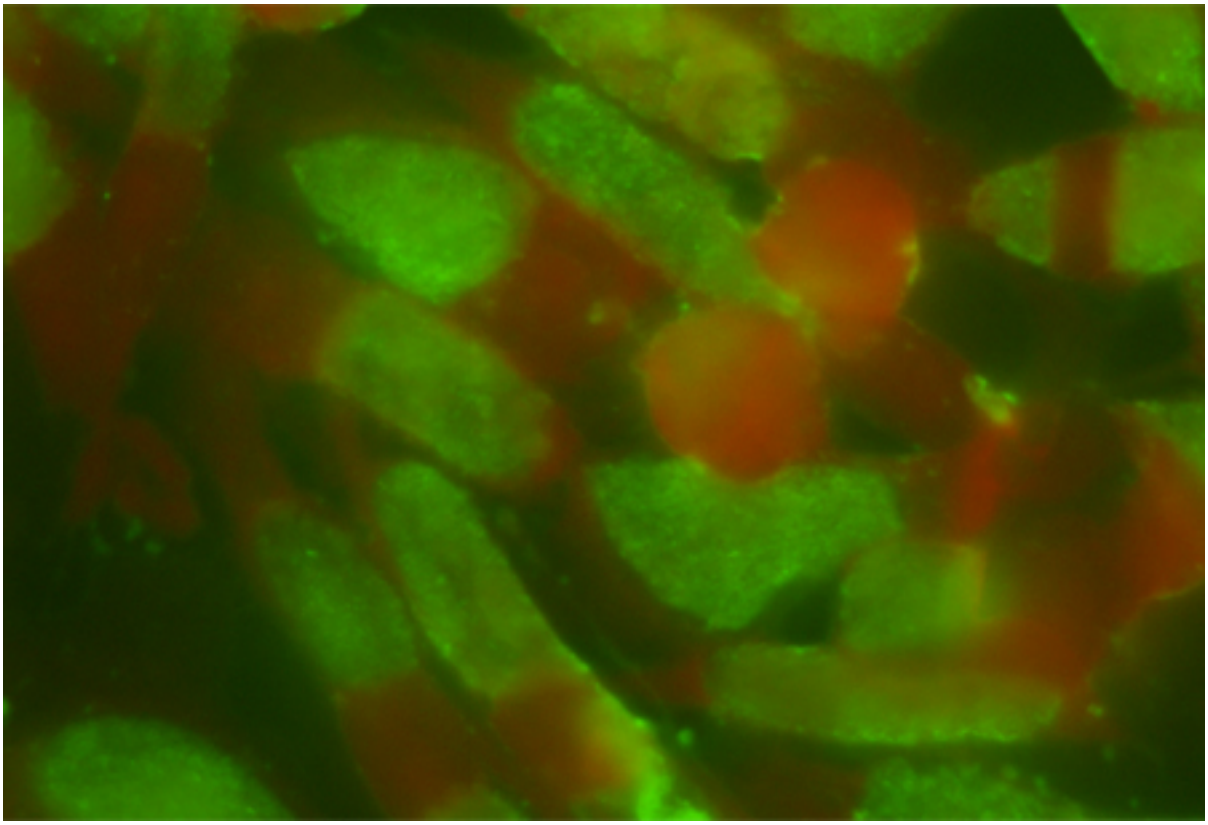
Human-to-human transmission is thought to be rare and can cause more severe disease.[5] [26] [27]

# Pathophysiology

*C psittaci* has a distinct biphasic developmental cycle consisting of the infectious elementary body (EB) and the replicative form termed the reticulate body (RB). The EB attaches to the host cell and is either endophagocytosed or taken up by receptor-mediated processes that are not well understood. Once inside

the cell, the organism becomes incased in an inclusion body, where there is ineffective lysosomal fusion, thus ensuring the survival of the inclusion body. The organism produces proteins that contribute to the membrane of the inclusion body. The EB transforms into an RB, which replicates by binary fission, producing intermediate bodies, where the chromatin condenses to become an EB. The EBs are released from the host cell either by cell lysis or by exocytosis of the inclusion body, leaving the cell intact, and can then infect adjacent cells. This occurs at 36 to 48 hours following infection.[28]

*C psittaci* can be readily cultured in permissive cell lines, including HEp-2 and buffalo green monkey cells, but great caution must be taken because of the ease of creating aerosolised particles.



*Chlamydia psittaci -infected HEp-2 cells stained with a fluorescein isothiocyanate-conjugated monoclonal antibody against the lipopolysaccharide of Chlamydia (1000X)*

*From the collection of Professor Deborah Dean; used with permission*

Transmission of infection is by aerosolised particles or direct contact with faeces, nasal secretions, plumage, or tissue. There are 8 known genotypes, and likely more, of the organism; all can be transmitted to humans.[13] [12] The incubation period is 5 to 14 days.[13]

The long developmental cycle and the ability of the organism to persist are likely to contribute to chronic infection, more widespread pulmonary or systemic disease, and failure of antibiotic treatment regimens. Certain strains are also considered more virulent. Consequently, a longer course of antibiotics is required for successful treatment, although some patients may still harbour persistent infection. There are reports of some resistance to azithromycin.[29]

The extent of relapse and persistent infections is unknown due to the lack of epidemiological studies and sensitive and specific tests to assess infection.

THEORY

# Case history

## Case history #1

A 35-year-old woman who is a bird fancier presents with a 10-day history of low-grade fever and malaise, and a 2-day history of non-productive cough. On physical examination, she appears to be somewhat ill but without respiratory distress. Her temperature is 38.2°C (100.8°F) and she has a respiratory rate of 18 breaths per minute. There is pharyngeal erythema and diffuse rales on chest examination. There is also mild hepatomegaly.

