

# CASE REPORT

## ROUND PNEUMONIA IN AN ADULT

Yi Zhang, Yong-Sheng Yu, Zheng-Hao Tang, Xiao-Hua Chen and Guo-Qing Zang

Department of Infectious Diseases, Shanghai Sixth People's Hospital,  
Shanghai Jiao Tong University, Shanghai, PR China

**Abstract.** Round pneumonia is an uncommon form of pulmonary infection usually found in children. It may resemble pulmonary neoplasm on radiographs. We present a case of round pneumonia in a 43-year-old male with a history of smoking and a family history of lung cancer. The patient was treated with antibiotics for more than two weeks, after which the infection resolved completely both clinically and radiologically. Clinicians should consider this uncommon type of pneumonia in the differential diagnosis of spherical pulmonary masses to avoid unnecessary diagnostic tests.

**Keywords:** community-acquired pneumonia, round pneumonia, pulmonary mass, adult, radiological image

### INTRODUCTION

Community-acquired pneumonia (CAP) is a common infectious disease causing significant morbidity and mortality worldwide (McCabe *et al*, 2009). The annual incidence of CAP ranges from 2.6 to 13.4 cases per 1,000 adults (Almirall *et al*, 2000). Round pneumonia presenting as spherical or oval-shaped densities on chest radiographs and is an atypical radiological manifestation of pulmonary infection. It was first reported in the radiology literature in 1954 (Wagner *et al*, 1998). In 1973, Rose and Ward reviewed 21 cases of round pneumonia in chil-

dren; the radiological findings resembled pulmonary and mediastinal masses; the report stressed the importance of recognizing this entity (Rose and Ward, 1973). Round pneumonia has since been well-recognized in children; however, it is infrequently reported in adults. A literature search for round pneumonia in adults reveals this is an uncommon problem in adults (Greenfield and Gyepes, 1964; Sproul, 1969; Millard *et al*, 1977; Hershey and Panaro, 1988; Lossos and Breuer, 1989; Pandya *et al*, 1989; Soubani and Epstein, 1996; Katsumura *et al*, 1997; Zinkernagel *et al*, 2001; Durning *et al*, 2003; Wan *et al*, 2004; Zylberman *et al*, 2006; Shie *et al*, 2007; Camargo *et al*, 2008; Kara *et al*, 2010; Núñez Viejo *et al*, 2010; Velasco-Tirado *et al*, 2012). Round pneumonia may mimic pulmonary neoplasms due to its radiological appearance. Awareness of this disease is important. We present here a rare case of round pneumonia in an adult patient and

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Correspondence: Guo-Qing Zang, Department of Infectious Diseases, Shanghai Sixth People's Hospital, Shanghai Jiao Tong University, 600 Yishan Road, Shanghai 200233, PR China.

Tel: + 86 21 64369181-58673; Fax: + 86 21 24058384

E-mail: zangguoqin@126.com

conduct a review of the literature.

### CASE REPORT

A previously healthy 43-year-old male was admitted to our hospital with a six-day history of high fever (up to 40.2°C), chills and cough. He also complained of left-sided sharp chest pain worse on deep inspiration. He had no history of recent travel, sick contacts, animal contacts or environmental exposures. His past medical history was non-significant, but he did have a history of smoking 30 cigarettes per day for more than 20 years. His elder brother had died of lung cancer.

On physical examination, the patient had a temperature of 39.6°C, a pulse rate of 125 beats/min, a respiratory rate of 28 breaths/min and a blood pressure of 123/71 mmHg. Inspiratory rales were heard over the left lower lung zone. There was no sign of cyanosis or acropachy. The rest of the physical examination was unremarkable.

Laboratory data showed a white blood cell (WBC) count of  $9.7 \times 10^9/l$  with a left shift. Inflammatory markers were elevated with erythrocyte sedimentation rate (ESR) of 56 mm/h and C-reactive protein (CRP) of 89 mg/l. Arterial blood gas analysis revealed mild hypoxemia ( $PaO_2$  70 mmHg). The results of serum biochemistry tests were essentially within normal limits. A chest radiograph obtained on admission showed an oval mass in the left lower lung field (Fig 1).

The symptoms and laboratory results pointed to an infectious process, namely community acquired pneumonia (CAP). The patient was initially treated with intravenous azithromycin (0.5 g daily) and ceftriaxone (2 g daily). A computed tomography (CT) scan of the chest was performed to determine whether a pul-



Fig 1—Posteroanterior chest radiograph showing an oval mass in the left lower lung field with peripheral air bronchograms and spicules.

monary neoplasm was present or not. Serological studies, tumor markers and immunological tests were also performed.

The chest CT scan demonstrated a 3.5x3.5 cm, well-defined and round mass in the lingular segment of the left upper lobe with enlarged left hilar lymph nodes and the presence of air bronchograms and spicules (Fig 2). Due to his smoking history, family history of lung cancer and radiological findings, bronchogenic carcinoma was considered in the differential diagnosis. Bronchoscopy was planned but the patient responded well to the above-mentioned therapy and his clinical condition improved rapidly. On the 5<sup>th</sup> day of hospitalization, the fever and chest pain subsided. A purified protein derivative (PPD) tuberculin skin test was negative. Serological tests, tumor markers and immunological studies were also negative. No organisms were isolated from the sputum, urine or blood.

