Chest Radiograph Abnormalities in Patients Hospitalized with Leptospirosis in the City of Salvador, Bahia, Brazil

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This study was designed to estimate the prevalence of pulmonary radiograph abnormalities and describe the distribution of the patterns of radiographic alterations among patients hospitalized with leptospirosis. Chest radiographs of 139 patients hospitalized with leptospirosis in Couto Maia Hospital, in Salvador, Bahia, Brazil, between July, 1997, and July, 1999, were analyzed. The radiographs were requested soon after hospital admission, independent of the clinical manifestations of the patients. Only the first radiograph was considered. Pulmonary radiograph alterations were recorded in 35/139 patients (25.2%); 95% mid-point confidence interval = 18.5% to 32.9%. Among the patients with radiograph alterations, alveolar infiltrate was seen in 26/35 (74.3%). The lesions were bilateral in 54.3% and located in the inferior lobes in 45.5%. Pleural effusion, represented by blunting of the costo-phrenic angle, was detected in 8.6% of the patients. The pattern of the pulmonary alterations, predominantly bilateral alveolar infiltrates, is consistent with the evidence that the basic pulmonary alteration in leptospirosis is a generalized capillaritis.

Key Words: Leptospirosis, chest radiography.

Leptospirosis is a zoonotic disease prevalent worldwide, but with they highest incidence in tropical countries [1-7]. In Brazil, this disease is endemic in several regions with outbreaks occurring in relation to seasons of increased precipitation and contact with flood waters contaminated with urine of infected animals, particularly rats [7, 8]. Clinical manifestations of the disease are the result of a multisystemic involvement [9]. In spite of the potential importance of lung involvement in leptospirosis, few studies have adequately addressed questions related to the pulmonary radiographic alterations of the disease.

Estimates of frequency of pulmonary radiographic alterations in leptospirosis have varied from 11% to 67% [1-6, 10, 11]. This great variation may be partly related to the criteria used to request radiographic exams and the lack of precision of the estimates due to a relatively small sample size. However, the possibility that this variation is related to differences in the distribution of various serotypes of leptospira across geographic regions, cannot be completely ruled out. It is important to note, that the highest frequencies of radiographic alterations have been reported in studies from Korea, China and Reunion Island [1, 2, 4, 11]. By contrast, studies from the western hemisphere have reported the lowest frequencies of pulmonary radiographic abnormalities in patients with leptospirosis [3, 5, 6, 10].

The present investigation was carried out in Salvador, a large city in northeast Brazil, where there is a high incidence of leptospirosis [12]. The main

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objective was to estimate the prevalence of alterations in chest radiographs of patients hospitalized with leptospirosis and to describe the patterns of radiographic alteration in these patients.

Materials and Methods

Chest radiographs were requested for 139 patients admitted to Couto Maia Hospital, a referral center for infectious diseases, between July, 1997, to July, 1999, independent of clinical findings. These patients were participating in a randomized clinical trial developed to test the efficacy of penicillin on the late stage of leptospirosis. In keeping with the research protocol of the clinical trial, all patients were older than 15 years and had the disease with more than 4 days of symptoms. Each patient signed a consent form, approved by the local institutional review board. The radiographs were independently analyzed by two penumologists who were blinded to any other data from the patients. The agreement between the pneumologists who analized the radiograph alterations, was generally high (kappa=0.7). Radiographs with discordant diagnoses were submitted to a radiologist for independent opinion. The discordance was resolved by consensus among the three observers. The radiographic variables were: 1) presence of radiograph alterations, 2) type of abnormality: alveolar, alveolo-interstitial, interstitial and pleural effusion, 3) involved lobe, 4) side and 5) extension of the abnormalities.

The macroscopic slide test for leptospiral antigens was performed for all patients. The microagglutination test (MAT) and hemoculture for leptospira were performed for 17 and 12 patients, respectively. The probability score proposed by Faine was also used to diagnoses leptospirosis [13]. MAT and hemocultures for leptospira were performed at the Centro de Pesquisas Gonçalo Moniz da Fundação Oswaldo Cruz – FIOCRUZ. The macroscopic slide test was performed at the Laboratório Central de Saúde Pública Gonçalo Moniz – LACEN. MAT was considered positive when there was a 4-fold increase in the reciprocal titre between paired serum samples or when the reciprocal titre was greater than 800 in one or more serum samples. The macroscopic slide test was classified as positive or negative.

