NECROTIZING PNEUMONIA IN AN IMMUNOCOMPETENT CHILD: A CASE REPORT

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Abstract: *Necrotizing pneumonia is a rare but emerging complication of community acquired pneumonia in children. Traditional concepts regarding classic manifestations of lung abscess associated with high fever, severe toxic syndrome and extrapulmonary complications has been changing over the last decades. To some extent, an increasing number of reported cases is due to the availability of computed tomography, but also to changes over time in circulating pathogens and prescription of high-dose antibiotics. Most of necrotizing pneumonia cases can be found in immunocompetent, previously healthy children and commonly detected pathogens are pneumococci and Staphylococcus aureus. In the majority of patients, a good clinical and radiologic recovery is achieved after 6-12 months following the disease. The described case will increase knowledge of necrotizing pneumonia evolution and will ultimately improve the diagnosis and treatment.*

INTRODUCTION

Pneumonia is one of the main reasons for hospitalizing children.(1,2) Even though most cases of bacterial pneumonias are resolved with antibacterial treatment of the underlying infection, some cases are complicated by the development of lung abscess, cavitary lesions (necrotizing pneumonia), or pleural empyema.

Recent studies report an increased incidence of complicated cases of pneumonia in children.(3,4,5) Out of these, one of the most severe complications of community-acquired pneumonia in children is necrotizing pneumonia (NP). According to the published data, the number of patients with NP is relatively low, though an increasing incidence of this form of pneumonia has been reported in the last decades.(1,4,6,7) The characteristic pathogenetic manifestation is the lung necrosis, that is caused by toxins produced by invasive bacterial strains (*Streptococcus pneumoniae*, *Staphylococcus aureus* and *Streptococcus pyogenes* – group A streptococcus) and secondary vascular changes, including vasculitis and intravascular thrombosis.(8)

Children with complicated pneumonia have many signs and symptoms of uncomplicated pneumonia, including tachypnea, fever, cough and respiratory distress. The patient may be consulted because of complicated pneumonia or initially uncomplicated pneumonia that responds poorly to antibiotics, defined as persistence of fever after 48 to 72 hours of antibiotic therapy without clinical improvement, persistent respiratory distress, and worsening or hypoxia or clinical signs of pleural effusion. Signs that are consistent with pleural effusion include decreased breathing sounds, thoracic expansion and dullness on percussion on the affected side.

The chest X-ray is always the first imaging technique. Chest ultrasound is a non-invasive, radiation-free method of investigation that confirms the presence of a suspected pleural effusion at the chest X-ray. In addition, it allows to assess the size of the effusion and to distinguish fluid effusions from the fibrinous ones. The computed tomography of the chest is associated with marked exposure to radiation, and in general, it does not predict outcomes. That is why it must not be used systematically.(9)

Blood cultures are positive only in a minority of cases (around 10%), but they must be performed before the start of antibiotic therapy, in the hope of guiding the choice of antibiotics administered to children sick enough to be hospitalized because of their pneumonia.(10) Sputum cultures are sometimes useful, but it is difficult to obtain them, especially in small children.

Complete recovery of lung function normalization of chest X-ray is expected in the majority of children with complicated pneumonia. Children follow-up after discharge should be ensured until their clinical recovery and the return of the chest X-ray to near-normal aspect. It may take several months before chest X-ray is fully recovered.(11,12)

CASE REPORT

A previously healthy 3.5-year-old female child from Chişinău presented to the emergency department with a 2-day history of pain in the left ear, fever, and nonproductive cough. She had a subfebrile body temperature (37.8°C), an altered general status, dry cough, pain in the left flank and moderate tachypnea and tachycardia (respiratory rate 38-42 breaths/min and heart rate 140-150 beats/min). She manifested mild acute respiratory distress; auscultation of the chest revealed attenuated breath sounds and crackles in the basal area of the left lower lobe. The chest radiograph demonstrated left lower lobe pneumonia with opacification of the left costophrenic sinus (figure no. 1).

