Association of lung consolidation with clinical prognosis in children with *Mycoplasma pneumoniae* pneumonia: a retrospective study

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Research

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Abstract

Objectives

Lung consolidation is common in patients with *Mycoplasma pneumoniae* pneumonia (MPP). In this study, we aimed to investigate whether this lung lesion associated with the severity and prognosis of MPP.

Methods

Clinical experts reassessed and collected the clinical characteristics, imaging features, and laboratory examination of 752 hospitalized children with MPP who received low-dose computerized tomography (CT) examination between August 2014 and July 2019. We evaluated the impact of lobar consolidation on the fever duration and length of hospital stay using Kaplan-Meier analysis and COX model. The relationship between lobar consolidation and inflammatory markers was also determined, as well as hospital charges.

Results

Among the 752 patients included, 90.3% (679/752) presented lung consolidation, 25.1% (189/752) with 2 or more lobar consolidation, and 16.2% (122/752) patients developed severe MPP (SMPP). Beyond pleural effusion, lobar consolidation had the highest risk of SMPP among low-dose CT imaging-based evidence. Compared with 0 and 1 lobar consolidation, 2 lobes, 3 lobes, and 4 lobes were associated with a 1-fold, 3.1-fold, and 7.5-fold increased risk of SMPP (OR 2.0 [95% CI 1.3–3.2], OR 4.1 [95% CI 2.0–8.5], OR 8.5 [95% CI 2.2–32.6]). The length of stay and fever duration were prolonged correspondingly with increase of number of lobar consolidation, as were hospital charges.

Conclusion

Lobar consolidation is a stable and reliable CT feature for assessing of severity of illness and clinical prognosis for children with MPP.

Background

Mycoplasma pneumoniae pneumonia (MPP), one of the most common respiratory tract infections in children, accounts for 8–37.5% of all community-acquired pneumonia (CAP) cases [1, 2]. Although *M. pneumoniae* infections generally are mild and self-limiting, patients of study has shown about 12% of hospitalized children with MPP required intensive care[3]. Some patients with *M. pneumoniae* may develop extrapulmonary manifestations, such as encephalitis, arthritis, and pericarditis, presenting with a severe clinical course [4, 5]. Hence, early and accurate assessment of the clinical course of MPP is crucial

for patients and clinicians. Usually, chest radiography (CR) is the first-line investigation for patients with suspected CAP. However, it is non-specific for MPP [6–8]. CR fails to demonstrate the details and distribution of lesions, while computed tomography (CT) can clearly show interstitial abnormalities and lobular distribution, such as bronchial wall thickening and reticulonodular or centrilobular nodules, which are common features in patients with MPP [9, 10]. Thus, chest CT is a favourable method for assessing radiological features in cases with MPP, and it can be applied safely in children through reasonable indication and adjustment of scan parameters, such as low-dose CT. Consolidation is more frequent in MPP than in other community-acquired pneumonia on CR, accounting for 33–79% of the cases [10, 11]. However, the association between lobar consolidation and the severity and prognosis of MPP is unclear. To our knowledge, only a few articles are presently available that describe the imaging findings of MPP on CR or chest CT, which primarily consists of large-area or multi-lobe consolidation [12]. The quantitative correlation analysis between consolidation features and the clinical course or prognosis is under-investigated.

Therefore, we aimed to verify consolidation confirmed by low-dose chest CT, as a critical feature with clinical significance in a large sample of patients with MPP; quantitatively evaluate the association between consolidation and the clinical course; thus, ensure that patients receive timely and reasonable treatment.

Methods

Patients

In the period between February 2016 and July 2019, 917 out of 5112 hospitalized children with CAP were diagnosed with MPP in Xinhua Hospital, affiliated to Shanghai Jiao Tong University School of Medicine. MPP was diagnosed based on the following conditions: (i) fever, cough, or auscultatory findings and a pulmonary infiltrate visible on chest imaging; and (ii) *M. pneumoniae* DNA detected in nasopharyngeal secretions by polymerase chain reaction or ≥ 4 -fold changes in *M. pneumoniae* IgM and IgG antibody titre between paired acute and convalescent sera, according to the Infectious Diseases Society of America guidelines of 2018 [13, 14]. Patients with mixed infection, immunodeficiency, and congenital diseases were excluded. Finally, 752 patients with MPP who underwent low-dose CT were included in the study. The workflow is displayed in Figure 1. This retrospective study was approved by the Institutional Ethics Committee of our hospital, and informed consent was obtained.

