A Brief Review of . . .

Psittacosis in the aviculturist

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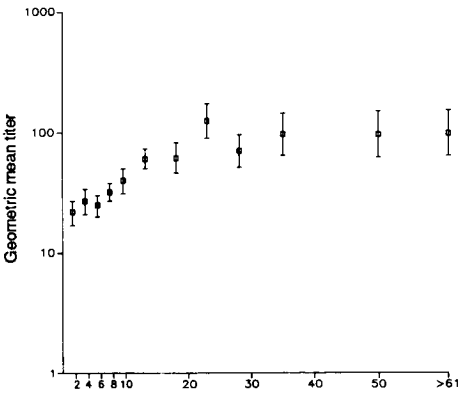
Psittacosis is an infectious disease in birds which can be transmitted to humans. This disease process may be mild or serious. It may encompass infection without symptoms, a transient flu-like syndrome, pneumonia, or serious multi-systemic organ compromise resulting in death. Fever (99.1%), chills (100%), cough (96.1%), headache (98.9%), weakness or fatigue (100%), and aching all over (99.1%) were the six most commonly reported signs and symptoms associated with psittacosis. Obviously these findings are non-specific and frequently associated with more common viral or bacterial diseases such as "colds" or respiratory tract infections. The aforementioned signs and symptoms were among those frequently reported in the 1975 through 1984 *Psittacosis Surveillance* by the Centers for Disease Control (CDC).

In fiscal year 1986, approximately 700,000 caged birds were brought to the United States through quarantine stations suggesting potential disease exposure to significant numbers of persons. For the 1,025 cases with reported source of psittacosis infection, pet cage birds accounted for 719 cases (70%). Turkeys accounted for 159 cases (15%), and domestic and wild pigeons accounted for 100 (10%). The figures and tables from the CDC illustrate part of the epidemiology of psittacosis in the United States. Diagnosis is challenging, confirmation is slow, and initial evaluation may be hampered by a low index of suspicion. In reality, the disease is likely to be missed unless the treating physician knows the patient has bird contact. Initiation of therapy may precede laboratory verification of infection. It is hoped the following information will prove helpful in understanding and preventing this disease process.

While recognizing that there are disease-causing agents common to both man and birds, only two diseases are credited with being capable of being contracted directly from birds by man, psittacosis and salmonellosis. Additionally, there are four fungal disease processes associated with bird habitats (aspergillosis, blastomycosis, crypttococcosis, and histoplasmosis). As greater than 30% of pet birds may be asymptomatic carriers for psittacosis and frequently, contact between aviculturist and his/her feathered friends is quite close, transmission of disease is possible. Cases of the disease have been reported after only brief or no known exposure to birds. The overall incidence of avian associated disease is low in humans, such that anticipation of the possibility of psittacosis is required by your physician to make the diagnosis. It is important that your doctor know of patient contact with birds and that aviculturists learn

Geometric Mean Titers for 1405 Specimens from 768 Confirmed and Presumptive Cases of Psittacosis, by Days After Onset



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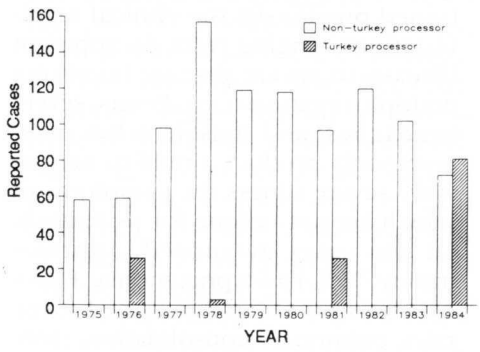
Psittacosis in Humans, by Year and Source, United States, 1975 - 1984



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about reducing the risk of transmitted disease.

Specific diagnosis of psittacosis is of extreme importance because of its potential severity, its response to antibiotics, and the public health significance of psittacosis infection. A superficial knowledge of the causative agent is necessary for the practical understanding of limitations of testing commercially available for diagnosis.

Chlamydia psittaci is the organism responsible for "psittacosis" of avian origin as well as of non-avian disease origin. *Chlamydia* at one time were originally considered to be large viruses, but now are felt to be unique bacteria consisting of only one genus and two species. Most tests cannot distinguish between the two species. The reason for this is that both species share many biological properties including a cell wall with a genus specific, lipopolysaccharide antigen determinant. As most of the more common tests utilize this cell wall antigen, they will not distinguish between the two species. Although the cell wall is very similar between these two species, there is less than 10% chromosomal DNA homogeneity and they have considerable differences in their manner of infection. The other species, *Chlamydia trachomatis,* naturally affects only humans and mice, and is the causative agent of certain genital infections and conjunctivitis in man. Fortunately, the clinical process caused by the two species in man is very much different such that there is usually little difficulty in differentiating these two disease processes. Whereas many of our diagnostic tests will not distinguish between these two species in man, we do not have to distinguish between species in birds, as only the *C. psittaci* infects birds. It should be added that *C. psittaci* have different host-specific strains in different disease states. This means that there are heterogenous strains of *C. psittaci* which affect animals other than birds and man.

