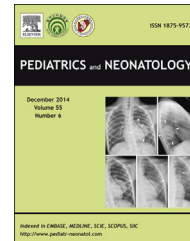




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CASE REPORT

## Pediatric Round Pneumonia



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“Round pneumonia” or “spherical pneumonia” is a well-characterized clinical entity that seems to be less addressed by pediatricians in Taiwan. We herein report the case of a 7-year-old boy who presented with prolonged fever, cough, and chest X-rays showing a well-demarcated round mass measuring  $5.9 \times 5.6 \times 4.3$  cm in the left lower lung field, findings which were typical for round pneumonia. The urinary pneumococcal antigen test was positive, and serum anti-*Mycoplasma pneumoniae* antibody titer measurement using a microparticle agglutination method was 1:160 (+). After oral administration of antibiotics including azithromycin and amoxicillin/clavulanate, which was subsequently replaced by ceftibuten due to moderate diarrhea, the fever subsided 2 days later and the round patch had completely resolved on the 18th day after the diagnosis. Recent evidence suggests treating classical round pneumonia with antibiotics first and waiving unwarranted advanced imaging studies, while alternative etiologies such as abscesses, tuberculosis, nonbacterial infections, congenital malformations, or neoplasms should still be considered in patients with atypical features or poor treatment response.

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## 1. Introduction

Pneumonia is a common disease in children that has caused much burden to patients, families, and health-care systems. In Taiwan, the average annual incidence of patients hospitalized with pneumonia was 1240 with 6.7 mortalities per 100,000 children younger than 18 years of age, costing NT\$1,475,000,000 (about US\$49 million) per year.<sup>1</sup> Occasionally, a child may develop an opaque pulmonary consolidation with unusually round shape, which raises the concern of a tumor in the chest, causing anxiety to the pediatrician and parents. Herein, we report the case of a patient with so-called “round pneumonia”, whose initial chest X-ray (CXR) findings mimicked those of a lung mass, but subsequently showed complete response to oral antibiotics alone. Recent findings and recommendations in the literature are also reviewed.

## 2. Case Report

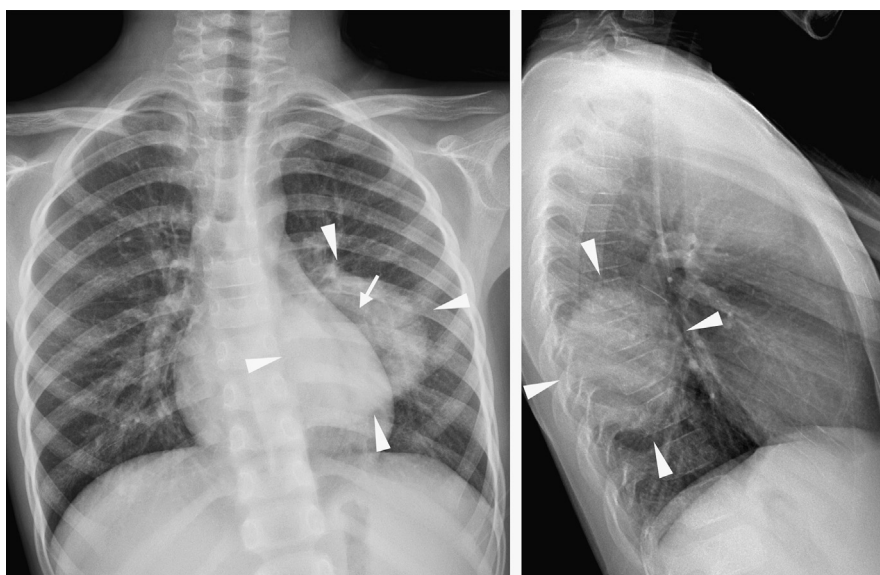
A 7-year-old boy was referred to the emergency room (ER) of a regional hospital due to intermittent fever for 4 days. He had had dry cough for 3 weeks, intermittent abdominal pain in the periumbilical area for 2 days, and vomiting once on the day of arrival. He also had decreased appetite but with excellent activity. There was no history of systemic diseases. The patient’s weight was 20 kg (3<sup>rd</sup>%; dropped 1 kg during the recent year), and his height was 119.6 cm (15–50<sup>th</sup>%).

