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A STUDY OF CORRELATION BETWEEN RADIOLOGICAL FINDINGS ON X RAY AND THE CLINICAL FINDINGS IN PNEUMONIA CAUSED BY MYCOPLASMA PNEUMONIAE

Radio-Diagnosis

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ABSTRACT

Objective: This study was done to study the radiological and pathological laboratory data of cases i.e. children and adults with Mycoplasma pneumoniae pneumonia (MPP) and to evaluate the correlation between the total affected lung area and the clinical findings.

Methods: It was a record based observational study in which data from MPP patients who visited our hospital during the period from Jan 2019 to December 2019. All data were analyzed to investigate the correlation between the clinical findings and the total affected lung area using a chest X-ray scoring system.

Results: We identified 21 children and 14 adults with MPP. The incidence of consolidation, which was the most common chest X-ray finding in both groups, was similar (children: n = 18, 85.7%; adults: n = 11, 78.57%). In contrast, air bronchogram, bronchial thickening, and atelectasis were observed significantly more frequently among children than among adults. The total score did not significantly correlate with the above-mentioned inflammatory markers or the presence of hypoxemia in either group.

Conclusion: This study showed correlation between the extent of lung abnormalities on chest X-ray and the clinical findings.

KEYWORDS

Mycoplasma pneumoniae pneumonia, chest X-ray, scoring system, hypoxemia, child and adult

INTRODUCTION.

Lower respiratory tract infection like Mycoplasma pneumoniae (MP) pneumonia is well known for its diverse radiological findings. While other causes of pneumonia are extensively studied, very few studies are done to study mycoplasma pneumonia infections hence this study was done to study the correlation between the areas of lung involvement on chest X-ray and the clinical findings in both children and adults with MPP, to investigate the association between the values obtained by a chest X-ray scoring system and the clinical findings.

MATERIALS AND METHODS:

It was a record based observational study done in a tertiary medical college from January 2019 to December 2019. In the present study, "child" was defined as <12 years of age, while "adult" was defined as ≥12 years of age. The diagnostic criteria for MPP used were as follows: 1) the presence of new abnormal lung shadows on a chest X-ray, and one of the following: 2) a ≥4-fold titer rise [complement fixation (CF) or particle agglutination (PA) tests] during the convalescent phase in comparison to the acute phase; or a single PA titer of >1:160; or 3) the isolation of MP in sputum culture.

The radiological investigation used were the chest X-ray films which were divided into three levels: 1) the bronchial bifurcation, 2) the upper level of the diaphragm, and 3) halfway between 1) and 2), and total visual scores were defined as follows: grade 0, no opacity; grade 1, 5% opacity; grade 2, 5-24% opacity; grade 3, 25-49% opacity; grade 4, 50-74% opacity; and grade 5, ≥75%. The system of scoring that was applied in the present study consisted of a total of six areas, the scores for each area were summed to determine the total score (range, 0-30). A clinician along with an experienced radiologist independently studied the x ray and a definite diagnosis was made. The correlations between the total score and the clinical and/or laboratory data were also evaluated.

Statistical analysis

The following tests were used: Kolmogorov-Smirnov test and Levene's median test. Statistical comparisons of nonparametric data were performed using the Mann-Whitney test. Categorical data were compared using the chi-squared test. All tests were two-sided. p values of <0.05 were considered to indicate statistical significance. All statistical analyses were performed using the SPSS software program.

RESULTS:

A total of 21 children and 14 adults with MPP were studied. The general characteristics of the two groups were comparable with regard to the proportions of sex, underlying respiratory diseases, the incidence of hypoxemia, and incidence of the management (table 1). However, the child group showed significantly higher body temperatures (children, 38.3 ± 0.7 vs. adults, 37.6 ± 1.2°C, p = 0.02) and higher serum levels of lactate dehydrogenase (LDH; 352 ± 132 vs. 234 ± 66.2 IU/L; p <0.001) and aspartate aminotransferase (36.2 ± 14.6 vs. 28.2 ± 16.9 IU/L, p <0.001) in comparison to the adult group. In contrast, the serum C-reactive protein levels in the adult group were significantly higher in comparison to the child group (adult group, 9.1 ± 9.1 mg/dl vs. child group, 3.1 ± 3.5 mg/dl; p <0.001).

Regarding the chest X-ray findings, consolidation was a major radiological finding in both groups (table 2). Air bronchogram, bronchial wall thickening, and atelectasis were observed significantly more frequently in the child group than in the adult group. Other findings, such as reticular shadowing, tiny nodules, and pleural effusion, did not differ to a statistically significant extent.

