Epidemiology and clinical characteristics of pathogens responsible for the hospitalization of children with segmental/lobar pattern pneumonia

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Research article

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Abstract

Backgrounds: The occurrence of segmental/lobar pattern pneumonia (S/L-PP) in children has recently increased. The pathogens of the disease may change due to the misuse of antibiotics and the application of vaccines. Therefore, pathogens of S/L-PP in hospitalized children and their association with clinical characteristics may have changed. Objective: To analyze the pathogens of S/L-PP in hospitalized children and their association with clinical characteristics. Methods: The current study analyzed the epidemiological and clinical characteristics of pathogens in children with S/L-PP under 14 years old at a single hospital between 1 st Jan 2014 and 31 st Dec 2018 retrospectively. The pathogens were detected by microbial cultivation, and/or indirect immunofluorescence of the kit (PNEUMOSLIDE IgM), and/or ELISA, and/or realtime PCR in the samples of the patients. Results: A total of 593 children with S/L-PP received treatment at a single hospital during the study period by inclusion criteria. 451 (76.05%) patients were single positive for one pathogen and 83 (14.00%) patients had multiple infections. Mycoplasma pneumoniae (M.pneumoniae) (72.34%) was the most frequently identified pathogen, followed by Streptococcus pneumoniae (S.pneumoniae) (8.77%). The infection of M.pneumoniae in children with S/L-PP increased with time ($p<0.05$). The positive rate of M.pneumoniae increased with ages of patients ($p<0.05$). M.pneumoniae was statistically associated with extrapulmonary manifestations while S.pneumoniae was statistically associated with abnormal white blood cells (WBCs) and C reactive proteins (CRPs) ($p<0.05$). Conclusion: M.pneumoniae was the most frequently identified pathogen in children with S/L-PP. The positive rate of M.pneumoniae in children with S/L-PP increased with time and the ages of children. M.pneumoniae was associated with extrapulmonary manifestations while S.pneumoniae was associated with abnormal WBCs and CRPs.

Introduction

Community-acquired pneumonia (CAP) is one of the most common respiratory disorders in children, which often needs hospitalization [1]. Segmental/lobar pattern pneumonia (S/L-PP) is one of the common CAPs in children based on chest radiological findings of consolidation. Patients with S/L-PP often suffer from cough, fever, and even serious complications such as pulmonary atelectasis, pulmonary consolidation, pulmonary necrosis and respiratory failure, increasing the rate of morbidity, mortality as well as the cost of health care. The epidemiology of pathogens of S/L-PP in children may vary with regions, times, antibiotics use, and vaccines. The detection of pathogens often needs several hours or even days. In usual, pediatricians treat patients with antibiotics on experiences. The misuse of antibiotics may prolong the course of the disease, the suffering of patients and even cause more sequelae. Then it was important to understand the pathogen profile of S/L-PP in children and their associations with clinical characteristics.

The occurrence of S/L-PP in children increases with time and has drawn the great attention of patients and doctors. In this research, the pathogens of S/L-PP and their clinical characteristics were retrospectively analyzed in hospitalized children who were admitted to Zibo Central Hospital during 1st Jan 2014 and 31st Dec 2018 as follows.

Patients And Methods

Patients.

Zibo Central Hospital is situated in the central of Shandong Province in China. The hospital serves as a primary source of healthcare for people in Zibo area, which provides about six million people with common economic development and stable infrastructure. In the study, the medical records of children with pneumonia (as defined by the specifications in the International Classification of Diseases, 10th edition, ICD-10 code) who were admitted to Zibo Central Hospital between 1st Jan 2014 and 31st Dec 2018 was retrospectively analyzed.

The pneumonia pattern was characterized according to the World Health Organization Standardization of Interpretation of Chest Radiographs for the diagnosis of CAP in children [2]. Patients were included by the inclusion criteria: 1) Patients had a chest radiograph performed during hospitalization; 2) Patients had a serological test of pathogens detected ≥7 days following the onset of the disease. Patients were excluded according the exclusion criteria: 1) Patients >14 years of age; 2) Patients suffering from known coexisting chronic, progressive or oncological illnesses; 3) Patients had a chest radiograph of pulmonary perihilar linear opacities or reticulonodular infiltrates.