The child was fully vaccinated including the

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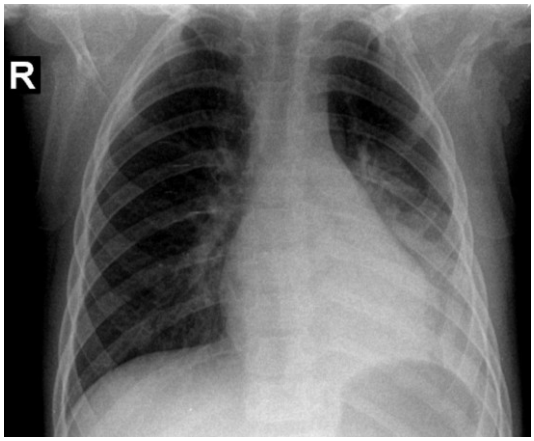
pneumococcal conjugate vaccine; there was no history of contact with tuberculosis patients or travelling abroad, and a negative family history for immune, respiratory or hereditary diseases.

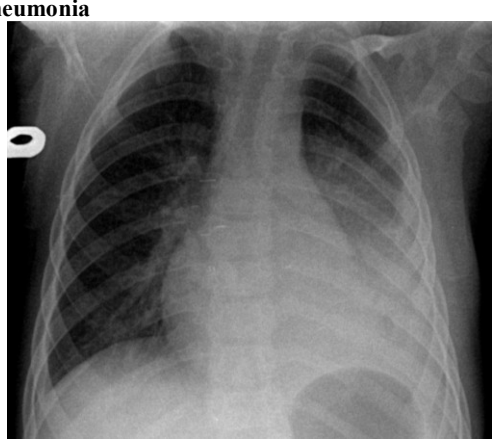
Figure no. 1. Anteroposterior chest radiograph shows left-sided lower lobe pneumonia. A parapneumonic effusion is also noted



Initial laboratory evaluation showed mild leucocytosis (WBC $12.0 \cdot 10^9$/l) with granulocytosis (87.1%) and mild anemia (Hb 10.7 g/dl). Oxygen saturation was 93-95% in room air. The chest ultrasound revealed left-sided pleural effusion in a small amount (25-30 ml), therefore the pleural puncture was not performed. The patient started empirical antibacterial treatment with intravenous (I.V.) Ampicillin 800 mg every 8h, but after 24 hours, considering the absence of clinical improvement, the treatment was switched to I.V. cephalosporins and supportive measures.

On a third day of hospitalization she developed mild fever (38.2°C), continued pain in the left flank, irritability, poor appetite. The CBC showed mild anemia (Hb 10.5 g/dl), increased total leukocyte count of $16.8 \cdot 10^9$/l with significant "shift to the left" – myelocytes 3%, metamyelocytes 2%, bands 19%, segmented 29%, and ESR 50 mm/hour. C-reactive protein level was >24 IU (normal range <6 IU). The second chest radiograph (figure no. 2) revealed extensive infiltrate in the inferior lobe of the left lung and pleural effusion without positive dynamics of the pathological process. The USG of the pleural cavity showed pleural effusion in the left side with volume equal to 30 ml.

Figure no. 2. Second chest radiograph shows worsening of the pneumonia

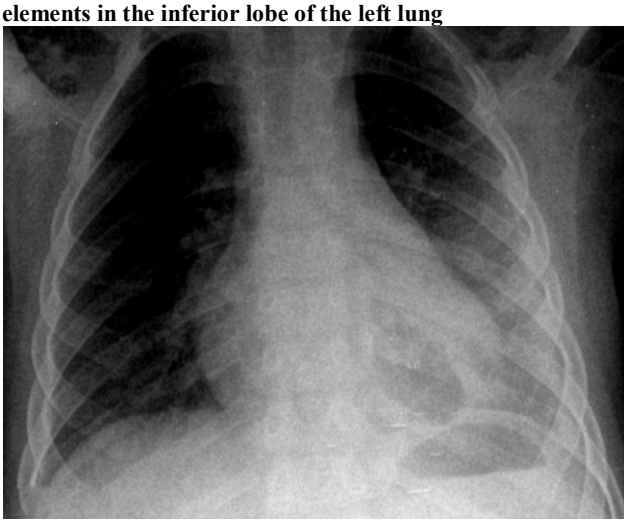


Next days she continued to manifest mild fever and increased leucocytosis (WBC $25.6 \cdot 10^9$/l) with elevated ESR. Blood cultures were negative and physiological flora was found in the nasopharyngeal swab. The antibacterial treatment was changed to carbapenems (I.V. Prepenem 500 mg every 8 hours). In the following days, there were noticed slowly positive dynamics, with subfebrile body temperature since the 13th day of disease and 10th day of hospitalization.

