Delayed Roentgenographic Signs Associated with Acute Pneumonia in Children

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Three cases are reported in order to emphasize occult presentations of pneumonia in children. In each hospitalized child, the initial chest roentgenogram was negative, only to become positive up to five days after presentation. Possible explanations for delayed roentgenographic signs of pneumonia are discussed. Less common signs and symptoms of pneumonia in children of various ages are outlined in order to increase the awareness of primary care physicians to atypical presentation of pneumonia in childhood.

The recognition of the child with acute infectious pneumonia is usually accomplished with little difficulty by primary care physicians. Once past early infancy, the child with pneumonia usually presents with cough, fever, a loss of appetite, and malaise. The auscultation of rales and the discovery of an infiltrate on chest roentgenogram yield the correct diagnosis.

Occasionally, the presenting symptoms and signs of an early pneumonic process may be subtle or misleading. Three cases are presented in order to illustrate the masquerading effect of pneumonia in children when neither rales on auscultation nor an infiltrate on chest x-ray study can be demonstrated during the initial examination.

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Case 1

A two-year-old black girl was in satisfactory health until two days prior to admission, when she developed coryza and cough. On the day of admission, she had an elevated temperature (104 F) and a brief generalized tonic-clonic seizure. In the emergency room she had a second generalized clonic seizure. She was given phenobarbital (5 mg/kg) intravenously, acetaminophen, and a tepid bath.

She had had several episodes of seizures with fever in the past—at 14 months, 16 months, and 21 months of age—associated with high fevers and upper respiratory tract infection. The child had been hospitalized at nine weeks of age for pneumonia and at 16 months of age for a seizure evaluation. Results of studies included a normal blood glucose, electrolytes, urea nitrogen, and calcium levels, and a lumbar puncture; an electroencephalogram was not performed. Phenobarbital was prescribed after the second seizure but was discontinued because of hyperactivity. A history of respiratory allergic symptoms was not present.

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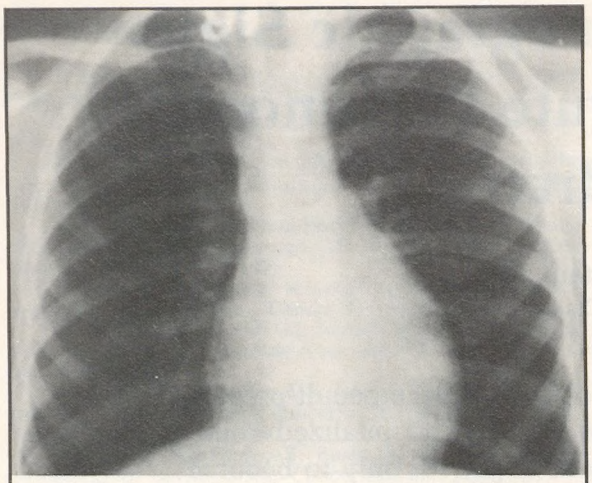

Figure 1. Admission chest x-ray study was without infiltrate (Case 1)

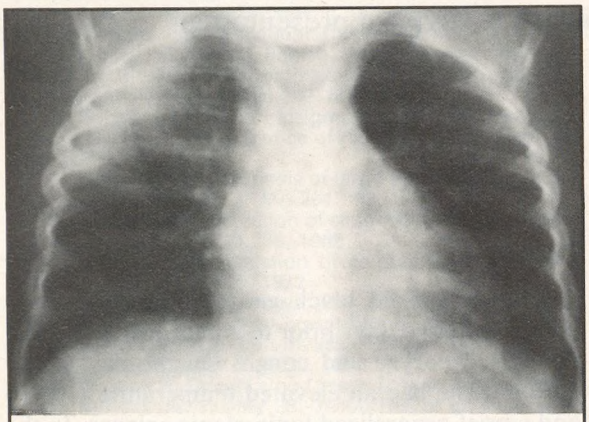

Figure 2. A right upper lobe consolidation was present five days later (Case 1)

Physical examination revealed a sleepy toddler who was arousable and cooperative. Her temperature was 102.4 F, pulse 102 beats/min, respiratory rate 24/min, and weight 24 lbs 6 oz. The left tympanic membrane was noted to be dull. Examination of her lungs revealed no wheezing, rales, or dullness. A grade II/VI systolic ejection murmur was heard at the left sternal border. Physical examination was otherwise unremarkable.