Statistical analysis. The statistical analysis was basically descriptive. The quantitative variables were described by the mean (±SD) and the median. The categorical variables were described by their relative frequencies. Exact mid-p 95% confidence interval for the prevalence of radiographic abnormalities was determined by using the module CONFINT of the Computer Programs for Epidemiologists, PEPI, version 3.01 [14].

Results

The diagnosis of leptospirosis was confirmed by serologic test or hemoculture in 96.4% (134/139) of the participants; in 5 pateints, the diagnosis was based on clinical and epidemiological findings according to the Faine criteria. Characteristics of the 139 patients are shown in Table 1. The mean (±SD) of age was 34.7±12.9 years (median = 31 years). There was a predominance of males (87.8%); 95% (132/139) were icteric. Dyspnea was reported by 14 (10.1%) of the patients. The mean ± (SD) of the respiratory rate was 24±8 movements per minute (median=23). The mean (±SD) of serum creatinine was 3.9 ± 1.9 mg/dL (median=4).

The frequency of chest radiographic alterations was 25.2% (35/139); 95% CI=18.5% to 32.9% (Table 2). Among the radiographs with alterations, 74.3% (26/35) were classified as alveolar infiltrate (Figure 1 A and 1 B). The interstitial and alveolar-interstitial types of infiltrates were found in 17.1% (6/35) and 2.8% (1/35), respectively. The involvement was bilateral in 19 of 35 (54.3%) patients. The alteration was located on the right side of the chest in 11 of the 16 pateints (68.8%) with unilateral lesion.

Pleural effusion, represented by blunting of the costo-phrenic angle, was detected in 3 of the 35 patients (8.6%) with abnormal radiographs. Among the 33 with parenchymatous alterations, the lesion was restricted to the inferior lobes in 15 (45.5%). Alone,

Table 1. Characteristics of the Patients

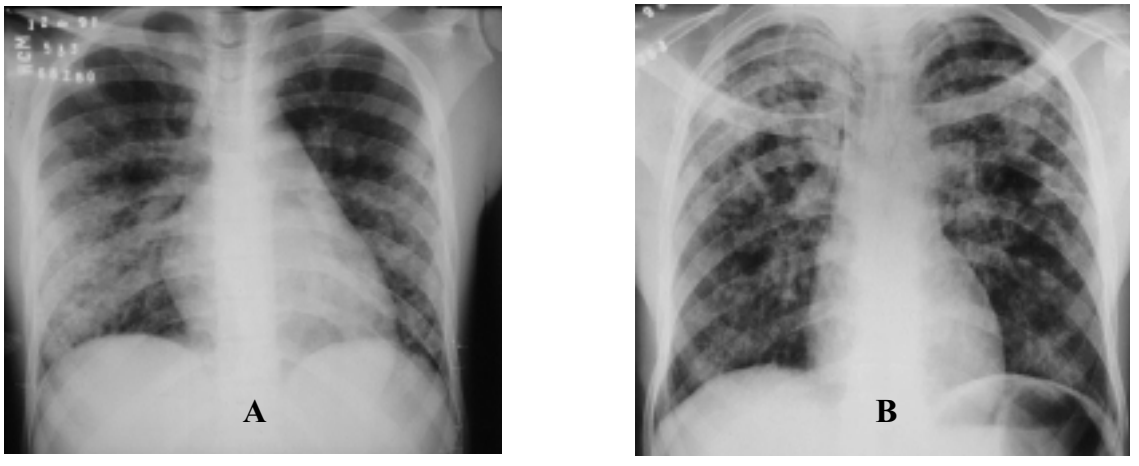
Characteristic	**N = 139**
Age (years)	
Mean±SD	34.7±12.9
Median	31
Male	122 (87.8%)
Jaundice	132 (95%)
Dyspnea	14 (10.1%)
Respiratory Rate per Minute	
Mean±SD	24±8
Median	23
Creatinine (mg/dL)	
Mean±SD	3.9±1.9
Median	

Table 2. Distribution of pulmonary radiograph findings

% Radiograph with Alterations	25.2%(35/139)
(95% CI)↓	18.5%-32.9%
Type of Alteration	
% Alveolar Infiltrate	74.3%(26/35)
% Interstitial Infiltrate	17.1%(6/35)
% Alveolo-interstitial Infiltrate	2.8%(1/35)
% Pleural Effusion *	8.6%(3/35)

↓ CI= Confidence Interval. * A patient had alveolo-interstitial infiltrate associated with pleural effusion.