A follow-up CT scan performed two weeks after admission showed a substan-



Fig 2—Initial computed tomography (CT) scan of the chest showing a 3.5x3.5 cm, heterogeneous, round and spiculated mass in the lingular segment of the left upper lobe of the lung with well-circumscribed margins. Note low attenuation centrally and air bronchograms within the mass and left hilar lymph node enlargement.

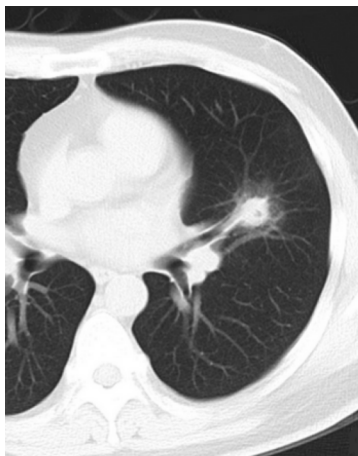


Fig 3—Second computed tomography (CT) scan of the chest showing the mass reduced in size by 75%.



Fig 4—Third computed tomography (CT) scan of the chest showing total resolution of the lung mass.

tial reduction in the size of the mass (Fig 3) and an improvement in the inflammatory markers. The patient was discharged after 16 days of hospitalization. A third CT scan obtained one month after discharge demonstrated total resolution of the mass (Fig

4). The patient was eventually diagnosed with round pneumonia and a neoplastic origin of the mass was ruled out. Bronchoscopy was not performed. At 6-month follow-up, the patient was asymptomatic with no radiological evidence of relapse.

## DISCUSSION

Round pneumonia in adults is uncommon. It generally occurs in adult patients at a relatively younger age; Camargo *et al* (2008) reported the average age of adults with round pneumonia was 40.9 years. Round pneumonia has been reported to comprise fewer than 1% of cases of pneumonia (Zinkernagel *et al*, 2001), but the actual incidence is probably higher than reported (Camargo *et al*, 2008). One reason is patients may receive antibiotic treatment without undergoing chest radiography (Wagner *et al*, 1998; Wan *et al*, 2004). Detecting round pneumonia is fortuitous (Gharib and Stern, 2001). A case series study from Taiwan which described the clinical course and radiographic evolution of round pneumonia in patients with severe acute respiratory syndrome (SARS) found a surprisingly high incidence of round pneumonia of up to 29% (Wan *et al*, 2004). It should be noted that all the patients were closely followed up with chest radiography due to the high infectivity and virulence of the SARS coronavirus (Wan *et al*, 2004). The opportunity for discovering round pneumonia may be dependent on how early and how frequently radiological examinations are performed during the illness.

*Streptococcus pneumoniae* is the most frequent pathogen found in round pneumonia (Zinkernagel *et al*, 2001). Antón (2004) supposed Q fever might be the most common cause of round pneumonia in adults and concluded the findings of round pneumonia were evidence for Q fever. Besides *S. pneumoniae*, *Coxiella burnetii* and the SARS coronavirus, other organisms have been reported to cause round pneumonia, including *Klebsiella pneumoniae*, *Haemophilus influenzae*, *My-*

*cobacterium tuberculosis*, *Legionella pneumophila*, *Mycoplasma pneumoniae*, *Chlamydia pneumoniae*, *Chlamydia psittaci*, *Nocardia* spp and *Aspergillus* spp (Franquet, 2001; Zinkernagel *et al*, 2001; Antón, 2004; Zylberman *et al*, 2006). No organisms were isolated from sputum, urine or blood cultures in our patient. All serological tests were also negative. Approximately 78% of cases of round pneumonia among adults had no definite etiology described in one study (Durning *et al*, 2003).

The pathogenesis of round pneumonia is unclear. Round pneumonia may be an early manifestation of the disease and the clinical symptoms may be non-specific at the time of presentation (Wagner *et al*, 1998; Zinkernagel *et al*, 2001). In the early course, the process of inflammation and exudation is confined mainly to the alveolar spaces (Pandya *et al*, 1989; Soubani and Epstein, 1996; Zinkernagel *et al*, 2001). It then spreads by direct extension through the intra-alveolar channels (the pores of Kohn and the channels of Lambert) and this produces a lesion with nonsegmental distribution and smooth borders (Pandya *et al*, 1989; Soubani and Epstein, 1996; Zinkernagel *et al*, 2001). Afterward, the lesion may become segmental or lobar with centrifugal and peribronchial spread and then the typical appearance of pneumonia may be seen on chest radiography (Pandya *et al*, 1989; Soubani and Epstein, 1996; Zinkernagel *et al*, 2001).