General, clinical, and laboratory characteristics

General information, clinical symptoms, and laboratory examination were re-evaluated by infectious specialists who reviewed the clinical records of patients enrolled in this study: general characteristics, including sex and age; clinical symptoms, including duration of fever prior to and after admission (days), total duration of fever (days), length of stay (days), rash, neurological symptoms, encephalitis, hypoxemia, treatment in intensive care unit, and death; and laboratory indices such as lactate

dehydrogenase (LDH) and interleukin 2-receptor (IL-2R), as well as C-reactive protein (CRP) level at the time of admission.

Image analyses

Low-dose CT examinations were performed using 64-detector row CT (Brilliance iCT, Philips) [15]. Evaluation of CT features, including consolidation, bronchial wall thickening, nodules, ground glass attenuation, interstitial reticulation opacities, bilateral pneumonia, atelectasis, lymphadenopathy, and pleural effusion, were guided by expert consensus from a Delphi study on image assessment of patients with MPP [9, 7, 8, 10, 16] (Figure 2). Based on the related features of consolidation, all patients were further evaluated for the following features: the number of lobe consolidation, location of lobar consolidation (upper, middle, or lower right lung lobe; upper or lower left lung lobe), and the occurrence of consolidation without air bronchograms. Two chest radiologists independently assessed the CT images of each patient. Consensuses reached by both of them were as the final appraisal reports. Disagreements were resolved by consulting a third chest radiologist with 12 years of experience.

Each patient's medical history was re-evaluated by an adjudication experts committee including paediatricians, radiologists, and infection specialists. Severe pneumonia was assessed according to the guidelines by the Paediatric Infectious Diseases Society and Infectious Diseases Society of America on the management of CAP in infants and children older than three months [17]. Refractory pneumonia was defined as prolonged fever, worsening of clinical symptoms, emergence of extrapulmonary complications, and deteriorating radiological findings, despite administration of appropriate macrolide therapy ≥ 7 days [18].

Statistical analyses

Categorical variables are expressed with n (%) and continuous variables are presented as median (interquartile range [IQR]). Differences in clinical and radiological variables in children with MPP were assessed using Chi-squared test for Categorical variables and *t* test or Mann-Whitney *U* test for continuous variables. Spearman's method was used to analyse the association between lobar consolidation and laboratory indices. Logistic regression analyses were then performed to assess the correlation between lobar consolidation and the clinical course. The association between lobar consolidation category and prognosis, including fever duration after admission and length of hospital stay, was assessed using Kaplan–Meier estimates, and using Cox proportional-hazard models to calculate hazard ratios (HRs) with 95% confidence. $P < 0.05$ indicated a statistically significant difference. Statistical analyses used R (<https://www.R-project.org>, R foundation for Statistical Computing, Vienna, Austria).

Results

Of the 5112 patients with a diagnosis of CAP during the study time frame, 752 patients met eligibility criteria and were included in the study cohort (Figure 1), 122 of 752 patients (16.2%) had SMPP (Table 1).

Most patients were pre-school and school-aged children. Patients with SMPP were more likely to have neurological symptoms, encephalitis, hypoxemia, refractory pneumonia and receive treatment in intensive care unit, and they had higher LDH, IL-2R, and CRP levels. Furthermore, patients with SMPP also tended to have longer median fever duration after admission, total fever duration, length of hospital stay (median 3.0 [IQR 2.0-4.0], 9.0 [IQR 7.0-12.0], and 9.0 [IQR 7.0-12.0] respectively) than those without SMPP.

Consolidation was present in 90.3% (679/752) of children with MPP, and this rate was the second only to that of bronchial wall thickening (93.2%) (Table 2). The proportions for one, two, three, and four lobar consolidations were 65.1%, 19.3%, 4.7%, and 1.2%, respectively. Pleural effusion and atelectasis were observed in 15.8% and 9.7% of patients with MPP. Compared with zero and one lobar consolidations, two, three, and four lobes were associated with a 1-fold, 3.1-fold, and 7.5-fold increased risk of SMPP (OR 2.0 [95% CI 1.3–3.2], OR 4.1 [95% CI 2.0–8.5], OR 8.5 [95% CI 2.2–32.6]). The presence of consolidation without air bronchogram was an independent risk factor for SMPP (OR 3.7 [95% CI 2.3–6.0]). Patients with atelectasis had a significantly higher rate of SMPP (OR 3.9 [95% CI 2.3-6.6]), compared with those without. The presence of lymphadenopathy was associated with SMPP (OR 1.6 [95% CI 1.1–2.4]).