Laboratory evaluation demonstrated the following values: hematocrit, 31.5 percent; white blood cell count, 15,200 cells/cu mm with 82 percent polymorphonuclear cells, 3 percent band forms, 11 percent lymphocytes, and 4 percent monocytes. Platelet count was 338,000/cu mm. The sodium value was 136 mEq/liter; potassium, 3.9 mEq/liter; chloride, 100 mEq/liter; and bicarbonate, 17 mEq/liter. The calcium value was 9.1 mg/100 ml; and glucose, 110 mg/100 ml. A lumbar puncture was performed and showed 0 red blood cells, 0 white blood cells. Cerebrospinal fluid glucose value was 86 mg/100 ml and protein was 14 mg/100 ml. Urinalysis was normal. A chest x-ray study on admission was normal (Figure 1).

The child was treated with acetaminophen, aspirin, and tepid sponge baths. Antibiotics were withheld. She was given an additional 5 mg/kg dose of phenobarbital; because of previous hyperactivity associated with phenobarbital, dilantin at 7 mg/kg/day in two divided doses was initiated for long-term seizure control. The child did not have seizures while in the hospital.

Bacterial cultures of blood, cerebrospinal fluid, and urine were all negative. However, the child's temperatures continued to be recorded to 105 F. Several subsequent blood cultures were negative. A complete blood count was repeated on day three and was unchanged from the admission hemogram. On the fifth hospital day a second chest x-ray study was performed though the child had no clinical signs of pneumonia. A right upper lobe consolidation was demonstrated (Figure 2). Following amoxicillin (50 mg/kg/day) and chest physical therapy, the child's fever abated rapidly. Her subsequent course was benign, and a follow-up chest x-ray film at three weeks was normal.

Case 2

A five-year-old white girl was admitted to the hospital following a four-hour history of increasing visual hallucinations. She told her mother, "spiders are crawling all over me." She never had a similar experience. On the evening prior to admission, she was given one teaspoon of an antihistamine (Dimetapp) for mild coryza and a low grade fever without cough or sneezing. Her past history was significant for a mild prematurity with an uneventful perinatal course, strabismus associated with a unilateral optic nerve dysplasia, and a vulnerable psychosocial development complicated by an alcoholic father, divorce of parents,

and increasingly defiant and immature behavior. She had never had either pneumonia or asthma.

Physical examination revealed a well-nourished, well-developed girl who complained of "small spiders" on her clothing and bedding. She was terrified and picked the imaginary spiders from her clothing. Temperature was 100 F, blood pressure 100/65 mmHg, pulse 100 beats/ min, respiratory rate 26/min. There were no adventitious breath sounds. Other than the visual hallucinations, her mental status and neurological examination were unremarkable except for a right exotropia, severely limited vision in the right eye, and a small, pale right optic disk. The remainder of the examination was normal, except for coryza.

A toxicology urine screen revealed only brompheniramine maleate in the amount consistent with the therapeutic dose taken the evening prior to admission. The peripheral white blood cell count was 18,700/cu mm with a normal differential count. Urinalysis, electrolytes, glucose, and blood urea nitrogen values were normal. A chest roentgenogram was also normal (Figure 3). Over a 24-hour period, the hallucinations resolved, although she developed a temperature of 102.9 F without any further evidence on physical examination for a source of fever other than coryza. She was evaluated by a child psychiatric consultant and plans were made for further outpatient evaluation. Forty-eight hours after admission, she was discharged.