More recently, a strain of *C. psittaci* termed the "TWAR agent" has been found to be a cause of human infection and studies have indicated that although there is human to human transmission of this organism there is no evidence of birds hosting this particular strain. Thus we have a form of psittacosis in man which is not felt to be transmitted to or by birds. It would appear that strains of *C. psittaci* from non-human mammalian species such as cattle, sheep, horses and swine appear to have much less public health significance than do strains of avian origin. Enough said regarding strains of *C. psittaci,* the point being that all "psittacosis" is not from birds and that our usual diagnostic tests are not species specific.

The history of what is now recognized as human psittacosis is relatively recent, the initial report credited to Ritter in 1879 from Ulter, Switzerland. Seven cases of pneumonia, fever and stupor with three fatalities were described in patients exposed to sick birds. Bird importation in the United States was restricted in 1930 due to a worldwide epidemic of human psittacosis. The responsible organism was discovered in 1930 as was the complement fixation antibody test still used as a primary diagnostic tool. The United States prohibited the commercial

Psittacosis in Humans, by Age and Sex, United States, 1975-1984

Age	Poultry Processing Associated				Non-Poultry Processing Associated				Total				
	Male	Female	Unknown	Total	Male	Female	Unknown	Total	Male	Female	Unknown	Total	Percent
0-9					15	9		24	15	9		24	2.1
10-19	12	8	1	21	29	37		66	41	45	1	87	7.7
20-29	22	21		43	72	99		171	94	120		214	18.8
30-39	14	15		29	97	92		189	111	107		218	19.2
40-49	7	9		16	88	76		164	95	85		180	15.9
50-59	12	6		18	93	81		174	105	87		192	16.9
60-69	2	6		8	71	37		108	73	43		116	10.2
70-79	1			1	21	18		39	22	18		40	3.5
80 plus					5	6		11	5	6		11	1.0
Subtotal	70	65	1	136	491	455		946	561	520	1	1082	95.3
Unknown					27	17	10	54	27	17	10	54	4.7
Total	70	65	1	136	518	472	10	1000	588	537	11	1136	100.0
Percent	6.1	5.8	0.1	12.0	45.6	41.5	0.9	88.0	51.7	47.3	1.0	100.0	

Ref: Centers For Disease Control

importation of psittacine birds in 1946 after a variety of unsuccessful regulatory measures were tried. Since that time there have been repeated modifications to the regulations pertaining to the importation of pet cage birds. The minimal thirty-day quarantine period of birds is primarily for the detection of Newcastle's Disease. Food containing tetracycline may be offered by the quarantine station but even if the birds eat the treated food, the thirty-day period has proven to be inadequate to eradicate the carriage of *C. psittaci* in all infected birds. In birds, a minimum forty-five day treatment period is felt necessary to eradicate the disease including the carrier state. It is felt that if the birds do indeed eat the tetracycline containing foods, this treatment may effectively suppress the transmission of disease from birds to humans or between birds while in the quarantine station.

The study of *C. psittaci* in birds has been discussed in avicultural publications, and thus it is only touched upon here. Suffice it to say that psittacosis is primarily a gastrointestinal tract infection in birds. Organisms are shed in nasal (nose) and lacrimal (tearduct) secretions as well as in feces, with infection appearing to be mainly by breathing the fecal dust. In the poultry industry, the greatest risk seems to be for workers who eviscerate and pluck turkeys. The avian species may or may not have significant symptomatology. Older birds tend to present fewer or no signs of illness, and birds that recover from infection may shed *C. psittaci* in their discharges for long periods of time. It is estimated that approximately 10% of untreated, infected birds will become chronic carriers.

Disease in humans appears to occur indirectly via the respiratory route by either direct contact with infected birds or through inhalation of fecal or nasal discharges. The incubation period varies from six to fifteen days. Symptoms are often like those seen with influenza (viremia, flu) mentioned previously, the clinical manifestations ranging from no apparent disease to severe disease involving multiple organ systems. Fevers, severe headaches, and muscle aches most commonly produce a mild to moderately severe illness the symptoms of which are not unique for psittacosis. Of the cases diagnosed, approximately 75% had a pneumonia. Physical signs cited have included fever, rales, pulmonary consolidation, swelling of extremities, liver enlargement, confusion, and slow heart rate. More severe cases have demonstrated severe lung, liver, brain, heart, and kidney involvement. Central nervous system signs and symptoms may accompany more severe psittacosis with cerebrospinal fluid being reported as normal. Cardiac infection has been recognized as well as a variety of primarily immune-mediated disease processes. Clearly, the disease process varies from mild and self-limiting to severe and life-threatening.