Figure 1. Chest radiograph of two patients with leptospirosis showing the pattern of bilateral alveolar infiltrate. A – Areas of confluent consolidation located in peripheral zones of the inferior lobes. B – Diffuse nodular and small, patchy opacities



or in combination, the inferior lobes accounted for 87.9% (29/33). Involvement restricted to one or two lobes was seen in 60.6% (20/33) patients with parenchymatous alteration. In 15.2% (5/33), the lesion was more diffuse, involving 4 or 5 lobes.

Discussion

According to the results of the present study, pulmonary radiograph alterations can be detected in the first 48 hours after hospitalization in approximately 25% of patients older than 15 years with symptoms of leptospirosis for more than 4 days. The frequency of alterations in chest radiographs estimated in this study (25.2%) is not very different from previous observations by other Brazilian studies, from São Paulo (33.3%; 6/18) [10] and another one from Rio de Janeiro (34.9%; 15/43) [5]. The prevalence of 25.2% found in the present study is also similar to the one described in a study from Jamaica (22.7%; 10/44) [3]. The Jamaican study is apparently the only previous investigation developed with the specific objective of estimating the prevalence of pulmonary radiograph alterations in patients with leptospirosis. A lower prevalence of pulmonary radiograph alterations (11%) was reported by Heath, et al. in the United States [6]. Much higher, estimates of prevalence of pulmonary alterations in leptospirosis than the one found in the present study have been reported from China (66.7%; 62/93) [2]; Korea (two studies: one with 43.0% (40/93) [1], and one with 63.8% (37/58) [11]); and Reunion Island (51.9%, 80/154) [4].

The existing data do not allow us to conclude whether the geographic variation in pulmonary findings in the radiographic examination is related to the genetic background of the patients, environmental factors, the infecting serovars, or a combination of these factors. It is important to note, however, that the studies with the highest frequencies of alterations in the chest radiograph are those with the highest proportions of anicteric leptospirosis. In the study from China, the one with the highest prevalence of pulmonary alterations, all patients were anicteric [2]. In the Korean studies, the percentages of icteric patients were 37.0% [11] and 16% [1]. In the Reunion Island investigation, icteric patients corresponded to 47% [4]. The percentages of icteric leptospirosis in these studies (i.e., from China, Korea and Reunion Island) were lower than the percentage observed in the present study (95%) and in the studies from São Paulo (100%) [10] and Jamaica (68%) [3]. Unfortunately, the percentage of icteric patients among those who had chest radiographs were not reported in the studies from Rio de Janeiro or from the United States. It is also important to note that, except for the Reunion Island study (n=154) [4], all of the studies had smaller sample sizes than the present one. In addition, the previous studies, except for the Jamaican study, were not planned to assess prevalence of pulmonary alterations. Thus, chance and the criteria used for radiographic indications (indication bias) should be viewed as potential explanations for the variation in the prevalence of pulmonary radiograph alterations across studies.

In the present sample, alveolar infiltrate was the most frequent pulmonary radiologic alteration. In addition, the lesions were more often bilateral. The predominance of this pattern in the radiographs has also been found in other studies [1-5, 11]. It is important to observe that alveolar infiltrate is associated with intra-alveolar hemorrhage [15], a finding consistently described in autopsies and experimental studies in animals with leptospirosis [1, 2, 11, 16-18]. These findings are also consistent with evidence that the basic mechanism of pulmonary alterations in leptospirosis is a generalized capillaritis with increased susceptibility to bleeding [11, 17-19].

The relatively lower frequency of pleural effusion (8.6%) observed in the present study is a finding also described by other investigators [3, 4, 10, 16]. The highest frequencies of pleural effusion were described in two studies from Korea, with 19% [11] and 30% [1]. It is important to note that these Korean studies are among those with the highest prevalences of radiographic chest abnormalities overall. These data are additional support for the existence of differences in the clinical presentation of leptospirosis across geographic regions.

The parenchymatous alterations were located more often in the inferior lobes. It should be observed, however, that lateral radiographs were not performed in the present study. Lateral radiographs are important, particularly to differentiate alterations in the inferior lobes from those in the median and the lingula lobes. It is unlikely, however, that an assessment of chest radiographs based solely on a posteroanterior projection has biased the estimate of prevalence [1-5].

According to the results from this and previous studies, radiographic chest alterations are relatively frequent in patients with leptospirosis. These alterations are more often bilateral and consistent with alveolar infiltrates. Studies are still necessary to describe the evolution of the pulmonary findings in patients with leptospirosis. It is also important to assess the value of alveolar infiltrates in the identification of cases of leptospirosis among patients with different forms of the disease. The determinants of the large variation in the prevalence of radiographic chest alterations in patients with leptospirosis across geographic regions is another important question for future research.

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