During a 24-hour period following discharge, the fever rose to 104 F, and the visual hallucinations returned in the form of various animals in addition to spiders. Physical examination on readmission revealed a temperature of 101.4 F, pulse 144 beats/min, respiratory rate 36/min. She was restless and intermittently screaming about spiders and other animals on her clothing. Now there were inspiratory rales in the left posterior-inferior lung fields.

A complete blood count revealed a white blood cell count of 27,600 cells/cu mm with 54 percent polymorphonuclear cells, 38 percent band forms, 4 percent lymphocytes, 3 percent monocytes, and 1 percent metamyelocytes. Hemoglobin was 12 gm/ 100 ml. Platelet value was normal. A C-reactive protein value was 1:30. A lumbar puncture was performed and showed no cells or organisms, and the protein value was 4 mg/100 ml and glucose was 85 mg/100 ml. Bacterial cultures of blood, urine, and spinal fluid were negative.

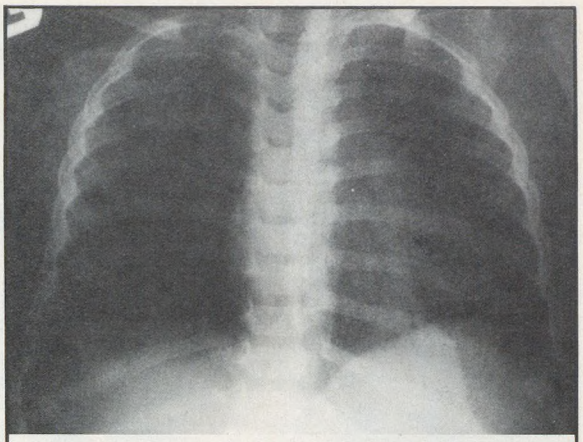

Figure 3. The lungs are clear on the initial x-ray film (Case 2)

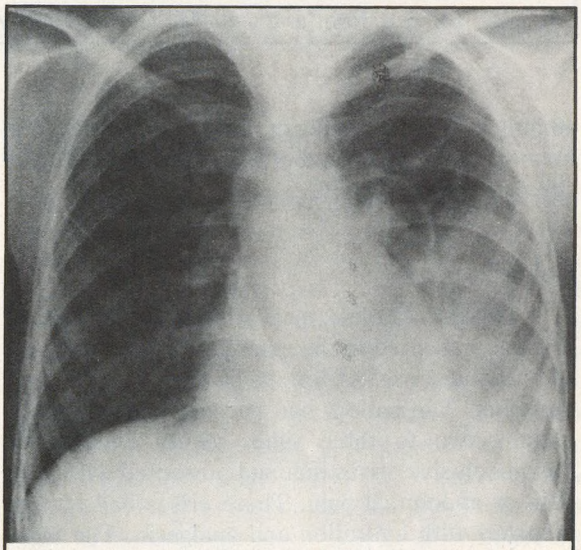

Figure 4. A left lower lobe infiltrate with pleural effusion was demonstrated subsequently (Case 2)

As a result of a negative chest roentgenogram approximately 60 hours previously, a repeat film was not taken on readmission. On the second day of the hospitalization, a chest roentgenogram demonstrated a large pulmonary infiltrate in the left lower lobe with a small left pleural effusion (Figure 4). Following treatment with oral phenoxymethyl penicillin, the fever subsided in 12 hours and visual hallucinations gradually resolved over