During the study period, a total of 9342 patients were hospitalized and 593 patients with S/L-PP were included in this study. Data including gender, age, clinical signs and symptoms, complications, laboratory and radiological findings, and duration of hospitalization were collected. Microbial cultivation was carried out by culturing and processing with blood or sputum specimens in accordance with standard microbiological procedures. Indirect immunofluorescence of the kit (PNEUMOSLIDE IgM) was used to detect IgM antibodies against *M. pneumoniae*, *respiratory syncytial virus (RSV)*, *chlamydia pneumonia (CP)*, *influenza A virus (IFA)*, *parainfluenza virus (PIVS)*, *adenovirus (ADV)*, *Q fever Coxiella (COX)*, *Legionella pneumophila (LP)*, and *influenza B virus (IFB)* according to the instructions. Specific IgM antibody against *M. pneumoniae* was also assayed in sera samples of patients by ELISA. Realtime PCR was used to dectect *M. pneumoniae* and *Mycobacterium tuberculosis* in the bronchoalveolar lavage fluids of the patients. The patient was determined as pathogen positive if the pathogen was identified by any one of the methods.

Statistical analysis.

The Statistical package for the Social Science for Windows version 11.5 (SPSS, Inc., Chicago, IL, USA) was used for Statistical analyses. Continuous variables are expressed as mean ±standard deviation. For the age of patient may relate to the levels of certain laboratory indices such as erythrocyte sedimentation rate (ESR), white blood cell counts (WBCs) and C-reactive proteins (CRPs) , they were transformed into categorical data (normal or abnormal). Poisson regression was used to evaluate the pathogens distribution over the years and seasons. Other categorical variables were assessed by the Chi-square test while the continuous variables were assessed by the method of t-test. $P<0.05$ was indicated as a statistically significant difference.

Results

Overview of patients

Of 9342 children hospitalized with pneumonia (1752, 1803, 1849, 1885, and 2053) from 1st Jan 2014 to 31st Dec 2018, 593 (6.35%) patients with S/L-PP were enrolled in this study. Among them 398 patients were boys and the rest were girls. The male to female ratio was about 2:1. The age of the patients with S/L-PP ranged from 1 year to 13 years (7.4±3.1years). The percent of patients with S/L-PP among patients with pneumonia each year was 4.91% (86/1752), 5.44% (98/1803), 6.22% (115/1849), 7.27% (137/1885) and 7.65% (157/2053) respectively from 2014 to 2018. The annual incidence of S/L-PP increased with time over the study period (table 1). The duration of fever and cough were 4.6±2.1 days and 10.6±8.7 days respectively. 28.50% (169/593) patients had a gasping and 35.08% (208/593) patients had pulmonary crackles at onset. There were 25.13% (149/593) patients with extrapulmonary manifestations including erythematous maculopapular rash, liver and kidney function lesions, and neurological complications. Only a few patients had pleural effusion. The duration of hospital stay was 15.5±3.1 days. There were 64.59% (383/593) patients with abnormal WBCs, 11.64% (69/593) patients with abnormal ESR and 24.96% (148/593) patients with abnormal CRP. 59 (9.95%) bacteria were identified by blood culture and sputum culture, while the rest of the pathogens were identified by other methods.

Pathogens distribution over time

Table 1 summarized pathogens distribution over time including *M. pneumoniae*, *RSV, CP, IFA, PIVS, ADV, COX, LP, IFB, S.pneumoniae, Staphylococcus aureus (S. aureus), Pseudomonas aeruginosa (P.aeruginosa), Escherichia coli (E.coli), Klebsiella pneumoniae (K.pneumoniae)*, and showed the positive rate of *M.pneumoniae* increases over time. The number of patients infected by *M.pneumoniae* was 43, 67, 96 106, and 117 respectively each year during the study period, and the positive rate of *M.pneumoniae* between the groups over time was significantly different ($p<0.05$). But no significant differences in the positive rate for other pathogens between the groups over time were found ($p>0.05$).

Age distribution of pathogens

Table 2 summarized the distribution of pathogens with age group and showed that the positive rate of *M.pneumoniae* increased with ages. Significant differences were observed in the positive rate of *M.pneumoniae* between the age groups ($p<0.05$). However, no significant differences were found in the positive rate of other pathogens between the age groups ($p>0.05$).