## Other presentations

*C psittaci* causes community-acquired, atypical pneumonia that can be asymptomatic or abrupt in onset. It can range from a brief, self-limiting, influenza-like illness to the less common fulminant disease with multi-organ failure. The clinical presentation can be confused with many other diseases of infectious or non-infectious origin, including hepatitis, endocarditis, septicaemia, fever of unknown origin, myocardial infarction, and tonsillitis.[1] *C psittaci* has also been associated with acute and chronic follicular conjunctivitis.[3] [4]

# Approach

Pneumonia due to *Chlamydia psittaci* cannot be clinically differentiated from other community-acquired, atypical pneumonias, particularly pneumonia caused by *Chlamydophila pneumoniae* or *Mycoplasma pneumoniae* . The clinical presentation varies from a mild influenza-like illness to fulminating pneumonia complicated by multi-organ involvement. Molecular testing and/or serology is required to confirm the diagnosis. A chest x-ray is also recommended. Some patients may present with acute or chronic follicular conjunctivitis only. Although gestational psittacosis is rare, delays in diagnosis can lead to significant maternal and fetal morbidity and mortality.[31]

Psittacosis is a notifiable condition in some countries.

## History

A history of exposure to birds and mammals is paramount to the diagnosis. Contact with birds, for example among pet bird owners, people who work in zoos or pet shops, veterinarians, poultry and wildlife workers, and diagnostic laboratorians, appears to be the primary risk factor.[13] Illness in other family members may also prompt suspicion, as spread often occurs from pet birds to many members of a family. Approximately 25% of affected patients deny exposure; therefore, infection should be considered in all patients with clinically compatible symptoms even if there is no history of exposure.[13]

Presentation is usually non-specific. The most common presentation is a respiratory tract infection with constitutional symptoms. Patients may have a history of gradual onset of fever, malaise, headache, and sore throat, with later onset of a non-productive cough.[1] [32] Less commonly, the onset may be more abrupt.

*C psittaci* infection has also been associated with acute and chronic follicular conjunctivitis. Patients with ocular infection often complain of a foreign body sensation.[3] [4] [33]

## Physical examination

Patients are usually febrile, and may have pharyngeal erythema and diffuse rales with or without tachypnoea. There may also be hepatomegaly. Occasionally, patients present with confusion, tachycardia, and splenomegaly.[1]

When patients have infection confined to the eye, the only finding may be unilateral or bilateral diffuse erythema of the sclera, with or without a discharge.[33]

## Investigations

Diagnosis can be difficult. Molecular testing and/or serology are required to confirm the diagnosis. Several methods are used to detect *C psittaci* infection, but some tests are only available in specialised laboratories. Tests should always be interpreted in the context of the history, clinical presentation, and response to treatment. Physicians are encouraged to contact their local health department early to discuss laboratory testing.

Laboratory invesitgations

- General: white blood cell count with differential may be normal or elevated with a shift to the left; eosinophilia is occasionally present. Liver function tests may be normal or slightly elevated.



- Polymerase chain reaction (PCR): send a respiratory specimen for PCR, if available. PCR is more readily available than it was in the past, and real-time PCR assays are now available in some specialised laboratories. It is a highly sensitive and specific test for *C psittaci* .[13] It offers rapid detection and results can be obtained in time to guide treatment decisions.
- Serology: microimmunofluorescence on paired serum samples (taken 2 to 4 weeks apart) is the preferred serological test and can be performed as a supportive test when PCR is available, or as an initial test when PCR is not available. Tests are available in many laboratories. Consider collecting a third specimen 4 to 6 weeks after the acute specimen in patients started on antimicrobial therapy. Cross reaction between other Chlamydia species can occur; therefore, results should be interpreted with caution, especially if the titer is <1:128.[13]
- Culture: cultures of sputum, pleural fluid, or clotted blood can be performed; however, culturing *C psittaci* is not recommended unless an experienced reference laboratory is available. Testing can be hazardous to laboratory personnel and it is not as sensitive as PCR. Also, detection of the organism in tissue culture is not standardised.[1]

Imaging

- Chest x-ray: may reveal the presence of pneumonia, and shows single lobar consolidation in approximately 90% of cases, usually in the lower lung. Approximately 50% of patients may have a small pleural effusion.[1]

# History and exam

## Key diagnostic factors

### presence of risk factors (common)

- Contact with birds, for example among pet bird owners, people who work in zoos or pet shops, veterinarians, poultry and wildlife workers, and diagnostic laboratorians, appears to be the primary risk factor.[13]

### illness in other family members (common)

- Spread can occur from pet birds to many members of a family.

## Other diagnostic factors

### fever (common)

- Can be low grade and of gradual onset.

### malaise (common)

- Patients may have 1 to 2 weeks of gradual onset of malaise.[28] [34]

### headache (common)

- Patients may have 1 to 2 weeks of gradual onset of headache.[28] [34]

### cough (common)

- Usually non-productive.

### sore throat (common)

- Can be mild to severe.

### rales (common)

- Consistent with pneumonia.

### tachypnoea (common)

- Variable, dependent on extent of lung involvement.

### pharyngitis (common)

- Variable presentation, with no distinguishing characteristics.

### conjunctivitis (common)

- *Chlamydia psittaci* has been associated with acute and chronic follicular conjunctivitis. The only finding may be unilateral or bilateral diffuse erythema of the sclera, with or without a discharge. Patients with ocular infection often complain of a foreign body sensation.[3] [4]

### hepatomegaly (uncommon)

- Diffusely enlarged liver with pain on palpation but no appreciable masses. It is more common in cases of systemic illness.