On examination, this child had intact throat and tympanic membranes, several small and soft lymph nodes over bilateral anterior cervical triangles, clear lung sound, regular heart beat with no murmurs, epigastric tenderness, and warm extremities with prompt capillary refilling. CXRs showed a round-shaped opacity with clear margins in the left lower lobe (LLL) and the retrocardiac region, measuring

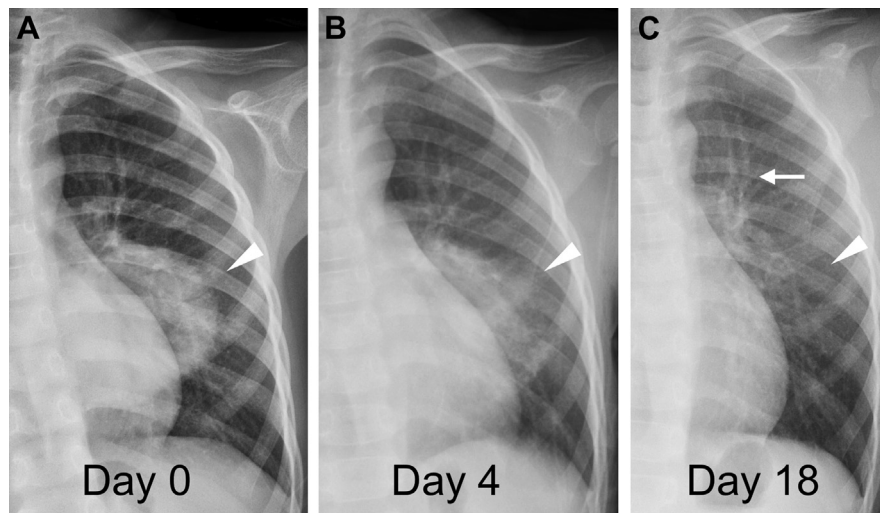
5.9 × 5.6 × 4.3 cm in size (width × height × depth). There were also mild streaking infiltrates in bilateral lower lung fields, especially the perihilar regions, while no pleural effusion was noted (Figures 1 and 2A). Laboratory data showed a white blood cell count of 9800/μL with left shift (metamyelocyte 5%, band-form 5%, segmented neutrophils 68%, lymphocytes 7%, atypical lymphocytes 1%, and monocytes 14%), a hemoglobin level of 11.5 g/dL, platelets count of 173 × 10<sup>3</sup>/μL, a C-reactive protein level of 8.7 mg/dL, with normal electrolytes, blood sugar, lactate dehydrogenase, and uric acid levels, renal and liver function tests, and peripheral blood smear. Under the working diagnosis of round pneumonia, the patient was suggested to be hospitalized and undergo antimicrobial therapy. However, due to family reasons, his mother requested that he be treated as an outpatient. His subjective abdominal pain had improved after an enema and intravenous administration of metoclopramide, and he was discharged and given oral amoxicillin/clavulanate (87.5 mg amoxicillin/kg/day) and azithromycin (10 mg/kg/day).

Two days later, the patient had become afebrile, but was still coughing badly and developed moderate diarrhea at home. On the 4<sup>th</sup> day after diagnosis, the LLL opacity had become smaller and less dense (Figure 2B). Further results of laboratory tests obtained at the ER showed serum anti-*Mycoplasma pneumoniae* antibody titer measurement to be 1:160 (+), rapid urinary antigen test for *Streptococcus pneumoniae* to be positive, and no bacterial growth on blood culture. Azithromycin was extended to a 5-day course, and amoxicillin/clavulanate was replaced with cefibuten due to antibiotic-associated diarrhea.

Three days later, or on the 7<sup>th</sup> day after the first ER visit, the patient reported that both his cough and diarrhea had improved. Cefibuten was continued to complete a 7-day course. On the 18<sup>th</sup> day after his first ER visit, follow-up CXRs showed complete resolution of the LLL lesion (Figure 2C), and serum anti-*M. pneumoniae* antibody titer



**Figure 1** Chest X-rays at presentation showed a well-demarcated round opacity in the left lower lung field (arrowheads). Note the apparent air bronchogram on the posteroanterior view (arrow).



**Figure 2** Serial follow-up of chest X-rays (A) at presentation and (B) on the 4<sup>th</sup> and (C) 18<sup>th</sup> days after the first visit. Note the gradual resolution of round pneumonia (arrowheads) after antibiotic treatment, although the last film still showed residual interstitial infiltrations and peribronchial thickening of the left upper bronchus, suggesting residual inflammation (arrow).

measurement remained at 1:160 (+). A follow-up complete blood count test showed that the white blood cell count had decreased to 5800/ $\mu$ L, with neutrophils constituting 39.1%, lymphocytes 51.3%, and monocytes 8.1%.

