ABSTRACT

Purpose:
To perform a retrospective descriptive study of the initial findings and evolutive changes in the chest radiograph of a series of patients diagnosed with psittacosis. To relate the imaging findings with the clinical profile. To correlate these findings with those mentioned in the consulted bibliography.

Materials and methods:
Thirty patients with Chlamyphila (formerly Chlamydia) psittaci infection were included in the series, diagnosed by serologic examination or matching clinical profile, all of them sharing the same source of infection.

Two radiologists independently assessed the PA radiograph of every patient, admitting only those studies in which interobserver coincidence existed.

The analysis of each radiograph followed a pre-established scheme.

Once obtained, the radiologic data was processed with imaging and clinical criteria and compared with that of the consulted bibliography.

Results:
Forty four radiographs belonging to 30 patients were analyzed; thirty of them corresponding to the first study and 14 to the follow-up of nine patients.

Eleven patients had normal radiographs. In the remaining 19, thirty three parenchymal alterations were found, of which 24 corresponded to airspace opacification, four to ground-glass opacity, two showed an interstitial pattern, one had a pulmonary nodule, and finally two of them corresponded to atelectasis. Unilateral affection was present in 14 patients, of whom 11 presented a solitary focal lesion. Five cases had bilateral involvement. The left lung was more frequently affected, with 18 radiologic findings. The more involved sectors were the lower thirds of the lung fields (13 lesions to the left and 10 to the right) and the central sectors of the fields (12 lesions to the left and 11 to the right).

Scarce pleural effusion was present in only one case, and no mediastinal alterations were found. In every case in which follow-up was performed lesions evolved to radiologic improvement, and only in one case bilateral pleural effusion developed. We wish to emphasize the limited bibliographic material available about this disease in our country, especially in the imaging aspect, of which there is no published bigger series than the one examined in this study.
ORNITOSIS - CHEST RADIOLOGICAL MANIFESTATIONS

1. INTRODUCTION

The term psittacosis derives from the Greek word “psittakos” which means parrot, and was used for the first time by Morange in 1892 (1).

Psittacosis, better named ornithosis given that 130 bird species other than the belonging to the Psittacidae family can transmit it, is a zoonosis of which the etiologic agent is Chlamydophila (formerly Chlamydia) psittaci (Ch. p.). This is an obligate intracellular pathogen that differs in genetics, antigens and morphology with other Chlamydophila species (i.e. pneumoniae, trachomatis) (2).

This ornithosis has a universal distribution and can happen sporadically or in epidemic fashion at any time of the year (2-3).

Its incidence is low but has increased in developed countries. In Germany approximately 40 cases are reported every year (4), in Australia 36 cases were reported in 2001 (NSW Public Health Bulletin 2003), and in the U.S.A. 935 cases were notified to the Center for Disease Control between 1988 and 2003 (5).

In Uruguay no official numbers are available since it is not an obligatory reporting disease. In a multi-centric study, 2 of 26 non-nosocomial pneumonias were psittacosis (6). In another national series of non-nosocomial pneumonias from 1994 no Ch. p.-caused case was identified (7). The mortality of this disease is less than 1% if treatment is conducted (1-3).

It has no predilection for race or genre and it more frequently affects middle-aged individuals (2).

FIG 1 - Extensive parenchymal consolidation with air bronchogram and bulge of the minor fissure.

The disease is contracted by inhalation of excrement, secretions and feather debris of infected animals, being exceptionally transmitted by a peck (1-3) and human-to-human transmission have been reported (2-3-8).

A percentage of cases that varies between 20% and 60% in different publications do not report contact with birds (1-3).

The population at greatest risk of contracting psittacosis is that who handles infected poultry; regarding it as an occupational disease that compromises pigeon breeders, farmers and employees of zoos, pet stores and
poultry processing plants. The incubation period is usually between 7 and 14 days but can be extended up to 4 weeks after exposure (1-2). Most often it affects the respiratory system, rarely becoming a fatal systemic disease with the development of pericarditis, endocarditis, myocarditis, hepatitis, and encephalopathy (2-3-9). The clinical picture is characterized by an insidious onset with constitutional and nonspecific symptoms (1-3) accompanied by usually scarce pulmonary signs. The diagnosis should be considered in the face of atypical community-acquired pneumonia and especially when a history of contact with vectors exists.