Sex distribution of pathogens

Significant differences were not observed for *M. pneumoniae* and *S.pneumoniae* between male patients and female patients ($p>0.05$). 18 patients were positive for *IFB* including 6 male patients and 12 female ones. Female patients displayed significantly higher positive rate for *IFB* ($p<0.05$). No significant difference was observed for the other pathogens between sex groups ($p>0.05$). (supplemental table 1).

Seasonal distribution of pathogens

In general, the seasonality profile of each individual pathogen was diverse. However, we did not observe a distinct pattern for the pathogens. (supplemental table 2).

Mixed infection types of pathogens

Co-infections with multiple pathogens were common. There were 91 patients in whom 2 or more pathogens were positive, representing 15.34% of the patients, and the types of co-infection were complex. These data indicated that 18.88% (81/429) of the children with *M.pneumoniae* infections were co-infected with other pathogens. 2.53% (15 /593) patients showed infection with 3 pathogens or more. (Table 3)

Association between pathogens and patients' demographic and clinical characteristics

Table 4 summarized the patients' demographic and clinical information found in association with pathogens infection. The patients were divided into 10 groups according to pathogens. Patients with co-infections were excluded. Since the sample size was too small to obtain significance in some statistical analyses, only *M. pneumoniae* and *S.pneumoniae* were included in the statistical analyses. *M.pneumoniae* was statistically associated with extrapulmonary manifestations ($p<0.05$). *S.pneumoniae* was statistically associated with abnormal WBCs and CRPs ($p<0.05$). (Table 5)

Discussion

S/L-PP is one kind of CAPs and a common low respiratory tract infection [3]. The incidence of S/L-PP has recently increased in clinical practice. The considerably serious clinical manifestations including hyperpyrexia, cough and expiratory dyspnea often result in extra pulmonary multi-system complications. Currently there were no standardized therapeutic strategies on pediatric S/L-PP [3]. Although new antibiotics are increasingly developed, no obvious fall in

the morbidity and mortality of S/L-PP has been observed. Generally, patients with S/L-PP often have more severe symptoms than those with no S/L-PP. S/L-PP was more closely related to severe manifestations including pleural effusion, higher rates of fever, extrapulmonary manifestations, abnormal WBCs, abnormal CRPs, bacterial co-infection, as well as longer durations of fever and hospitalization [4]. In our research, the duration of fever and hospitalization of the patients with S/L-PP were 4.6±2.1 days and 15.5±3.1 days, which were similar to the previous report [4]. However, the pathogens distribution of the disease and their association with clinical characteristics in children may change with time and regions. The microbes are difficult to isolate in children with S/L-PP for the difficulties in sputum expectoration and low positive rate of blood culture [5]. Some detection may be positive about a week after the onset of the disease. Therefore, the treatment of the disease based on knowledge and experience is very important. This research described the pathogens and their association with clinical characteristics in the patients with S/L-PP, which can add knowledge and experience of the disease for pedatricians to treat them.

The positive rate of the pathogens in patients with S/L-PP was highly diverse in this research. *M. pneumoniae* was the most frequently identified pathogen. The positive rate of *M. pneumoniae* was 72.34 % (429/593) and increased over time, which suggested *M. pneumoniae* has become the main pathogen of the disease. This was different from the previous report [6-7]. In fact, it is estimated that *M. pneumoniae* infection is accountable for up to 30-40% of CAP [8-11]. The classical radiological manifestations of *M. pneumoniae* pneumonia include segmental/lobar air-space consolidation, diffuse tiny centrilobular nodules and bronchovascular thickening [12-15]. The S/L-PP is considered to account for 17-76.5% of pediatric *M. pneumoniae* pneumonia cases. However, there has been no any type of vaccines approved for use against *M. pneumoniae* presently [20]. The incidence of S/L-PP infected by *M. pneumoniae* has shown an increasing trend [16-19]. *M. pneumoniae* has drawn the great attention of pedatricians and patients. The positive rate of *M. pneumoniae* in patients with S/L-PP increased with ages of children. It was postulated with 2 explanations. First, old patients prefer social activity in herd and chances for them to be infected were high. Second, the progression of the immune system in the patients was different between old patients and young ones. A report suggested that *M. pneumoniae* pneumonia was closely correlated with the immune system of the patients [20]. The different progression state of the immune system between old patients and young ones may be related to the different positive rate of *M. pneumoniae* in the patients. The positive rate of *M. pneumoniae* in male patients was not statistically different from that in female ones, which suggested that *M. pneumoniae* infection was not affected by gender. The patients with S/L-PP infected by *M. pneumoniae* occurred all the year round and didn't vary with the change of seasons. The extrapulmonary complications in patients with S/L-PP infected by *M. pneumoniae* were common and the prevalence of this kind of complication may be up to 26.17 % [4], which was similar to the results in this research. However the complications occurred few in patients infected by other pathogens and was not discussed in the research.