The consolidation rates were 86.6%, 92.6%, 90.2%, 88.5% in patients with fever durations of ≤ 3 days, 3-6 days, 6-9 days and >9 days before admission. There was little change in the proportions of the lobar consolidation subclasses over the duration of fever prior to admission (Figure 3). Levels of inflammatory markers, such as LDH, IL-2R, and CRP, consistently rose with lobar consolidation class (Figure 4).

In the Kaplan-Meier analysis (Figure 5), the risk of fever duration significantly increased with increasing lobar consolidation ($P = 0.0025$), as well as the length of stay ($P < 0.0001$). The more of consolidation lobar were associated with longer hospital length of stay, with the longest time observed for 4 lobar consolidation (HR 0.17 [95% CI 0.08–0.33]), followed by 3 lobar consolidation (HR 0.31 [95% CI 0.21–0.47]), then 2 lobar consolidation (HR 0.36 [95% CI 0.21–0.47]) and 1 lobar consolidation (HR 0.42 [95% CI 0.33-0.54]) (Table 3). Similarly, the same trends were observed for the time to defervescence. An increasing number of lobar consolidations leads to a gradual increase in costs, including hospital charges, laboratory tests, imaging costs, and medications (Table 4).

Discussion

In our large sample study, consolidation was a stable and reliable feature in assessing disease severity and prognosis in patients with MPP. Lobar consolidation was independently associated with a higher risk of SMPP, longer fever duration and length of stay, and higher costs. These results demonstrated that an increased number of lobar consolidations could predict the severity of MPP and significantly enhance the accuracy of clinical outcome prediction in patients with MPP at an early stage.

Radiographic manifestations of MPP vary, including bronchial wall thickening, reticulonodular, segmental and lobar consolidations, atelectasis, hilar lymphadenopathy, and pleural effusion. Of these, consolidation as a CT feature presents a homogeneous increase in lung parenchymal attenuation that obscures the margins of vessels and airway walls [12]. In this study, consolidation was the second most

common imaging feature and had good stability in evaluating the MPP course. The incidence of consolidation was up to 86.6% in patients with duration of fever ≤ 3 days, and 88.5% for duration of fever > 9 days. In other words, the rate of consolidation was quite high in the early stages of infection and did not increase significantly with an increase of fever duration before admission, which may be relevant to type II hypersensitivity. Furthermore, we found that an increased number of lobar consolidations was associated with higher odds of SMPP. As a previous literature has reported, patients with consolidations were more likely to have hypoxia, tachypnoea, tachycardia, and extrapulmonary manifestations, which indicate severe pneumonia in children, than those without consolidation on CR [12]. However, to our knowledge, no study has investigated the association between the number of lobar consolidations and SMPP. This is the first study to achieve a quantitative evaluation of consolidation, which is superior to the previous vague assessments of large-area and multilobe consolidations.

Inflammatory cytokines were involved in the immunopathogenesis of *Mycoplasma pneumoniae* infection [14, 19]. In our study, we found a positive correlation between lobar consolidation and LDH, IL-2R, and CRP levels in children with MPP, which is consistent with the findings of previous studies [12,14].

Mycoplasma pneumoniae attach to the ciliated epithelial cells on the respiratory tract through the P1 protein, exerting cytotoxicity by expression of community-acquired respiratory distress syndrome and production of hydrogen peroxide, then activating host immunity, including macrophages, mast cells, neutrophils, and natural killer cells, as well as T and B lymphocytes and humoral immune responses [20]. Cell-mediated immunological responses play an important role in the development of MPP. In SMPP, the immune response is exaggerated, and interleukin levels are elevated, resulting in diffuse alveolar damage with fibrinous exudates within the alveolar lumens histopathologically, which was correlated with consolidation on CT [21].