On the 17th day of disease and 14th day of hospitalization the CBC showed mild-to-moderate anemia (Hb 8.8 g/dl), but normal total leukocyte count of $7.3 \cdot 10^9$/l with normal neutrophils count (bands 5%, segmented 41%, eos. 5%, lymph. 44%, mon. 9%) and ESR 41 mm/h. Coagulation tests showed increased fibrinogen levels (6.4 g/l). Blood chemistry showed marginal decrease of total serum protein level and marginal increase of creatinine level (up to 92 mmol/l). IgM and IgG levels anti-*Mycoplasma pneumonia* and anti-*Chlamydia pneumonia* were negative.

Clinically, the child's health improved – she was active, with good appetite, normal sleep, and no pain in the left flank. The third chest radiograph revealed cavitary elements in the inferior lobe of the left lung and fibrinous pleurisy (figure no. 3).

Figure no. 3. Third chest radiograph shows cavitary elements in the inferior lobe of the left lung



The antibacterial treatment was changed to the combination of I.V. Prepenem 500 mg every 8 hours with I.V. Vancomycin 250 mg every 6 hours (1,0 g/24 hours). Next days the body temperature was normal but rising up to 37.0-37.1°C every day in evening hours. On 25th day of disease (22rd day of hospitalization) the CBC showed normal results: Hb 11.8 g/dl, WBC $6.4 \cdot 10^9$/l with normal neutrophils count, decreased ESR - 24 mm/hour. The I.V. Prepenem was withdrawn and the patient continued the antibacterial treatment with Vancomycin 250 mg every 6 hours. C-reactive protein was negative. Blood chemistry results were normal.

At this time, the computed tomography (CT) with contrast was performed (figures no. 4a, 4b). The CT scan revealed normal aspect of mediastinal lymph nodes, non-significant pleural effusion on the left site with regional thickening of pleura, and presence in the inferior lobe of the left lung (postero-medial areas) of pulmonary parenchymal consolidations with partially positive bronchogram, mostly in S_{10}, with several communicant cavernas (the biggest having 2.5x2.5x2.0 cm) with irregular, relatively thickened walls, under and sharp angle to pleura.

On 27th day of hospitalization the patient was discharged home to continue oral antibiotic therapy for 14 days with Josamycin. Follow-up CT scan was obtained 17 months

later after hospitalization and revealed normal aspect with no evidence of cavitation (figure no. 5).

Figure no. 4 (a, b). The CT scan shows cavernas in the posterior basal segment (S10) of the left lower lobe

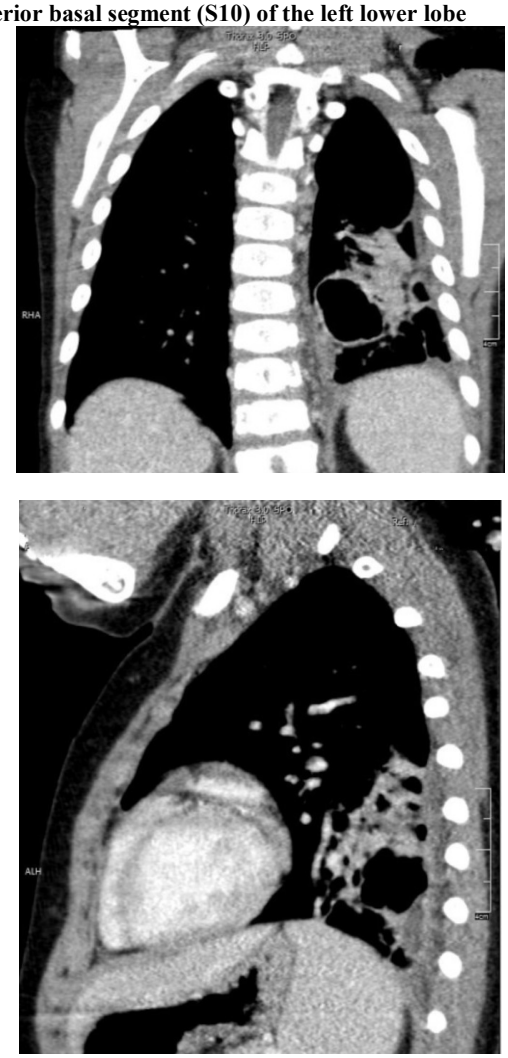
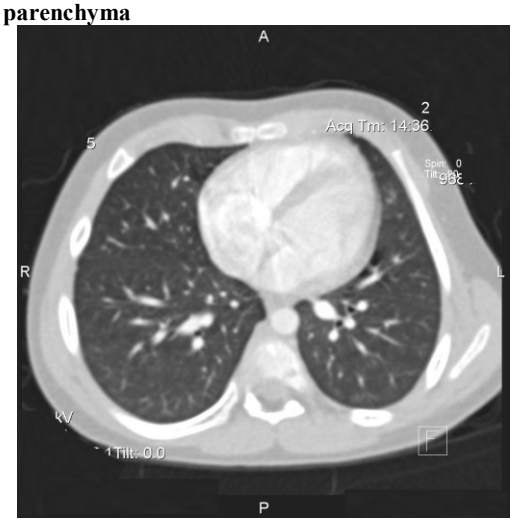