The second positive rate of pathogen in patients with S/L-PP was *S.pneumoniae* and it was 8% in the research. The positive rate of *S.pneumoniae* was much lower than that of *M. pneumoniae*, which was different from the previous understanding [6-7]. It may be associated with the application of *S.pneumoniae* vaccines in China, which can prevent the occurence of *S.pneumoniae* infection [21-24]. The misuse of antibiotics was common in the nation, which can also bring down the infection of *S.pneumoniae*. The microbial cultivation can bring false negative results in some samples. And samples were usually taken after the patients had taken oral or intravenous antibiotics. That may be another reason for the low positive rate of *S.pneumoniae* infection in the study. Compared with other pathogens, *S.pneumoniae* was significantly associated with abnormal WBCs and CRPs, which may be used for the determination of S/L-PP pathogens in clinical practice. However, *M.pneumoniae* and *S.pneumoniae* in children with lobar pneumonia counted for 81.1% of the pathogens in total, which was much higher than that reported by Saraya T [25]. Other pathogens had low positive rate in this research, which was not discussed here.

Some patients were infected by two or more pathogens in the research. Two pathogens co-infection type was the most common one. The common co-infection type of two pathogens was *M. pneumoniae* and *S.pneumoniae*. The co-infection of 3 pathogens or more was less. The association between co-infection of pathogens and their clinical characteristics were not further discussed here for small cases.

The study is also associated with some limitations. First, clinical data were collected from medical records retrospectively, and therefore there may have been some selection bias. Second, the sample size of some samples was not large enough to obtain significance in some statistical analyses. Third, some pathogens may not be found due to the limitation of the detection method. Sputum culture was a low effective method, which made some pathogens unidentified. Indirect immunofluorescence was limited to identifying 9 common atypical pathogens.

In summary, *M. pneumoniae* was the most frequently identified pathogen in the children with S/L-PP. The prevalence of *M. pneumoniae* infection increased with time and ages of children. Old patients are more prone to be infected by *M. pneumoniae*. *M. pneumoniae* was associated with extrapulmonary manifestations while *S.pneumoniae* was associated with abnormal WBCs and CRPs.

List Of Abbrevations

S/L-PP segmental/lobar pattern pneumonia

M.pneumoniae Mycoplasma pneumoniae

S.pneumoniae streptococcus pneumoniae

CAP Community-acquired pneumonia

WBCs white blood cells

CRPs C reactive proteins

RSV respiratory syncytial virus

CP chlamydia pneumonia

IFA influenza A virus

PIVS parainfluenza virus

ADV adenovirus

COX Q fever Coxiella

LP Legionella pneumophila

IFB influenza B virus

ESR erythrocyte sedimentation rate

1. aureus Staphylococcus aureus

P.aeruginosa Pseudomonas aeruginosa

E.coli Escherichia coli

K.pneumoniae Klebsiella pneumoniae

Declarations

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Zibo Central Hospital. Written informed consent was obtained from the guardians of the patients.

Consent for publicaiton

Not applicable

Availability of data and material

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Li yuyun and Wang yanxia conceptualized the study. Li yuyun and Wang yanxia were responsible for data curation, formal analysis and wrote the original draft. Ma liji, Li ying, Zheng yanfei and Zhang xiaoyue were responsible for resources, supervision, validation and visualization. All authors read and approved the final manuscript.