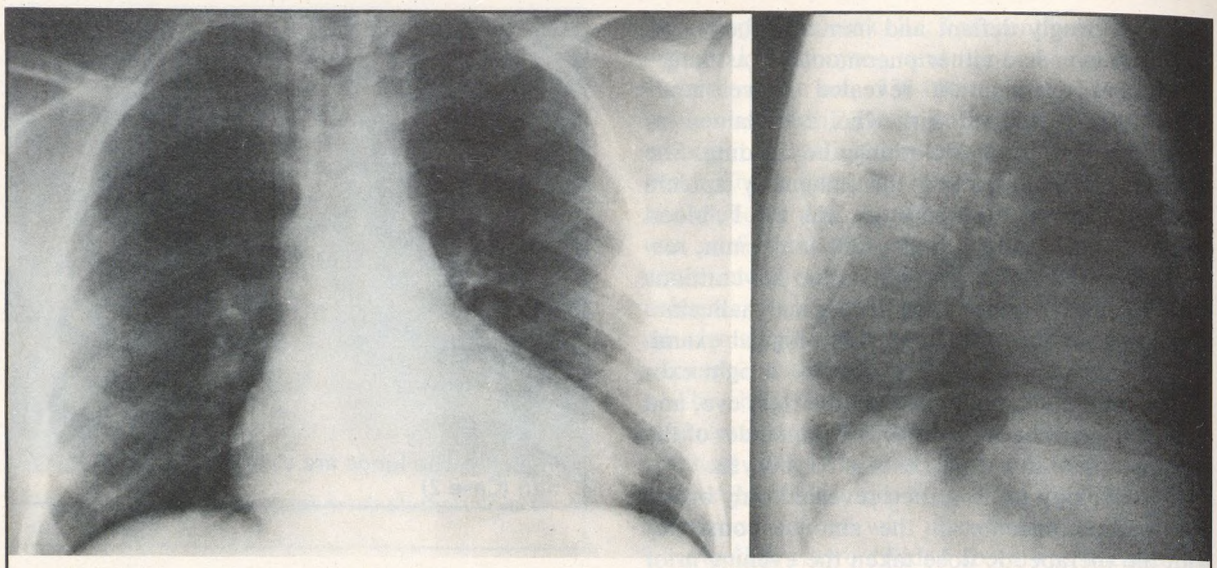

Figure 5a and b, front and side. Mild cardiomegaly without pulmonary infiltrates (Case 3)

48 hours. After ten days of antibiotic therapy, the pulmonary infiltrate and effusion had cleared, and she was well clinically.

Case 3

A 16-year-old black male patient with sickle cell disease presented to the emergency room because of an acute onset of low back pain, nausea, and vomiting. The patient had had multiple hospitalizations two to three times yearly because of vaso-occlusive crises that had presented with joint pain or abdominal pain. These crises had always resolved with hydration and analgesia. The most recent admission was six months previously, when he had a cholecystectomy for cholelithiasis and an incidental appendectomy. He had been doing well since his last hospitalization until about nine hours prior to admission, when he noted the gradual onset of low, mid-back pain that increased in intensity. The pain was dull, aching, and nonradiating and associated with mild nausea and emesis. There was no hematuria, dysuria, or change in urinary frequency, joint pain, cough, chills, pleuritic, substernal, or abdominal pain. He had difficulty bending over at the waist, and he felt more comfortable lying in bed.

On physical examination the temperature was 99.4 F, pulse 90 beats/min, and respiratory rate 30/min. His blood pressure was 160/80 mmHg. He was a well-developed, well-nourished Black male who was writhing in pain in bed although he was fully oriented. The chest was clear to auscultation and percussion. There was a grade 2/6 systolic ejection murmur at the lower left sternal border. He had voluntary abdominal guarding without rebound or rigidity. There were no abdominal masses, the liver was normal size, and the spleen was not palpated. Examination of his back revealed moderate lumbar pain on percussion over the spinous processes, with left paraspinal muscle spasm and tenderness. He did not have true costovertebral angle tenderness. The psoas sign was negative.

