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Lobar pneumonia in a 3-year-old boy with a several-day history of influenza-like symptoms – a case report

Płatowe zapalenie płuc u 3-letniego chłopca z kilkudniowym wywiadem objawów grypopodobnych – opis przypadku

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Abstract

Influenza is an acute viral respiratory disease, which is particularly common in the paediatric population. Every year it affects about 25% of children. According to the National Institute of Public Health – National Institute of Hygiene, almost three times as many cases of influenza were registered in the 2022/2023 infectious season compared to previous years. However, in the era of the influenza epidemic, diagnostic vigilance should be maintained, keeping in mind that the symptoms of some serious bacterial infections may initially mimic those of influenza. We present a case report of a 3-year-old boy with influenza-like symptoms, who was finally diagnosed with lobar pneumonia complicated by parapneumonic effusion. Early diagnosis and treatment spared the patient from invasive treatment for complications of pneumonia.

Keywords: influenza, pneumonia, *Streptococcus pneumoniae*, parapneumonic effusion

Streszczenie

Grypa jest ostrą wirusową chorobą dróg oddechowych, która szczególnie często dotyka populację pediatryczną i co roku występuje u około 25% dzieci. W sezonie infekcyjnym 2022/2023 według danych Narodowego Instytutu Zdrowia Publicznego – Państwowego Zakładu Higieny w Polsce zarejestrowano niemal trzykrotnie więcej przypadków zachorowań na grypę niż w latach poprzednich. W dobie epidemii grypy należy jednak zachować czujność diagnostyczną, ponieważ objawy niektórych poważnych infekcji bakteryjnych początkowo mogą imitować objawy grypy. W pracy przedstawiono przypadek kliniczny 3-letniego chłopca z objawami grypopodobnymi, u którego finalnie rozpoznano płatowe zapalenie płuc powikłane wysiękiem parapneumonicznym. Wczesne postawienie diagnozy i włączenie leczenia uchroniły pacjenta przed koniecznością inwazyjnej terapii powikłań zapalenia płuc.

Słowa kluczowe: grypa, zapalenie płuc, *Streptococcus pneumoniae*, wysięk parapneumoniczny

INTRODUCTION

Influenza is an acute viral respiratory disease. It may vary in severity from sparsely symptomatic or asymptomatic to acute respiratory failure[1]. Paediatric patients are a population particularly vulnerable to infection. According to World Health Organization (WHO) estimates, on average 20–30% of children and 5–10% of adults suffer from full-blown influenza.

In the current clinical practice, confirmed virological positivity is the basic diagnostic criterion in addition to typical symptoms of acute infection. Tests to detect viral antigens in nasopharyngeal cavities are widely used due to their simplicity and relatively low price. They show high specificity (about 98%), but a relatively low sensitivity (about 62%), and can therefore be used to confirm rather than exclude the infection[2].

Possible diagnosis of influenza should be considered especially in patients with fever or respiratory symptoms, who present to the doctor during epidemic.

In the northern hemisphere, most infections occur between October and April, with the peak incidence usually occurring in late February. According to the National Institute of Public Health – National Institute of Hygiene, the highest number of cases during the 2022/2023 infection season in Poland was recorded between 1 and 31 December 2022. At that time, 1,139,739 influenza cases and suspected cases were registered, with a peak in the last 2 weeks of December. There were almost three times as many cases compared to the same period in 2021[3].

However, even during the epidemic period, particular vigilance and careful examination of each patient presenting with symptoms of airway infection are advisable as influenza may be accompanied by other diseases with very similar symptoms. This paper presents a case report of a 3-year-old boy with influenza-like symptoms who was diagnosed with lobar pneumonia complicated by parapneumonic effusion.

CASE REPORT

A three-year-old boy was admitted to the Department of Paediatrics, Paediatric Nephrology and Allergology of the Military Institute of Medicine – National Research Institute in Warsaw during an influenza epidemic due to fever of up to 40°C persisting for 6 days, accompanied by cough for 2–3 days, as well as poor appetite and thirst. His epidemiological history of recent contact with a person with confirmed influenza A was noteworthy. Three days prior to admission, the boy had been examined by a paediatrician in the primary care setting, who raised the suspicion of a viral infection, most likely influenza, and recommended symptomatic treatment only. The boy had not been vaccinated against influenza that season; he had received all other vaccinations according to the Immunisation Programme.