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Tables

Table 1. Pathogen distribution with time in patients with segmental/lobar pattern pneumonia (S/L-PP)

year		2014	2015	2016	2017	2018	p
pneumoniae		1752	1803	1845	1885	2053	
S/L-PP		86（4.91%）	98（5.44%）	115（6.23%）	137（7.27%）	157（7.65%）	
M.pneumoniae	pneumoniae	451(25.74%)	452(23.57%)	523(28.35%)	594(31.51%)	734(35.75%)	
	S/L-PP	43(50.00%)	67(68.37%)	96(83.48%)	106(77.37%)	117(74.52%)	<0.01
RSV	pneumoniae	165(9.42%)	205(11.37%)	209(11.33%)	215(11.41%)	235(11.45%)	
	S/L-PP	5(5.81%)	4(4.08%)	5(4.35%)	3(2.19%)	3(1.91%)	>0.05
CP	pneumoniae	32(1.83%)	49(2.72%)	61(3.31%)	36(1.91%)	52(2.53%)	
	S/L-PP	4(4.65%)	4(4.08%)	4(3.48%)	2(1.46%)	2(1.27%)	>0.05
IFA	pneumoniae	99(5.65%)	131(7.27%)	80(4.34%)	116(6.15%)	152(7.40%)	
	S/L-PP	4(4.65%)	1(1.02%)	3(2.61%)	3(2.19%)	2(1.27%)	>0.05
PIVS	pneumoniae	58(3.31%)	61(3.38%)	42(2.28%)	98(5.20%)	105(5.11%)	
	S/L-PP	6(6.98%)	5(5.10%)	5(4.35%)	6(4.38%)	4(2.55%)	>0.05
ADV	pneumoniae	169(9.65%)	185(10.26%)	145(7.86%)	220(11.67%)	173(8.43%)	
	S/L-PP	5(5.81%)	5(5.10%)	4(3.48%)	4(2.92%)	2(1.27%)	>0.05
COX	pneumoniae	98(5.59%)	73(4.05%)	84(4.55%)	79(4.19%)	112(5.46%)	
	S/L-PP	4(4.65%)	5(5.10%)	5(4.35%)	4(2.92%)	4(2.55%)	>0.05
LP	pneumoniae	39(2.23%)	45(2.50%)	53(2.87%)	71(3.77%)	46(2.24%)	
	S/L-PP	3(3.49%)	3(3.06%)	4(3.48%)	1(0.73%)	1(0.64%)	>0.05
IFB	pneumoniae	102(5.82%)	134(7.42%)	163(8.83%)	218(11.56%)	213(10.38%)	
	S/L-PP	4(4.65%)	4(4.08%)	2(1.74%)	4(2.92%)	3(1.91%)	>0.05
S.pneumoniae	pneumoniae	85(4.85%)	74(4.10%)	90(4.88%)	88(4.67%)	101(4.92%)	
	S/L-PP	11(12.79%)	10(10.20%)	10(8.70%)	11(8.03%)	10(6.37%)	>0.05

Table 2. Age distribution of pathogens in patients with S/L-PP

age	age<6year	6≤age＜14	χ^2	p
n	189	404		
M.pneumoniae	112(59.26%)	317(78.47%)	25.74	<0.01
RSV	9(4.76%)	11(27.23%)	1.64	>0.05
CP	7(3.70%)	9(2.23%)	1.07	>0.05
IFA	4(2.12%)	9(2.23%)	0.05	>0.05
PIVS	7(3.70%)	19(4.70%)	0.31	>0.05
ADV	8(4.23%)	11(27.23%)	0.95	>0.05
COX	6(3.17%)	17(4.21%)	0.37	>0.05
LP	5(2.65%)	7(1.73%)	0.18	>0.05
IFB	8(4.23%)	10(2.48%)	1.35	>0.05
S.pneumoniae	16(8.47%)	36(8.91%)	0.03	>0.05