Laboratory values were as follows: hemoglobin, 9.4 gm/100 ml; hematocrit, 27 percent; and white blood cell count, 17,900 cells/cu mm, with 74 percent polymorphonuclear cells, 10 bands, 9 percent lymphocytes, 6 percent monocytes, and 1 percent basophils. Urinalysis was normal. Bacterial cultures of the urine and blood were negative. The SGOT was 55 mg/100 ml; total protein, 8.0 gm/100 ml; and albumin, 4.7 gm/100 ml. Amylase was 55 mg/100 ml; blood urea nitrogen, 4 mg/100 ml; and the electrolytes were normal. Blood glucose value was 112 mg/100 ml. Roentgenographic examination of the chest, spine, and abdomen was unrevealing except for mild cardiomegaly consistent with chronic anemia.

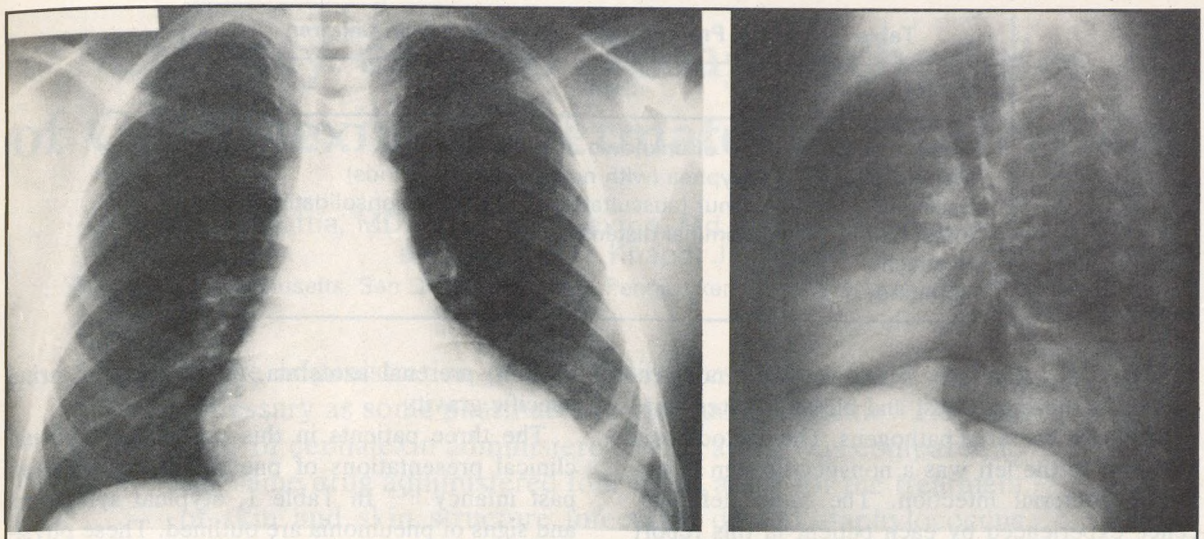

Figure 6a and b, front and side. By the fifth hospital day, a left lower lobe consolidation was demonstrated (Case 3)

In the hospital, his nausea and vomiting gradually subsided over a two-day period as his temperature rose to 101 F. The back pain persisted though decreased in intensity. Serial abdominal examinations were unremarkable, and the spinal process tenderness and paraspinal muscle spasm resolved. Because of an elevated temperature, leukocytosis, and a rising sedimentation rate, a bone scan and gallium scan were performed in an attempt to discover an occult focus of inflammation in the spine or retroperitoneal region. Both studies were negative. Repeat x-ray studies of the chest and abdomen on day two and again on day three were unrevealing (Figure 5a and b).

On the fifth hospital day, physical examination for the first time demonstrated decreased breath sounds and dullness over the left posterior-inferior lung field. A chest x-ray film at that time (Figure 6a and b) revealed a left lower lobe consolidation that was not present on the three previous roentgenogram evaluations of the lungs. Response to penicillin was rapid. A review of the patient's vital sign chart showed that his respiratory rate never exceeded 30/min and averaged in the low 20s throughout the hospital course. Dyspnea or retractions were never observed. A follow-up chest roentgenogram two weeks later revealed clearing of the pulmonary infiltrate.

