Teaching Case of the Month

“Round Pneumonias”

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Introduction

Round pneumonia is a term referring to round or oval densities on chest X-ray (CXR). Round pneumonias have been rarely reported. First recognized in children, round pneumonias were due to S. pneumoniae or H. influenzae. Round pneumonias are probably frequently undiagnosed in the adult population. The appearance of a “round pneumonia” on CXR may be round or oval, the borders may be smooth or lobulated. Round pneumonias may be accompanied by air bronchograms and are usually located in the lower lobes of the lung. Most round pneumonias are small and solitary but others are multiple and may be larger. Cavitation is not a usual feature of round pneumonias. Infiltrates may contain calcifications or be spiculated. There are many potential causes of round pneumonia, some of which are infectious and others are mimics or pneumonia. In adults the usual diagnostic challenge of round pneumonias is to differentiate bacterial pneumonia from bronchogenic carcinomas.1,2

Case Summary

A 50 year-old male presented to his primary care physician with cough, fever, malaise, myalgias, and shortness of breath that began one week before admission. He reported no recent travel, sick contacts, animal contacts, or environmental exposures. His past medical history included hypertension and schizophrenia well-controlled on medication. His physician performed a chest x-ray (CXR) in the office, which was abnormal and he was referred to our institution for diagnostic work-up.

Vital signs revealed a temperature of 100.2 °F, a pulse 108/min, a blood pressure of 137/71 mm/Hg and a respiratory rate of 18/min. His physical examination was unremarkable except for tachycardia and right upper lobe rales.
Complete blood count revealed a WBC count of 14.4 K/mm$^3$, a hemoglobin of 9.9 g/dL, a hematocrit of 28.9 %, and platelet count was 406 K/mm$^3$. The erythrocyte sedimentation rate (ESR) was 104 mm/hr. Serum ferritin level was 407 ng/mL (n = 14-235 ng/mL), alanine aminotransferase (ALT/SGPT) was 22 IU/L (n = 4-36 IU/L), aspartate aminotransferase (AST/SGOT) 22 IU/L (n = 13-39 IU/L), and alkaline phosphatase 55 IU/L (n = 25-100 IU/L). Procalcitonin level was 0.11 mg/mL (n = 0-0.5 mg/mL). His admission CXR is shown. (figures 1a, 1b) Urine legionella antigen, *Legionella species* titers, *Mycoplasma pneumoniae* and *C. pneumoniae* IgM and IgG titers were negative. Cold and febrile agglutinins were negative, Anti-smooth muscle (ASM) antibody titers were negative. Q fever phase I and II antigens were negative. Blood, urine, and sputum cultures were negative. He was treated empirically for 6 weeks with doxycycline which has activity against all of the infectious causes of round pneumonias. A specific etiology was not identified. Repeat CXR taken 8 weeks later demonstrated near resolution of the round pneumonia. (figures 2a, 2b)