### confusion (uncommon)

- Occasionally present.

### tachycardia (uncommon)

- Occasionally present.

### splenomegaly (uncommon)

- Diffusely enlarged spleen with pain on palpation is occasionally present.

## Risk factors

### Strong

#### exposure to infected birds and mammals

- Contact with birds, for example among pet bird owners, people who work in zoos or pet shops, veterinarians, poultry and wildlife workers, and diagnostic laboratorians, appears to be the primary risk factor.[13] The organism is spread by direct contact with infected secretions, including faeces, nasal discharge, and tissue, or by aerosolised particles.[5] [20]
- Outbreaks have been observed on duck, turkey, and other poultry farms, among abattoir workers, and from exposure to feral pigeons and non-psittacine birds.[1] [5] [6] [16] [17] [18] [19] [20] [21] [22] There have also been reports of outbreaks associated with bird shows and in veterinary teaching hospitals.[23] [24] [25]
- Owners of exotic and other pet birds or mammals, and those exposed to feral animals that are acutely or chronically infected with *Chlamydia psittaci* , are also highly susceptible to infection.[1] [5] [20]

### Weak



### young children

- Young children are at an increased risk of infection and more severe disease if they come in contact with infected animals.[1]

### older adults

- Older adults are at increased risk of infection and more severe disease if they come in contact with infected animals.[1] In the US, the main age group affected is people 40 to 64 years of age; however, it is unknown whether this is due to age-related differences in susceptibility or exposure.[13]

### immunocompromised

- People with a compromised immune system are at increased risk of infection and more severe disease if they come in contact with infected animals.[1] However, pet birds are thought to pose a low risk to these patients.[13]

# Investigations

## 1st test to order

| Test | Result |
|---|---|
| **white blood cell count with differential**<br>• Order in all patients. Not specific for *Chlamydia psittaci* infection. | **slightly elevated with a left shift; eosinophilia later in disease course** |
| **liver function tests**<br>• Order in all patients. Alanine transaminase (ALT) and aspartate transaminase (AST) can be slightly elevated. AST:ALT ratio <1 can suggest hepatitis. Sometimes total bilirubin is elevated and, along with elevated direct bilirubin, suggests cholestasis, which can be seen with systemic disease. Alkaline phosphatase is a more direct marker for cholestasis. | **normal or slightly elevated** |
| **polymerase chain reaction (PCR)**<br>• Send a respiratory specimen for PCR, if available. Results are rapid and can be obtained in time to guide treatment decisions. PCR is more readily available than it was in the past, and real-time PCR assays are now available in some specialised laboratories. It is a highly sensitive and specific test for *C psittaci* . May also be performed on blood and tissue if necessary.[13]<br>• Laboratories that perform these tests should be contacted early as careful specimen collection and handling are required. | **positive for *Chlamydia psittaci*** |
| **chest x-ray**<br>• Order in all patients with suspected pneumonia. Reveals presence of pneumonia, but is not specific for *C psittaci* infection. Other findings include a diffuse ground-glass or miliary appearance, atelectasis in association with consolidation, hilar enlargement but never alone, and a reticular pattern. | **lobar consolidation with hilar enlargement; small pleural effusion** |

## Other tests to consider

| Test | Result |
|---|---|
| **serology**<br>• Microimmunofluorescence (MIF) on paired serum samples (taken 2 to 4 weeks apart) is the preferred serological test and can be performed as a supportive test when PCR is available, or as an initial test when PCR is not available. Tests are available in many laboratories. Consider collecting a third specimen 4 to 6 weeks after the acute specimen in patients started on antimicrobial therapy. Cross reaction between other Chlamydia species can occur; therefore, results should be interpreted with caution, especially if the titre is <1:128. MIF is more sensitive and specific compared with complement fixation tests.[13] | **positive for *Chlamydia psittaci*** |
| **culture**<br>• Sputum, pleural fluid, conjunctival fluid, or clotted blood can be cultured. However, culturing *C psittaci* is not recommended unless an experienced reference laboratory is available. Testing can be hazardous to laboratory personnel and it is not as sensitive as PCR. Also, detection of the organism in tissue culture is not standardised.[1] | **positive for *Chlamydia psittaci*** |



# Differentials

| Condition | Differentiating signs / symptoms | Differentiating tests |
|---|---|---|
| **Atypical pneumonia caused by other pathogens** | • There are no differentiating signs/symptoms. | • Serology, culture, or polymerase chain reaction is positive for organisms such as *Mycoplasma pneumoniae* , *Chlamydophila pneumoniae* , or *Legionella pneumophila.* |
| **Sepsis** | • There are no differentiating signs/symptoms. | • Blood cultures are positive for gram-positive and gram-negative organisms, including facultative and fastidious organisms. |
| **Infective endocarditis** | • A history of intravenous drug use. | • Serial cultures are positive for typical bacteria such as *Streptococcus* and *Staphylococcus* ; other organisms require special culture, such as *Aspergillus* , *Brucella* , *Coxiella* , and HACEK bacteria ( *Haemophilus* , *Actinobacillus* , *Cardiobacterium* , *Eikenella* species, and *Kingella* species). |
| **Myocardial infarction** | • Chest pain. | • The rise and fall of cardiac biomarkers such as troponin and creatine kinase are important in the diagnosis, as is a serial change in the electrocardiogram. |
| **Tonsillitis** | • There are no differentiating signs/symptoms. | • Oropharyngeal swab test is positive for group A and beta-haemolytic *Streptococcus* . |
| **Hepatitis** | • There are no differentiating signs/symptoms.<br>• Can be caused by many different aetiologies. | • Serology is positive for hepatitis A to E (>95% of viral causes), cytomegalovirus, or herpes simplex virus. Epstein-Barr virus is a less common case in the setting of systemic disease. |
| **Fever of unknown origin** | • A comprehensive history of exposure to others who are ill, travel to a tropical | • Extensive testing is required and includes serology, blood |

| Condition | Differentiating signs / symptoms | Differentiating tests |
|---|---|---|
| | or developing country, and recent treatment.<br>• Physical examination may reveal skin rash, lymphadenopathy, bites, or skin discoloration depending on the cause. | cultures, and specialised tests for immune function. |