The association of multilobar involvement with prognosis has been previously investigated in some studies [12, 22, 23]. Patients with more lobar consolidations experienced longer fever duration, length of stay and higher costs, which are consistent with the results of this study. Some previous studies suggested that prolonged fever duration was associated with MP macrolide resistance [24,25]. We investigated the presence of macrolide-resistant genes through convenience sampling and found that almost MP were shown to have an A-to-G transition mutation at position 2063 in the 23S rRNA genes. Meanwhile, one study revealed that the presence of homogeneous lobar consolidation was responsible for prolonged fever ≥ 7 days after the initiation of macrolides regardless of macrolide resistance. Hence, quantitative analysis of consolidation can be more accurate in predicting the clinical course of MPP and guide rational clinical medication, with major clinical significance.

Clinicians are cautious about using CT in children because of the problem of radiation dose. First, we used a low-dose CT assessment of MPP in this study. According to scans parameters, when patients weigh < 20 kg, the patient absorbs about 0.4–0.8 millisieverts (mSv) of radiation, equivalent to the dose of 4–8 chest radiographs, and when patients weigh 20 kg to 60 kg, the patient absorbs about 0.7–1.6 mSv, equal to the dose of 7–16 chest radiographs [26]. Therefore, low-dose CT scans ensure safe radiation doses in children. Second, in contrast to the 33–79% incidence of consolidation currently

reported [10, 11], our results showed that the proportion of patients with consolidation was up to 90.3%, which is attributed to the superiority of CT over X-ray for demonstrating lesion patterns and lung anatomy [7]. Consolidation of a large area or an entire lobe can be clearly observed on CR and CT, while patchy consolidation indicative of bronchopneumonia on CT may manifest as a non-consolidative feature on CR. Additionally, we performed quantitative evaluation of consolidation. It was evident that the quantification of consolidation by CR was not achievable. Finally, low-dose CT is recommended for assessment when patients fail to respond to treatment, had severe complications suggested by CR, or when there is a need to exclude HIV infection and tuberculosis [15]. CT examination is an important and indispensable method. Thus, using low-dose CT can not only ensure safety but also improve the validity of assessment. Low-dose CT is recommended for children with MPP with poor efficacy or requiring differential diagnoses.

Our study has some limitations. First, this study was conducted retrospectively, and therefore analysis was limited to the patient's available medical records. Second, we are unable to obtain the patients' lung pathological specimens, as a result, the correlation analysis between imaging and pathology could not be performed. Considering the repeatability and operability of the study, CT is a non-invasive examination that can best reflect the actual pathological condition. Third, as the present study was performed at a tertiary hospital, patients may present with more severe diseases than are usually admitted in primary or secondary hospitals; however, the presented associations among evaluated variables are still present and convincing.

Conclusions

Our findings showed that consolidation is a stable and reliable CT feature for evaluating MPP. Quantitative analysis of lobar consolidation can comprehensively and accurately assess and predict the clinical course of MPP. Low-dose CT examination is recommended for complex and severe hospitalized children with MPP.

Abbreviations

MPP *Mycoplasma pneumoniae* pneumonia; CT computed tomography; CR chest radiography; CAP community-acquired pneumonia; SMPP severe MPP; LDH lactate dehydrogenase; IL-2R interleukin 2-receptor (IL-2R), CRP C-reactive protein; IQR interquartile range;

Declarations

Ethics approval and consent to participate

This retrospective study was approved by the Institutional Ethics Committee of our hospital, and informed consent was obtained from the participants.

Consent for publication

All the authors consent to the publication of this manuscript.

Availability of data and materials

The data and any material can be shared.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

CC and LW designed the study and undertook most of the work, they should be regarded as co-first author. HL, SX, LZ, QL, XZ, WZ, WL and LH participated in data collection and analysis. All authors have contributed to the last version of the manuscript. The authors read and approved the final manuscript.

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Tables

Table 1. Characteristics of children with *Mycoplasma pneumoniae* pneumonia stratified by severe *Mycoplasma pneumoniae* pneumonia (SMPP) (n = 752).

