

Round Pneumonia

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Abstract

Round pneumonia is a rare disease infectious presentation that typically follows a benign course and has a favorable prognosis. The clinical symptoms can vary and are nonspecific. It is characterized as round opacities in the posterior lower lobes of the lung on chest radiograph. It is more prevalent in the lower lobes, but can arise in all areas of the lung. The diagnosis is confirmed after a course of antibiotics when the patient's symptoms resolve with an unremarkable repeat imaging.

Keywords: Infection, Pulmonary, Acquired

Case Summary

A tweenaged boy was evaluated in an urgent care setting for fever and cough of a duration of 3 days. He did not have any relevant medical history. At presentation, he was febrile with otherwise normal vital signs. His cough was not associated with any sputum production.

Imaging Findings

Chest radiographs show an area of rounded airspace opacity in the right upper lung (no associated pleural effusion is present). The lateral radiograph localizes the airspace opacity to the anterior segment of the right upper lobe (Figure 1).

Diagnosis

Round pneumonia (also known as spherical pneumonia).

Differential diagnosis includes lung malformations such as congenital pulmonary airway malformation (CPAM), bronchogenic cyst, diaphragmatic hernia, pulmonary abscess, fungal and tuberculosis infections, and neoplasms such as lymphoma, neuroblastoma, and chest wall lesions.¹

Discussion

Round pneumonia (RP) are spherical opacities typically found on the chest radiographs of children.¹ The disease process tends to be most common in children due to the underdeveloped pores of Kohn and channels of Lambert within the alveoli that serve as collateral air flow pathways for the spread of infection. Therefore, this anatomy leads to trapping of infected fluid in a spherical consolidation.²⁻⁴ The mean age of this type of infection is about 6 years, with a range of 4 months to 19 years.⁵ Only about 1% of all cases of RP occur in adults.⁶

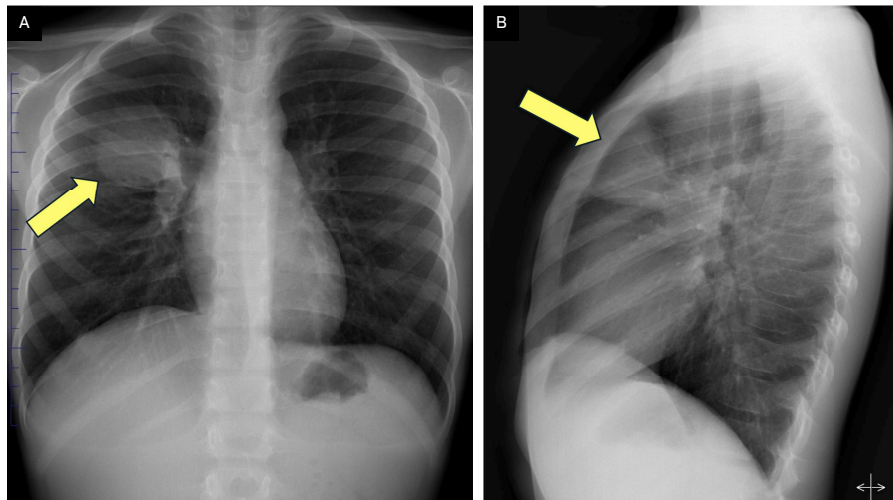
RP presents clinically with a wide range of nonspecific symptoms, making it difficult to diagnose. In rare cases, patients can even be asymptomatic.³ Of those who are symptomatic, the most prevalent symptoms are fever (79%), cough (62%), dyspnea (41%), and chest pain (28%).⁷ The range of presenting features includes dyspnea, cough, chest pain, fever, tachypnea, malaise, leukocytosis, rales on auscultation, and dullness to percussion.⁸ The causative agent of RP can be either bacteria or virus, although a bacterial etiology is most common, with *Streptococcus pneumoniae* being the most common etiology.³ Other bacterial origins include *Klebsiella pneumoniae*, *Haemophilus influenzae*, *Mycobacterium tuberculosis*, *Chlamydia psittaci*, *Coxiella burnetii*, and *Mycoplasma pneumoniae*.^{3,4} Of viral etiologies, SARS-associated coronavirus is the most common.²

Chest radiographs display round opacities that are most commonly solitary, clearly defined borders, and located in the lower lobes posteriorly near a pleural surface.^{2,4} In one study, out of 109 pediatric patients with RP, 83% were located posteriorly, and in the lower lobes, 90% were solitary and 70% presented with well-defined borders.² Less commonly, an RP presents as a nodular opacity, with poorly circumscribed borders in the right middle lobe or upper lobes. Of the 109 children, 28 cases (26%) involved the right upper lobe, 7 cases (6%) involved the left

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Disclosures: The authors have no conflicts of interest to disclose. None of the authors received outside funding for the production of this original manuscript and no part of this article has been previously published elsewhere.