# Criteria

## Centers for Disease Control and Prevention (CDC): psittacosis/ ornithosis ( *Chlamydophila psittaci* ) 2010 case definition[35]

Laboratory criteria for diagnosis:

- Isolation of *C psittaci* from respiratory specimens (e.g., sputum, pleural fluid, or tissue) or blood, or
- Fourfold or greater increase in immunoglobulin G (IgG) against *C psittaci* by complement fixation (CF) or microimmunofluorescence (MIF) between paired acute- and convalescent-phase serum specimens obtained at least 2 to 4 weeks apart, or
- Supportive serology (e.g., *C psittaci* immunoglobulin M [IgM] of ≥32 in at least 1 serum specimen obtained after onset of symptoms), or
- Detection of *C psittaci* DNA in a respiratory specimen (e.g., sputum, pleural fluid or tissue) via amplification of a specific target by polymerase chain reaction (PCR) assay.

Probable case:

- An illness characterised by fever, chills, headache, cough, and myalgia that has either:
  - Supportive serology (e.g., *C psittaci* antibody titer [IgM] of ≥32 in at least 1 serum specimen obtained after onset of symptoms), or
  - Detection of *C psittaci* DNA in a respiratory specimen (e.g., sputum, pleural fluid or tissue) via amplification of a specific target by PCR assay.

Confirmed case:

- An illness characterised by fever, chills, headache, cough, and myalgia, and laboratory confirmed by either:
  - Isolation of *C psittaci* from respiratory specimens (e.g., sputum, pleural fluid, or tissue) or blood, or
  - Fourfold or greater increase in IgG against *C psittaci* by CF or MIF between paired acute- and convalescent-phase serum specimens obtained at least 2 to 4 weeks apart.

# Approach

Empiric antibiotic therapy is the mainstay of treatment. Standard infection control procedures, including droplet transmission precautions, are sufficient as human-to-human transmission is rare.

## Antibiotic treatment in adults

Tetracycline antibiotics are the treatment of choice.[13] Macrolides (e.g., erythromycin, azithromycin) and fluoroquinolones (e.g., moxifloxacin) are alternative second-line options when tetracyclines are contraindicated. Erythromycin is the best alternative, although it may be less efficacious than tetracyclines in severe illness, and treatment courses of up to 6 weeks may be required. Azithromycin may also be used, although there are reports of resistance.[29] Third-line treatment options include chloramphenicol and rifampicin; however, there are many drug-drug interactions that limit the use of rifampicin.

Macrolides are the preferred option in pregnant women, with chloramphenicol as a suitable second-line option. There is a lack of data to support the safety of chloramphenicol in pregnant women, and it should only be used if the benefits to the mother outweigh the risks to the fetus. It should not be used near term or during labour due to the risk of gray syndrome and bone marrow suppression in the neonate. Extreme caution should be used in pregnant women and is also recommended in breastfeeding women. Tetracycline is not recommended due to detrimental effects on the skeletal development of the fetus but can be given in extreme cases as a life saving measure if erythromycin is ineffective.[36] [37] The use of doxycycline has been described in a case report.[38]

Oral therapy is indicated in mild-to-moderate disease. Intravenous therapy is required in patients who are severely ill (i.e., with signs of pulmonary disease with diffuse involvement and fever, sepsis, disseminated intravascular coagulation, or findings consistent with other organ involvement such as the spleen or liver). A response is usually seen within 24 to 48 hours. The treatment course is variable; however, 2 to 3 weeks is usually sufficient to prevent relapse. Longer courses of up to 6 weeks may be required in some patients, particularly those with severe illness.

*Chlamydia psittaci* is susceptible to tetracyclines, macrolides, chloramphenicol, fluoroquinolones, and rifampicin. However, in one study, the minimal inhibitory concentration of fluoroquinolones was 0.25 micrograms/L compared with 0.05 to 0.20 micrograms/L for doxycycline, suggesting that there is the possibility of treatment failure with fluoroquinolones.[39]

Topical erythromycin is recommended for *C psittaci* conjunctivitis.[3]

## Antibiotic treatment in children

Erythromycin is the treatment of choice in children. Azithromycin may be used as an alternative. Chloramphenicol is a suitable second-line option; however, extreme caution should be used in children. Gray syndrome (also known as gray baby syndrome), a type of circulatory collapse that is potentially life-threatening, has been reported in premature and newborn infants receiving chloramphenicol, and more rarely in children aged up to 2 years. As with adults, intravenous antibiotic therapy is indicated in patients who are severely ill.

It is generally recommended that tetracyclines are not used in children <8 years of age (<12 years of age in some countries such as the UK) due to the risk of tooth discolouration; however, they may be used in younger children if the benefits outweigh the risks, especially in life-threatening situations where other therapies are not effective.[13]

Topical erythromycin is recommended for *C psittaci* conjunctivitis.[3]

### Supportive therapy

Patients with severe pneumonitis require oxygen therapy. Complications such as endocarditis, hepatitis, myocarditis, arthritis, and encephalitis may occasionally occur and require appropriate treatment.