**Discussion**

Patients with round pneumonias due to infection often present with antecedent symptoms or fever and cough for 1-2 weeks. In others, round densities are often an incidental finding on CXRs. Noninfectious/non-neoplastic causes of round pneumonias include atelectasis, and congenital bronchopulmonary sequestration. Pulmonary sequestration usually occurs at the lung bases, more commonly on the left.$^{3,4}$ If the antecedent history suggests a bacterial etiology, then the clinician should proceed in a diagnostic work-up to rule out *S. pneumoniae*, *H. influenzae* and particularly in adults Q fever and *Legionella micdadei*. *S. pneumoniae* and *H. influenzae* pneumonias are acquired by inhalation and on CXR typically begin at the pleura, e.g., pleural chest pain/pleural effusion and later extend along the segment within the major fissures of the lungs. Approximately, 75 % of round pneumonias have no proven etiology. (Table 1)$^{5,7}$ Q fever round pneumonias occur more commonly in Q fever epidemic areas and also occur in 14% of sporadic cases. Q fever round pneumonias are 5-10 cm in diameter and
usually located in the lower lobes. While all diagnostic tests for round pneumonia pathogens were negative, diagnostic tests were focused on Q fever and *L. micdadei*. Q fever is a zoonotic infection transmitted to humans usually from parturient cats or sheep. Acute Q fever presents as a zoonotic atypical pneumonia with relative bradycardia and often with splenomegaly. Non-specific laboratory tests associated with Q fever pneumonia include a highly elevated ESR, thrombocytosis, mildly elevated transaminases, elevated cold agglutins, or elevated ASM antibody titers. *Legionella micdadei* pneumonia is associated with relative bradycardia, but none of the other extrapulmonary findings of Q fever pneumonia (*vide supra*). Initial infiltrates on the CXR may become rounded during resolution of pneumonia. Therefore, the radiologic appearance of a round pneumonia depends largely on when the CXR is taken relative to the time the patient presents. Air bronchograms are common with bronchogenic carcinomas but do not help to differentiate infectious from non-infectious round pneumonias. The round appearance on CXR is thought to occur from an infectious process that spreads from small peripheral alveoli centrifugally through interalveolar channels via the pores of Kohn and the channels of Lambert. This explains the non-segmental distribution and shape of round pneumonias. Because specific etiologic diagnosis of round pneumonia is usually not always possible, the best clinical approach is to differentiate infectious from a malignant etiology. For this purpose, serial CXRs are most helpful. Inflammatory/infectious round infiltrates resolve over time. In contrast, neoplastic infiltrates do not resolve with antibiotic therapy/over time. If a round pneumonia resolves with antimicrobial therapy, the round pneumonia was likely due to an infectious disease. If there is any doubt that a round pneumonia may be malignant, then chest CT/biopsy will settle the issue.

**Teaching Points**

Round pneumonias are more common in children than adults. Round pneumonias appear as single or multiple nodular densities and occur predominantly in the lower lobes. Upper lobe round pneumonias suggest a malignant rather than infectious etiology. Common cause of round pneumonias in children are *S. pneumoniae* or *H. influenzae* community acquired pneumonias (CAP).
In adults, common causes of round pneumonias are Q fever and *Legionella micdadei*. For this reason, in adults with round pneumonias, *C. burnetii* and *Legionella species* titers should be sent. Serial CXRs are helpful in differentiating malignant from benign causes of round pneumonias. The persistence/progression of a round pneumonia on CXR favors a malignant process. Whereas decreased size of a round pneumonia/ resolution on CXR favors an infectious etiology. The appearance of a “round pneumonia” on CXR is largely dependent on whether the CXR is taken early or late in the course of the disease process. Most patients with round pneumonias due to an infectious etiology give an antecedent history of 1-2 weeks of cough and fever, whereas those with a malignant etiology are usually asymptomatic.
References

Table 1

Differential Diagnosis of “Round Pneumonias” in Adults

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<thead>
<tr>
<th>Infectious Causes</th>
<th>Non-Infectious Causes</th>
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<tbody>
<tr>
<td>• Q fever</td>
<td>• Bronchogenic carcinomas</td>
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<tr>
<td>• <em>L. micdadei</em></td>
<td>• Round atelectasis</td>
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<tr>
<td>• <em>S. pneumoniae</em></td>
<td>• Bronchopulmonary sequestration</td>
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<tr>
<td>• <em>H. influenzae</em></td>
<td>• BOOP</td>
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<tr>
<td>• <em>R. typhi</em></td>
<td>• Wegener’s granulomatosis</td>
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<td></td>
<td>• Septic pulmonary emboli</td>
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<td>• Rheumatoid nodules</td>
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BOOP = bronchiolitis obliterans organizing pneumonia
Figure 1a. Admission chest film in a 50 year old male.
Figure 1b. Lateral view of admission chest film in a 50 year old male
Figure 2a. Chest film 8 weeks later showing near complete resolution of round pneumonia
Figure 2b. Lateral chest film 8 weeks later showing near complete resolution of round pneumonia