Discussion

It is a recognized clinical principle that the infiltrate on the chest roentgenogram may lag behind the clinical presentation of pneumonia.[1] This time course is seen frequently in hydrocarbon (and other forms of aspiration) pneumonia, less commonly in infectious pneumonia. The demonstration of rales on chest auscultation, which characteristically precedes the presence of pneumonia on chest x-ray examination, provides an important clue in the early diagnosis of pneumonia. This is consistent with the knowledge that rales represent fluid in the microalveoli, whereas an infiltrate on an x-ray film usually reflects a significant area of consolidation of the inflamed lung tissue. The unusual aspect of the three cases in this report is that both rales and x-ray evidence for pneumonia were absent for as long as five days after each child was admitted to the hospital.

There are several possible explanations for the clinical course of these patients. An acute nonfocal viral process may have initiated the febrile illness, followed by a secondary bacterial infection. That virus infections predispose certain patients to subsequent bacterial invasion and infection has been apparent to clinicians for many years; the molecular basis for the interaction between viruses and bacteria is unknown.[2] Unfortu-

Table 1. Atypical Presentations of Pneumonia in Children

Symptoms	Signs
Abdominal pain	Fever of unknown origin
Meningismus	Tachypnea (with normal breath sounds)
Back pain	Murmur (auscultated over area of consolidation)
Chest pain	Abdominal distension (ileus)
Headache	
Vomiting	

nately, viral cultures or serologies were not performed in these patients, and blood cultures were negative for bacterial pathogens. The leukocytosis and shift to the left was a nonspecific sign of potential bacterial infection. The rapid defervescence experienced by each patient in this report following penicillin or amoxicillin suggests, but does not prove, that a penicillin (or amoxicillin) sensitive bacterial organism was responsible for the pneumonia.

A second explanation for the observed phenomenon might be related to the early timing of clinical presentation. These children were hospitalized because of either a complication associated with high fever or an underlying chronic illness. A generalized seizure, visual hallucinations, and a known history of sickle cell hemoglobinopathy led to hospitalization in these children. Although a pneumonia was searched for in each case, the first diagnostic roentgenogram was negative. In the absence of these complicating factors, these children might have sought medical attention several days later when the chest roentgenogram was diagnostic.

The pulmonary density in the patient with homozygous sickle cell disease may have represented pneumonia, pulmonary infarction associated with a vaso-occlusive crisis, or a combination of infection and infarction.[3] In support of a pneumonia is the rapid defervescence following penicillin and the development of the pulmonary density at a time in the clinical course when other symptoms and signs were subsiding.

Pneumonia in a dehydrated patient may be present in the absence of visible infiltration on chest roentgenogram or rales on auscultation. Following rehydration, the consolidation appears on x-ray examination of the chest and rales may be demonstrated. It is unlikely that this process occurred in the absence of physical signs of dehydration, prerenal azotemia, or an elevated urine specific gravity.

The three patients in this report had unusual clinical presentations of pneumonia for children past infancy.[1,4,5] In Table 1, atypical symptoms and signs of pneumonia are outlined. These physical findings may be seen in children with pneumonia in all age groups, although the referred pain syndromes are found when pneumonia is present after infancy.

Very young children with pneumonia characteristically have nonpulmonary manifestations of disease. The neonate with a pneumonia may appear "septic" with systemic signs (eg, irritability, lethargy, poor feeding, vomiting) without any pulmonary manifestations. The older infant with pneumonia may present with limited signs; tachypnea, tachycardia, and fever, often without rales or diminished breath sounds, are not an unusual presentation of pneumonia in this age group.

The cases presented in this report serve to caution the clinician against an early dismissal of pneumonia as the primary diagnosis in a febrile child without signs of pulmonary infiltration on the initial physical examination or chest roentgenogram. If the fever persists, and other diagnostic studies are unrevealing, a second roentgenogram examination may be diagnostic.

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