

COMPLICATED COMMUNITY-ACQUIRED PNEUMONIA CAUSED BY STREPTOCOCCUS PNEUMONIAE

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(Original scientific paper)

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Abstract

Community-acquired pneumonia is one of the most common reasons for paediatric hospitalizations in the world and also in our country. Microbiological identification is challenging, since collection of respiratory samples in children is problematic in comparison to adults. Small proportion of children with community acquired pneumonia will develop pleural effusion or empyema. Common causative organisms are *Streptococcus pneumoniae* and *Staphylococcus aureus*. Complicated community-acquired pneumonia should be suspected in any child with pneumonia not responding to appropriate antibiotic therapy within 48-72 hours. New conjugated vaccines against *Streptococcus pneumoniae* have contributed to decreases in radiologic, clinical and complicated pneumonia cases and have reduced hospitalizations and mortality. We report a case of 10 – year old boy with complicated community-acquired pneumonia presented with pleural effusion and pericarditis caused by *Streptococcus pneumoniae* infection.

Key words: streptococcus pneumonia,

Introduction

Community-acquired pneumonia (CAP) is a significant cause of hospitalization and mortality in pediatric population globally, despite advances in vaccination and treatment strategies. Haemophilus influenzae type b immunization programs have reduced the rate of CAP in both developed and developing countries (Harris et al., 2011). The subsequent implementation of the pneumococcal conjugate vaccine (PCV) resulted in a reduction in invasive pneumococcal disease (IPD), as well as a further reduction in the incidence of CAP, but clinical management still remains complex, particularly due to increasing antibiotic resistance (Bradley et al., 2011 & Donà et al., 2024). The extended valency of PCV from 7-valent (PCV7) to 13-valent (PCV13) has also led to reduced infections with resistant pneumococcal strains due to the inclusion of non-susceptible *S. pneumoniae* serotypes, mainly serotype 19A. Recent large-scale studies have performed extensive microbiological testing to investigate the etiology in children with radiologically confirmed CAP. A viral and/or bacterial pathogen was detected in the upper respiratory tract in 81–99% of these children. (Jain et al., 2025 & , PERCH Study Group, 2019). Most children with CAP recover, but some children develop local or systemic complications. Local complications include pleural effusion, empyema, necrotizing pneumonia, and lung abscess, while systemic complications include sepsis, septic shock, multiple organ failure, disseminated infection, acute respiratory distress syndrome, disseminated intravascular coagulation, and death (de Benedictis et al., 2020). Acute purulent pericarditis is a rare complication of CAP but is associated with high mortality despite aggressive drainage and antibiotic therapy. With the introduction of the 13-valent pneumococcal vaccine into the immunization schedule, the rate of acute purulent pericarditis caused by *S. pneumoniae* has been significantly reduced.

Case report

A 10-year-old male child was brought for examination due to occasional shortness of breath, fever and malaise for the last 2 weeks. The family doctor had been treating the child for the previous 7 days with inhalation therapy and Amoxicillin. Due to breathing worsening, a chest X-ray was performed with a finding of reduced lung transparency on the left paracardiobasal side with a shadowed left frenico-costal sinus from a larger pleural effusion (Figure 1). Additionally, an echocardiography was performed with a finding of a pericardial effusion behind the left ventricle < 0.5 cm (Figure 2).



Fig. 1: Chest X-ray - reduced lung transparency on the left paracardiobasal side with a shadowed left frenico-costal sinus from a larger pleural effusion



Fig. 2: Echocardiography showing pericardial effusion behind the left ventricle < 0.5 cm

On admission, child was subfebrile 37.2 C° , conscious, communicative, with tachydyspnea and forced position in bed - breathing in a horizontal position was significantly difficult. Skin and mucous membranes with pale discoloration. Skin turgor was slightly reduced. Tonsilopharyngeal region was slightly hyperemic. Auscultation of lungs with weakened to inaudible vesicular breathing on the left in the middle and basal parts. Child was tachycardic with a heart frequency of 122 beats/min, with clear tones and without murmur. The child was monitored with oxygen saturation = 97%, number of respirations 40/min and tensia arterialis was 131/88 mmHg. Electrocardiography showed sinus tachycardia. Laboratory tests with increased inflammatory markers: Le= $10.11 \times 10^9 /L$ Er= $4.73 \times 10^9 /L$ Hgb = 111g/L HCT = 35.36% PLT= $301 \times 10^9 /L$, CRP=111.7 mg/L. A chest Computed Tomography scan showed a larger zone of parenchymal

consolidation in the lower left lobe with a positive air bronchogram and pleural effusion on the same side. Without significantly increased lymph nodes in the mediastinum and hilus. Airways had a free lumen. Small pericardial effusion was seen. (Figure 3).