### 3. Discussion

Round pneumonia, also called spherical pneumonia, has been recognized since the 1970s as a clinical entity that usually occurs in children.<sup>2</sup> Young children are predisposed to round pneumonia because of their underdeveloped pores of Kohn and Lambert's channels that may cause the centrifugal spread of fluid or bacteria.<sup>3</sup> In a recent large study involving 109 children with round pneumonia, the consolidations tended to be solitary, have well-defined borders, and were located posteriorly and in bilateral lower lobes (63%),<sup>4</sup> which exactly matched the initial radiographic findings in our patient (Figure 1). Although the exact term "round pneumonia" does not seem to be widely used by pediatricians in Taiwan, a previous study identified typical imaging features in 5% (2/39) of children with mycoplasmal pneumonia, whose lesions had been described as "nodular or mass-like opacification".<sup>5</sup>

The diagnosis of classical round pneumonia in children should be kept straightforward. In comparison to that in adults, in whom neoplastic diseases such as bronchogenic carcinoma are more common and pneumonia only comprises less than 1% of "coin lesions", round pneumonia in children is likely to represent a benign process.<sup>6</sup> With the typical clinical presentation and radiographic appearance, misdiagnosis of round pneumonia is unlikely, and unwarranted additional imaging should be avoided.<sup>3</sup> Computerized tomography (CT) of the chest is recommended when (1) the clinical features are not consistent with pneumonia, (2) the round opacity does not resolve after appropriate antibiotic treatment, or (3) there are radiographic signs of a nonpulmonary origin on CXR.<sup>3</sup>

Round pneumonia is most commonly caused by *S. pneumoniae*<sup>3</sup> and may rarely be caused by other bacteria,<sup>4</sup> while viral etiology such as severe acute respiratory syndrome has also been seen in adults.<sup>7</sup> In our patient, although the initial blood culture was negative, results of a urinary antigen test revealed the presence of *S. pneumoniae*. As Taiwanese children's nasopharyngeal carriage rate of pneumococcus has decreased to approximately 10% with the advent of conjugate vaccines,<sup>8</sup> urinary antigen positivity nowadays may serve as a reliable indicator of recent pneumococcal disease. By contrast, mycoplasmal pneumonia is prevalent in children older than 2–5 years of age,<sup>9</sup> and its diagnosis in most clinical laboratories relies solely on serology.<sup>10</sup> The patient's sera were tested with a microparticle agglutination assay (FTI Serodia Myco II; Fujirebio Taiwan Inc., Taoyuan, Taiwan), which detects both IgG and IgM simultaneously. The test was considered positive when the acute- and convalescent-phase sera showed a fourfold or higher increase in antibody titer, or when one sera had an antibody titer measurement of at least 1:160 (+),<sup>11,12</sup> as was the case in our patient. The test kit had a sensitivity of 48.1% and specificity of 86.9%,<sup>12</sup> thereby indicating a high likelihood of concomitant *M. pneumoniae* infection in this child. However, neither imaging studies nor laboratory data can perfectly distinguish these two pathogens, and mixed infections are not uncommon in children with community-acquired pneumonia.<sup>8,13</sup> Therefore, combination therapy was given to treat both pathogens.

The differential diagnoses of pediatric round pneumonia include fungal infection, lung abscess, tuberculosis, pulmonary malformations (sequestration, congenital cystic adenomatoid malformation, and bronchogenic cyst), neoplasms (lymphoma, neuroblastoma, and chest wall tumors), and diaphragmatic hernia. Their clinical and radiographic characteristics have been thoroughly reviewed.<sup>3,14</sup> The normal results of lactate dehydrogenase, uric acid, liver function tests, and peripheral blood smear in our patient suggested a very low likelihood of malignancy. Meanwhile, the patient's good clinical condition permitted a

therapeutic trial with oral antibiotics. As the lesion resolved completely after oral antibiotic use (Figure 2), the diagnosis of round pneumonia was confirmed, and therefore a chest CT was not indicated. Of note, with the recent emergence of macrolide-resistant *M. pneumoniae*,<sup>15</sup> mutation analysis may be considered in patients with poor improvement despite adequate antibiotic treatment.

In conclusion, we have presented a typical case of pediatric round pneumonia with probable *S. pneumoniae* and *M. pneumoniae* infections. Recent evidence suggests treating classical round pneumonia with antibiotics first and waiving unwarranted advanced imaging studies, while abscesses, tuberculosis, nonbacterial infections, congenital malformations, or neoplasms should still be considered in patients with atypical features or poor treatment response.

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