Figure 1. (A) Frontal chest radiograph showing an area of rounded airspace opacity in the right upper lung. No associated pleural effusion is present. (B) The lateral chest radiograph localizes the airspace opacity to the anterior segment of the right upper lobe.



upper lobe, and 4 cases (3%) involved the right middle lobe.⁵ In children under the age of 8, borders tend to be sharply defined, while children over the age of 8 tend to have ill-defined borders. The density of the opacity is usually more pronounced centrally, and the average size of the lesion is roughly 4 cm, ranging from 1 cm to 7 cm.⁸ Lastly, associated pleural effusion and hilar lymphadenopathy are rare.

The diagnosis of RP requires both clinical signs and positive imaging. The diagnosis is suggested when a child is febrile, symptomatic, has an elevated white blood cell count, and laboratory findings resolve after a course of antibiotics and confirmed with normal chest radiography.² Chest CT is recommended if the round opacity does not resolve after the course of antibiotics.⁴ It is hypothesized that the actual incidence of RP is higher than reported as many patients are treated with antibiotics without imaging.³

A variety of other etiologies can present similarly to RP such as neoplasms (lymphoma, chest wall tumors, neuroblastoma), congenital malformations, fungal infections, tuberculosis, and lung abscess.¹

Malignancies can present on chest radiography as a round opacity. In the

pediatric population, neuroblastomas are usually located in the posterior mediastinum and associated with destructive lesions of ribs and vertebrae. In rare cases, round pulmonary metastases may occur.⁹ Approximately half of the neuroblastomas have associated calcification. Tumors of the chest wall may present as a round opacity, with the location suggested by spreading of ribs and periosteal reaction of the ribs. Chest CT is helpful in confirming the location of the lesion.

Congenital pulmonary malformations include bronchogenic cysts, CPAM, and pulmonary sequestration (PS). CPAM is the most common type of congenital pulmonary anomaly. It presents as a round mass like RP. A key differentiating factor is patient age. CPAM is present in newborns and may be cystic, while it is rare for RP to do so. PS consists of a nonfunctional lung tissue that does not communicate with the tracheobronchial tree, creates mass effect on adjacent structures, and has an arterial supply (CPAM does not). PS is differentiated from RP due to the blood supply contrast-enhanced CTA. Bronchogenic cysts are usually mediastinal; however, 15-20% are intrapulmonary and may present as a round lesion on chest radiographs in the same locations of RP. The cysts may contain calcium

oxalate unlike RP. Congenital pulmonary malformations will not resolve on imaging after a course of antibiotics.¹

Fungal infections like aspergillosis can occur in children such as those who are immunocompromised at any age and may be difficult to differentiate from an RP of bacterial or viral origin. It is best differentiated on contrast-enhanced CT, which may show an intracavitary lesion and signs of lung parenchymal invasion. Lung abscess may imitate RP, especially in the early abscess stage, but can be differentiated due to the presence of an air fluid level on imaging in some cases. Tuberculosis can present like RP but will portray hilar adenopathy, which does not occur in RP.¹

RP does not demonstrate calcification, cavitations, lymphadenopathy, or pleural effusions. In children under the age of 8 with clinical symptoms and radiograph characteristics, it is important to have RP as a differential diagnostic consideration.¹

A chest CT in a patient with RP can demonstrate the halo sign, although this is nonspecific as it is present in many other conditions.⁸ The halo sign represents a pulmonary nodule/mass surrounded by ground-glass opacity and is often associated with alveolar hemorrhage. This is common in pulmonary aspergillosis as invasion into the nearby vasculature leads to thrombosis, necrosis, and ground-glass attenuation. The halo sign not only occurs in pulmonary aspergillosis, but also in pulmonary infarction, tuberculosis, primary tumors, lung metastases (such as osteosarcoma, melanoma, angiosarcoma, and choriocarcinoma), rickettsia, Q fever pneumonia, and Wegener granuloma.¹ The halo sign, in some instances, can occur in the absence of hemorrhage due to surrounding tumor cells or inflammatory infiltrate.⁸

RP typically follows a benign course when treated appropriately. Of note, there are rare reports of death in high-risk groups such as immunocompromised patients succumbing to the disease.³ The treatment for RP includes a targeted antibiotic course based on

the culture results. A 2-week follow-up chest radiograph is advised to confirm the resolution of the infection.^{2,4,8}

Conclusion

RP is a rare disease infectious presentation that typically follows a benign course and has a favorable prognosis. The clinical symptoms can vary and are nonspecific.⁸ It is characterized as round opacities in the posterior lower lobes of the lung on chest radiograph. It is more prevalent in the lower lobes, but can arise in all areas of the lung. The diagnosis is confirmed after a course of antibiotics when the patient's symptoms resolve with an unremarkable repeat imaging.⁸

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