On admission, the patient was in a moderately good general condition. Physical examination revealed single, small palpable cervical lymph nodes, nasal discharge, and a red pharynx. Normal, symmetrical alveolar murmur was heard over the lungs. Rapid antigen test for influenza was negative. Laboratory workup showed significantly elevated inflammatory markers: C-reactive protein (CRP) 28.6 mg/dL vs. normal (N) ≤0.8 mg/dL; procalcitonin 34.61 ng/mL, N: ≤0.046 ng/mL; erythrocyte sedimentation rate (ESR) 109 mm, N: ≤8 mm. Liver and renal function markers were normal. Urinalysis and urine culture showed no signs of infection. There were also no features of myocarditis (N-terminal fragment of B-type natriuretic propeptide 239.5 pg/mL, N: 5–391 pg/mL; troponin T 5.2 ng/L, N: ≤14 ng/L; creatine kinase (CK) 64 U/L, N: 38–171 U/L; CK-MB 37 U/L, N: 0–25 U/L). Due to the boy's average general condition and septic inflammatory markers, a broad-spectrum antibiotic, ceftriaxone at 100 mg/kg body weight as 1 daily dose, was included in the treatment and blood cultures were done.

On day 2 of hospital stay, physical examination revealed decreased vesicular murmur on the right side, with a corresponding percussion dullness. The diagnosis was extended with a chest radiograph. Massive parenchymal thickening with an air bronchogram was present in the middle and upper fields of the right lung, and shadowing in the lower field peripherally, probably corresponding to fluid (Fig. 1). Lung ultrasound (LUS) confirmed the presence of massive inflammatory consolidations with right lung atelectasis. Pleural fluid up to 16 mm was detected.

Right lobar pneumonia with pleural effusion was diagnosed. Treatment with ceftriaxone was continued and, due to increased inflammatory changes on radiography and lack of improvement, amikacin at 15 mg/kg body weight in 2 divided doses and clarithromycin at 15 mg/kg body weight in 2 divided doses were included.

Gradual improvement in the boy's general condition was observed in the following days. Negative blood culture was obtained on day 7 after admission. Due to the improvement in the clinical condition and gradual regression of

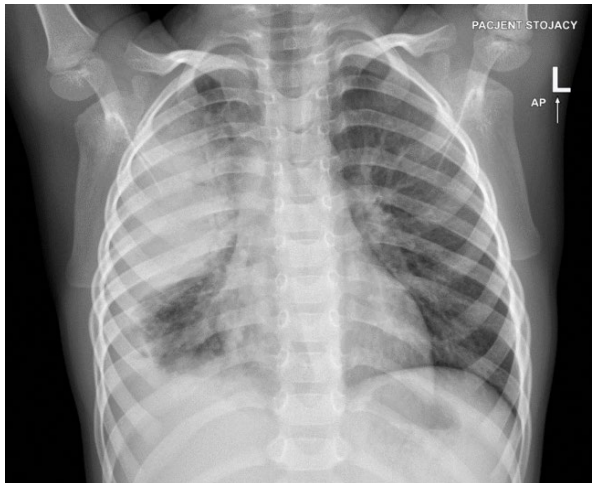

Fig. 1. Chest X-ray on day 2 of hospital stay

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inflammatory changes in subsequent LUS scans, a decision was made to continue ceftriaxone and clarithromycin.
On day 21 of antibiotic therapy, complete resolution of pleural effusion was achieved and the boy was discharged home. A follow-up visit to the Department was scheduled 6 weeks after the end of treatment.
A follow-up lung ultrasound was performed after 6 weeks, showing further regression of inflammatory changes. No pleural fluid was visualised.