Diagnostic confirmation is usually done by serological methods, the most widely used being the complement fixation test (CF), a sensitive but not specific study (1-2-3). A fourfold increase in CF antibody titers between the acute and convalescent phases confirms the disease, although a single title of 1/32 in clinically compatible patients is considered a presumptive case worthy of treatment (1-3).

Respiratory compromise, often with little clinical expression, is usually radiologically demonstrable, being this clinical-imaging dissociation classically described in atypical pneumonias (3). The chest radiograph is abnormal in a high percentage of cases (1-10). Radiological manifestations are varied and nonspecific, indistinguishable from other causes of pneumopathy (10-11). Different radiological patterns with varying frequencies are described in different studies. Several of them describe a unilateral infiltrate or consolidation located in the lower lobe as the most common finding (1-3-9-10). Predilection for the middle lobe is also reported (3). Other communications indicate a ground glass pattern as the most frequent finding (12). It may be bilateral or present a nodular, miliary or interstitial pattern (1-10-13). Rarely patients develop pleural effusion (9-13-14). Radiologic abnormalities resolve within 3-20 weeks, with a mean of six weeks (1-3-10).

In January of 2004 the city of Tacuarembó, Uruguay, saw an outbreak of ornithosis. The epidemiological monitoring office of the local public health department estimated at 42 the
number of cases, identifying an informal sale of birds (parrots) as a focus of disease spread. We present the radiological analysis of 30 of these patients, which we believe this is the first relatively large series of ornithosis cases documented in our country.

2. PURPOSE
To perform a retrospective descriptive study of the initial findings and evolutionary changes in chest radiograph in a series of 30 patients with the diagnosis of psittacosis. To relate the imaging manifestations encountered and the clinical picture. Finally, to compare these findings with those provided by the consulted literature.

3. MATERIALS AND METHODS
This series consists of 30 patients, 20 of them from the Ministry of Public Health (Hospital Regional de Tacuarembó) and 10 of the mutual sphere (Cooperativa Médica Tacuarembó).
The following criteria were used for inclusion in the sample:
1. Confirmed cases: patients with confirmatory serology for Chlamydophila psittaci (anti-Ch. p. IgM by indirect immunofluorescence method performed by the Laboratory of Monitoring and Diagnosis of Respiratory Diseases of the Ministry of Public Health).
2. High probability cases: clinically compatible patients who referred contact with birds from the same origin as the patients with serological confirmation (the primary focus, in this case an informal trader of parrots).

All patients underwent a posteroanterior chest radiograph with a focus-film distance of 150 cm as first imaging study. No participation of imaging specialists mediated in the technical quality assessment of the obtained documents, leaving to the requesting physician their acceptance or rejection. All radiographs were included in the sample and analyzed by the two radiologist physicians that participated in the study, who primarily evaluated their technical quality, discarding those that lacked the requirements for reaching diagnostic conclusions.
In each radiograph the following items were evaluated systematically by a preset tab:

1. Bone alterations.
2. Pleural space: defining the presence of effusion, its location (right, left or bilateral), its extent (I-effacement of the costophrenic recess, II-less than half a hemithorax, III-more than half a hemithorax), or presence of pleural thickening (right, left or bilateral).
3. Cardiothoracic index.
4. Right paratracheal line greater than 3 mm.
5. Pulmonary hila: shape, size and density.
6. Lung parenchyma:
   a. Presence of atelectasis defining whether it is total or partial and its topography.
   b. Presence of any of the following radiological patterns: mass/nodule - occupation of airspace - ground glass - interstitial - other findings. In each case was established: I) the location, for which the pulmonary areas were divided into upper, medium and bottom thirds, defined by two horizontal lines drawn above and below the hila; and external, medium and central sectors, defined by the midclavicular line and a vertical line located immediately outside the pulmonary artery in the hilum. II) The size, defining as small any parenchymal alteration under or equal to 4 cm², as large those greater than 25 cm², and as medium those ranging between 4 and 25 cm².