## Treatment algorithm overview

Please note that formulations/routes and doses may differ between drug names and brands, drug formularies, or locations. Treatment recommendations are specific to patient groups: see disclaimer

| Acute | | | ( summary ) |
|---|---|---|---|
| **children ≥8 years of age and non-pregnant adults** | | | |
| | | **1st** | **tetracycline ± oxygen** |
| | | **2nd** | **macrolide or fluoroquinolone ± oxygen** |
| | | **3rd** | **chloramphenicol or rifampicin ± oxygen** |
| | **with conjunctivitis** | **plus** | **topical ophthalmic erythromycin** |
| **children <8 years and pregnant women** | | | |
| | | **1st** | **macrolide ± oxygen** |
| | | **2nd** | **chloramphenicol or tetracycline ± oxygen** |
| | **with conjunctivitis** | **plus** | **topical ophthalmic erythromycin** |

# Treatment algorithm

Please note that formulations/routes and doses may differ between drug names and brands, drug formularies, or locations. Treatment recommendations are specific to patient groups: see disclaimer

## Acute

### children ≥8 years of age and non-pregnant adults

**1st** **tetracycline ± oxygen**

**Primary options**

» doxycycline: children: 2.2 mg/kg orally twice daily on day 1, followed by 2.2 mg/kg once or twice daily; or 4.4 mg/kg intravenously on day 1, followed by 2.2 mg/kg once or twice daily; adults: 100 mg orally twice daily on day 1, followed by 100 mg once or twice daily; or 200 mg intravenously on day 1, followed by 100 mg once or twice daily

**OR**

» tetracycline: children: 25-50 mg/kg/day orally given in 4 divided doses; adults: 250-500 mg orally four times daily

» Tetracyclines are the treatment of choice.[13]

» Oral therapy is indicated in mild-to-moderate disease. Intravenous therapy is required in patients who are severely ill (i.e., with signs of pulmonary disease with diffuse involvement and fever, sepsis, disseminated intravascular coagulation, or findings consistent with other organ involvement such as the spleen or liver). A response is usually seen within 24 to 48 hours.

» Treatment course is variable; however, 2 to 3 weeks is usually sufficient to prevent relapse. Longer courses of up to 6 weeks may be required in some patients, particularly those with severe illness.

» Patients with severe pneumonitis require oxygen therapy.

**2nd** **macrolide or fluoroquinolone ± oxygen**

**Primary options**

» erythromycin base: children: 50 mg/kg/day orally given in 2-4 divided doses, maximum 2000 mg/day; adults: 500 mg orally every 6 hours

**OR**

## Acute

» erythromycin lactobionate: children: 50 mg/kg/day intravenously given in divided doses every 6 hours, maximum 4000 mg/day; adults: 500-1000 mg intravenously every 6 hours, maximum 4000 mg/day

### Secondary options

» azithromycin: children: 10 mg/kg orally once daily on day 1, followed by 5 mg/kg once daily; adults: 500 mg orally/intravenously once daily on day 1, followed by 250 mg once daily

### Tertiary options

» moxifloxacin: adults: 400 mg orally/intravenously every 24 hours

» Macrolides (e.g., erythromycin, azithromycin) and fluoroquinolones (e.g., moxifloxacin) are considered alternative second-line options when tetracyclines are contraindicated. Erythromycin is the best alternative, although it may be less efficacious than tetracyclines in severe illness, and treatment courses of up to 6 weeks may be required. Azithromycin may also be used, although there are reports of resistance.[29]

» Oral therapy is indicated in mild-to-moderate disease. Intravenous therapy is required in patients who are severely ill (i.e., with signs of pulmonary disease with diffuse involvement and fever, sepsis, disseminated intravascular coagulation, or findings consistent with other organ involvement such as the spleen or liver). A response is usually seen within 24 to 48 hours.

» Treatment course is variable; however, 2 to 3 weeks is usually sufficient to prevent relapse. Longer courses of up to 6 weeks may be required in some patients, particularly those with severe illness.

» Patients with severe pneumonitis require oxygen therapy.

**3rd** **chloramphenicol or rifampicin ± oxygen**

### Primary options

» chloramphenicol: children and adults: 50-100 mg/kg/day intravenously given in divided doses every 6 hours, maximum 4000 mg/day

**OR**



## Acute

» rifampicin: children: 10 mg/kg/day orally/ intravenously given in divided doses every 12 hours, maximum 600 mg/day; adults: 600 mg orally/intravenously every 12-24 hours

» Third-line treatment options include chloramphenicol and rifampicin, although there are many drug-drug interactions that limit the use of rifampicin.

» Oral therapy is indicated in mild-to-moderate disease. Intravenous therapy is required in patients who are severely ill (i.e., with signs of pulmonary disease with diffuse involvement and fever, sepsis, disseminated intravascular coagulation, or findings consistent with other organ involvement such as the spleen or liver). A response is usually seen within 24 to 48 hours.

» Treatment course is variable; however, 2 to 3 weeks is usually sufficient to prevent relapse. Longer courses of up to 6 weeks may be required in some patients, particularly those with severe illness.

» Patients with severe pneumonitis require oxygen therapy..