Table 3. Mixed infection types of pathogens

Co-infection type	number
2 pathogens	76
M.pneumoniae +RSV	5
M.pneumoniae +CP	4
M.pneumoniae +IFA	4
M.pneumoniae +PIVS	7
M.pneumoniae +ADV	4
M.pneumoniae +COX	10
M.pneumoniae +LP	4
M.pneumoniae +IFB	6
M.pneumoniae + S.pneumoniae	20
M.pneumoniae + S. aureus	2
M.pneumoniae + K.pneumoniae	1
M.pneumoniae + E.coli	1
RSV+CP	1
RSV+ E.coli	1
CP+IFA	1
CP+PIVS	1
CP+ADV	1
CP+ S.pneumoniae	1
IFA+LP	1
COX+LP	1
3 pathogens	14
M.pneumoniae +CP+ADV	1
RSV+LP+IFB	1
PIVS+ADV+COX	1
M.pneumoniae +PIVS+ADV	1
M.pneumoniae +CP+ S.pneumoniae	1
M.pneumoniae +RSV+LP	1
M.pneumoniae +CP+IFA	1
M.pneumoniae +ADV+IFB	1
M.pneumoniae +PIVS+COX	1
M.pneumoniae +LP+ S.pneumoniae	1
M.pneumoniae +IFA+ P.aeruginosa	1
M.pneumoniae +ADV+COX	1
M.pneumoniae +RSV+CP	1
M.pneumoniae +IFA+COX	1
4 pathogens	1
M.pneumoniae +IFA+ADV+COX	1

Table 4.Association between pathogens and patients’ demographic and clinical characteristics

variables	M.pneumoniae	RSV	CP	IFA	PIVS	ADV	COX	LP	IFB	S.pneumoniae
N	353	11	7	3	14	8	6	4	8	28
gender										
male	246(69.69%)	10(90.91%)	3(42.86%)	3(100.00%)	10(71.43%)	4(50.00%)	3(50.00%)	2(50.00%)	4(50.00%)	20(71.43%)
female	107(30.31%)	1(9.09%)	4(57.14%)	0(0.00%)	4(28.57%)	4(50.00%)	3(50.00%)	2(50.00%)	4(50.00%)	8(28.57%)
Age(years)	7.8±4.1	8.4±3.1	10.2±2.6	5.4±3.6	6.5±5.2	6.8±4.5	7.6±3.8	8.3±5.2	6.8±3.9	7.9±3.5
fever										
yes	302(85.55%)	8(72.73%)	5(71.43%)	3(100.00%)	10(71.43%)	7(87.50%)	4(66.67%)	3(75.00%)	6(75.00%)	21(75.00%)
no	51(14.45%)	3(27.27%)	2(28.57%)	0(0.00%)	4(28.57%)	1(12.50%)	2(33.33%)	1(25.00%)	2(25.00%)	7(25.00%)
Duration of fever(days)	4.9±2.8	5.7±3.2	3.5±2.6	4.3±3.2	3.8±2.3	4.5±1.9	5.6±2.4	4.1±2.6	4.7±2.6	4.5±2.4
Duration of cough(days)	10.2±6.2	8.6±5.8	13.6±6.5	10.3±6.9	11.8±9.3	8.9±4.3	10.1±6.8	8.2±4.3	9.4±7.6	11.3±6.4
gasping										
Yes	122(34.56%)	3(27.27%)	0(0.00%)	0(0.00%)	1(7.14%)	2(25.00%)	0(0.00%)	0(0.00%)	0(0.00%)	2(7.14%)
No	231(65.44%)	8(72.73%)	7(100.00%)	3(100.00%)	13(92.86%)	6(75.00%)	6(100.00%)	4(100.00%)	8(100.00%)	26(92.86%)
Pulmonary crackles at onset										
yes	120(33.99%)	3(27.27%)	2(28.57%)	0(0.00%)	4(28.57%)	2(25.00%)	2(33.33%)	1(25.00%)	3(37.50%)	9(32.14%)
no	233(66.01%)	8(72.73%)	5(71.43%)	3(100.00%)	10(71.43%)	6(75.00%)	4(66.67%)	3(75.00%)	5(62.50%)	19(67.86%)
Pleural effusion										
Yes	15(4.25%)	2(18.18%)	1(14.29%)	0(0.00%)	1(7.14%)	0(0.00%)	0(0.00%)	0(0.00%)	1(12.50%)	1(3.70%)
no	340(96.32%)	9(81.82%)	6(85.71%)	3(100.00%)	13(92.86%)	8(100.00%)	6(100.00%)	4(100.00%)	7(87.50%)	27(96.43%)
Extrapulmonary manifestations										
Yes	102(28.90%)	0(0.00%)	0(0.00%)	1(33.33%)	2(14.29%)	1(12.50%)	0(0.00%)	0(0.00%)	1(12.50%)	3(10.71%)
Erythematous maculopapular rash	20(5.67%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	2(7.14%)
Liver lesion	46(13.03%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)
Kidney lesion	9(2.55%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)
Neurological complications	79(22.38%)	0(0.00%)	0(0.00%)	1(33.33%)	2(14.29%)	1(12.50%)	0(0.00%)	0(0.00%)	1(12.50%)	1(3.57%)
no	251(71.10%)	11(100.00%)	7(100.00%)	2(66.67%)	12(85.71%)	7(87.50%)	6(100.00%)	4(100.00%)	7(87.50%)	25(89.29%)
WBC										
abnormal	245(69.41%)	5(45.45%)	4(57.14%)	2(66.67%)	6(42.86%)	5(62.50%)	2(33.33%)	2(50.00%)	4(50.00%)	27(96.43%)
normal	108(30.59%)	6(54.55%)	3(42.86%)	1(33.33%)	8(57.14%)	3(37.50%)	4(66.67%)	2(50.00%)	4(50.00%)	1(3.57%)
ESR										
abnormal	36(10.20%)	1(9.09%)	2(28.57%)	0(0.00%)	1(7.14%)	1(12.50%)	0(0.00%)	1(25.00%)	2(25.00%)	3(10.71%)
normal	317(89.80%)	10(90.91%)	5(71.43%)	3(100.00%)	13(92.86%)	7(87.50%)	6(100.00%)	3(75.00%)	6(75.00%)	25(89.29%)
CRP										
abnormal	81(22.95%)	3(27.27%)	2(28.57%)	1(33.33%)	4(28.57%)	3(37.50%)	2(33.33%)	1(25.00%)	3(37.50%)	24(85.71%)
normal	272(77.05%)	8(72.73%)	5(71.43%)	2(66.67%)	10(71.43%)	5(62.50%)	4(66.67%)	3(75.00%)	5(62.50%)	4(14.29%)
Duration of hospitalization (days)	15.8±4.1	14.2±4.3	13.6±5. 8	12.5±3.6	14.9±5.2	15.1±3.7	13.9±6.2	14.7±5.1	14.6±2.4	15.3±4.4