DISCUSSION

Pneumonia is the most common cause of death among children under 5 years of age worldwide[4]. The incidence of community-acquired pneumonia is also highest in this age group, estimated at 36–46 cases per 1,000 inhabitants[5], with more than half of patients requiring hospital treatment[6].
In the paediatric population, the prevalence of specific aetiological agents depends on the child's age. Influenza viruses, respiratory syncytial virus (RSV) and severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) are predominant viral pathogens in the population of 2–5 year olds, i.e. the age group of the described patient. They are estimated to account for 28–37% of pneumonia cases[7,8]. Bacterial pneumonias are most commonly caused by *Streptococcus pneumoniae*, accounting for 14–36% of all infections and 70% of cases requiring hospital treatment[4,9]. Other relatively common pathogens in this age group include *Haemophilus influenzae* type B and *Mycoplasma pneumoniae*.
In recent years, there has been a decrease in morbidity and mortality from pneumonia caused by *Haemophilus influenzae* type B and *Streptococcus pneumoniae*, which is due to the common use of vaccination. However, there has been an increase in infections with antibiotic-resistant strains, such as methicillin-resistant *Staphylococcus aureus* (MRSA) and macrolide-resistant *Mycoplasma pneumoniae*, which pose a therapeutic challenge[4]. Additionally, after the COVID-19 pandemic, the incidence of out-of-season respiratory infections and severe pneumonia, including necrotising pneumonia, has increased. According to some theories, this may be the result of an "immune debt" arising as a consequence of restrictions imposed on society to limit the spread of SARS-CoV-2 (social distancing, protective masks) and thus reduced exposure of children to bacterial and viral pathogens[8].
The diagnosis of pneumonia is based primarily on medical history and physical examination. The clinical presentation of the disease may include fever, cough and dyspnoea (accelerated breathing, increased respiratory effort). These may be additionally accompanied by less specific symptoms such as headache, vomiting or abdominal pain[10]. The severity of pneumonia is determined by the severity of the symptoms (Tab. 1).
On physical examination, auscultatory changes indicative of parenchymal inflammation are usually found: crackles, decreased or increased alveolar murmur. In the case of our patient, no abnormalities suggestive of pneumonia were found on the initial physical examination. Auscultatory changes were not found until the next day of hospital stay.
Although laboratory workup, including blood count with differential or CRP and procalcitonin, does not clearly determine the aetiology of infection, it may help assess the severity of inflammation and patient's condition. Low procalcitonin usually suggests a non-bacterial aetiology[11].
According to current recommendations, diagnostic imaging is not necessary for the diagnosis of pneumonia. Chest radiography (X-ray) is recommended for hospitalised patients in severe condition, when complications are suspected or when diagnostic doubts arise[12]. Other imaging modalities useful in the diagnosis and monitoring of pneumonia include lung ultrasound, which is particularly useful in monitoring treatment progress due to its low cost and lack of exposure to ionising radiation[13]. It allows for the visualisation of pleural lesions and has a sensitivity and specificity estimated at around 90%[14]. It has greater sensitivity

	Mild-to-moderate pneumonia	Severe pneumonia
Infants	• Temperature <38.5°C • Respiratory rate <50/min • Mild intercostal retractions • Normal appetite	• Temperature >38.5°C • Respiratory rate >70/min • Moderate-to-severe intercostal retractions • Nasal flaring • Cyanosis • Periodic apnoea • Grunting • Difficulty feeding • Tachycardia • Capillary refill time ≥2 s
Older children	• Temperature <38.5°C • Respiratory rate <50/min • Mild dyspnoea • No vomiting	• Temperature >38.5°C • Respiratory rate >50/min • Significant breathing problems • Nasal flaring • Cyanosis • Grunting • Signs of dehydration • Tachycardia • Capillary refill time ≥2 s

Tab. 1. Assessment of the severity of pneumonia based on symptoms in different age groups[10]

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in imaging pleural fluid and can therefore be used successfully for its monitoring[15].

Symptomatic treatment includes antipyretics, adequate hydration and oxygen therapy. Passive oxygen therapy should be initiated when saturation drops below 92% while breathing ambient air.

Antibiotic therapy should be used in all cases of clinically confirmed pneumonia, as it is not possible to reliably determine the aetiology. According to the recommendations of the National Programme for the Protection of Antibiotics, antibiotic therapy can only be avoided in mild pneumonia without fever in children aged between 4 months and 5 years, especially in patients vaccinated with conjugate pneumococcal vaccine[12]. In other cases, amoxicillin should be included first. Alternatively, amoxicillin-clavulanic acid or cefaclor can be considered. Macrolides may be included if there is no clinical improvement after first-line treatment and in more severe forms of infection[10,12].

The recommended duration of antibiotic therapy in children is a disputable issue. A growing number of literature reports indicate that it is reasonable to shorten antibiotic therapy when rapid improvement in the patient's condition is observed. In their randomised clinical trial in a group of 380 children, Williams et al. showed comparable efficacy of a 5-day vs. 10-day antibiotic treatment, with a concomitant reduction in treatment-induced antibiotic resistance in the first treatment strategy[16]. Similar conclusions were drawn by Li et al. from their meta-analysis of nine randomised clinical trials involving 11,143 paediatric patients[17].