**with conjunctivitis** **plus** **topical ophthalmic erythromycin**

Treatment recommended for ALL patients in selected patient group

**Primary options**

» erythromycin topical: (0.5%) apply to the lower conjunctiva twice daily

» Topical erythromycin is recommended for *Chlamydia psittaci* conjunctivitis.[3]

**children <8 years and pregnant women**

**1st** **macrolide ± oxygen**

**Primary options**

» erythromycin base: children: 50 mg/kg/day orally given in 2-4 divided doses, maximum 2000 mg/day; adults: 500 mg orally every 6 hours

**OR**

» erythromycin lactobionate: children: 50 mg/kg/day intravenously given in divided doses every 6 hours, maximum 4000 mg/day; adults: 500-1000 mg intravenously every 6 hours, maximum 4000 mg/day

MANAGEMENT

# Acute

### Secondary options

» azithromycin: children >6 months of age: 10 mg/kg orally once daily on day 1, followed by 5 mg/kg once daily; adults: 500 mg orally/intravenously once daily on day 1, followed by 250 mg once daily

» Erythromycin is the treatment of choice in children. Azithromycin may be used as an alternative. Macrolides are also the preferred option in pregnant women.

» Oral therapy is indicated in mild-to-moderate disease. Intravenous therapy is required in patients who are severely ill (i.e., with signs of pulmonary disease with diffuse involvement and fever, sepsis, disseminated intravascular coagulation, or findings consistent with other organ involvement such as the spleen or liver). A response is usually seen within 24 to 48 hours.

» Treatment course is variable; however, 2 to 3 weeks is usually sufficient to prevent relapse. Longer courses of up to 6 weeks may be required in some patients, particularly those with severe illness.

» Patients with severe pneumonitis require oxygen therapy.

**2nd** **chloramphenicol or tetracycline ± oxygen**

### Primary options

» chloramphenicol: children and adults: 25-100 mg/kg/day intravenously given in divided doses every 6 hours, maximum 4000 mg/day
Severe infections may require doses of up to 100 mg/kg/day; however, the dose should be reduced to 50 mg/kg/day as soon as possible. A lower dose of 25 mg/kg/day is recommended in premature neonates and term neonates, and in neonates and children in whom immature renal and/or hepatic function is suspected.

**OR**

» tetracycline: children: 25-50 mg/kg/day orally given in 4 divided doses; adults: 250-500 mg orally four times daily

» Chloramphenicol is a suitable second-line option; however, extreme caution should be used in children and pregnant women.

## Acute

» Gray syndrome (also known as gray baby syndrome), a type of circulatory collapse which is potentially life-threatening, has been reported in premature and newborn infants receiving chloramphenicol, and more rarely in children up to 2 years of age.

» There is a lack of data to support the safety of chloramphenicol in pregnant women, and it should only be used if the benefits to the mother outweigh the risks to the fetus. It should not be used near term or during labour due to the risk of gray syndrome and bone marrow suppression in the neonate. Extreme caution is also recommended in breastfeeding women.

» Tetracycline is not recommended due to detrimental effects on the skeletal development of the fetus but can be given in extreme cases as a life saving measure if erythromycin is ineffective.[36] [37] The use of doxycycline has been described in a case report.[38]

» It is generally recommended that tetracyclines are not used in children <8 years of age (<12 years of age in some countries such as the UK) due to the risk of tooth discolouration; however, they may be used in younger children if the benefits outweigh the risks, especially in life-threatening situations where other therapies are not effective.[13]

» Treatment course is variable; however, 2 to 3 weeks is usually sufficient to prevent relapse. Longer courses of up to 6 weeks may be required in some patients, particularly those with severe illness.

» Patients with severe pneumonitis require oxygen therapy.

**with conjunctivitis** **plus** **topical ophthalmic erythromycin**

Treatment recommended for ALL patients in selected patient group

### Primary options

» erythromycin topical: (0.5%) apply to the lower conjunctiva twice daily

» Topical erythromycin is recommended for *Chlamydia psittaci* conjunctivitis.[3]

MANAGEMENT

# Primary prevention

Preventive strategies include screening high-risk avian and mammalian species for infection and treating these animals appropriately. Gloves and masks should be worn when handling birds or cleaning their cages.[13]No vaccines have been developed, but vaccine candidates have been tested in animals.[30]

# Secondary prevention

Psittacosis is a notifiable condition in some countries.

It is difficult to recommend preventive actions, because pet birds and animals may asymptomatically carry *Chlamydia psittaci* . Consequently, the recommendation is to seek treatment early for respiratory symptoms if pet birds in particular are kept in the home, or if there is exposure to commercially raised birds or poultry, or exposure to meat suspected of being contaminated with the organism.

The following prevention measures are recommended:[13]

- Educate people in contact with birds about the risk.
- Reduce risk of infection when caring for exposed or ill birds (e.g., wear protective clothing when handling birds or cleaning cages).
- Sellers should maintain accurate records of bird-related transactions for 1 year.
- Avoid buying or selling birds that are ill.
- Avoid mixing birds from multiple sources to prevent outbreaks.
- Quarantine newly-acquired or exposed birds (e.g., bird shows/fairs) for at least 30 days.
- Isolate ill birds.
- Screen birds with frequent public contact.
- Practise preventive husbandry (e.g., position cages to prevent transfer of material between cages, clean food and water bowls daily).
- Control transmission from infected/exposed birds using good husbandry.
- Use disinfection measures (e.g., 1:1000 dilution of quaternary ammonium compounds, 1:32 dilution of household bleach).

# Patient discussions

Advise patients to avoid contact with the likely source of infection (e.g., faeces or nasal secretions of pet birds), and to seek immediate medical attention if they develop an influenza-like or respiratory tract illness after exposure to infected birds. Advise farm workers to wear a mask when working with poultry.