DISCUSSION:

This study done in central India is one of the few ones studying the total affected lung area (calculated as a total score) on chest X-ray films and the clinical and laboratory findings in both children and adults with MPP.

In our study, no correlation was found between the total score and the presence of hypoxemia in either children or adults with MPP. Also, this study clearly demonstrated that the middle-to-lower lung fields were predominantly affected by MPP. In previous studies, where chest X-ray films were analyzed implied that the lower lung field was predominantly affected in both children and adults with MPP (1, 2), while peribronchial and perivascular interstitial infiltration and/or air space consolidation were the common radiological patterns. These trends were quantitatively confirmed in the present study, with the use of the chest X-ray scoring system and by the assessment of the radiological patterns.

Although the precise reason why the incidence of atelectasis in children with MPP was significantly higher in comparison to adults with MPP is unknown, it was possibly caused by the obstruction of the airway by a mucus plug due to the increased expression of mucins by the bronchial epithelial cells after MP infection. (3)

A positive correlation between the maximum PA titer and the total

score was only observed in children with MPP. This discrepancy found suggested the possibility that an excessive immune reaction to MP antigens (4, 5, 6), which was predominantly attributed to the inflammatory process, occurred in children rather than adults. Indeed, the findings of Tanaka et al. (7, 8) and the data from our previous studies (4, 5, 6) demonstrated that the enhanced cellular-mediated and/or humoral immune response to MP can exaggerate lung inflammation in mouse models.

Worthy to note that the total lung score was not correlated with the presence of hypoxemia. General physicians who treat MPP pneumonia anticipated this finding. The serum LDH level has been considered a marker for refractory MPP (9); however, no one has elucidated the significance of LDH levels in predicting hypoxemia. In this regard, the present study demonstrated a lack of correlation between these factors.

The limitations include that the extent of lung abnormalities might have been underestimated due to the low sensitivity of chest X-rays in the detection of tiny nodules and reticular shadowing, which might have affected the relationship between the total score and the laboratory/clinical findings. Furthermore, this study was conducted at a tertiary care center; thus, the adult MPP patients seemed to have a greater incidence of underlying respiratory disease in comparison to the typical MPP patients described in previous reports (10) who were usually treated in local hospitals. This might have affected the results of our study.

However, physicians who treat MPP patients have usually recognized that no correlation exists between the extent of lung involvement on chest X-ray and the presence of hypoxemia. The results of the present study are compatible with their position.

CONCLUSION

This study showed that the calculated area of lung abnormalities on chest X-ray films is associated with the clinical findings, including the presence of hypoxemia, in both children and adults with MPP.

Tables:

1. Comparisons of Clinical Characteristics between the Child and Adult MPP Groups.

	Child (n=21)	Adult (n=14)	P value
Age (years)	6.8 ± 3.2	36.5 ± 18.1	p<0.001
M:F	10:11	5:9	NS
Underlying diseases (%)	10.9	22.4	NS
Asthma	7	9	NS
Emphysema	0	1	NS
Lung caner	0	1	NS
BT (°C)	38.3 ± 0.7	37.6 ± 1.2	p=0.02
Hypoxemia (%)	17.9	12.1	NS
Treatment by Azithromycin(%)	50	38.2	NS

2. Pathologic Laboratory Characteristics between the Child and Adult MPP Groups.

	Child (n=21)	Adult (n=14)	P value
WBC (×103/μL)	8.6 ± 5.5	8.4 ± 4.4	NS
CRP (mg/dL)	3.1 ± 3.5	9.1 ± 9.1	p<0.001
LDH (IU/L)	352 ± 132	234 ± 66.2	p<0.001
AST (IU/L)	36.2 ± 14.6	28.2 ± 16.9	p<0.001
ALT(IU/L)	23.9 ± 22.3	22.4 ± 18.2	NS
Diagnostic method			
Single titer (PA≥1:320 or CF≥1:64)	90%	75%	p=0.005
Pair (×4)	8.0%	25	p=0.005

3. Comparisons of Radiological Findings between the Child and Adult MPP Groups.

	Child	Adult	P value
Total number of patients	21	14	
Consolidation	18 (85.7%)	11 (78.6)	NS
Air bronchogram	15 (71.4%)	5 (35.7%)	p=0.003
Reticular shadowing	6 (28.6%)	3 (21.4)	NS
Tiny nodules	5 (23.8)	3 (21.4)	NS
Bronchial wall thickening	7 (33.3%)	2 (14.3)	p=0.02
Atelectasis	2 (9.52)	0 (0)	p=0.01

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