Figure no. 5. Follow-up CT scan shows normal aspect of lung parenchyma



After completing the treatment course the child had been feeling well, had no respiratory symptoms and returned to her usual activities.

DISCUSSIONS

We presented a case of necrotizing pneumonia with favourable evolution. It was characterized by moderate infiltration of the lung tissue without clear borders with multiple small-lumen cavities. At the stage of inflammatory infiltration of the lung parenchyma, parapneumonic pleurisy developed that manifested typically by the lack of differentiation of the diaphragm dome and pleural sinus on the affected side due to exudate layering, homogeneous opacification of various degree, and absence of pulmonary markings on chest X-ray.

Chest ultrasound is a very valuable method of examination because it allows determining the presence of fluid in the pleural cavity, its quantity and location. The value of chest ultrasonography is augmented by the fact that this non-invasive method of examination can be used to assess and select anatomical areas for drainage in severe cases. Also, it helps to determine the stage of the inflammatory process.

Regarding the antibacterial treatment it is mostly empirical, based on the severity of the disease and local guidelines, because randomized studies are unlikely to be organized due to the rarity of this disease. The selected drug or combination of drugs should be, at a minimum, effective against *Streptococcus pneumoniae* and *Staphylococcus aureus*. Therefore, specialists from the Canadian Pediatric Society recommend using cefotaxime or ceftriaxone as initial choice for empirical antibiotic therapy in the absence of a confirmed organism.(2,13) The Infectious Diseases Society of America and the Pediatric Infectious Diseases Society recommend empiric antibiotic therapy with ampicillin to children received Hib and pneumococcal vaccination. In our case ampicillin treatment did not improve the clinical evolution of the disease and the patient continued the treatment with cephalosporins.

As in our case, children with NP usually have a prolonged hospital stay. The median length of stay is between 12 and 30 days.(14) Children may have prolonged intermittent fever from days to weeks due to the natural evolution of the infection, possible poor penetration of the antibiotics into de areas with infiltration and/or cavitation that finally may lead to tissue necrosis.(15) Also, antibiotic resistance must be considered, especially in cases with limited efficiency of the administered treatment and negative cultures.

As compared to fatality rates in adults in whom it may reach up to 40%, (16,17) in children it is much lower.(18)

CONCLUSIONS

Necrotizing pneumonia is on the most severe complications of community-acquired pneumonia that is increasingly recognized in immunocompetent and previously healthy children of different age. Frequently identified pathogens are *S. pneumoniae* and *S. aureus*. Important clues to consider this diagnosis are: prolonged febrile period and lack of clinical improvement despite recommended antibacterial treatment for community-acquired pneumonia. Many NP cases manifest with extrapulmonary complications such as empyema and/or bronchopleural fistula.

Diagnostic methods include chest X-ray, CT scan and chest ultrasonography. The recommended treatment is prolonged antibiotic therapy of 4-6 weeks. Surgical interventions usually may be kept to a minimum, under a close monitoring of the evolution of the disease. A follow-up imaging examination must be warranted in order to exclude sequelae that are rare in children.

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