Variables	Non-SMPP (n = 630)	SMPP (n = 122)	P-value
General characteristics			
Male	298 (47.3)	56 (45.9)	0.78
Age, years	5.0 (3.0-7.0)	6.0 (4.0-7.0)	0.07
Clinical signs			
Duration of fever prior admission, days	6.0 (5.0-8.0)	7.0 (5.0-8.0)	0.82
Rash	2 (0.3)	0 (0.0)	0.53
Neurological symptoms	0 (0.0)	9 (7.4)	< 0.01
Encephalitis	0 (0.0)	2 (1.6)	0.01
Hypoxemia	0 (0.0)	12 (9.8)	< 0.01
Refractory pneumonia	164 (26.0)	61 (50.0)	< 0.01
Treatment in intensive care unit	0 (0.0)	7 (5.7)	< 0.01
Death	0 (0.0)	0 (0.0)	-
Laboratory indicators			
LDH, U/L	328.5 (282.8-390.2)	422.0 (332.0-588.0)	< 0.01
IL-2R, U/mL	961.5 (711.0-1274.5)	1371.5 (972.5-1985.2)	< 0.01
CRP, mg/L	11.0 (4.0-22.0)	18.0 (8.0-39.5)	< 0.01
Clinical outcomes			
Duration of fever after admission, days	1.0 (0.0-3.0)	3.0 (2.0-4.0)	< 0.01
Total fever duration, days	8.0 (6.0-10.0)	9.0 (7.0-12.0)	< 0.01
Length of hospital stay, days	6.0 (5.0-8.0)	9.0 (7.0-12.0)	< 0.01

LDH, lactate dehydrogenase; IL-2R, interleukin-2 receptor; CRP, C-reactive protein.

Male, rash, neurological symptoms, encephalitis, hypoxemia, refractory pneumonia, treatment in intensive care unit, and death are presented as n (%); the rest of the variables are indicated as median (25th-75th percentiles).

Table 2. Association of computed tomography features with severe *Mycoplasma pneumoniae* pneumonia (SMPP) (n = 752).

CT Characteristics	Non-SMPP (n = 630)	SMPP (n = 122)	OR (95% CI)	P- value	OR ^a (95% CI)	P- value ^a
Consolidation	557 (88.4)	122 (100.0)				
Number of lobar consolidation						
0 and 1 lobe	491 (77.9)	72 (59.0)	1.0		1.0	
2 lobes	113 (17.9)	32 (26.2)	1.9 (1.2, 3.1)	0.01	2.0 (1.3, 3.2)	< 0.01
3 lobes	22 (3.5)	13 (10.7)	4.0 (1.9, 8.4)	< 0.01	4.1 (2.0, 8.5)	< 0.01
4 lobes	4 (0.6)	5 (4.1)	8.5 (2.2, 32.5)	< 0.01	8.5 (2.2, 32.6)	< 0.01
Location of consolidation						
Upper lobe, right lung	109 (17.3)	34 (27.9)	1.8 (1.2, 2.9)	0.01	1.9 (1.2, 2.9)	0.01
Middle lobe, right lung	170 (27.0)	47 (38.5)	1.7 (1.1, 2.5)	0.01	1.8 (1.2, 2.7)	0.01
Lower lobe, right lung	156 (24.8)	40 (32.8)	1.5 (1.0, 2.3)	0.07	1.4 (0.9, 2.1)	0.13
Upper lobe, left lung	144 (22.9)	30 (24.6)	1.1 (0.7, 1.7)	0.68	1.1 (0.7, 1.7)	0.68
Lower lobe, left lung	147 (23.3)	45 (36.9)	1.9 (1.3, 2.9)	< 0.01	1.9 (1.3, 2.9)	< 0.01
Consolidation without air bronchogram	54 (9.7)	35 (28.7)	3.7 (2.3, 6.1)	< 0.01	3.7 (2.3, 6.0)	< 0.01
Bilateral pneumonia	339 (53.8)	74 (60.7)	1.3 (0.9, 2.0)	0.17	1.4 (0.9, 2.1)	0.11
Pleural effusion	15 (2.4)	104 (85.2)	236.9 (115.8, 484.7)	< 0.01	245.2 (117.9, 510.1)	< 0.01
Atelectasis	45 (7.1)	28 (23.0)	3.9 (2.3, 6.5)	< 0.01	3.9 (2.3, 6.6)	< 0.01
Lymphadenopathy	226 (35.9)	59 (48.4)	1.7 (1.1, 2.5)	0.01	1.6 (1.1, 2.4)	0.01
Bronchial wall thickening	588 (93.3)	113	0.9 (0.4,	0.78	0.9 (0.4,	0.85