The arbitrary classification into these four radiographic patterns was the result of previous bibliographic consultation on findings in this disease.

We define the a ground-glass pattern as an homogeneous low density opacity through which vascular structures can be seen, and that may contain small radiolucent areas, definition established by PK Barrett and MJ Greenberg in 1966 to describe the findings on this disease (15). The rest of the patterns used are consistent with the definitions found in the imaging text by C Pedrosa (16).

In cases with iconographic follow-up the same procedure was performed with each radiograph, assessing each item for emergence of new findings or the magnitude of changes in the existing ones by placing them in one of the following categories: growth-unchanged-reduction-disappearance.
Seven patients had serologic confirmation of Chlamydia psittaci, and in the remaining 23 the diagnosis was considered highly probable according to predetermined criteria.

The history of contact with parrots was established in 29 patients (96.6%). In the only case in which epidemiological record was not obtained, serology was confirmatory.

In 22 of the 30 patients the frequency of symptoms and signs could be evaluated, which was the following: fever (91% of patients), musculoskeletal pain (68%), headache (50%), cough (45%), asthenia (36%), dyspnea (23%) and moist rales (41%).

Forty-four radiographs were analyzed, 30 corresponding to the initial assessment and 14 controls of 9 patients. All initial radiographs were of diagnostic value; only one control was excluded because of poor technical quality in a control study.

There was agreement between the two radiologists in all cases studied.

The radiographs were normal in 11 patients (36.6%). In the remaining 19 (63.3%), 33 parenchymal abnormalities were identified, of which 24 (77.4%) corresponded to airspace (Figure 1-965), 4 (12.9%) to ground-glass (Fig. 2-981), 2 (6.4%) to interstitial pattern (fig3-969), 1 (3.3%) to lung mass (fig 4-993), and 2 (6.4%) to atelectasis (Figure 5-979).

Fourteen patients, that represent 74% of cases with lung involvement, showed unilateral compromise, 11 of them

---

**FIG. 4-** Lung mass of 6cm localized in the inferior lower third of the left lung.
showing a single parenchymal alteration (nine with airspace occupation, one with ground-glass and one with mass) and the remaining three showing two alterations. Bilaterality was seen in 5 cases (26%) (Figure 6 - 1015-1018-1019): one with two pulmonary alterations, two cases with three alterations and two with four alterations.

The left lung was the most frequently involved, with 18 radiological findings, while the right showed 15.

The sectors most affected in both lungs were the lower thirds (13 injuries to left – 10 to the right), followed by the medium third (7 to the left - 6 to right) and finally the upper third (3 to the left - 2 to the right).

As for the central, medium or external compromise, the medium sectors were the most affected (12 injuries to left - 11 to the right), then the external (9 to the right and to the left) and central (5 to the left - 3 to the right).

Except for a case that presented a mass and another which showed an isolated ground glass pattern, in the remaining 17 patients (89.4%) with radiological evidence of pulmonary involvement airspace occupation pattern was observed, being the only finding in 13 of them.

The 24 lesions that corresponded to this radiological pattern were divided by their size into 11 large, 9 medium and 4 small (Fig7-1001). Air bronchogram sign was identified (fig1-965) in 18 of them (75%), being present in 82% of large lesions (9 lesions), 89% of medium size (8 lesions) and 25% of small lesions.

In large lesions with airspace opacities, the time from symptoms onset ranged between 1 and 21 days, with a mean of 8 days. Given the lack of information this correlation could not be made in cases with lesions of intermediate and small size.

In 14 of the 17 patients who had airspace opacities, the frequency of findings could be determined: fever was present in 86%, musculoskeletal pain in 78.5%, headache, dry cough, and moist rales in 50%, asthenia in 42 % and dyspnea in 21% of cases.

FIG. 5- Lateral radiograph. Partial atelectasis of superior lobbe.
Ground glass pattern was present in 4 patients, was of medium size in one case and large in three. In the latter, it was accompanied airspace opacities of small size in two cases and of medium size in one.

On all four cases external and central sectors were affected. The time from the onset of clinical manifestations was between 24 hours and five days with a mean of 48 hours. The most frequent symptoms in these patients were fever, present in four cases, and musculoskeletal pain present in three.