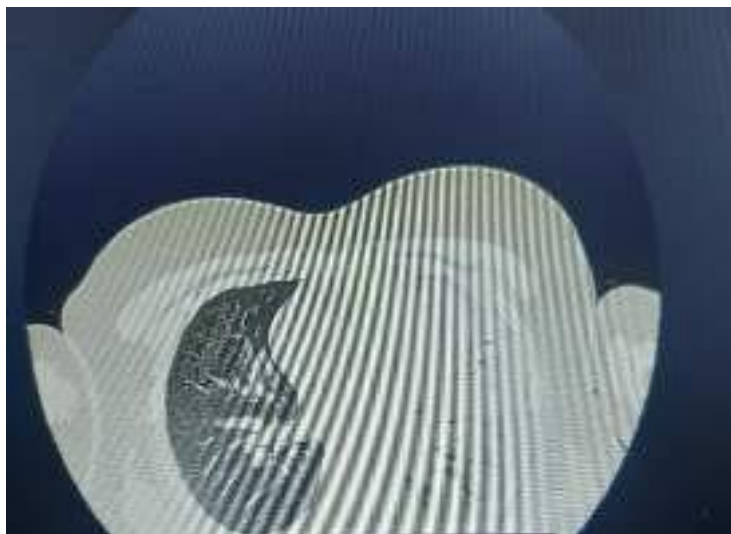


Fig. 3: Computed Tomography Scan - Larger zone of parenchymal consolidation in the lower left lobe with a positive air bronchogram, pleural effusion on the same side and small pericardial effusion.

We started oxygen support 2l/min, dual antibiotic therapy with Ceftriaxone and Amikacin, systemic corticosteroid and diuretic therapy with Furosemide. Fever was treated symptomatically with antipyretics. Result from bacteriological examination of sputum with isolation of *Streptococcus pneumoniae*, due to which a partial change in antibiotic therapy was made according to the antibiogram. Treatment continued with Ceftriaxone and Azithromycin, systemic corticosteroid, diuretic and non-steroidal anti-inflammatory drug. The results from blood culture were negative. During the two-week hospital stay, the pleural and pericardial effusion gradually receded, with complete normalization of the lung auscultatory finding and improvement of the general condition. Control laboratory analyses with normalization of inflammatory markers and control chest X-ray with receding of the previous findings. The patient was discharged in a good general condition, hemodynamically stable.

Discussion

Streptococcus pneumoniae colonizes the nasopharynx and is considered as a part of the normal flora during early childhood. The bacteria can spread from colonized sites to mucosal tissues causing infection or can enter the circulation with consecutive bacteremia and invasive infection (Dagan et al., 2004). In the study by Rueda et al. 2022, the frequency of *Streptococcus pneumoniae* and *Haemophilus influenzae* as causes of CAP was 11.2% and 4.6%, respectively, compared with a viral etiology that was isolated in 72% of patients. Another study conducted between 2004 and 2012 included 164 children with pleuropneumonia. The median age was 32 months, and the predominant symptoms were fever (93.9%), cough (56.7%), and dyspnea (48.1%). *S. aureus* was isolated in 59% of the children, and *Streptococcus pneumoniae* was isolated in 26% (Hamouda et al., 2019). After the introduction of the polyvalent vaccine for *Streptococcus pneumoniae* in our country, the incidence of pneumonia caused by this bacterium has significantly decreased, including its complications. In our case, we are dealing with an immunocompetent 10-year-old child who was previously fully immunized, including with the 13-valent pneumococcal vaccine. In 2017 was published a case of a 2.5 year old boy with parapneumonic effusion as a complication of pneumonia caused by *S. pneumoniae* although the child was fully immunized. Biological assesment, computed tomography scans and chest radiography were done that confirmed a diagnosis of a pneumococcal parapneumonia with abscess of the left lower lobe with encysted empyema (Diawara et al., 2017). A similar case has been reported in a 2-year-old child who had previously been immunized with pneumococcal vaccine and who developed empyema as part of a pneumococcal infection caused by Serotype 9V (Sütçü et al., 2017). An additional complication in our case was a small pericardial effusion but the child was hemodynamically stable and its resolution occurred after starting the above-mentioned therapy. Pericarditis

in the context of streptococcal pneumonia is an acute and severe complication with a mortality rate of 30% (Go et al., 1998). However, the pathogenesis is still unclear. Some authors suggest that the pathogenetic mechanism consists of direct extension of the infection from the pleural empyema, according to others the infection occurs hematogenously or by spread from the nasopharynx. Specific pneumococcal virulence factors have not yet been demonstrated to be crucial for heart involvement (Feinstein et al., 2010). In our case, the favorable outcome was probably related to a high index of suspicion, early diagnosis and treatment, and infection with an organism relatively susceptible to antibiotics.

Conclusion

The conclusion of these case is that failure of the PCV13 vaccine may result in a complicated pneumonia with empyema. Early detection of complicated pneumonia is important and should be suspected if the child does not respond to antibiotic therapy after 48-72 hours. Imaging diagnostics are important in the evaluation of children with complicated pneumonia. Microbiological diagnosis is challenging, especially when the causative agent is of bacterial etiology. Molecular diagnostic tests have the advantage, especially PCR. The prognosis of complicated CAP is good without clinical and radiological sequelae and without consequences on lung function in most children.

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