Abstract:
We present a 6-month-old boy with failure to thrive who was referred to the emergency department by his primary care doctor for leukocytosis and was found to be hypoxic with diffuse infiltrates on chest radiograph. Our patient was admitted and eventually diagnosed with *Pneumocystis jirovecii* pneumonia secondary to hyper immunoglobulin M syndrome. Even though *P jirovecii* pneumonia is an uncommon cause of hypoxia in infants, this case illustrates the need for pediatric emergency physicians to be cognizant of this rare but life threatening cause of hypoxia.

Keywords:
hypoxia; hyper immunoglobulin M syndrome; Pneumocystis jirovecii pneumonia

Presented during the American Academy of Pediatrics (AAP) Section on Emergency Medicine Emergi-Quiz Case Competition held at the AAP National Convention and Exhibition, San Diego, CA, October 2014.
Reprint requests and correspondence: Ji Won Kim, MD, Yale University School of Medicine, 100 York Street - Suite 1F, New Haven, CT 06511.
JiWon.Kim.jk969@yale.edu

1522-8401

From White Count to White Out

Ji Won Kim, MD

A 6-month-old male infant with failure to thrive was referred by his pediatrician to a tertiary care pediatric emergency department (ED) for further evaluation of leukocytosis. He was seen 3 days prior for a well child check where a complete blood count drawn revealed a white blood cell count of 35 000/μL.

Upon arrival to the ED, the infant was noted to be in mild respiratory distress. He had a rectal temperature of 37.3°C, a heart rate of 176 beats per minute, and a respiratory rate of 48 breaths per minute. Oxygen saturation measured by pulse oximetry was 53% on room air.

On physical exam, he was active and vigorous. He had an open and flat anterior fontanelle, moist mucus membranes, and a clear oropharynx. He was tachycardic, but his cardiovascular exam did not reveal any murmurs. His lungs were clear to auscultation bilaterally without any wheezes, crackles, or rhonchi, and he was in mild respiratory distress with tachypnea. His abdomen was soft, nontender and nondistended with no organomegaly. His skin was warm and well perfused, and his neurological examination was normal.

Upon arrival to the ED, the patient was immediately placed on a nonrebreather oxygen mask with flow of 10 L/min, with an immediate improvement in oxygen saturation, which rose to the high 90s. Intravenous (IV) lines were placed and laboratory studies were sent. A complete blood count revealed a white blood cell count of 48,100/μL (15% neutrophils, 71% lymphocytes, 5% monocytes, 3% eosinophils), hemoglobin of 13.8 g/dL, hematocrit of 43%, and a platelet count of 528,000/μL. A chest radiograph was obtained and is shown in the Figure. An electrocardiogram obtained in the ED showed sinus tachycardia and was interpreted as being otherwise normal.

After initial stabilization, further history was obtained. The patient was a full term baby born via normal spontaneous vaginal

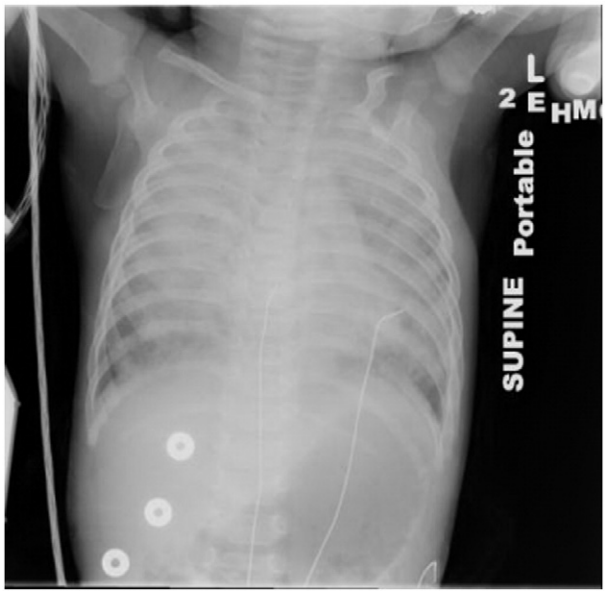

Figure. Chest radiograph obtained in the ED demonstrating bilateral infiltrates.

delivery. He was born to a 22-year-old mother with negative serologies and negative for HIV with no concerns during her pregnancy. Past medical history was significant for respiratory syncytial virus bronchiolitis at 4 months of age, which did not require hospitalization. He had recently been found to have failure to thrive by his pediatrician. The patient did not have any past surgical history, home medications, or allergies. The family history was notable for a great grandfather with seizure disorder but was otherwise unremarkable.

On review of systems per mother, he had exhibited decreased activity for the past 1.5 weeks, with mild coughing and congestion, and no increased work of breathing. He otherwise had normal oral intake and urine output. His mother denied the presence of fevers, emesis, or diarrhea.

The social history revealed that the child lives in a 2-bedroom condominium with his mother, 8-year-old uncle, and maternal grandmother. He does not attend daycare. His home had a recent basement flooding. There are no pets in the home. He had a brief contact with the maternal grandmother's boyfriend, who was recently incarcerated.

In the ED, after obtaining cultures, he was given IV ceftriaxone and admitted to the inpatient pediatric unit on 2 L/min of oxygen via nasal cannula. On the inpatient unit, he had intermittent episodes of increasing tachypnea and grunting; azithromycin was added to his antimicrobial regimen. Within 12 hours of admission, he was transferred to the pediatric intensive care unit for worsening respiratory distress.

DIFFERENTIAL DIAGNOSIS

Hypoxia in an infant has many potential causes. These include common etiologies such as viral bronchiolitis, pneumonia, and airway obstruction. Rare causes, such as pneumonia from atypical agents from an undiagnosed immunodeficiency, congenital heart disease, methemoglobinemia, and pulmonary malformations, should be entertained as possible components of the differential diagnosis in the ED. In this child, the differential diagnosis narrows significantly to a pulmonary etiology in a patient who had infiltrates on chest radiograph and whose respiratory distress and hypoxia responded readily to supplemental oxygen, making the diagnosis of congenital heart disease unlikely.

Viral bronchiolitis is one of the most common causes of hypoxia and respiratory distress in infants, especially in the fall and winter. Bronchiolitis is a lower airway disease mostly affecting the bronchioles, causing acute inflammation, edema, increased mucus production, and bronchospasm. Viral bronchiolitis typically presents with upper respiratory symptoms followed by lower respiratory infection resulting in wheezing and rales in children younger than two years of age. Common pathogens of viral bronchiolitis include respiratory syncytial virus, rhinovirus, parainfluenza virus, human metapneumovirus, influenza, adenovirus, and coronavirus. Findings on a chest radiograph are almost always nonspecific but may include hyperinflation, peribronchial thickening, and patchy atelectasis. Bronchiolitis is therefore a clinical diagnosis; quality improvement guidelines typically discourage the routine use of imaging. The causative agent may be confirmed by antigen detection or immunofluorescence of respiratory secretions, and treatment is mainly supportive.[1]

Pneumonia is another common cause of hypoxia and respiratory distress in children and can be the result of both bacterial and viral infections. Patients often present with cough and fever, and may also present with tachypnea, hypoxia, or respiratory distress. Physical exam may reveal crackles, decreased breath sounds over areas of consolidation, rhonchi, or wheezing. Though viral pneumonia is more common in infants, bacterial pathogens such as *Streptococcus pneumoniae*, *Staphylococcus aureus*, and *Streptoccocus pyogenes* may also cause pneumonia in infants, with *Streptococcus pneumoniae* being the most common pathogen. Chest radiograph typically reveals a focal area of consolidation. In older school-