In two cases partial atelectasis of the upper lobe was observed, which was not suspected in the frontal radiographs, but in the lateral studies. Airspace occupation was also present in both cases of atelectasis.

Interstitial pattern was present in a single patient, where it was bilateral, radiating from de hila and appearing mainly in lower and middle thirds and inner sectors, with small extension to the left and medium to the right.

One mass of intermediate size was detected, and it was located in the central sector of the middle third.

Pleural effusion of low magnitude and located to the left was found in one case, and it associated airspace occupation of medium size and a large extension ground-glass pattern.

For technical reasons in three patients the mediastinum, hila and cardio-pericardial silhouette could not be assessed; in the remainder no changes suggestive of lymphadenopathy were observed, and cardiomegaly was found in two cases.

Other findings observed were regular and biapical pleural thickening in one patient and in other images that were compatible with bronchiectasis in the medium and inner right lower third.

**Controls**

Of the nine patients with more than one radiograph, one case was dismissed, three evidenced no abnormalities on initial radiographs or in the control and five had pulmonary disease (nine images of airspace occupation -three large and six medium-, and one with ground glass pattern) with a total of 10 controls (one patient with one control Rx, three patients with two controls, and one patient with three controls) performed between 24 hours and 21 days after the initial study, having mediated antibiotic treatment in all cases.

Four of the nine studies with airspace occupying lesions were controlled within the first three days, all of them showing an increase in size (Fig. 8 to 972, 976 and 980).

At 21 days eight of the nine airspace occupying lesions were resolved, developing dense tracts in the topography of the initial lesions in 2 radiographs that belonged to the same patient (Fig. 6-1015-1018-1019). At this time only one medium sized consolidation persisted, but smaller in size and density.

The only lesion with ground glass pattern
that was controlled presented a reduction in density at 5 days and was completely resolved at 21 days from the initial study.

In one case small bilateral pleural effusion developed at 48 hours.

5-DISCUSSION

5.1-DISCUSSION OF METHODOLOGY
As weakness in the conception of the work may be the low number of patients with serological confirmation (7 of 30). The epidemiological and clinical support was considered by the authors as a key to the inclusion of patients. The cases occurred in a short period of time (first twenty days of January), off the seasonal peak of respiratory infections caused by common germs, in a relatively small community (41,000 inhabitants) and a common source of infection was clearly identified in almost all cases.

The small number of cases that included a lateral chest radiograph bounded the imaging analysis to the frontal radiograph only. This fact limited the possibility of locating parenchymal abnormalities within lobes and segments and of accurately assessing the size in cases where multiple lesions were superimposed. Lack of lateral projection also limits the diagnosis of atelectasis, mainly those of the lower lobes and in particular to the left, and renders impossible to completely exclude small pleural effusions located in the posterior recess.

5.2-DISCUSSION OF RESULTS
The diagnosis of ornithosis must be considered against the raise of atypical

FIG. 6- A- Bilateral compromise with airspace occupation pattern associated with ground glass. B- Control 20 days after treatment. Good evolution with bilateral dense tracts.
community-acquired pneumonia and especially in face of an epidemiological history of contact with vectors. Since the natural history of disease may be to the aggravation, the excellent response to antibiotic treatment requires early diagnosis. The clinical picture is characterized by an insidious onset and nonspecific symptoms such as fever, headache, asthenia, anorexia, musculoskeletal pain, chills, sore throat, cough, and photophobia, sometimes indistinguishable from a viral infection(3). The clinical features found in this work do not differ substantially from those reported in literature: fever (91% of patients), musculoskeletal pain (68%), headache (50%), cough (45%), asthenia (36%), dyspnea (23%) and moist rales (41%). No differences in symptoms in relation to the different radiological patterns were found.

In the analyzed series only one patient required admission to ICU, due to a severe case with myocardial compromise. The chest radiograph showed bilateral foci and unilateral ground glass pattern; mediastinum could not be analyzed due to technical limitations. It was the only case that developed pleural effusion in the evolution.