Round pneumonia is seen more frequently in children. The pathways of collateral ventilation are poorly developed in children who have more closely apposed connective tissue septa and smaller alveoli than adolescents and adults (McLennan, 1998; Zinkernagel *et al*, 2001). These factors contribute to more compact confluent areas of pulmonary consolidation without softer margins, more often found in adults



(McLennan, 1998; Zinkernagel *et al*, 2001). These also lead to a slower progression of the disease in children (Zinkernagel *et al*, 2001). As a result, there is a greater chance of detecting round pneumonia in children, explaining the higher incidence of round pneumonia seen in children.

Round pneumonia is found more often in the lower lobes (Wagner *et al*, 1998; Durning *et al*, 2003), mainly because gravity causes infected fluids to concentrate in the most dependent bronchi (McLennan, 1998). If it occurs in an upper lobe, neoplasm should be considered even the presence of symptoms suggesting infection (Wagner *et al*, 1998), such as the case described here. The right lung is more frequently involved (Durning *et al*, 2003; Camargo *et al*, 2008), in up to 69% of cases (Camargo *et al*, 2008). No predisposing factors have been observed.

Patients with round pneumonia usually present with acute or subacute symptoms of pneumonia. They may also present with mild symptoms mimicking viral syndromes or bronchitis. Some patients may even be asymptomatic (Wagner *et al*, 1998; Durning *et al*, 2003; Camargo *et al*, 2008), but this is rare. Of 32 cases of round pneumonia in adults described in one study, only two were asymptomatic (Camargo *et al*, 2008).

The radiological features of round pneumonia in adults vary widely. The overall appearance can range from a small dense mass to a large ill-defined round opacity (Wagner *et al*, 1998). In most cases of round pneumonia, the radiological appearance is a solitary round nodule with or without hilar lymphadenopathy and borders may be smooth or lobulated (Katsumura *et al*, 1997). Radiographically, lesions may be round or oval (Wagner *et al*, 1998). A CT scan of the chest showing a heterogeneous mass with soft tissue

attenuation, spicules, air bronchograms, pleural thickening and satellite lesions, suggests the diagnosis of round pneumonia (Wagner *et al*, 1998). About 22% of round pneumonia lesions have spicules on CT scans (Kohno *et al*, 1993) and 17% of patients with round pneumonia have air bronchograms on chest radiographs (Wagner *et al*, 1998). Air bronchograms are seen on 50% of CT scans in cases of round pneumonia (Kohno *et al*, 1993; Price, 1999). However, air bronchograms are not always helpful in diagnosing round pneumonia and may also indicate pulmonary malignancy. Air bronchograms may also be seen on chest radiographs or CT scans in cases of adenocarcinoma or bronchoalveolar carcinoma. One study found the presence of air bronchograms on CT scans in solitary pulmonary lesions was significantly more common in malignant lesions than in benign lesions and was seen in all types of lung cancer (Kui *et al*, 1996).

Because radiological images of round pneumonia may simulate those of pulmonary malignancy, it may be difficult to distinguish between them even when all the usual analytical and radiological tests have been performed. Round pneumonia may even mimic pulmonary malignancy on positron emission tomography/computed tomography (PET/CT) scan (Shie *et al*, 2007). Invasive diagnostic tests, such as bronchoscopy, biopsy and thoracotomy, are performed in 39% of cases of round pneumonia to rule out pulmonary neoplasm (Durning *et al*, 2003). Differentiating round pneumonia from bronchogenic carcinoma is challenging. If rapid radiological improvement is not seen, pulmonary malignancy should be pursued since only radiological resolution can rule out neoplasm. For this reason, serial chest radiographs or CT scans can

be helpful. Clinicians should be aware of this uncommon radiological appearance of pneumonia to avoid mistaking it for a tumor, which could lead to unnecessary invasive tests.

Round pneumonia in adults usually follows a benign course and is similar in treatment to lobar pneumonia (Durning *et al*, 2003; Camargo *et al*, 2008). In most cases, the outcome is favorable. Round pneumonia resolves as quickly as lobar pneumonia with appropriate antibiotics (McLennan, 1998). Most cases of round pneumonia resolve clinically and radiologically within one month using conventional antibiotics; no pulmonary complications, such as abscess or empyema, have been reported (Durning *et al*, 2003; Zylberman *et al*, 2006). One case was reported to resolve spontaneously (Camargo *et al*, 2008). Round pneumonia is not a mild disease, deaths due to round pneumonia have been reported (Greenfield and Gyepes, 1964; Soubani and Epstein, 1996; Wan *et al*, 2004). The outcome primarily depends on the virulence of the organism, patient age and host immunity (Wan *et al*, 2004; Camargo *et al*, 2008).

Although lung cancer is a common cause of pulmonary masses in adults, round pneumonia should be considered in the differential diagnosis of an adult patient who presents with a spherical mass on chest radiography, especially if the patient has symptoms of respiratory tract infection. Early recognition and treatment may prevent unnecessary diagnostic tests and the associated complications, hospitalizations and costs.

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