In the patient presented in this paper, the initial decision was to include a third-generation cephalosporin due to the boy's average general condition and septic inflammatory markers with an unclear starting point of infection. After the diagnosis of lobar pneumonia complicated by parapneumonic effusion, macrolide and aminoglycoside were included to protect the patient against atypical bacteria and Gram-negative bacilli as a potential aetiology of pneumonia.

Pleural effusion and pleural abscess are among the most common complications of pneumonia and occur in approximately 1% of patients. Pleural effusion may affect up to 40% of hospitalised patients[18]. In their study in a group of 1,933 children hospitalised for pneumonia, Krenke et al. reported parapneumonic effusion in 323 patients (16.7%)[19]. These are the most common complications of pneumonia caused by *Streptococcus pneumoniae*, especially serogroup 6 (serotype 6B) and serotype 19A[20].

Pleural effusion can be visualised using imaging modalities. Chest X-ray shows blunting of the costophrenic angle and, in the case of more fluid, the so-called Damoiseau–Ellis line. Ultrasound has a higher sensitivity in detecting parapneumonic effusion. It allows visualisation of small volumes of fluid (≥20 mL) and the location of fluid collections, as well as imaging of pleural movements[21].

The management of a patient with parapneumonic effusion should depend on the amount of fluid, the patient's condition and the dynamics of the disease process. Broad-spectrum antibiotic therapy, monitoring of vital signs and symptomatic treatment are always indicated.

The indications for surgical treatment of parapneumonic effusion have remained the subject of debate for years. According to the guidelines of the British Thoracic Society and the American College of Chest Physicians, pulmonary consultation and pleural puncture or drainage are indicated for a fluid layer >10 mm in the supine position or moderate/severe patient condition[22,23]. Similar recommendations have been proposed by the Pediatric Infectious Diseases Society (PIDS) and Infectious Diseases Society of America (IDSA)[22,24].

In contrast, Skouras et al. and España et al. suggested the possibility of watchful waiting and pharmacological treatment inclusion in the case of pleural fluid thickness up to 20 mm[25,26]. Also in the case we described, therapeutic success was achieved without pleural puncture at an initial fluid layer thickness of 16 mm on ultrasound.

In selected situations, fibrinolytic agents (urokinase, streptokinase or alteplase) may also be indicated. They are used when drainage is difficult and multiple fluid collections with septations are present[27]. If conservative treatment fails, videothoracoscopy or thoracotomy with decortication may be necessary[28].

Patients with pneumonia complicated by parapneumonic effusion should be followed-up for 4–6 weeks after hospital discharge, depending on their clinical status on discharge. Repeat imaging is recommended during the follow-up examination[27]. In children, 80% of pleural thickening following parapneumonic effusion resolves within 5 months. It does not affect further growth or expansion of the lung[29].

During the epidemic influenza season, it is important to remember that fever is a common and non-specific symptom in the paediatric population. Although the majority of febrile children in the autumn-winter season have self-limiting viral infections, fever, together with a worsening general condition, may be the first sign of a serious bacterial infection, such as lobar pneumonia.

Although the incidence of lobar pneumonia has decreased significantly following the introduction of widespread vaccination against *Haemophilus influenzae* type B and *Streptococcus pneumoniae*, severe complicated pneumonia can still be encountered in the paediatric population during the infectious period. The presented case demonstrates that vigilance and patient monitoring throughout the course of infection often lead to a correct diagnosis and allow for the rapid initiation of adequate treatment, which can spare the patient from the need for invasive medical procedures and prolonged convalescence.

CONCLUSIONS

During the influenza season, it is important to remember that fever is a common and non-specific symptom in the paediatric population. It may accompany multiple

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conditions. Furthermore, the patient may simultaneously develop infections of different aetiologies. Diagnostic vigilance and patient monitoring throughout the course of infection may allow for a correct diagnosis and appropriate treatment.

Conflict of interest

The authors report no financial or personal relationships with other individuals or organisations that could adversely affect the content of the publication and claim ownership of this publication.

Author contributions

Original concept of study: AG, AB. Collection, recording and/or compilation of data: AG, AB. Analysis and interpretation of data: AG, AB. Writing of manuscript: AG, DD. Critical review of manuscript: AB, BK. Final approval of manuscript: BK.

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