Pulmonary involvement in ornithosis is very common, showing a high percentage of pathologic chest radiographs. In this series 63.3% of the patients had abnormal X-rays, being within the values reported in the literature, which range between 50% and 90% (1-9-10).

Although no predilection for either lung is described in literature, in this group of patients the left one was more frequently affected, existing no statistically significant difference. Pulmonary involvement was unilateral in most cases (14 of 19 patients), findings that coincide with reports in the literature (1-11-12-17), as it happens with the presence of a single parenchymal changes being more frequent (11 of 19 patients). The clear basal predominance evidenced in this series is found in different studies (10-17-14) and referred by some of them as characteristic finding in the disease (18-19).

![FIG. 7- Small acinar images in both pulmonary bases.](image)
The central and peripheral areas of the lung were the most frequently involved. Itoh and Ishida (12) describe the prevalence of central area, which is more marked in their group of patients than it is in our series.

The images in psittacosis are varied and may be of different radiological patterns, within which have been reported: segmental or lobar consolidation with or without atelectasis, homogeneous ground glass appearance, reticular pattern radiating from the hilum, miliary pattern and hilar enlargement of unilateral or bilateral distribution (1-10).

In this series we identified airspace occupation with and without atelectasis, ground glass pattern, interstitial pattern, and a pulmonary mass.

Air bronchogram was identified in 75% of cases with airspace occupation, being more frequent in lesions of medium and large size (82 and 89 respectively).

While some of these features of the consolidation produced by Ch. p. can help in the diagnosis, there are no imaging findings that differentiate it from pneumonia of other causes.

Partial atelectasis occurred in two patients and was associated with consolidation; research materials do not provide data on the frequency of this finding.

Ground glass pattern is mentioned in the consulted series and texts. In Japan, in a series that comprised 37 patients, it was present in 62% of cases affecting more frequently, as in our series, the central

FIG. 8- A- Bilateral and multiple airspace occupation pattern. B- 3 days post treatment control, increased lesion size. C- 21 days pos treatment control, complete resolution of parenchymal abnormalities.
sector of the lung (12). This pattern was detected in our series both at the onset and five days of evolution when no treatment mediated. 

The classic image of the interstitial infiltration radiating form the hila described by Glanzmann and referenced in the series of F Goupil et al. (7) occurred in only one patient and in bilateral fashion. 

The radiological finding in one case was that of a left basal mass, and although this is not a classic pattern of disease, a similar presentation has been reported. 

In this particular patient the clinical and epidemiological aspect as well as the satisfactory outcome in response to the instituted antibiotic treatment support the presumptive diagnosis, but due to the lack of a radiological follow-up we cannot discard that it corresponded to a concomitant pathology. 

Hilar adenopathy and basal affectation have been described as being characteristic of ornithosis (17). No radiographic abnormalities suggestive of hilar or mediastinal lymphadenopathy were identified in this series. 

It is accepted that pleural effusion is rare and when present is small (9-13-14), although Schlossberg refers its frequency being up to 50% (1). 

The average time of radiological findings resolution is six weeks with an estimated period of one to 20 weeks (1-10). The radiographic resolution occurred sooner than this average in 9 of the 10 controlled lesions in this series. 

Only one citation refers to initial radiographic deterioration, considering it as a rare condition, although the four lesions of this group that were controlled before 3 days passed from the initial study showed an increase in size.

6. CONCLUSIONS
The clinical and radiological findings are mostly consistent with those reported in the literature. 

No images are pathognomonic of the condition; airspace occupation and the basal topography of the radiological abnormalities were the most frequent findings. 

The absence of characteristic clinical and radiologic features makes the epidemiological notion of contact with animal vectors acquire a relevant role. For that reason we consider of essential importance the performance of prospective studies to determine the prevalence of the disease in our country.

8. REFERENCES
ORNITOSIS- CHEST RADIOLOGICAL MANIFESTATIONS

9-MOSCHIONI C, PEREIRA FARIA H, SOARES REIS MA.Pneumonia grave por Chlamydia psittaci. J.Pneumologia 2001; 27(4 )
13-COUTTS I, MACKENZIE S, WHITE R. Clinical and radiographic features of psittacosis infection.THRAX1985;40:530-32--).