Table 5. Comparison between M.pneumoniae and S.pneumoniae with patients' demographic and clinical characteristics

variables	M.pneumoniae	S.pneumoniae	χ^2	p
N	353	28		
gender				
male	246(69.69%)	20(71.43%)	2.06	>0.05
female	107(30.31%)	8(28.57%)		
Age(years)	7.8±4.1	7.9±3.5	0.13	>0.05
fever				
yes	302(85.55%)	21(75.00%)		
no	51(14.45%)	7(25.00%)	1.5	>0.05
Duration of fever(days)	4.9±2.8	4.5±2.4	0.73	>0.05
Duration of cough(days)	10.2±6.2	11.3±6.4	0.90	>0.05
gasping				
Yes	122(34.56%)	2(7.14%)		
No	231(65.44%)	26(92.86%)	8.88	<0.01
Pulmonary crackles at onset				
yes	120(33.99%)	9(32.14%)		
no	233	19(67.86%)	0.05	>0.05
Pleural effusion				
Yes	15(4.25%)	1(3.70%)		
no	340(96.32%)	27(96.43%)	0.03	>0.05
Extrapulmonary manifestations				
Yes	102(28.90%)	3(10.71%)		
Erythematous maculopapular rash	20(5.67%)	2(7.14%)		
Liver lesion	46(13.03%)	0(0.00%)		
Kidney lesion	9(2.55%)	0(0.00%)		
Neurological complications	79(22.38%)	1(3.70%)		
no	251(71.10%)	25(89.29%)	10.72	<0.05
WBC				
abnormal	245(69.41%)	27(96.43%)		
normal	108(30.59%)	1(3.70%)	9.28	<0.01
ESR				
abnormal	36(10.20%)	3		
normal	317(89.80%)	25(89.29%)	0.06	>0.05
CRP				
abnormal	81(22.95%)	24(85.71%)		
normal	272(77.05%)	4(14.29%)	51.2	<0.01
Duration of hospitalization (days)	15.8±4.1	15.3±4.4	0.62	>0.05

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Supplementaltable2.pdf
- Supplementaltable1.pdf