The mechanism for resistance to reinfection is unclear, although it appears to be lymphocyte mediated. Of antibiotic treatment, tetracyclines have traditionally been the drugs of choice in treating psittacosis in humans although there is disagreement over optimal dosages and duration of therapy. Tetracycline is most

Psittacosis in Humans by Category of Risk and Most Probable Source of Infection, United States, 1975-1984

Source	Non-Bird Owner	Pet Bird Owner	Pet Bird Fancier	Pigeon Fancier	Pet Shop Employee	Other Commer. Trade	Poul. Prod.	Poultry Process.	Misc.	Unknown Risk Category	Total	Percent of Total
Budgerigar	9	83	10			1			2	1	106	9.3
Cockatiel	8	80	8		1	1			4	3	105	9.3
Other Psittacine Spp.	15	126	28		31	11			14	7	232	20.4
Mixed/Unspecified Psittacine Spp.	15	35	34		31	3			8	2	128	11.3
Psittacine/Non-psittacine	13	22	42		46				8	2	133	11.7
Canary/Finch	1	11	1		1				1		15	1.3
Domestic Pigeon	8			50		2			3	1	64	5.6
Wild Pigeon	22	5		1					6	2	36	3.2
Miscellaneous Wild Birds	11	3	4				3		12		33	2.9
Turkey	2						6	135	16		159	14.0
Chicken	1						7				8	0.7
Other	2		2					1	1		6	0.5
Unknown Source	54								2	55	111	9.8
Total	161	365	129	51	110	18	16	136	77	73	1136	100.0
Percent of Total	14.2	32.1	11.3	4.5	9.7	1.6	1.4	12.0	6.8	6.4	100.0	

Ref: Centers For Disease Control

commonly recommended at 250 to 500 mg. administered orally four times a day for 10 to 21 days, and in more severely ill patients it has been administered at a dosage of 10 to 15 mg. per kg. of body weight per day. More recently doxycycline (Vibramycin) has been utilized. It has been particularly suggested for pediatric patients because of reduced tooth staining, and twice a day dosage. Chloramphenicol has some clinical efficiency, but it has an increased risk of relapse as compared to tetracycline. Rifampin has been utilized, but relapses have occurred following cessation of therapy, and resistance to rifampin develops quickly *in vitro* (in cultures). Erythromycin has previously been recommended as the best alternative drug to tetracycline in instances where tetracycline could not be used; however, there have been several case reports indicating a lack of response to erythromycin therapy. The CDC reports clinical responses to penicillin, cephalosporines, and aminoglycosides have not been "promising." The fluoroquinolones (Cipro, Noroxin) are reported to have good activity against *C. psittaci in vitro,* comparable to doxycycline. Recently released by the FDA in our country, there is little clinical data available with this class of drugs regarding the treatment of psittacosis.

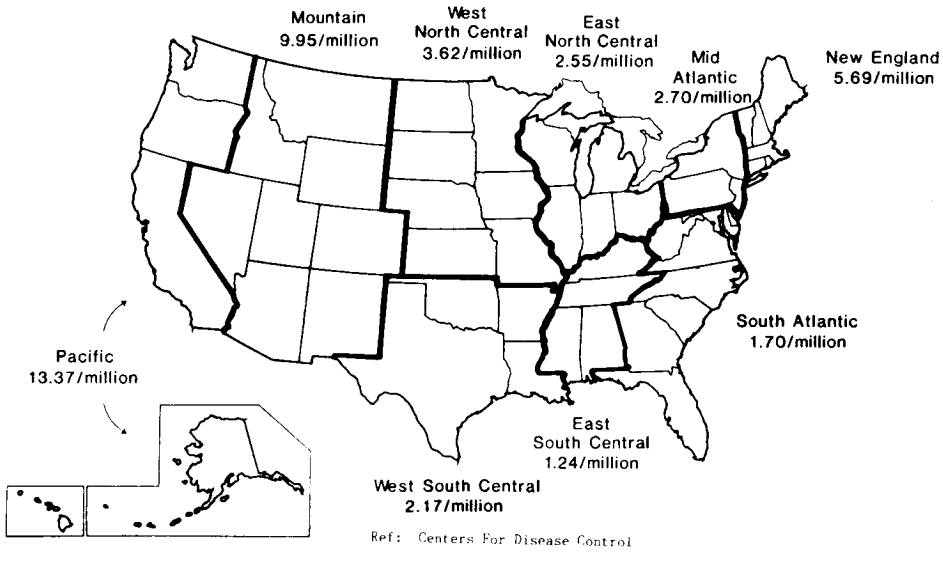
Laboratory confirmation of psittacosis is slow. Routine laboratory screening tests are not helpful in establishing a diagnosis. A specific diagnosis can be made only by isolation of the agent or by serologic studies. Growing only in cells, cultures for *C. psittaci* are rarely done as the organism must be grown in tissue culture, an expensive and less than readily available process. As might be expected, there are only four patients with positive culture results in the CDC surveillance period between 1975 and 1984. Confirmation of suspected cases of psittacosis in people is normally done by the genus specific complement fixation test which is based on the cell wall antigen previously mentioned. Usually blood is drawn, the blood centrifuged, the serum separated, and specimens submitted with appropriate information to state health department or reference laboratory. Both an acute specimen and one drawn two to three weeks into the recovery period are usually obtained. Whereas a normal acute titer is less than 1:8, it takes a 1:32 titer on the acute specimen to