The following general prevention measures are recommended:[13]

- Reduce risk of infection when caring for exposed or ill birds (e.g., wear protective clothing when handling birds or cleaning cages).
- Avoid buying or selling birds that are ill.
- Avoid mixing birds from multiple sources to prevent outbreaks.
- Quarantine newly-acquired or exposed birds (e.g., bird shows/fairs) for at least 30 days.
- Isolate ill birds.
- Practise preventive husbandry (e.g., position cages to prevent transfer of material between cages, clean food and water bowls daily).
- Control transmission from infected/exposed birds using good husbandry.

- Use disinfection measures (e.g., 1:1000 dilution of quaternary ammonium compounds, 1:32 dilution of household bleach).

FOLLOW UP

# Complications

| Complications | Timeframe | Likelihood |
|---|---|---|
| **acute respiratory distress syndrome (ARDS)** | **short term** | **low** |
| *Chlamydia psittaci* infection may lead to ARDS with variable outcomes. Intravenous antibiotic treatment with tetracycline or doxycycline is indicated in these patients. | | |
| **endocarditis** | **short term** | **low** |
| Usually requires valve replacement and long-term antibiotics. Intravenous antibiotic treatment with tetracycline or doxycycline is indicated in these patients. | | |
| **pericarditis** | **short term** | **low** |
| *C psittaci* infection may lead to pericarditis.[1] Intravenous antibiotic treatment with tetracycline or doxycycline is indicated in these patients. | | |
| **myocarditis** | **short term** | **low** |
| *C psittaci* infection may lead to myocarditis.[1] Intravenous antibiotic treatment with tetracycline or doxycycline is indicated in these patients. | | |
| **disseminated intravascular coagulation (DIC)** | **short term** | **low** |
| *C psittaci* infection may lead to DIC with variable outcomes, including death or, in the case of an infected pregnant woman, fetal demise.[40] [37] | | |
| **bacterial meningitis** | **short term** | **low** |
| *C psittaci* infection may lead to other neurological complications, including cranial nerve palsy, transient focal signs, cerebellar involvement, and transverse myelitis. Intravenous antibiotic treatment with tetracycline or doxycycline is indicated in these patients. | | |
| **encephalitis** | **short term** | **low** |
| *C psittaci* infection may also lead to other neurological complications, including cranial nerve palsy, transient focal signs, cerebellar involvement, and transverse myelitis. Intravenous antibiotic treatment with tetracycline or doxycycline is indicated in these patients. | | |
| **hepatitis** | **short term** | **low** |
| *C psittaci* infection may lead to hepatitis.[1] Intravenous antibiotic treatment with tetracycline or doxycycline is indicated in these patients. | | |
| **pancreatitis** | **short term** | **low** |
| *C psittaci* infection may lead to pancreatitis.[1] Intravenous antibiotic treatment with tetracycline or doxycycline is indicated in these patients. | | |
| **cardiomyopathy** | **long term** | **low** |
| *C psittaci* infection may lead to cardiomyopathy.[1] | | |

| Complications | Timeframe | Likelihood |
|---|---|---|
| **seizures** | **variable** | **low** |
| *C psittaci* infection may also lead to other neurological complications, including cranial nerve palsy, transient focal signs, cerebellar involvement, and transverse myelitis. | | |
| **erythema nodosum** | **variable** | **low** |
| *C psittaci* infection may also lead to other skin manifestations such as Horder's spots, subungual splinter haemorrhages, superficial venous thromboses, and acrocyanosis.[1] | | |
| **erythema marginatum** | **variable** | **low** |
| *C psittaci* infection may also lead to other skin manifestations such as Horder's spots, subungual splinter haemorrhages, superficial venous thromboses, and acrocyanosis.[1] | | |
| **erythema multiforme** | **variable** | **low** |
| *C psittaci* infection may also lead to other skin manifestations such as Horder's spots, subungual splinter haemorrhages, superficial venous thromboses, and acrocyanosis.[1] | | |
| **urticaria** | **variable** | **low** |
| *C psittaci* infection may also lead to other skin manifestations such as Horder's spots, subungual splinter haemorrhages, superficial venous thromboses, and acrocyanosis.[1] | | |
| **reactive arthritis** | **variable** | **low** |
| *C psittaci* infection may lead to arthritis.[1] | | |
| **acute glomerulonephritis** | **variable** | **low** |
| *C psittaci* infection may lead to acute glomerulonephritis.[1] | | |
| **tubulointerstitial nephritis** | **variable** | **low** |
| *C psittaci* infection may lead to tubulointerstitial nephritis.[1] | | |
| **tubular necrosis** | **variable** | **low** |
| *C psittaci* infection may lead to tubular necrosis.[1] | | |
| **phlebitis** | **variable** | **low** |
| *C psittaci* infection may lead to phlebitis.[1] | | |
| **thyroiditis** | **variable** | **low** |
| *C psittaci* infection may lead to thyroiditis.[1] | | |

FOLLOW UP

# Prognosis

Patients respond well to antibiotic treatment with resolution of symptoms within 24 to 48 hours, although there is the potential for relapse from persistent infection. Severely ill patients have a good prognosis if there are no complications. Pulmonary, cardiac, and intravascular complications can be life threatening.[1] Mortality can be as high as 20% in untreated patients.[1] [13] Fetal mortality among pregnant women is very high.[31]

Resistance to antibiotics has been reported only anecdotally.[29] Due to the limited availability of cultures for testing, it remains unclear whether treatment failures are due to resistance or progression of disease from more virulent strains or host factors.