		(92.6)	1.9)		2.0)	
Nodules	313 (49.7)	73 (59.8)	1.5 (1.0, 2.2)	0.04	1.5 (1.0, 2.2)	0.06
Ground-glass attenuation	478 (75.9)	83 (68.0)	0.7 (0.4, 1.0)	0.07	0.7 (0.4, 1.0)	0.08
Interstitial reticulation opacities	193 (30.6)	47 (38.5)	1.4 (0.9, 2.1)	0.09	1.4 (0.9, 2.1)	0.10

OR and 95% CI intervals are presented to show the association between patients with CT characteristics and SMPP, as compared with patients without such CT characteristics.

^aAdjusted for age and sex.

CT, computed tomography; SMPP, severe *Mycoplasma pneumoniae* pneumonia; OR, Odd Ratio; CI: confidence interval.

Table 3. Clinical outcome of patients with MPP stratified by the number of lobar consolidation based-CT.

Number of lobar consolidation	Endpoint 1: Time to Hospital Discharge (Days)			Endpoint 2: Time to Defervescence (Days)		
	n (%)	Hazard Ratio ^a (95% CI)	P-value	n (%)	Hazard Ratio ^a (95% CI)	P-value
0 lobe of consolidation	73 (9.7)	Ref	-	38 (7.2)	Ref	-
1 lobe of consolidation	490 (65.2)	0.42 (0.33, 0.54)	< 0.01	346 (65.8)	0.64 (0.46, 0.89)	0.01
2 lobes of consolidation	145 (19.3)	0.36 (0.27, 0.48)	< 0.01	107 (20.3)	0.57 (0.39, 0.82)	< 0.01
3 lobes of consolidation	35 (4.7)	0.31 (0.21, 0.47)	< 0.01	28 (5.3)	0.52 (0.32, 0.84)	0.01
4 lobes of consolidation	9 (1.2)	0.17 (0.08, 0.33)	< 0.01	7 (1.3)	0.28 (0.12, 0.62)	< 0.01

MPP: *Mycoplasma pneumoniae* pneumonia; CT, computed tomography;

Data are presented as No. (%). OR = odds ratio; CI, confidence interval. All OR calculations were made using $\leq 75^{\text{th}}$ -percentile value data as a reference.

^a Adjusted for age, sex.

Table 4. Cost comparison in individuals stratified by number of lobar consolidation.

Number of lobar consolidation	0 N = 73	1 N = 490	2 N = 145	3 N = 35	4 N = 9	P- value
Hospital charges, \$	1022.6 (846.7- 1133.3)	1535.8 (1110.5- 1964.5)	1675.5 (1135.9- 2138.1)	1552.6 (1232.0- 2303.5)	2513.4 (1788.2- 3097.2)	<0.001
Laboratory tests, \$	414.3 (333.4- 542.5)	627 (396.5- 816.6)	611 (400.9- 816.6)	609.8 (409.0- 830.0)	834.6 (518.8- 951.7)	<0.001
Imaging costs, \$	67.7 (38.5- 84.2)	107.7 (64.6- 128.3)	104.9 (66.2- 127.8)	117.5 (73.5- 128.3)	128.3 (105.4-151)	<0.001
Medication, \$	206.2 (151- 282.4)	345.5 (238.2- 488.3)	389.4 (259.2- 545.7)	413.9 (267.5- 648.1)	554.7 (353.4- 1143.1)	<0.001

Data are presented as median (25th–75th percentile).

Figures

Figure 1

Flow diagram for generation of the study population.

Figure 2

Various chest CT features in patients with *Mycoplasma pneumoniae* pneumonia, including nodules (A), bronchial wall thickening (B), ground-glass attenuation (C), lobar consolidation (D) and pleural effusion (A-D).

Figure 3

The proportions of lobar consolidation in children with *Mycoplasma pneumoniae* pneumonia stratified by fever duration before admission (n = 752).

Figure 4

Mean concentrations of serum lactate dehydrogenase (LDH) (A), interleukin-2R (IL-2 R) (B), and C-reactive protein (CRP) (C) in patients with lobar consolidation from 0 to 4 lobes.

Figure 5

Kaplan–Meier analysis of fever duration after admission (A) and length of hospital stay(B) according to the number of lobar consolidation.