justify a presumptive diagnosis of psittacosis. In our area it usually takes three to four days to obtain these results. A fourfold change in titer between the acute and convalescent serum specimens confirms the diagnosis of psittacosis. A major problem is that many humans have a fairly high positive serology to *C. trachomatis* and as the above test is only genus specific (i.e., unable to distinguish between *C. psittaci* and *C. trachomatis*) it takes a rather extensive elevation in titer to confirm the diagnosis. The microimmunofluorescent test appears to be more sensitive and specific than the complement fixation test and may replace same. IgM antibody may appear 10 days after the onset of symptomatology and IgG titer may later rise for several weeks. Further serologic procedures to diagnose psittacosis have been developed including indirect agglutination tests and enzyme-linked immunoabsorbant assays (ELISA), but have not found widespread application. The ELISA procedure, to a different antigen, is being used routinely as a screening procedure for AIDS, thus the technique is being widely used. The ELISA using the *C. trachomatis* antigens has been used to diagnose psittacosis in humans, but, due to high background sero-positivity to *C. trachomatis,* interpretation of serologic results is somewhat difficult.

Testing birds for an accurate diagnosis of psittacosis is problematic. Cloacal swab kits are relatively insensitive and because of the intermittent nature of shedding of the *Chlamydia,* multiple birds or multiple cultures from individual birds must be taken, with negative cultures not insuring the absence of disease. Culture kits usually consist of sterile cotton tip swabs and transport media such as brain-heart infusion. If the specimens will arrive in the laboratory within 24 hours of collection, tubes containing the swabs should be maintained under refrigeration, but not frozen. If the transport requires more than 24 hours, antibiotics should be added to the transport media and swabs sent at room temperature (according to the USDA). Serodiagnosis has been used in birds but because of the absence of an "established standard" for true positive and true negatives, there has been controversy as to which tests are reliable indicators of current active infection. The direct complement fixation test is the most widely used; however, some avian species (budgerigars, lovebirds) do not fix complement so the indirect complement fixation test is also used, though frequently is not commercially available. Latex agglutination tests may have a positive predictive value of approximately 40%. Veterinary application of the ELISA kits holds promise. Recently the commercially available *C. trachomatis* ELISA has been shown to be suitable for the direct demonstration of antigen, and for detecting antibodies against *C. psittaci,* when used as presented at the recent Association of Avian Veterinarians' meeting. This technique appears to be very promising to the aviculturist since it is much more accurate than currently used testing procedures. Perhaps in the future, when we submit a feather sample for tissue culture and karyotyping ("feather-sexing"), we could test the bird for psittacosis on the same sample. Obviously there is a need for a rapid, sensitive and specific antigen/antibody detection method for the diagnosis of infection in birds and man.

In summary, psittacosis is a potential illness for the aviculturists as well as the large number of persons involved in the handling and transport of birds and poultry. The diagnosis is a challenge for physicians and veterinarians, and because of limitations of laboratory methods, confirmation of the disease process is slow. In reality, appropriate treatment of the seriously ill patient must be started prior to serological confirmation of *C. psittacosis.* A high index of suspicion on the part of the diagnostician is necessary for the diagnosis even to be considered as routine culture methods will not identify this organism. Human incidence of the disease may be underestimated. It is very important that we, as aviculturists, let our physicians know about our avian contacts in the case of personal illness. We should work with our veterinarians to eliminate psittacosis from our feathered friends. Additionally, as aviculturists, we should support research directed to the diagnosis and eradication of psittacosis in our birds.

Nonpoultry-processing-associated cases of psittacosis in humans, by region, 1975-1984



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