# Diagnostic guidelines

## United Kingdom

### Psittacosis (https://www.gov.uk/guidance/psittacosis)

**Published by:** Public Health England **Last published:** 2017

### UK standards for microbiology investigations: Chlamydial zoonotic infections (https://www.gov.uk/government/publications/smi-v-57-chlamydial-zoonotic-infections)

**Published by:** Public Health England **Last published:** 2016

## North America

### Compendium of measures to control Chlamydia psittaci infection among humans (psittacosis) and pet birds (avian chlamydiosis) (http://www.nasphv.org/documentsCompendiaPsittacosis.html)

**Published by:** National Association of State Public Health Veterinarians (US) **Last published:** 2017

## Oceania

### CDNA national guidelines for public health units: psittacosis (orthithosis) (http://www.health.gov.au/internet/main/publishing.nsf/Content/cdnasongs.htm)

**Published by:** Communicable Diseases Network Australia **Last published:** 2016

### Animal contact guidelines – reducing the risk to human health (https://www.health.qld.gov.au/publications/clinical-practice/guidelines-procedures/diseases-infection/governance/zoo-guidelines.pdf)

**Published by:** Queensland Department of Health **Last published:** 2014

# Treatment guidelines

## United Kingdom

### Guidelines for the management of community acquired pneumonia in adults: update 2009 (https://www.brit-thoracic.org.uk/quality-improvement/guidelines/pneumonia-adults)

**Published by:** British Thoracic Society **Last published:** 2009



## North America

### Compendium of measures to control Chlamydia psittaci infection among humans (psittacosis) and pet birds (avian chlamydiosis) (http://www.nasphv.org/documentsCompendiaPsittacosis.html)

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**Published by:** Communicable Diseases Network Australia **Last published:** 2016

## Key articles


- National Association of State Public Health Veterinarians (NASPHV). Compendium of measures to control Chlamydia psittaci infection among humans (psittacosis) and pet birds (avian chlamydiosis). 2017 [internet publication]. Full text (http://www.nasphv.org/Documents/PsittacosisCompendium.pdf)


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# Images

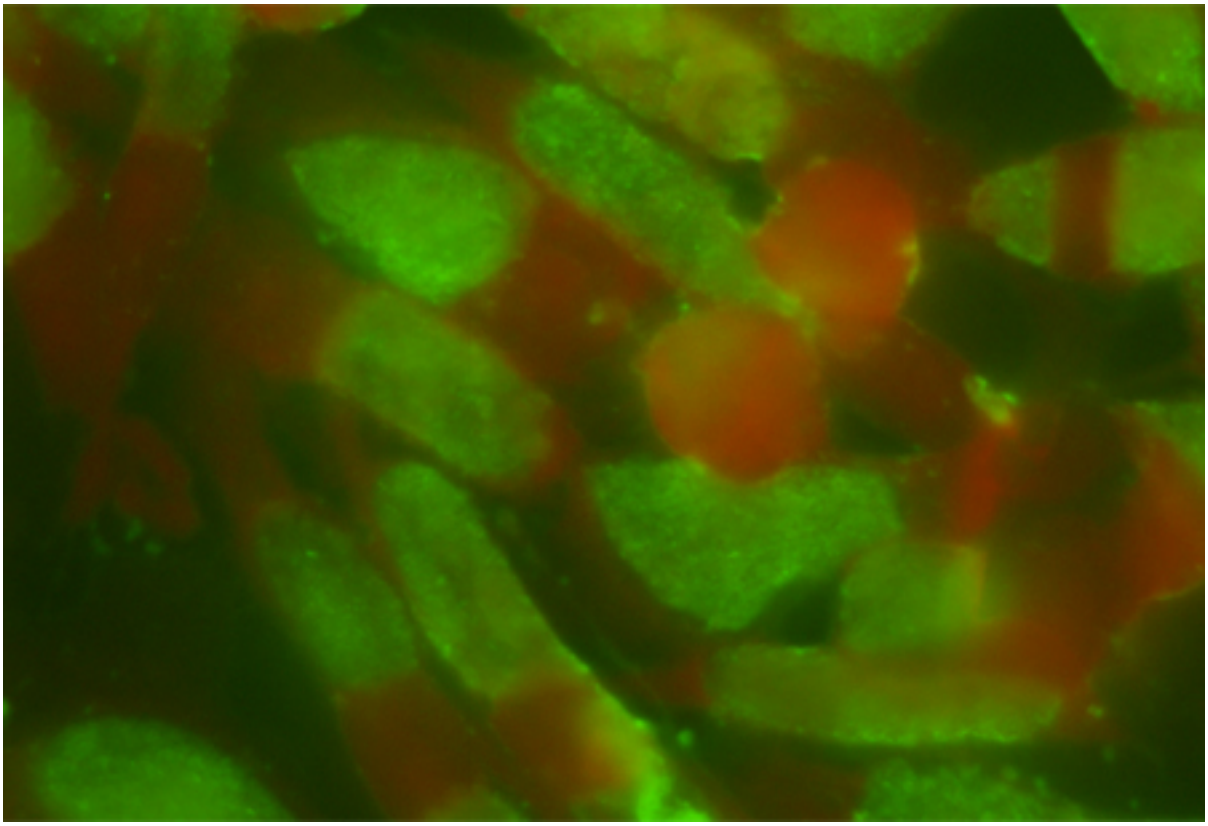

*Figure 1: Chlamydia psittaci -infected HEp-2 cells stained with a fluorescein isothiocyanate-conjugated monoclonal antibody against the lipopolysaccharide of Chlamydia (1000X)*

*From the collection of Professor Deborah Dean; used with permission*



 

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**Figure 1 – BMJ Best Practice Numeral Style**

5-digit numerals: 10,000

4-digit numerals: 1000

numerals < 1: 0.25

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